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Assessment of the 2009 Termination Rates Recommendation and costing methodologies for estimating termination rates

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0 Abstract

0.1 English

This is a study on the impact of the 2009 Termination Rates Recommendation and costing methodologies for estimating termination rates. It considers the evolution of termination rates levels in the different Member States and how it relates to the implementation of the recommendation (or not) and the date of implementation. A survey of National Regulatory Authorities across the EU was done to establish what market evolution have been observed since the publication of the 2009 Termination Rates Recommendation. It enabled to assess the impact of the recommendation on the fixed and mobile markets (market indicators, impact on the social welfare…). An assessment of the impact on trade between countries of the asymmetric implementation of the recommendation is also performed. The options for further harmonization of termination rates within the European Union (cost modelling approach, pricing) are then identified and discussed.

0.2 Français

Cette étude porte sur l'impact de la Recommandation sur les Terminaisons d'Appel (TRR en anglais) émise en 2009 par la Commission européenne, et les différents modèles de coûts estimant le niveau des terminaisons d'appel au sein de l'UE. Le rapport présente l'évolution des terminaisons d'appel dans les Etats Membres ainsi que l'influence de la TRR sur ces évolutions. Afin de mener cette mission à bien, un sondage des Autorités de Régulation Nationales au sein de l'UE a été réalisé pour déterminer quelles ont été les changements au niveau du secteur des télécommunications depuis la publication de la TRR en 2009, permettant ainsi d'évaluer son impact sur les marchés fixe et mobile. Une estimation des conséquences de l'implémentation asymmétrique de la Recommandation sur les Etats Membres a également été réalisée. Enfin, les différentes alternatives pour l'harmonisation des terminaisons d'appel au sein de l'Union Européenne (les approches de modélisation des coûts, tarification…) ont été identifiées et débattues.

1 Executive summary

1.1 The 2009 Recommendation

The Commission Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates (Termination Rate Recommendation or TRR) in the EU was issued in 2009 in order to reduce the inconsistencies observed in the regulation of wholesale voice call termination charges among the operators of the Member States.

While the main objective of the TRR was to limit differences in the treatment of fixed termination rates (FTRs) and mobile termination rates (MTRs)[1], another objective of the TRR was to lower FTRs and MTRs. Indeed, the TRR recommended the use of a bottom-up pure Long Run Incremental Cost model (below *"pure BU-LRIC"*) to calculate the costs of termination services and set regulated price caps. The use of this methodology was expected to drive MTRs and FTRs down.

Seven years after the adoption of the Recommendation, it is now possible to observe whether these planned expectations have materialised or not.

The goal of this study is to assist the Commission in assessing the impact of the implementation of the TRR on market developments in the telecommunications sector in the EU, including a review of different approaches to modelling fixed and mobile termination costs to identify the scope for further harmonization across the EU. In particular, the Commission is requesting TERA Consultants to:

- Assess the level of FTRs and MTRs in EU countries since its adoption, the differences in the level of FTRs and MTRS across EU countries and the differences between the levels of FTRs as compared to the level of MTRs across EU countries (see section 1.2).
- Assess the impact on fixed and mobile markets for several market indicators and in terms of social welfare and identify additional costs and benefits from the TRR since its adoption in 2009 (see section 1.3).
- Assess the impact on trade between countries of the asymmetric implementation of the TRR (see section 1.4).
- Identify scope for further EU-wide harmonization of the methodology and parameters used to derive pure BU-LRIC costs for fixed and mobile network operators (see section 1.5).

1.2 The level and disparity of F/MTRs between EU Member States (MSs)

The two main impacts of the TRR on F/MTRs have been to reduce the (i) level of MTRs across MSs and (ii) differences between the MTRs applied in every country. Both of these impacts in the case of FTRs and MTRs are observed below.

[1] See recital 3 of the TRR.

1.2.1 Mobile markets

With respect to mobile markets, most NRAs have implemented the TRR, albeit at different points in time. However, there still remain some NRAs that have not implemented the TRR as of today.

Figure 1 - Date of implementation of Pure LRIC mobile termination rates (when the MTR is set on a Pure LRIC level i.e. the end of the glide path)

Early Pure LRIC Group	Late Pure LRIC Group	No Pure LRIC Group
Austria (November 2013)	Croatia (January 2015)	Cyprus (Top-down LRIC)
Belgium (January 2013)	Greece (January 2015)	Finland (Top-down fully distributed cost approach)
Bulgaria (July 2013)	Hungary (April 2015)	Germany (LRAIC+)
Czech Republic (July 2013)	Latvia (benchmark July 2014)	Ireland (on its glide path towards Pure LRIC, adopted in February 2016 to be implemented as of 1 September 2016)[2]
Denmark (January 2013)	Luxembourg (July 2015)	Netherlands (LRAIC+)
Estonia (benchmark)	Malta (April 2014)	
France (January 2013)	Romania (April 2014)	
Italy (July 2013)	Slovenia (September 2014)	
Lithuania (benchmark)		
Poland (July 2013)		
Portugal (December 2012)		
Slovakia (August 2013)		
Spain (July 2013)		
Sweden (July 2013)		
United Kingdom (April 2013)		

Source: BEREC and NRAs replies to questionnaire

In relation to the level of MTRs, despite divergences in the timing of implementation of the TRR, MTRs have decreased significantly in all MS that have implemented the TRR, from an average of 8 EURcts/min in 2009 to 1 EURcts/min in 2015, a 87% decrease. In contrast, countries that have not yet implemented the TRR have MTRs which are always above those that have implemented the TRR (in fact, MTRs for the former group of countries are in average

[2] Irish NRA Comreg tried to benchmark Pure LRIC countries in July 2013 but was dismissed by the high Court following the appeal proceedings issued by Vodafone.

double those of the latter). However, MTRs in countries that have not implemented the TRR have also decreased significantly (by 78%). In spite of divergences in the timing of implementation, countries that implemented the TRR late have now very similar MTRs to those of early adopters.

The introduction of the TRR accelerated the trend of decrease of MTRs. Between 2005 and 2009 the annual decline in MTRs was -11%. This decreasing trend accelerated after 2009 to -27% per annum between 2009 and 2015. However, the decline was more pronounced for countries that implemented the TRR (-29%). We have estimated that without the TRR, average MTRs in the EU28 in 2015 would have been between 1EURct/min (+100%) and 4EURcts/min (+300%) higher than the MTRs currently in place.

In relation to the differences in MTRs between MSs, these have also significantly declined across countries in the last years. The level of disparities in MTRs between countries has been measured using the standard deviation. We found that the standard deviation in MTRs across all EU28 MSs, including those that have not applied the TRR or did so at a later stage, declined from 2.31 to 0.44 (i.e. 81%) between 2009 and 2015. Even for the MSs that have not followed the TRR, MTR disparities (as measured by the standard deviation) have decreased significantly in Europe and have decreased at a much faster speed than before after the issuance of the TRR. However, the level of MTR disparities in the Member States that have not followed the TRR or that have followed it late is currently twice the one of countries that have implemented the TRR before the end of 2013.

Finally, it is noted that, within each MS, differences in MTRs between mobile operators have significantly decreased and have now disappeared except in Cyprus

1.2.2 Fixed market

In relation to fixed telecommunications markets, most NRAs have similarly implemented the TRR, albeit at a much later date than in mobile markets. There remain however several NRAs that have not implemented the TRR to date (9 versus 5 for the mobile sector).

Figure 2 - Date of implementation of Pure LRIC fixed termination rates (when the FTR is set on a Pure LRIC level i.e. the end of the glide path)

Early Pure LRIC Group	Late Pure LRIC Group	No Pure LRIC Group
Austria (November 2013)	Czech Republic (August 2014)	Belgium (TD)
Bulgaria (July 2013)	Croatia (January 2015)	Cyprus (TD)
Denmark (January 2013)	Estonia (October 2014)	Germany (BU LRAIC+)
France (January 2013)	Greece (February 2014)	Finland (no ex ante price control, ex post verification based on FDC)
Malta (July 2013)	Hungary (January 2015)	Netherlands (BU LRAIC+)
Portugal (October 2013 Benchmark)	Ireland (July 2014)	Poland (TD FDC)
Slovakia (September 2013)	Italy (July 2015)	
	Latvia (benchmark July 2014)	
	Lithuania (January 2016)	
	Luxembourg (January 2015)	
	Romania (April 2014)	
	Slovenia (November 2014)	
	Spain (November 2014)	
	Sweden (January 2014)	
	United Kingdom (January 2014)	

Source: BEREC and NRAs replies to questionnaire

While FTRs were experiencing a decreasing trend before 2009 (-6% per annum), this decreasing trend has accelerated after the TRR (-13% per annum) and even faster between 2013 and 2015 (-22%) for the EU28. This is despite the fact that countries that did not implement the TRR have experienced a stable evolution of FTRs since 2011. Similarly to the case of MTRs, FTRs have significantly decreased since 2009: FTRs decreased significantly in all MS that have implemented the TRR, from an average of 0.7 EURcts/min in 2009 to 0.3 EURcts/min in 2015, a 57% decrease.

While the overall pattern is similar to the one observed for MTRs, there is however an important difference for countries which have not implemented the TRR: FTRs for the countries that have not implemented the TRR have not been decreasing between 2009 and 2015 (+2%) and except for Belgium and Germany, FTRs have been stable or increasing (Finland) for this group.

We estimate that without the TRR, average FTRs in the EU28 would have been 0.3EURct/min (+100%) higher than FTRs that have applied with the TRR in 2015 if the past trend (before the TRR was published in 2009) had continued.

Contrary to MTRs, we have measured disparities in FTRs levels across the EU28 using the standard deviation and have found that disparities in FTRs have not reduced but rather slightly

increased since 2009. The standard deviation went from 0.42 in 2009 to 0.51 in 2015 for the EU28. This is mainly due to countries which have not implemented the TRR. Indeed, the standard deviation has almost been divided by 2 for the Early Pure LRIC Group and by 3 for the Late Pure LRIC Group.

It is important to note that the difference between MTRs and FTRs has been significantly decreasing to around 1 EURct/min while it was 7 times greater in 2009. In relative terms, the MTR/FTR ratio has decreased from 10 in 2009 to 4 in 2015.

1.3 The impact on fixed and mobile markets

The European Commission assessed the impact of the TRR on fixed and mobile markets in its Impact Assessment (IA) accompanying the Recommendation[3]. The European Commission has asked us to assess the market developments in fixed and mobile telecommunications markets against the predictions made in its 2009 IA. Our conclusions on this comparison can be summarised as follows:

- For the mobile sector, most market developments have approximately followed the expectations at the time of the Commission's 2009 IA, notably:
    - a decrease in mobile revenues by 15% between 2010 and 2015;
    - an increase in mobile penetration (in terms of unique subscribers), from 73% to 77% between 2009 and 2015;
    - an increase in mobile investments measured by CAPEX[4]. CAPEX has increased by 55% in EU28 between 2009 and 2014;
    - a decrease in concentration in mobile markets measured by HHI. Concentration in EU28 has decreased by 7% between 2009 and 2015, supporting the EC's view that termination rates at pure BU-LRIC would help smaller players competing against incumbent mobile operators;
    - a decrease in pre-paid customers, from 50% to 39% between 2009 and 2014;
    - a decrease in on-net calls from 71% to 62% between 2009 and 2014 matching the Commission's expectations (a consequence of the development of flat rate offers and the disappearance of offers differentiating prices for on-net and off-net calls).
- For the fixed sector, the Commission's 2009 IA was correct in its expectation of the evolution of revenues which have been slightly declining since 2009. On the other hand, investments in the fixed sector have shrunk whereas the TRR was expecting an increase.

In relation to the social welfare impact, an assessment of the impact of the TRR on consumer and producer surplus between 2009 and 2015 has been conducted and results are broadly aligned with the EC's assessment in the TRR's IA on fixed and mobile markets (2009 IA). In particular, a 2 billion Euros increase in terms of mobile consumer surplus, and a 1 billion Euros

[3] http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2009/sec_2009_0599_en.pdf

[4] From GSMA database.

increase in terms of fixed consumer surplus have been estimated for the year 2013-2015 with the TRR compared to a situation without the TRR. A 1.7 billion Euros increase in terms of social welfare has been estimated for the year 2013-2015 with the TRR compared to a situation without the TRR. The update of the 2009 IA using the actual TRs rather than the forecasts used in 2009 by the Commission tends therefore to confirm the conclusions reached at the time of the TRR. The new assessment is also based on an update of traffics, prices and a better consideration of lower costs for operators (due to lower outpayments) compared to the first assessment.

A comparison between the countries that have implemented the TRR against those that have not sheds the following insights:

- Revenues decreased faster in countries that implemented the TRR (by 20% between 2009 and 2015) than in those that have not (10% over the same period);
- But mobile investments have been higher in countries implementing the TRR (an average annual CAPEX of 1.1 billion Euros against 667 million Euros in 2013 in countries that have not implemented the TRR). This may reflect higher competitive pressures in markets with TRRs set at incremental cost, which would drive the need to invest more in order to differentiate against competitors;
- Margins (before amortization) have increased in countries that implemented the TRR whereas they decreased in the countries that have not (+15% against -19% between 2010 and 2014),
- The level of concentration has remained lower in countries that implemented the TRR (although this result may be driven by the mergers occurred in several countries (Ireland and Germany) that have not implemented the TRR),
- Penetration rate in terms of SIM cards have increased faster in countries than implemented the TRR (by 17% compared to 6% for countries that did not implement the TRR).

However, the above observations should be read with caution. It is not considered that the market developments described above should be solely and directly attributed to the TRR. First, there are many other factors that have influenced developments in fixed and mobile markets in Europe over the last years. Second, there is significant heterogeneity between countries that have implemented the TRR and similarly between those that have not. Thus, it is sometimes difficult to establish a causal relationship between the implementation of the TRR and market developments. Third, countries that did not implement the TRR have also seen significant reductions in their F/MTRs, albeit lower than for those countries implementing the TRR. Thus, these countries are also likely to have somewhat benefited from the positive effects of decreasing termination rates.

Nonetheless, there is no evidence indicating that the TRR has had a negative impact on those countries that implemented it. In particular, we do not find evidence of the waterbed effect. To the contrary, we find evidence that revenues have decreased faster in countries that implemented the TRR than in those that did not. The decrease in retail prices associated with the decrease in revenues contradicts the theory of the waterbed effect. If the waterbed effect had occurred, retail prices and/or revenues would have remained stable or increased. Low MTRs have also helped in the development of new offers and the decrease in offers with price differences between on-net calls and off-net calls.

In addition, we find it more difficult to evaluate the impact of the TRR on the fixed sector than on the mobile sector. This is due to several factors. Firstly, due to the greater relevance of voice services in the mobile sector than in the fixed sector (where voice has a relatively smaller importance compared to broadband services, for example). Secondly, because citizens in Europe typically use their mobile phones to make calls more than their fixed phones[5], meaning that the voice service is of greater relevance to the user's decision to use a mobile device as opposed to a landline. Thirdly, FTRs have always been much lower than MTRs. Therefore, we consider that the impact of FTRs on the fixed market is likely to be small and difficult to determine. We consider that the main impact of the TRR on the fixed sector has been the strong increase in mobile calls to fixed networks in countries that have implemented the TRR and a decrease in outpayments to mobile operators. In fact, mobile-to-fixed calls increased by 66% between 2009 and 2014 in countries that implemented the TRR whereas they only increased by 9% in countries that did not implement the TRR. In addition, we conducted a survey of NRAs and most agreed that the reduction of FTRs was one of the drivers of the appearance of new retail offers and the reduction of both fixed and mobile] retail prices, although NRAs noted that termination rates were not the only factor.

We find evidence that the TRR has also facilitated the development of service-based competition in mobile markets since the number of MVNOs has been increasing since 2005, but it followed a faster growing trend since the TRR was issued in 2009. In particular, the number of MVNOs in EU28 has grown by 120% between 2009 and 2015. This tends to confirm the assumption that the TRR enhanced the level of competition in European mobile markets, allowing new-entrants and small operators to compete with larger operators. While several factors can potentially explain the growth in the number of MVNOs in Europe, we consider that the importance of MTRs for MVNOs is such that the TRR can be considered as one of the main factors facilitating their growth.

1.4 Impact on trade of the asymmetric implementation of the TRR

NRAs in response to our survey have most commonly observed the negative impact of the failure to implement TRR in all Member States of the EU, as well as the fact that non-EEA countries have much greater MTRs than EEA countries.

The impact of the asymmetric implementation of the TRR, i.e. the delay or failure of some Member States to implement it, on every EU country has been assessed. In particular, we have analysed the flow of funds between European countries at current termination rates and compared this to the flow of funds that would exist if all EU countries set termination rates following the TRR. For this we have compared two scenarios in 2013, 2014 and 2015:

- The real scenario using actual F/MTRs used by the MSs,
- A counterfactual scenario where F/MTRs in 2013, 2014 and 2015 are set on the level they would be if all MSs had implemented the TRR in 2013.

[5] In 2014, the average amount of minutes of mobile calls in Europe by country was 41 billion against 22 billion minutes of fixed calls.

Not surprisingly, we find that the countries that implemented the TRR earlier (i.e. Austria, Bulgaria, Denmark, Estonia, Greece, Latvia, Spain, France, Italy, Poland, Portugal, Sweden, Slovakia and the United Kingdom) are the countries that are most negatively impacted by the asymmetric implementation of the Recommendation. On the other hand, Luxembourg, Ireland, Malta, the Netherlands and Finland, which did not implement the TRR or have done so late, have positive balances. Luxembourg and Ireland have however experienced fall in MTRs (in 2015 for Luxembourg, in 2016 for Ireland) which should make the interconnection balance less asymmetric. In 2013, the impact of asymmetric implementation for Germany was barely positive, due to the high MTRs set in the majority of the MS of the Late Pure LRIC Group. However in 2014 and 2015, when those MS did implement the Pure LRIC approach whereas Germany still had not, the impact of asymmetric implementation begun to be positive. In absolute value, Germany has the highest positive interconnection balance.

The implementation of the TRR reduced the financial impact of the interconnection balances between MS as the MTRs/FTRs are lower and less heterogeneous among the MS. The interconnection balances of all MSs have indeed been decreasing between 2010 and 2014. The cross-border interconnection balance represents in general between 0.1% and 1% of operators' revenues.[6]

The interconnection balance with non-EEA countries is negative for EU MS because the TRR leas lower TR in EU MS than in non-EEA countries and amounts around 100 million of € every annum.

1.5 Looking-forward and scope for further harmonization

In summary, the TRR brought further consistency in the treatment of FTRs and MTRs in Europe and did not have any negative effects on the market. On the contrary, the effects appear largely positive, even if many other factors may have influenced mobile and fixed markets. Despite the higher level of consistency achieved, it is worth assessing whether there is some further room for harmonization.

When NRAs have to develop cost model, for each step, several options are available to the NRAs. The TRR provides some guidance for some steps but many remain discretional to NRAs. Indeed, NRA have to take several decisions before calculating the costs of MTRs and FTRs which also means that it is very likely that NRA can take divergent decisions from a country to another. There is therefore some room for further harmonization. Some topics have been discussed in the TRR and the European Commission provided some recommendations but NRA can sometimes choose to slightly deviate because of local circumstances.

For FTRs, it could be envisaged to recommend that FTRs recover only the 3 following categories of costs: wholesale commercial costs specific to termination, avoidable interconnection gateway costs, avoidable IMS costs. Indeed, these cost categories are the main (or even the only) cost categories recovered by FTRs and such an approach would offer further harmonization.

[6] TERA Consultants analysis.

For MTRs, each modelling issue could be further specified, in particular those issues which have been identified in the previous European Commission decisions addressed to individual NRAs in the context of the Article 7 procedure or which are related to new technological developments (such as use of Single-RAN, VoLTE, 4G, etc.). The appropriateness of these recommendations would have to be discussed with the industry.

To increase even further harmonisation a model skeleton could be built and used by each NRA which would fill it to calculate the costs relevant for its own country. From a practical point of view, if the design of the model task is performed at the European level rather than at the MS level, it could be envisaged to use a generic model that would be common to all MS and could only be fine-tuned at the country level for parameters that are country specific and are unlikely to be homogenised among MS: traffics and subscriber bases, coverage obligations, spectrum availability, unit costs of assets that are country specific (e.g. trenches that require significant man work as wages are significantly heterogeneous among EU28 countries). It is to be noted that TERA Consultants built for the EC in 2016 a model skeleton to assess roaming costs in EU28 countries.

In addition to these cost modelling recommendations for FTRs and MTRs, the European Commission may need to issue further pricing recommendations (glide path, requirement to apply different annual price caps, allocation of costs no more recovered by FTRs (when moving to the pure LRIC approach) to other regulated products, requirement not to choose the maximum value among a range of possible value for MTRs but a central estimate, requirement to apply symmetric rates, etc.).

2 Introduction

According to Article 8(3) of Directive 2002/21/EC, National Regulatory Authorities (NRAs) shall contribute to the development of the internal market, inter alia, by cooperating with each other and with the European Commission (EC) in a transparent manner to ensure the development of consistent regulatory practices. In 2009, in reviewing several hundreds of draft measures notified by NRAs notified under Article 7 of Directive 2002/21/EC it appeared to the EC that inconsistencies in the regulation of wholesale voice call termination rates (also called termination charges or TRs in the report) still existed for fixed and mobile networks. Wholesale voice call termination is the service required in order to terminate calls to called locations or subscribers. In Europe, the TR is set by the called network and paid by the calling network. Therefore, high TRs may be recovered through increasing call charges for end users.

Due to inconsistencies noticed in the regulation of wholesale voice call termination charges among the operators of the Member States of the European Union (EU), the EC issued in 2009 the Termination Rates Recommendation (below *"TRR"*)[7]. The TRR endorsed the application of a common framework for the calculation of TRs.

The TRR prescribed the application of a bottom-up pure Long Run Incremental Cost model (below *"pure BU-LRIC"*) for the calculation of the costs of termination services used to set termination rates. A period of transition until 31 December 2012 was also foreseen by the TRR to allow NRAs to develop their own cost model and for operators to adapt their business plans, although NRAs with limited resources were given an additional transitional period of 18 months. Since substantial disparities in the treatment of Mobile Termination Rates (MTRs) and Fixed Termination Rates (FTRs) are likely to create competitive distortions, the TRR set objective is the reduction of asymmetries among the termination rates in Europe.

Along with the TRR, the EC also issued an Impact Assessment in 2009 (below *"*2009 IA*"*) which assessed the repercussions of the TRR on the markets. The EC foresaw that yielding TRs closer to marginal costs as well as a more consistent and balanced regulatory environment would result in a more efficient pricing structure sending efficient investment signals to operators. However, it could have led to transitory reductions in wholesale revenues for some large operators which are net receivers of traffic. In terms of competition, the 2009 IA foresaw that the TRR would enhance a reduction of inefficient cross-subsidies between operators and a more consistent and balanced regulatory treatment of fixed and mobile networks in support of increased fixed-mobile competition. It also forecasted the reduction of termination payments of net-senders of call traffic leading to more neutral costs between on-net and off-net traffic helping to increase competition. For the consumers, the TRR was predicted to facilitate the development of innovative pricing structures, and enhanced competition to promote lower retail prices and the development of innovative services such as fixed-mobile convergent bundles.

Seven years after the adoption of the recommendation, it is possible to observe whether these planned effects have realized or not.

[7] Commission recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2009/396/EC).

The objective of this study is therefore to measure the evolution of TRs (see section 3) and assess both qualitatively and quantitatively the developments assumed in the 2009 IA against the actual developments, such as the contribution of the TRR to a decrease or an increase of the retail prices (see section 4). The study assesses as well the impacts of the TRR that have not been foreseen by the 2009 IA, like the potential additional costs or benefits which were not foreseen. Besides, despite the fact that most Member States (MS) have implemented the TRR, there have been some exceptions with TRs in several countries that do not follow the recommended approach. This study therefore evaluates and quantifies the potential impact on trade in internal market and end-users of the asymmetric implementation (or absence of implementation) of the TRR in the EU (section 5). Finally, the study looks into other areas of modelling costs for fixed and mobile termination than the specified ones in the TRR that may be subject to further EU-wide harmonization (section 6). The EC has mandated TERA Consultants to conduct this study.

Those assessments require significant amount of data. Multiple sources of information have been used. The BEREC annual and biannual reports and the annual reports from the EC have provided information about levels of TRs and the implementation of the recommended approach for the TRs calculations among the MS. NRAs have provided data via their answers to a questionnaire sent by the EC, such as traffics, prices, number of subscribers, offer structures and implementation of Pure LRIC, information that have also sometimes been found on their websites. The GSMA Intelligence database provided data on mobile market year by year for each country, such as the number of unique subscribers, the market shares of the operators, or the investments. Buddecom reports on each European country have been used for financial data and context information about the countries such as the entrance or the merge of operators. All sources of information are summarized and further detailed in annex (see section 5.1).

The study is structured as follows:

- The first part assesses the evolution of MTRs and FTRs (section 3) and includes:
  - A review of the evolutions of MTRs in the mobile market,
  - A review of the evolutions of FTRs in the fixed market,
  - An assessment of the evolution of MTRs and what would have happened without the TRR,
  - An assessment of the evolution of FTRs and what would have happened without the TRR,
  - An assessment of the evolution of the gap between the MTRs and the FTRs.
- The second part assesses the impact of the TRR on the related markets (section 4). This part evaluates the evolutions of the markets on different levels described as follows:
  - Review of the 2009 Impact Assessment against the actual developments,
  - Assessment of the potential additional costs and benefits due to the implementation of the TRR,
- The third part assesses the impact on trade of the asymmetric implementation of the TRR (section 5).

- The last part (section 6) defines the scope for further harmonization of the methodology and parameters used to derive pure BU-LRIC costs for fixed and mobile network operators among Member States.

It is important to note that the main body of the report does not provide a detailed analysis of the market evolutions in each MS. However a country by country analysis is provided in annex. Also, there is no data collected after December 2015. This means that the fact that MS have implemented the TRR in 2016 (such as Ireland for MTR [8]) is not taken into account.

[8] The Irish NRA Comreg tried to benchmark Pure LRIC countries starting from 2012 but was dismissed by the high Court following the appeal proceedings issued by Vodafone.

3 Evolution of MTRs and FTRs following the TRR

Subsequently to the TRR, many NRAs have implemented the pure LRIC methodology for the calculation of MTRs and FTRs. This part of the study assesses the resultant impacts of the recommendation on MTRs and FTRs in the 28 MS of the EU. The direct impact of the TRR is here assessed. The next section (section 4) rather focuses on impacts on the markets (which can be considered as "indirect" impacts of the TRR).

Observing the evolution of MTRs (or FTRs) in each country would not enable to observe differences between countries which have implemented the TRR and countries which have not or have done so late. A country by country analysis is provided in annex but in this part, the evolution of average MTRs (or FTRs) for three groups of countries is observed. Since the TRR expected the countries to implement Pure LRIC before the end of 2013[9], these three groups of countries are:

- the group of those MS which have implemented the TRR early (before the end of 2013);
- the group of those MS which have implemented the TRR late (since 2014); and
- the group of those MS which have not implemented the TRR.

The following table describes the different metrics which are used in this part of the study and their definitions.

Figure 3 - Metrics definition

Metrics		Definition/Scope
Flat averages	**MTRs/FTRs**	Flat averages of the values of MTRs/FTRs across countries of a given group
Weighted averages	**MTRs**	Average MTRs weighted by the number of subscribers of each country in terms of number of SIM cards (same approach as BEREC)
Weighted averages	**FTRs**	Average FTRs weighted by the number of fixed lines of each country (same approach as BEREC)
Standard deviation		Measure used to quantify the amount of dispersion of a set of values (whether data points tend to be very close to the mean or not)

Source: TERA Consultants analysis

The first part (see section 3.1) evaluates the evolution of MTRs in the EU. The second part focuses on FTRs following the same methodology as the first part (see section 3.2)[10]. Finally, differences between MTRs and FTRs are analysed (see section 3.3).

[9] See recital 22 of theTRR.

[10] The information about wholesale voice call termination rates has been collected from the BEREC reports and NRAs replies to the questionnaire sent by the EC. It allowed creating three groups of Member States based on if and when they implemented the recommended approach, in order to compare the levels of FTR and MTR among the EU, and tell whether the countries that did not adopt the TRR have higher TRs and greater disparities or not.

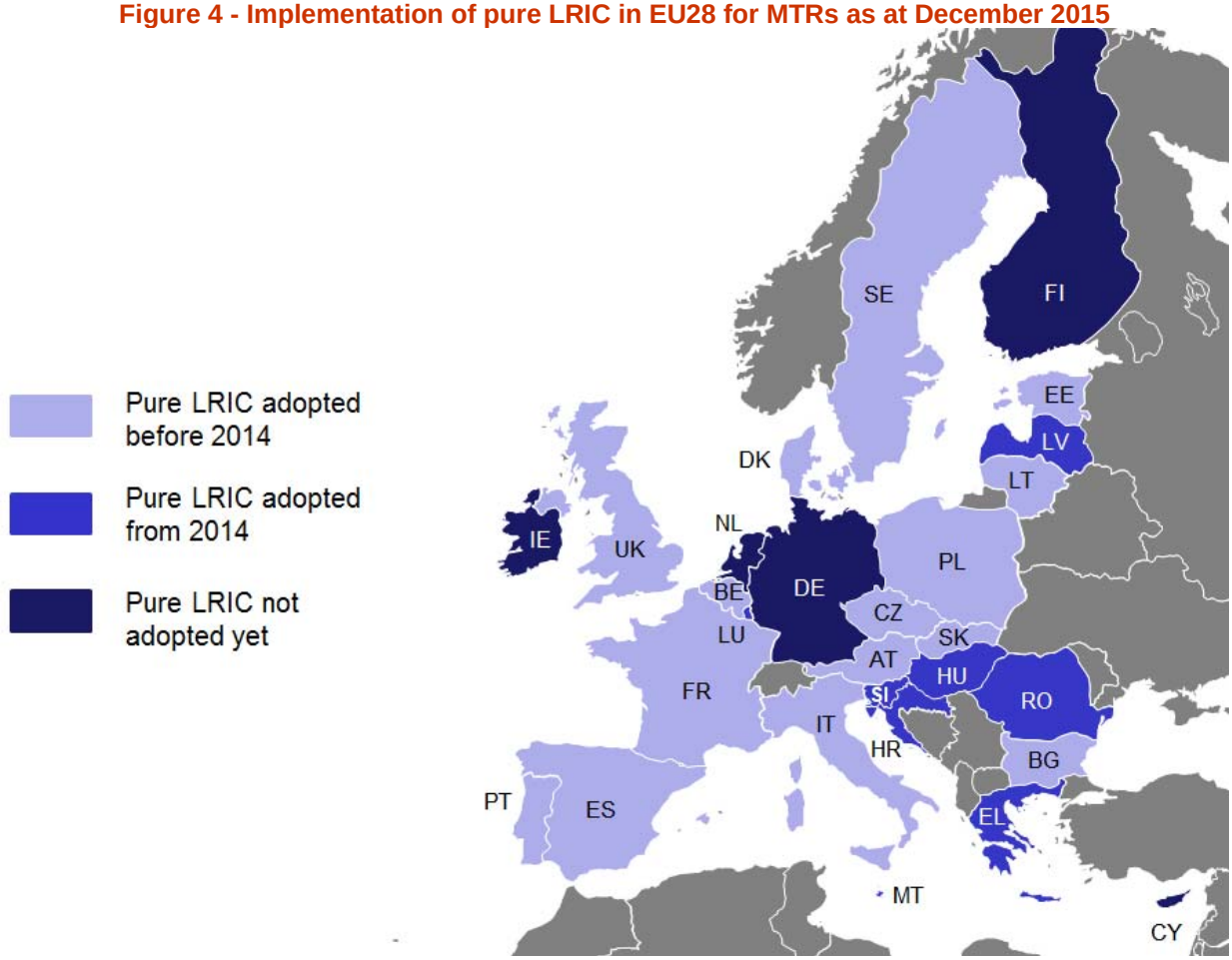
3.1 Mobile Termination Rates

First of all, the date of implementation of the TRR by EU Member States is reviewed (see section 3.1.1), then further analysis on the levels and disparities of MTRs of the three groups are provided (see section 3.1.2). Finally, the level of MTRs that would have been observed absent the TRR is compared with the current level of MTRs (see sections 3.1.3).

3.1.1 Timing of implementation of the TRR

Not all NRAs did implement the recommended pure LRIC approach to set MTRs. The method was mostly adopted by the countries by the end of 2013 as shown in Figure 4[11]. At the end of 2015, some countries (5) had not yet implemented the TRR. Some others (8) have implemented only recently the TRR (2014/2015). Most of countries (15) have implemented the TRR before 2014.

Figure 4 - Implementation of pure LRIC in EU28 for MTRs as at December 2015



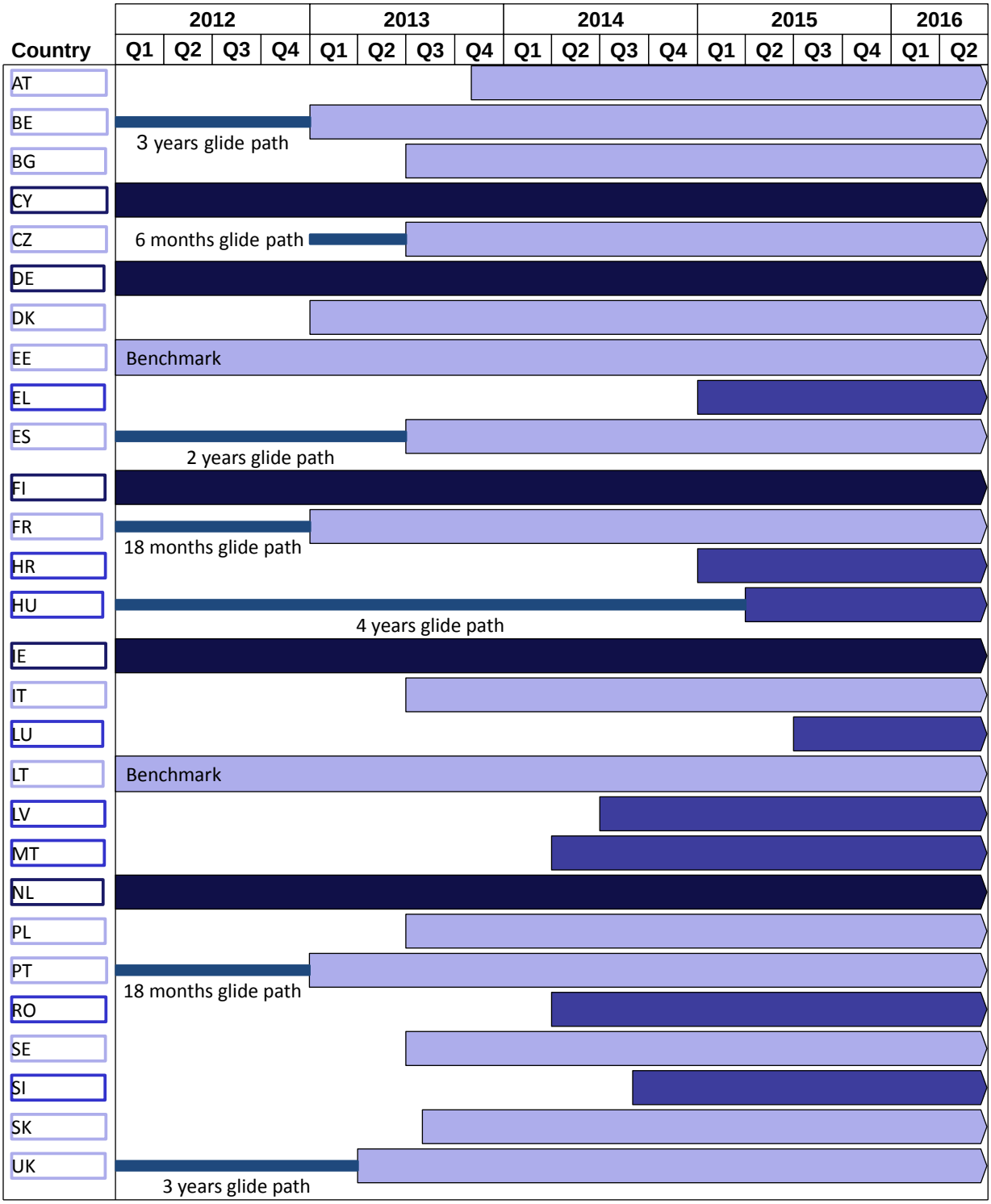
NB: In case a glide path is implemented to ensure a smooth move to pure LRIC, the date of the end of the glide path is considered.

Source: BEREC & NRAs Replies to questionnaire

[11] The information about the implementation of the TRR was given by both the NRAs answering the questionnaire of the EC and the BEREC reports.

Some countries took a decision to follow the TRR soon after the issuance of the TRR but adopted a glide path whereby rates progressively tended towards the pure LRIC rates. The glide path and the date when MTRs are set at a Pure LRIC level are defined in the decision adopted by the NRAs. Therefore it is possible to differentiate the date of decision, the starting date of the glide path (when MTR does not equal Pure LRIC yet) and the ending date of the glide path (when MTR does equal Pure LRIC). In some cases no glide path is applied, so the MTR equals Pure LRIC level immediately after the decision. It is noted that no pure LRIC rates where applied before the start of 2013. The implementation dates of pure LRIC are detailed in Figure 5.

Figure 5 - Date of implementation of pure LRIC in EU28



Source: BEREC and NRAs replies to questionnaire

In the rest of the analysis (except in annex where country by country analyses are conducted), each MS has been allocated to one of the three different groups in order to compare them depending on when and whether they have adopted the pure LRIC approach or not. MS where

MTRs have reached pure LRIC levels before the end of 2013[12] are attributed to the "Early Pure LRIC Group". If the recommendation has been followed and MTR equals Pure LRIC after 2014, MS have been attributed to the "Late Pure LRIC Group". The remaining countries which did not implement the TRR have then been allocated to the "No Pure LRIC Group", as summarized in Figure 6[13].

Figure 6 - Groups and date of implementation of Pure LRIC (when the MTR is set on a Pure LRIC level i.e. the end of the glide path)

Early Pure LRIC Group	Late Pure LRIC Group	No Pure LRIC Group
Austria (November 2013)	Croatia (January 2015)	Cyprus (Top-down LRIC)[14]
Belgium (January 2013)	Greece (January 2015)	Finland (Top-down fully distributed cost approach)
Bulgaria (July 2013)	Hungary (April 2015)	Germany (LRAIC+)
Czech Republic (July 2013)	Latvia (benchmark July 2014)	Ireland (on its glide path towards Pure LRIC) [15]
Denmark (January 2013)	Luxembourg (July 2015)	Netherlands (LRAIC+)
Estonia (benchmark)	Malta (April 2014)	
France (January 2013)	Romania (April 2014)	
Italy (July 2013)	Slovenia (September 2014)	
Lithuania (benchmark)		
Poland (July 2013)		
Portugal (December 2012)		
Slovakia (August 2013)		
Spain (July 2013)		
Sweden (July 2013)		
United Kingdom (April 2013)		

Source: BEREC and NRAs replies to questionnaire

[12] The date of end 2013 has been chosen to split countries because there is in general at least more than a year between the date of implementation of pure LRIC in countries which have implemented it before end 2013 and the date of implementation of pure LRIC in countries which have implemented it after end 2013.

[13] A few MS are using a benchmarking approach to evaluate their MTRs. In that particular case, the group to which such a country has been allocated to is defined by the methodology the benchmark is based on. If the country chose to benchmark Pure BU-LRIC, the country is then allocated to the "Early Pure LRIC Group" or "Late Pure LRIC Group" depending on its date of implementation. If not, the country is then allocated to the "No Pure LRIC Group".

[14] BEREC 2015 Termination Rates report.

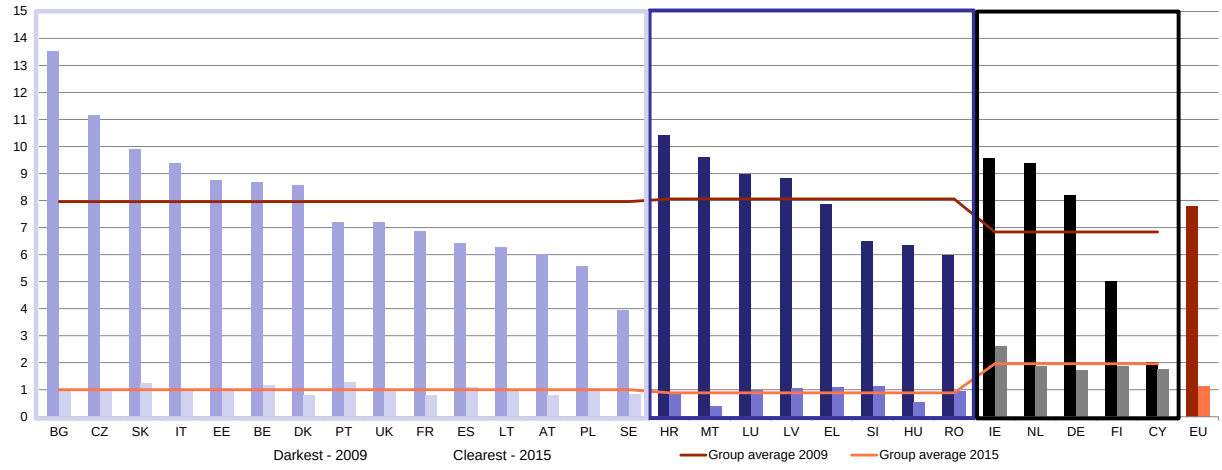
[15] Irish NRA Comreg tried to benchmark Pure LRIC countries in July 2013 but was dismissed by the high Court following the appeal proceedings issued by Vodafone.

3.1.2 Evolution of MTR levels in the EU and disparities between countries

While the main objective of the TRR was to lower divergences in the treatment of FTRs and MTRs[16], another objective of the TRR was to lower FTRs and MTRs. The choice of the pure LRIC cost standard as opposed to the LRAIC+ cost standard to calculate FTRs and MTRs implies that non unavoidable costs are no more included in the calculation of FTRs and MTRs leading to a reduction of FTRs and MTRs.

This is indeed what happened following the implementation of the TRR: MTRs decreased significantly in all MS that have implemented the TRR, from an average of 8 EURcts/min in 2009 to 1 EURcts/min in 2015 (see Figure 7), a 87% decrease. Bulgaria and Czech Republic have experienced the highest decrease while Sweden has experienced the smallest decrease. Countries that have not implemented yet the TRR currently have MTRs which are always above MTRs of countries which have implemented the TRR (for each country) and have MTRs that are in average twice higher than the average MTRs of countries that have implemented the TRR. It is however interesting to note that their MTRs have also significantly decreased. Two of these countries (Finland, Cyprus) already had very low MTRs in 2009.

Figure 7 – Evolution of MTRs in EU28 between 2009 and 2015 (EURcts/min) – Light blue: Early Pure LRIC Group / Dark blue: Late Pure LRIC Group / Black: No Pure LRIC Group



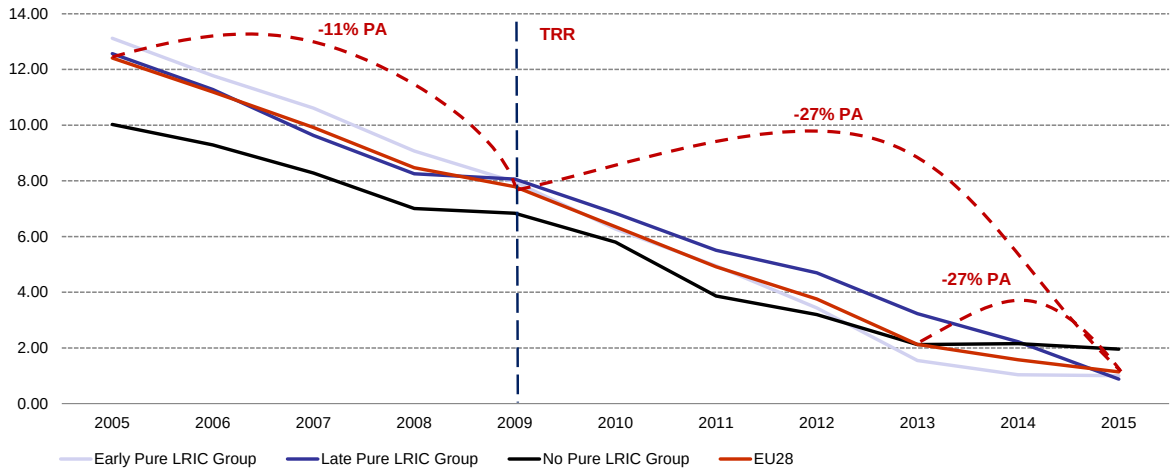
Source: TERA Consultants analysis, BEREC & EC reports

In each group, MTRs have been consistently declining between 2005 and 2013, and seem to converge towards 1EURcts/min for the Early and Late Pure LRIC Group countries and 2EURcts/min for countries which did not implement the TRR. In 2005 the No Pure LRIC Group had in average the lowest MTR: around 10EURcts/min whereas the Late Pure LRIC Group's average MTR was slightly above 12EURcts/min. In 2015 the Late Pure LRIC Group has the lowest average MTR (0.89EURcts/min) and the No Pure LRIC Group has the highest (1.96EURcts/min). The Late Pure LRIC group has now the same level of MTRs as the Early Pure LRIC group and is less than half the level of the No Pure LRIC group.

[16] See recital 3 of the TRR.

While MTRs were experiencing a decreasing trend before 2009 (-11% per annum), this decreasing trend has accelerated after the TRR (-27% per annum) and even faster for the Early Pure LRIC Group and the Late Pure LRIC Group (see Figure 8).

Figure 8 - Flat average MTR (EURcts/min)



NB: In annex (see section 6.1), the same analysis is provided where MTRs are weighted on the basis of the number of customers in each country of each group. Conclusions are similar. The only noticeable differences are the values of 2009 for the Late Pure LRIC group and for the No Pure LRIC group: with a weighted average approach, the decrease in absolute value for the No Pure LRIC group is almost the same as for the other groups (around 6EURcts/min) while with a flat average approach, the decrease in absolute value for the No Pure LRIC group is lower.

Source: TERA Consultants analysis, BEREC & EC reports

This review of the evolution of MTRs in Europe between 2009 and 2015 enables to conclude that:

- **Even for the MS that have not followed the TRR, MTRs have declined sharply in the EU since 2009 and at similar paces,**
- **However, the level of MTR in the Member States that have not followed the TRR is currently twice the ones of other countries,**
- **Since 2015, the Late Pure LRIC group has similar levels of MTRs to the Early Pure LRIC group. Because of this recent evolution for this group, it is possible that potential effects on the market are not directly visible today.**
- **MTRs were already decreasing before the TRR but after the TRR, MTRs decreased much faster (almost 3 times faster).**

The TRR main goal was to limit divergences between Member States:

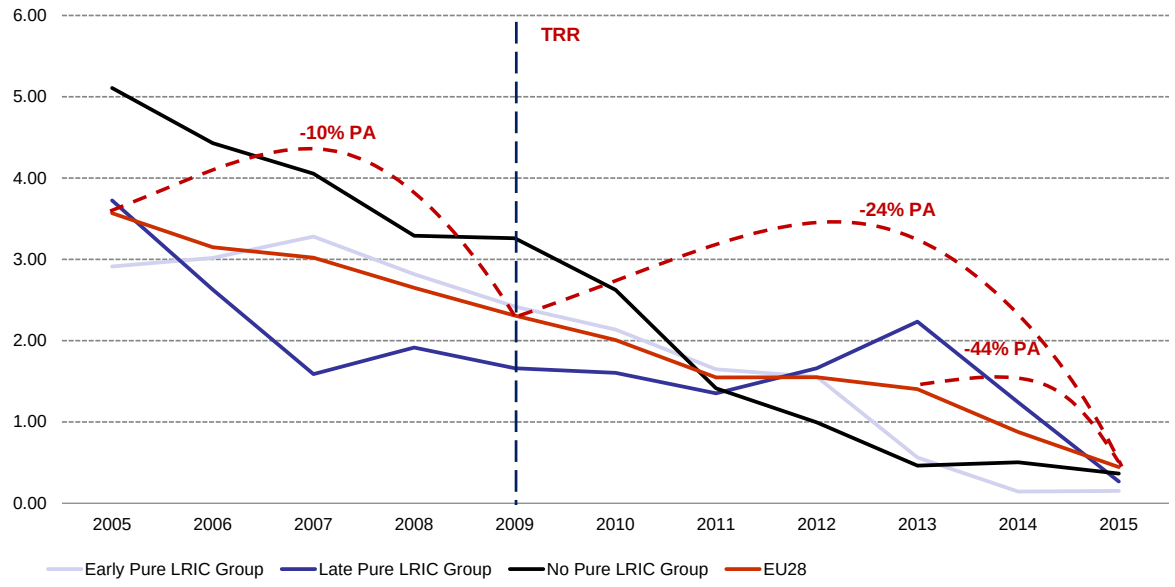
> *"Although some form of cost orientation is generally provided for in most Member States, a divergence between price control measures prevails across the Member States. In addition to a significant variety in the chosen costing tools, there are also different practices in implementing those tools. This widens the spread between*

wholesale termination rates applied across the European Union, which can only be partly explained by national specificities"[17]

To assess divergences between countries, the standard deviation of MTRs is calculated[18]. Before the 2009 TRR, standard deviations for the three groups (see Figure 9) were high and slightly decreasing (even it increased between 2006 and 2007 for the Early Pure LRIC group and between 2007 and 2008 for the Late Pure LRIC group). Since 2009 however, all deviations have been declining much faster (-24% per annum) and even faster between 2013 and 2015 (-44% per annum), and have been drawn closer, with an exception in 2013 for the Late Pure LRIC Group[19]. By the end of 2015, the Early Pure LRIC Group has the lowest standard deviation (and is therefore the most homogeneous group), and the No Pure LRIC Group and the Late Pure LRIC Group have the highest as noticed in Figure 9.

Overall, it can be observed that the differences among the MS have been constantly diminishing over the past six years. As a consequence, this objective pursued by the TRR has been met.

Figure 9 - Standard deviation of MTRs (EURcts/min)[20]



Source: TERA Consultants analysis, BEREC & EC reports

[17] TRR, §(2).

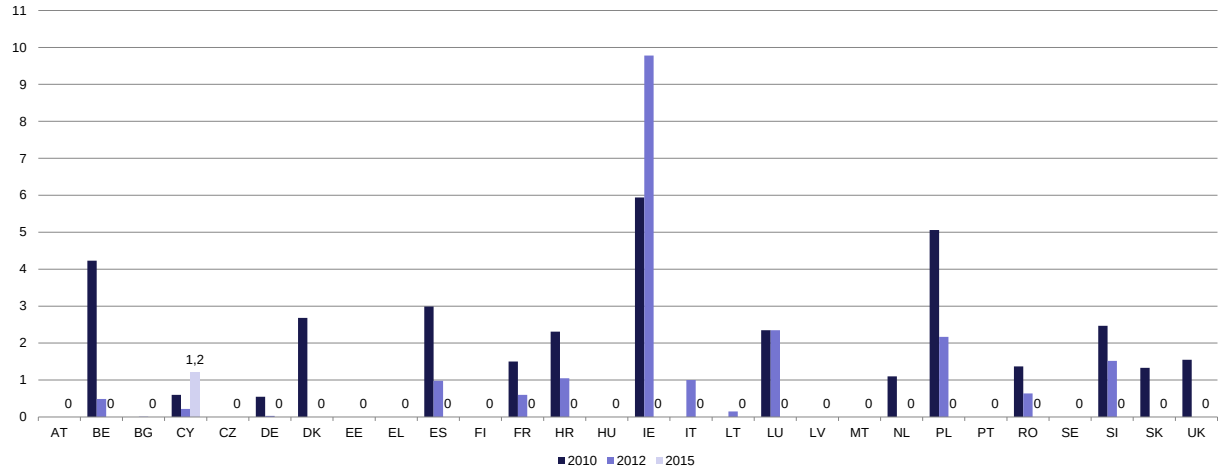
[18] The standard deviation evaluates the dispersion of a set of values within a group. It is calculated by taking the square root of the average of the squared deviations of the values from their average value. A standard deviation close to 0 indicates that the data points tend to be very close to the mean of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.

[19] This can be explained by the fact that 2013 corresponds to the period when most MS started implementing Pure LRIC with or without glide path and with rather high levels of MTR.

[20] The standard deviation has been calculated in absolute terms (see 6.2) rather than relative values since operators pay real Euros.

It is also important to note that, within each MS, differences in MTRs between mobile operators have significantly decreased and have now disappeared except in Cyprus (see figure below).

Figure 10 – Differences between highest MTRs and lowest MTRs in each MS in 2010, 2012 and 2015 (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

This analysis indicates that:

- **Even for the MS that have not followed the TRR, MTRs disparities (as measured by the standard deviation) have decreased significantly in Europe,**
- **Disparities have decreased at a much faster speed after the TRR and especially over the last 2 years,**
- **However, the level of MTR disparities in the MS that have not followed the TRR or that have followed it late is currently twice the one of countries that have implemented the TRR before the end of 2013,**
- **Within each MS, MTRs are now symmetric, except in Cyprus.**

3.1.3 Evolution of MTRs if the TRR had not been issued

Before the TRR, MTRs were already decreasing (see Figure 8). Therefore, it is likely that without the TRR, MTRs would have continued to decrease. In order to estimate the level of MTRs that would have been in place absent the TRR, two approaches can be used:

- **Use of past trends**: This is what would have happened if the past trends had continued. To conduct this scenario, the evolution of MTRs in each MS before the adoption of the pure LRIC methodology (2005-2008) in each country is assessed and rolled forward (applying the 2005-2008 CAGR to each year from 2009);
- **Evolution of MTRs in Europe if the BU-LRAIC+ methodology had been chosen**: Not all countries were following the BU-LRAIC+ approach before the recommendation but it is likely that many of them would have chosen this methodology since it was more and more considered as a best practice (and this is also the common

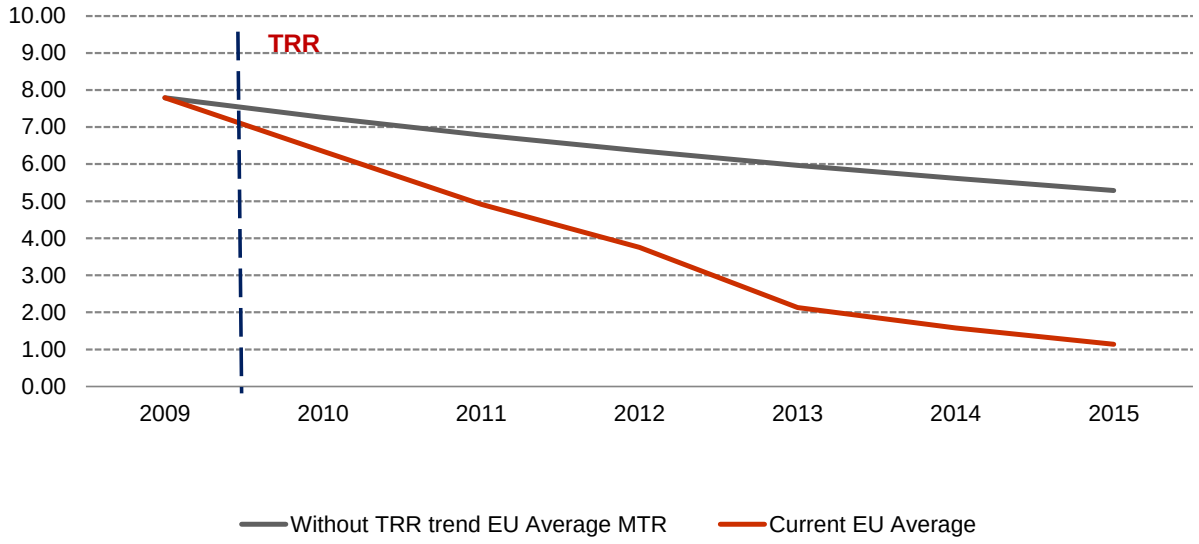
methodology used for many other regulatory products). Post 2009, BU-LRAIC+ MTRs are assessed for this scenario[21].

It is important to note that this assessment is obviously a conservative assessment since some NRAs would have been freer to diverge from these trends and assessments without the TRR.

Without the TRR, average MTRs in the EU would have been between 1EURct/min higher (+50%, with the BU-LRAIC+ methodology, see Figure 11) and 4EURcts/min higher (+200% with the past trend, see Figure 11) than MTRs that have applied with the TRR in 2013. In 2015, average MTRs in the EU would have been between 1EURct/min higher (+100%, with the BU-LRAIC+ methodology) and 4EURcts/min higher (+300% with the past trend, see Figure 11) than MTRs that have applied in reality[22]. It can be observed that the gap between the two curves steadily increases until 2013 (which corresponds to the end of the glide path for the Early Pure LRIC group of countries). Since 2013, the gap between the two curves is more stable in both assessments.

The fact that the BU-LRAIC+ methodology provides low MTRs is due to the increase of traffic over mobile networks. The BU-LRAIC+ methodology tends to drive lower unit costs (and therefore MTRs) as time elapses because common costs (not necessarily recovered with the pure LRIC approach) are spread over a greater amount of traffic. On the contrary, the pure LRIC methodology is less sensitive to increases in the volume of traffic carried by the network as it does not allow MTRs to recover fixed common network costs.

Figure 11 – Past trends - all groups MTRs trend (EURcts/min)

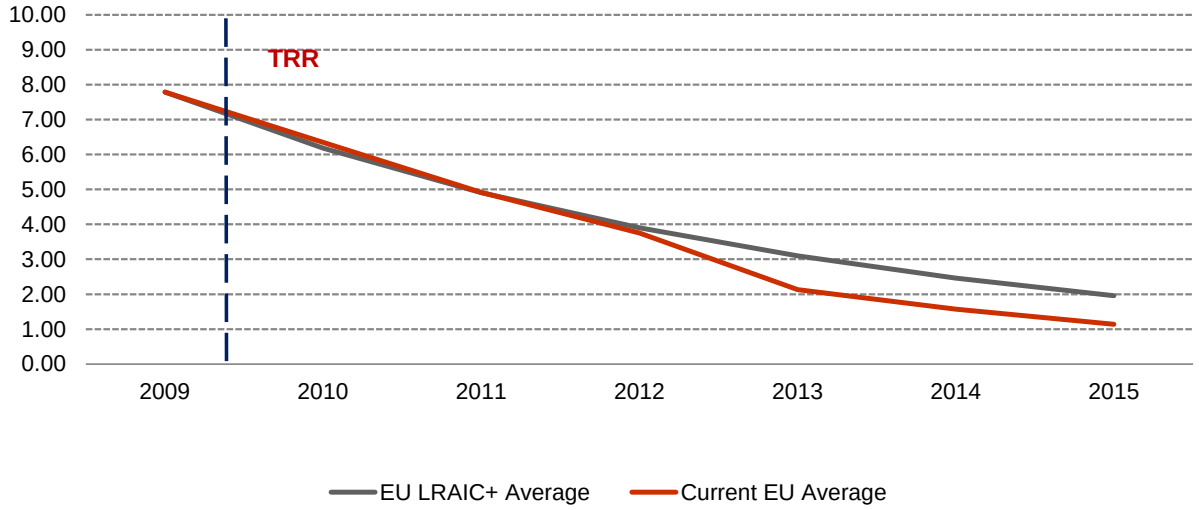


Source: TERA Consultants analysis, BEREC & EC reports

[21] In order to do so, the LRAIC+ outputs of their bottom-up models have been requested to all NRAs in the questionnaire sent by the EC. However, a very limited number of Regulatory Authorities provided this information. For the countries for which the information is available, the percentage of reduction between the 2009 MTR and the 2015 MTR target using LRAIC+ has been calculated. An average reduction has then been calculated for the three groups, and applied with a six years glide path from 2009 to 2015 to the post-2009 MTRs for all the Member States for which the information was not available. The information was provided by NRAs in Belgium, Denmark, Greece, Portugal and UK. NRAs in Germany and Netherlands are already using LRAIC+ to determine their MTR.

[22] In annex (see section 6.2), an analysis for each group of country is proposed.

Figure 12 - EU BU-LRAIC+ MTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

3.2 Fixed Termination Rates

First of all, the date of implementation of the TRR by EU Member States is reviewed (see section 3.2.1)), then further analysis on the levels and disparities of FTRs of the three groups are provided (see section 3.2.2). Finally, the level of FTRs that would have been observed absent the TRR is compared with the current level of FTRs (see sections 3.2.3).

It is to be noted that the focus is on Layer 1 FTRs.

3.2.1 Split of the countries within three groups

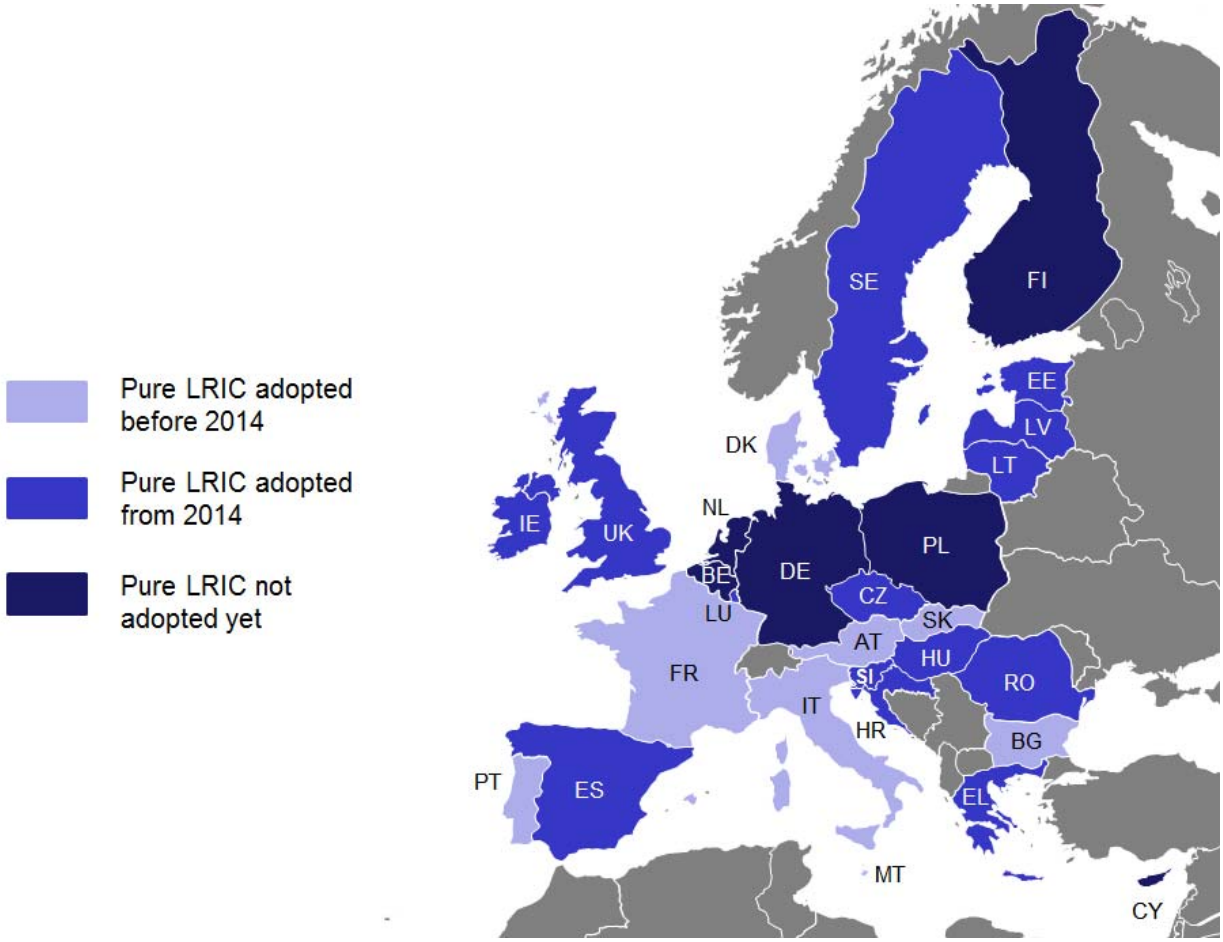
Like for MTRs, the 28 EU MS have been divided into three groups for FTRs. However, the date of implementation of the Pure LRIC approach for the FTRs is not the same as for MTRs. Ireland for instance has not yet implemented the Pure LRIC approach for MTRs[23], but did it for FTRs in July 2014. On the other hand, Poland, or Belgium have been using the Pure LRIC approach to set MTRs since 2013 but did not implement it for FTRs. Finally, some countries have adopted the pure LRIC approach earlier for MTRs than for FTRs, such as Spain, the UK or Italy. A small number of MS are using benchmark to evaluate their FTR[24].

At the end of 2015, some countries (6) had not yet implemented the TRR. Most of the countries (15) have implemented only recently the TRR (2014/2015). Some countries (7) have implemented the TRR before 2014

[23] When this report was written.

[24] In that particular case, the group is chosen on the basis of the level of FTRs: if the level is close enough to the Pure LRIC average by the end of 2013, the MS is attributed to the “Early Pure LRIC group”, if the FTR becomes close to Pure LRIC levels from 2014 the country is attributed to the Late Pure LRIC Group, and if the level of MTR is higher, it is then attributed to the “No Pure LRIC Group”.

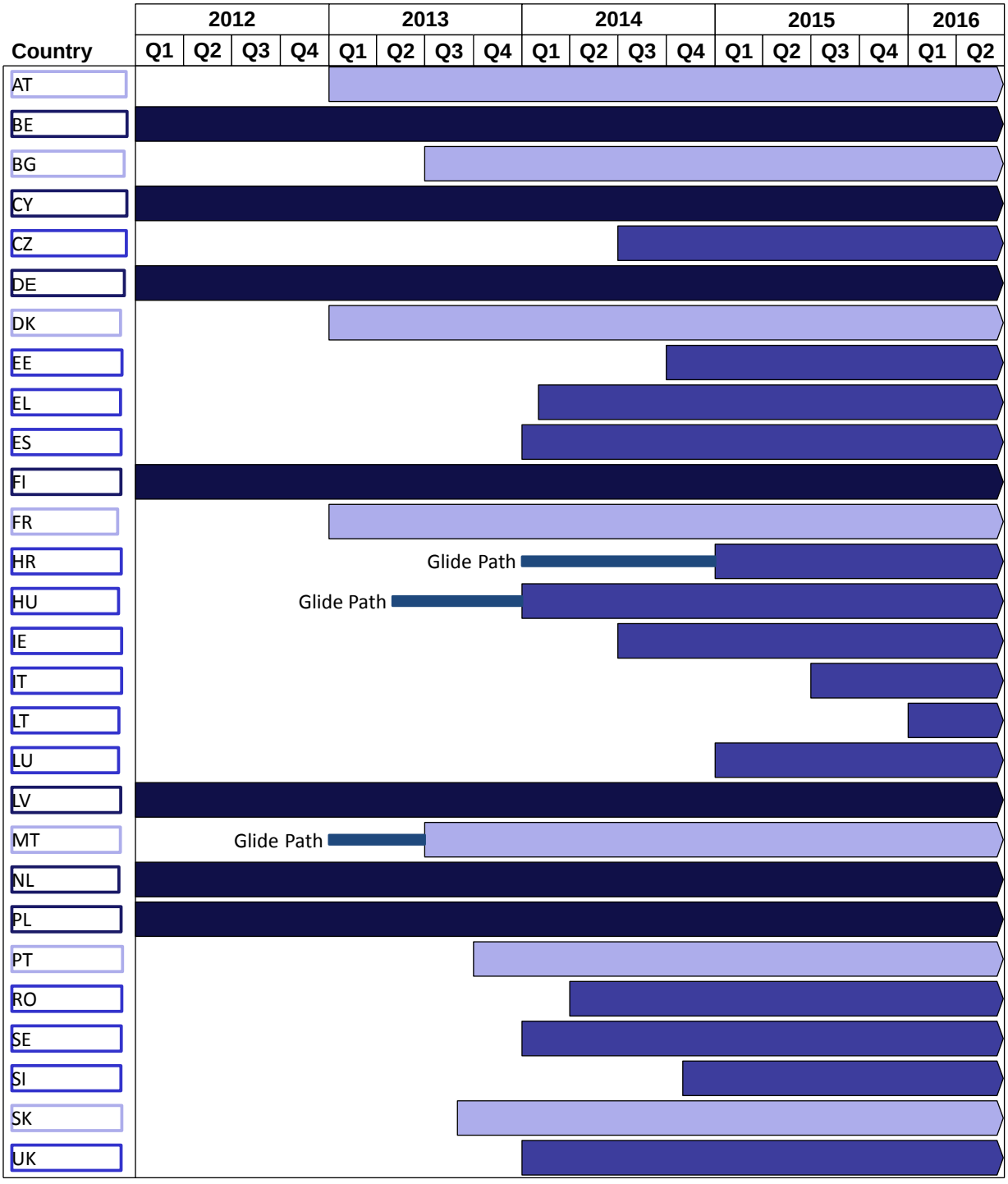
Figure 13 - Implementation of Pure LRIC in EU28 for FTR as at December 2015



Source: BEREC & NRAs Replies to questionnaire

Figure 14 summarizes the dates of implementation for all MS, with the potential glide path.

Figure 14 - Date of implementation of Pure LRIC in the EU28



Source: BEREC & NRAs Replies to questionnaire

The composition of the three groups is different as compared to the part of the study on MTRs (see §3.1), as shown in Figure 15. In particular, there are fewer MS in the Early Pure LRIC group.

Figure 15 - Groups and date of implementation of Pure LRIC (when the FTR is set on a Pure LRIC level i.e. the end of the glide path)

Early Pure LRIC Group	Late Pure LRIC Group	No Pure LRIC Group
Austria (November 2013)	Czech Republic (August 2014)	Belgium (TD)
Bulgaria (July 2013)	Croatia (January 2015)	Cyprus (TD)
Denmark (January 2013)	Estonia (October 2014)	Germany (BU LRAIC+)
France (January 2013)	Greece (February 2014)	Finland (FDC)
Malta (July 2013)	Hungary (January 2015)	Netherlands (BU LRAIC+)
Portugal (October 2013 Benchmark)	Ireland (July 2014)	Poland (TD FDC)
Slovakia (September 2013)	Italy (July 2015)	
	Latvia (benchmark July 2014)	
	Lithuania (January 2016)	
	Luxembourg (January 2015)	
	Romania (April 2014)	
	Slovenia (November 2014)	
	Spain (November 2014)	
	Sweden (January 2014)	
	United Kingdom (January 2014)	

Source: BEREC and NRAs replies to questionnaire

3.2.2 Evolution of FTR levels in the EU and disparities between countries

In order to compare the three groups previously defined, this part of the study follows the same methodology, using the same metrics as for MTRs (see section 3.1[25]).

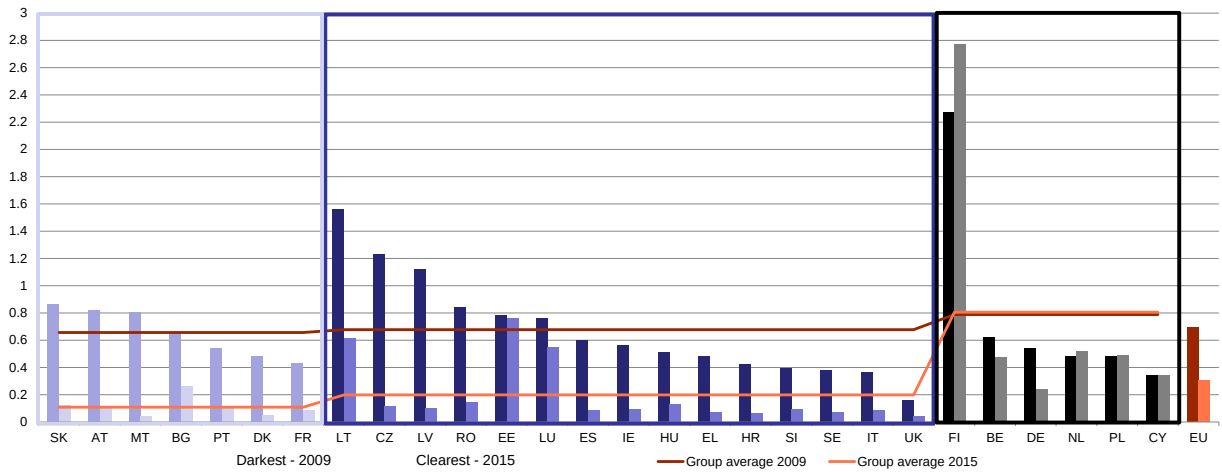
As for MTRs and as expected when the TRR was issued, FTRs have significantly decreased since 2009: FTRs decreased significantly in all MS that have implemented the TRR, from an average of 0.7 EURcts/min in 2009 to 0.3 EURcts/min in 2015 (see Figure 7), a 57% decrease. Latvia, Lithuania and the Czech Republic have experienced the highest decrease while the UK has experienced the smallest decrease. For countries which have implemented the TRR, FTRs are all lower or very close to 0.1 EURct/minute.

While the overall pattern is similar to the one observed for MTRs, there are however many differences with MTRs for countries which have not implemented the TRR: FTRs for the No

[25] The levels of FTR were taken from the BEREC reports and from the NRAs answers to the questionnaire. Weighted average FTR have been calculated by using the number of fixed lines in each country (source: Eurostat). Fixed incumbents' FTR have been used. When a "peak / off-peak" differentiation was made, the peak value has been used for this study.

Pure LRIC Group have only been slightly decreasing between 2009 and 2015 (-10%) and except Latvia and Germany, FTRs have been stable or increasing (Finland) for this group[26].

Figure 16 - Evolution of FTRs in EU28 between 2009 and 2015 (EURcts/min) – Light blue: Early Pure LRIC Group / Dark blue: Late Pure LRIC Group / Black: No Pure LRIC Group



Source: TERA Consultants analysis, BEREC & EC reports

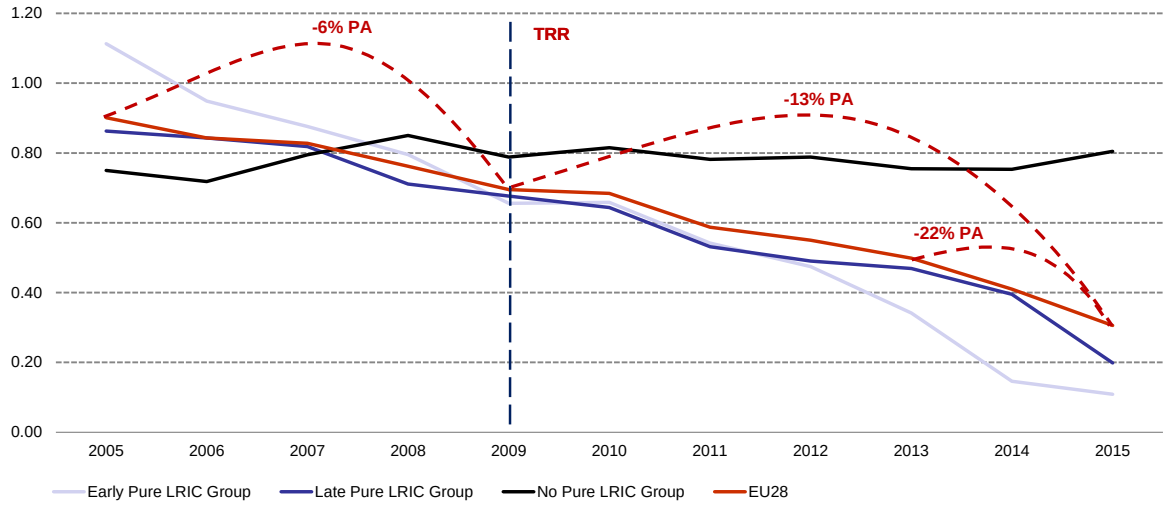
In both the Early Pure LRIC Group and the Late Pure LRIC Group, FTRs have been consistently declining between 2005 and 2013, and seem to converge towards 0.1EURcts/min in average (10 times lower than MTRs). The Late Pure LRIC group has now the same level of FTRs as the Early Pure LRIC group: the level of FTRs is 8 times lower than the level of the No Pure LRIC group.

While FTRs were experiencing a decreasing trend before 2009 (-6% per annum), this decreasing trend has accelerated after the TRR (-13% per annum) and even faster between 2013 and 2015 (-22%, i.e. 4 times faster than the pre TRR trend, see Figure 8). This is despite the fact that the No Pure LRIC Group has experienced a stable evolution of FTRs since 2011.

Since 2009 and the TRR, the gap has been widening between on the one hand the Early and Late Pure LRIC Groups' average FTRs and on the other hand the No Pure LRIC Group average FTR.

[26] See http://europa.eu/rapid/press-release_IP-13-1195_en.htm for more explanations of the context in Finland. FICORA had plans to deregulate the market for wholesale voice call termination on fixed networks.

Figure 17 - Flat average FTRs (EURcts/min)

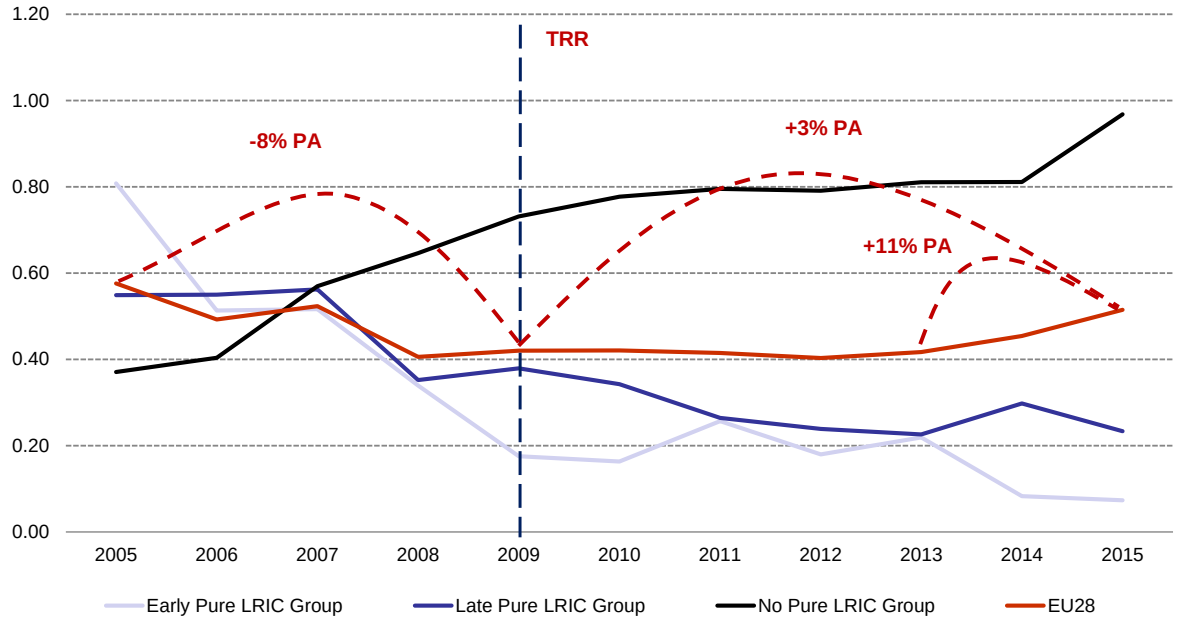


Source: TERA Consultants analysis, BEREC & EC reports

In annex (see section 6.4), the same analysis is provided where FTRs are weighted on the basis of the number of customers in each country of each group. The main difference which is observed is that the weighted average levels are circa half the flat averages FTR ones (Early Pure LRIC Group from 2005 to 2015, Late Pure LRIC Group in 2015, No Pure LRIC Group since 2013). This highlights the fact that high FTRs are common mostly in less-populated countries.

Contrary to MTRs, disparities in FTR levels across the EU (as measured by the standard deviation) have not reduced and have even slightly increased since 2009. This is mainly due to countries which have not implemented the TRR. Indeed, the standard deviation has almost been divided by 2 for the Early Pure LRIC Group and by 3 for the Late Pure LRIC Group (see Figure 18).

Figure 18 – FTR Standard deviation in the EU (EURcts/min) [27]



Source: TERA Consultants analysis, BEREC & EC reports

From this analysis, it can be concluded that:

- **Even for the MS that have not followed the TRR, FTRs have decreased in Europe,**
- **The speed of decrease is however much greater in Early Pure LRIC and Late Pure LRIC countries,**
- **Since 2009 the overall speed of decrease has been multiplied by 2 and by 4 in the last 2 years compared to the pre 2009 situation,**
- **There are still significant divergences between FTRs in Europe even if FTR levels are very homogeneous for the 20 countries which have implemented the TRR.**

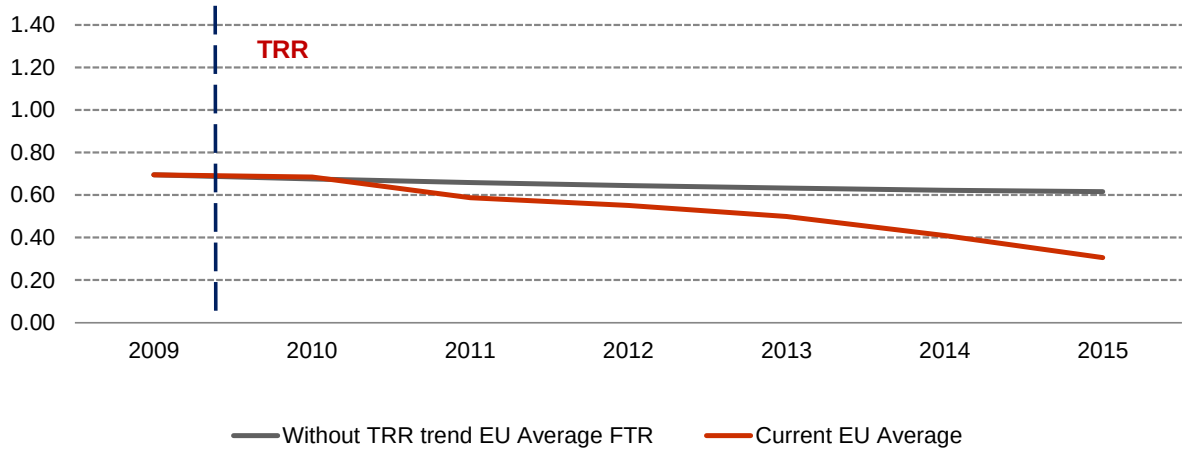
3.2.3 Evolution of FTRs if the TRR had not been issued

Using the same approach as in section 3.1.3, the study assesses what would have happened if the 2009 TRR had not been issued.

Without the TRR, average FTRs in the EU would have been 0.3EURct/min (+100%) higher than FTRs that have applied with the TRR in 2015 if the past trend had continued. In 2013, average FTRs would have been around 0.1 EURct/min (+20%). The gap between past trends and actual FTRs has therefore increased over the past few years (see Figure 19).

[27] The standard deviation has been calculated in absolute terms (see 6.2) rather than relative values since operators pay real Euros.

Figure 19 - EU FTR trend based on past trends and actuals EU FTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

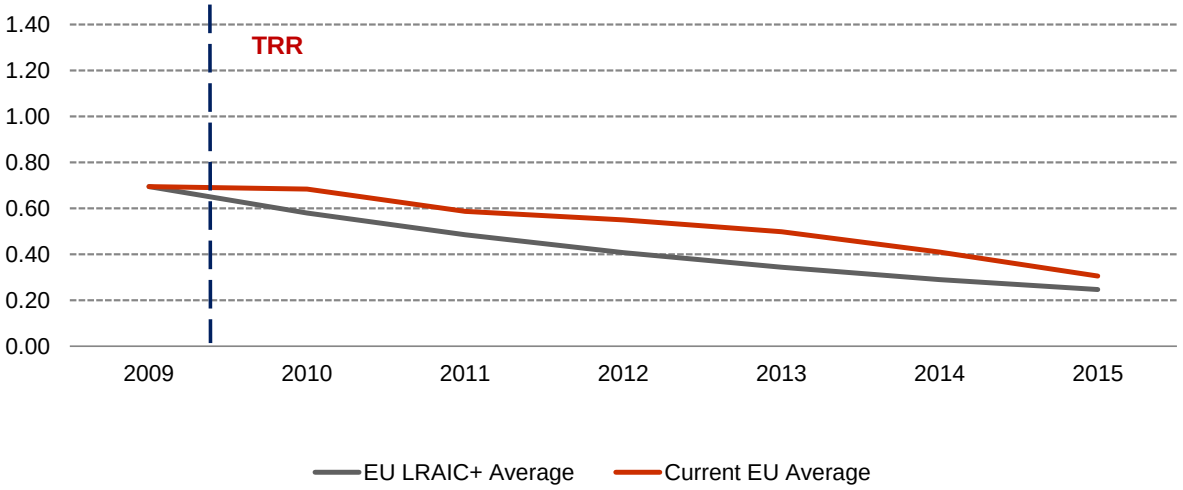
Several NRAs have not implemented the TRR and their FTRs are much greater than they would be if they had followed the TRR, leading to a high EU average (see annex, Figure 67 and Figure 68). It thus appears that if each country had applied the BU-LRAIC+ approach[1], FTRs would have been lower than they are currently when the TRR has not been implemented by all NRAs (see Figure 20)[2]. This is also due to the fact that the BU-LRAIC+ methodology provides relatively low FTRs compared to past values, although not as low as pure BU-LRIC. This is due to the increase of traffic over fixed networks, especially from broadband and leased lines services and due to the existence of significant fixed common costs in fixed networks[3].

[1] It is important to note that this assessment is obviously a conservative assessment since some NRAs would have been freer to diverge from these trends and assessments without the TRR.

[2] In order to do so, the BU-LRAIC+ outputs of their bottom-up models have been requested to all NRAs in the questionnaire sent by the EC. However, a limited number of Regulatory Authorities provided this information. For the countries for which the information is available, the percentage of reduction between the 2009 FTR and the 2015 FTR target using LRAIC+ has been calculated. The information was provided by NRAs in Lithuania, Portugal and the UK. NRAs in Germany and Netherlands are already using LRAIC+ to determine their FTR. An average reduction has then been calculated for the three groups, and applied with a six years glide path from 2009 to 2015 to the post-2009 FTRs for all the Member States for which the data is not available.

[3] As was noted in section 2.1.3, the BU-LRAIC+ methodology tends to drive lower unit costs (and therefore FTRs) as time elapses because common costs (not necessarily recovered with the pure LRIC approach) are spread over a greater amount of traffic. On the contrary, the pure LRIC methodology is less sensitive to increases in the volume of traffic carried by the network as it does not recover fixed common network costs.

Figure 20 - EU BU-LRAIC+ FTR against actual EU average FTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

In light of the fact that the current FTRs are still very high in some countries and higher than the BU-LRAIC+ values, it is very unlikely that, without the TRR, all NRAs would have aligned FTRs with BU-LRAIC+ values.

If past trends had continued, it is likely that FTRs would have been twice higher than they are today in the EU.

3.3 MTR/FTR differences

In this part, the study assesses the gap between the levels of MTRs and FTRs whose difference was supposed to decrease with the implementation of the TRR according to the 2009 IA:

> *"Third, a considerable gap in the methodologies and resulting levels of termination rates applied across fixed and mobile markets in the EU frequently results in considerably higher prices for fixed networks and their consumers than for mobile networks."*[28]

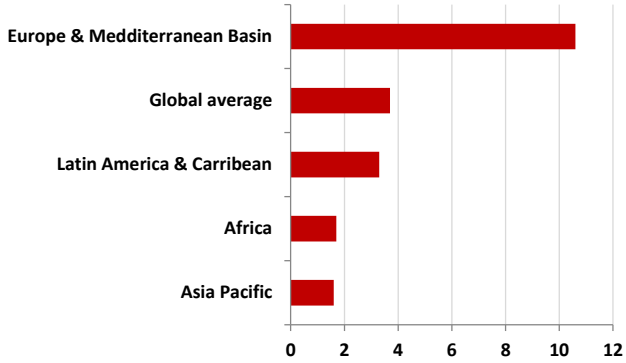
The 2009 IA also reported that MTR/FTR differences were significantly more important in Europe as compared to the rest of the world before the TRR:

> *"This disparity between fixed and mobile termination rates has traditionally been much more pronounced in the EU than has been the case in a number of other jurisdictions. The following 2006–2007 data gathered by the International Telecommunications Union demonstrates how the gap between fixed and mobile termination rates in the EU compares less favourably with that observed internationally."*[29]

[28] Page 11 of the IA.

[29] Page 11 of the IA.

Figure 21 - Comparison of the MTR/FTR ratio in several areas performed in the 2009 IA

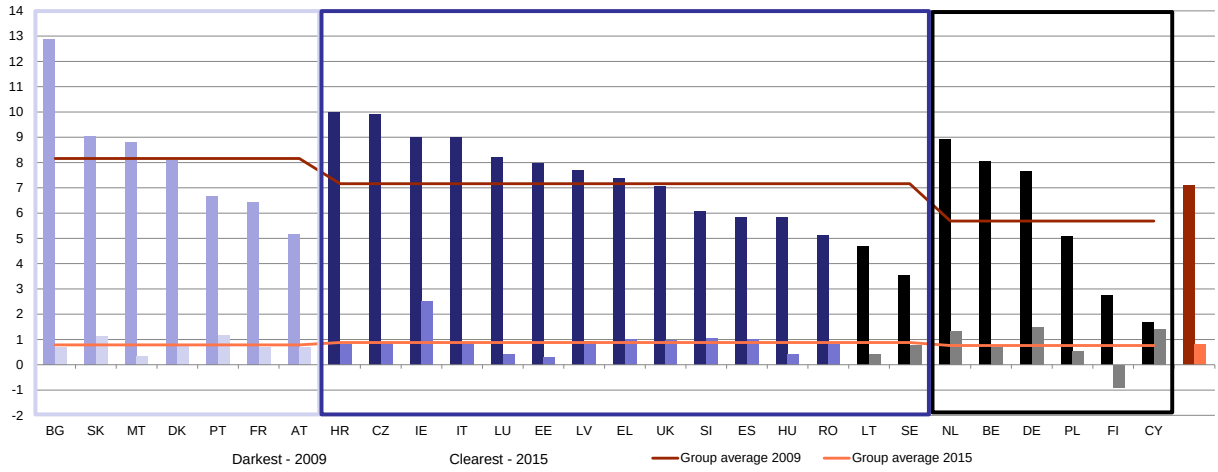


Source: Impact Assessment

Differences between FTRs and MTRs can be assessed in relative terms or in absolute value.

In absolute terms, the difference between MTRs and FTRs is mainly driven by the level of MTRs since MTRs are around 10 times greater than FTRs. This difference has therefore been significantly decreasing to around 1 EURct/min (the value of the MTR) while it was 7 times greater in 2009 (see Figure 22). There is no obvious difference between the different groups of countries. The TRR therefore enabled to reduce the asymmetric situation between fixed and mobile networks.

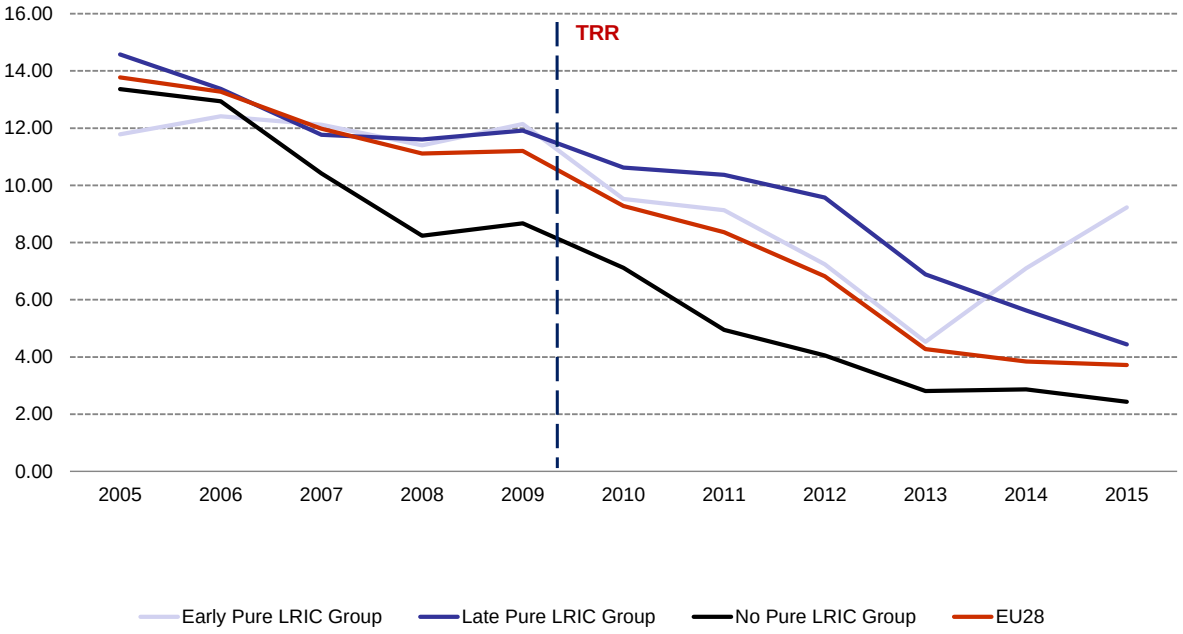
Figure 22 – Evolution of the MTR/FTR difference in 2009 and 2015 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

In relative terms, the MTR/FTR ratio has decreased significantly between 2009 and 2015: it was equal to 10 in 2009 and it is equal to 4 in 2015 (see Figure 23). The ratio is lower for the No Pure LRIC Group because countries have decreased their MTRs (less than the other but still a lot) while their FTR have remained stable. For the Early Pure LRIC Group, the ratio increased in 2014 and 2015 due to the decrease of FTRs in this group (while MTRs were already low and steady).

Figure 23 - Flat MTR/FTR ratio



NB: In annex (see section 6.6), the same analysis is provided where MTRs and FTRs are weighted on the basis of the number of customers in each country of each group. Conclusions are similar. The only noticeable difference is the fact that the ratio is much greater with weighted average MTRs and FTRs highlighting the fact that smaller countries have smaller gaps.

Source: TERA Consultants analysis, BEREC & EC reports

3.4 Conclusion

The review of the level of FTRs and MTRs between 2009 and 2015 in the EU indicates that:

- The TRR has not been implemented in all countries and among those that have implemented it, the date of implementation can vary significantly. The TRR has generally been more rapidly implemented for MTRs than for FTRs.
- MTRs have declined sharply in the EU since 2009 and at similar paces. After the TRR the speed of decrease was twice higher than before and same for FTRs. However the rate of decrease of FTRs has been twice lower than the rate of decrease of MTRs.
- MTRs have significantly decreased even in countries that have not implemented the TRR. For FTRs this is not the case since FTRs have remained stable in countries which have not implemented the TRR.
- The level of MTRs in the MSs that have not followed the TRR is currently twice the ones of other countries. For FTRs, the level in MSs that have not followed the TRR is currently eight times the ones of other countries.
- Even for the MSs that have not followed the TRR, MTRs disparities (as measured by the standard deviation) have decreased significantly in Europe. This is not the case for FTRs where significant differences are observed between countries mainly because of countries that have not yet implemented the TRR.
- MTRs disparities have decreased at a much faster speed after the TRR and especially over the last 2 years.

- However, the level of MTR disparities in the MSs that have not followed the TRR or that have followed it late is currently twice the one of countries that have implemented the TRR before the end of 2013.
- Within each MS, differences in MTRs between mobile operators have disappeared.
- Even if the TRR had not been implemented, MTRs and FTRs would probably have continued to decrease in Europe (for example because the increase in traffic supported by fixed and mobile networks reduces the unit cost of services).
- However, average MTRs in the EU would have been between 1EURct/min (+100%, with the BU-LRAIC+ methodology) and 4EURcts/min (+300% with the past trend) higher than MTRs that have applied in practice in 2015.
- If past trends had continued, it is likely that FTRs would have been twice higher than they are today in the EU. If all MS had followed a BU-LRAIC+ approach, it is likely that FTRs would have been close (but slightly greater) than current FTRs.
- The difference between MTRs and FTRs has been significantly decreasing to around 1 EURct/min (the value of the MTR) while it was 7 times greater in 2009. In relative terms, the MTR/FTR ratio has decreased from 10 in 2009 to 4 in 2015.

4 Market evolutions following the recommendation

In addition to the direct impact of the TRR on FTRs and MTRs across MSs observed in section 3, the TRR is likely to have had indirect impacts on both mobile and fixed markets in the EU. For example, one might have said that because of the lower FTRs and MTRs resulting from the TRR, operators' revenues may have reduced. Some also argued that the so called "waterbed effect" may lead to an increase in retail prices: lower MTRs or FTRs would be compensated by higher retail prices. The level of competition may have increased in the markets as well. Mobile and fixed markets in the EU may have been affected in several ways which can be measured by different metrics (see Figure 24). All these planned impacts when the TRR was issued need now to be verified.

In 2009 the Commission conducted a forward looking Impact Assessment (IA) of the TRR with several predictions about the evolutions of the fixed and mobile markets in Europe. In 2015, it is possible to observe whether these predictions have occurred or not.

Since 2009 and the issuance of the TRR publication, a number of factors have significantly affected the electronic communications markets: economic downturn as a result of the subprime crisis, deployment of 4G mobile networks, development of fibre networks, take up of smartphones penetration rates, increase of network sharing, development of wholesale offers, entry or exit of market players, etc. These factors make the assessment of the impact of the TRR on the different market metrics highly complex as the TRR is one factor among a number of others impacting market figures.

For these different reasons, one should be cautious when performing a review of the 2009 IA and analysing its results. In this section, the different trends observed may not be the direct result of the TRR but a combination of a number of other factors.

In order to perform the TRR impact assessment, a number of different approaches could be envisaged. These include (but not limited to):

- **Performing a statistical analysis**: a statistical relationship between the level of MTRs/FTRs and each metric could then be identified. Considering the limited number of data points available (28 countries within the EU assuming data is available everywhere) and the high number of potential factors influencing the metrics, this approach cannot be considered as robust from a statistical point of view and has not been followed.
- **Studying each country independently**: The analysis of each market metric could be performed independently for each European country and the impact of the TRR could be assessed at the national level. This approach has not been followed as it may be difficult in the end to identify general conclusions on the impact of the TRR at European level. However, a supplementary country-based analysis is performed in annex as a cross-check to ensure that the conclusions performed at the European level remain applicable at the local level.
- **Studying group of countries**: The different market metrics could be analysed for different groups of countries based on whether and when they implemented the TRR. This approach has been followed as it enables to derive conclusions at the European

level. The key point in the specific context of this study is that not all countries have implemented the TRR. While this is an issue in the context of the objective to harmonize practices at the EU level, the fact that some countries have not yet implemented the TRR is particularly interesting for the 2009 IA. This means that it is possible to compare how two countries – one having implemented the TRR and the other not – have seen their mobile and fixed electronic communications market evolve since 2009 (and especially since 2013 which the year where the first glide path ended).

As a consequence, the impact assessment is conducted for the 3 groups of countries identified earlier (Early Pure LRIC, Late Pure LRIC and No Pure LRIC). This is complemented by a country by country analysis in annex to assess the robustness of the analyses conducted at the group of countries level.

Analyses are generally conducted by comparing the current situation with the situation in 2009 (in the graphs below, the value in 2009 is set at 100, unless otherwise indicated).

This section first summarizes the forecasts of the Commission on several metrics (see section 4.1) and then provides an updated impact assessment by comparing the current scenario (with actual data) against the "without TRR" scenario (what would have happened without the TRR). The same approach is followed for the calculation of the consumers and producers' surpluses and social welfare: first the findings of the 2009 IA are reviewed (see section 4.2.1), and then an updated assessment is performed and presented (see section 4.2.2). Finally in section 4.3 a more qualitative assessment of additional costs and benefits from the TRR since its adoption in 2009 is proposed.

4.1 Updated Impact Assessment - market metrics

The 2009 IA performed by the EC relied on two scenarios for MTRs reductions by 2011:

- The so called *"baseline scenario"* is based on a rate of reduction of 40%. When it was performed, this scenario was in line with BEREC statements: the reduction in MTRs would be similar to the one experienced in the 4 years preceding 2007 as a result of regulatory interventions;
- The so called *"recommended scenario"* is based on a MTRs rate of reduction of 70%. Indeed in 2009, the EC was expecting that the adoption of Pure LRIC would result in a decrease by 70% of rates (rates have decreased on average by 87% between 2009 and 2015 as observed in section 3.1.2).

According to the 2009 IA, the TRR was expected to be the cause of an increase of efficient investments, but also a decrease in wholesale revenues. It was overall foreseen that the TRR would enhance the competition and make the retail prices decline for consumers as it is indicated in Figure 24:

Figure 24 - 2009 Impact Assessment findings - mobile and fixed markets

Expected impact by stakeholder	Baseline scenario (without TRR)	Recommended (with TRR)
Change in mobile revenues (in billion euros)	-52	-98
Increase of effective investments	No quantitative analysis performed	No quantitative analysis performed
Decrease of mobile retail prices	-11.3%	-19.4%
Increase in mobile traffic	6%	10.9%
Increase of competition in mobile market	No quantitative analysis performed	No quantitative analysis performed
Decrease of EBIT/EBITDA	No quantitative analysis performed	-7%
Change in fixed revenues (in billion euros)	0	-1
Increase in fixed traffic	0.1%	0.1%

Source: EC 2009 Impact Assessment

4.1.1 Mobile Impact Assessment: former and updated findings on market metrics

For the mobile markets, the impact of the TRR is analysed for revenues, investments, EBITDA, penetration rate (in terms of number of subscribers and in terms of number of SIM), retail prices, HHI, share of prepaid customers and traffic (see Table 1).

Table 1 - Metrics definition[30]

Metrics	Sources	Definition/Assumptions
Revenues	GSMA	Revenues from mobile sector in million €
Investments	GSMA	Investments from mobile sector in million €
EBITDA	Buddecom reports	Earnings before Interest, Taxes, Depreciation, and Amortization of operators
#SIM Penetration rate	BEREC	The penetration rate in terms of number of SIM cards
#Unique subscribers penetration rate	GSMA	The penetration rate in terms of unique subscribers
Retail Prices	NRAs answers to questionnaire	The price of a minute of call
HHI	TERA from GSMA	The Herfindahl Hirschman Index, measure of the amount of concentration in the mobile market of a country
Prepaid/Postpaid rate	BEREC progress reports	The share of postpaid/prepaid among the mobile subscriptions
Traffics	NRAs answers to questionnaire	The number of minutes of call per year

Source: TERA Consultants analysis

Revenues

The 2009 IA foresaw a 98 billion of euros decrease in mobile revenues at the EU level between 2007 and 2012 if the TRR was implemented and only 52 billion of euros without the TRR. Between 2007 (or 2009) and 2015, revenues have fallen by 35 billion of euros when the IA foresaw a fall by 98 billion by 2012.

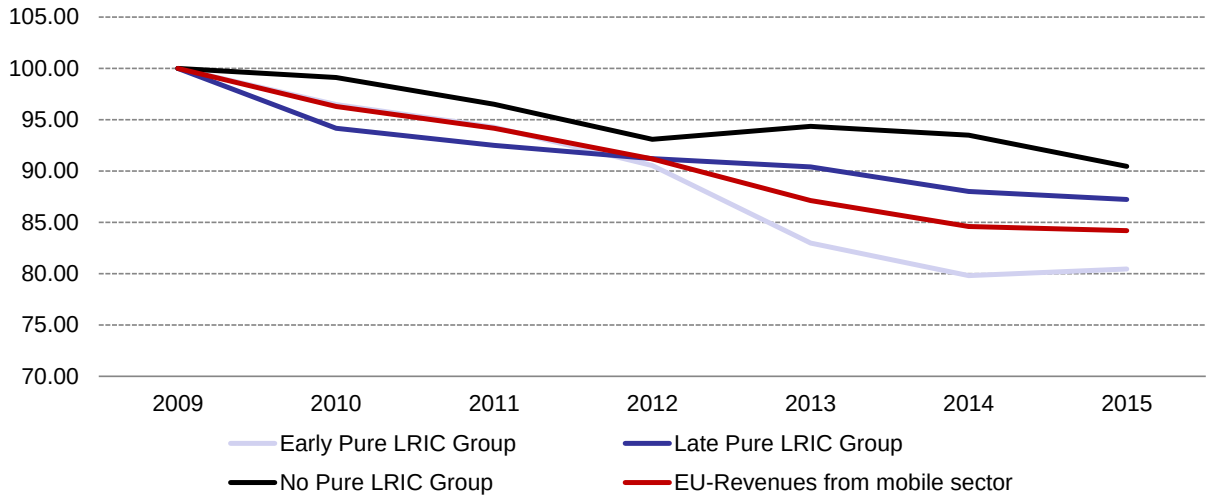
The forecasts of the 2009 IA were therefore correct about the decline of revenues. In practice, between 2009 and 2015, the revenues of all groups have declined (see Figure 25).

It is interesting to note that countries which have implemented the TRR earlier have seen their revenues decreasing faster than countries which have implemented the TRR later and themselves have seen their revenues decreasing faster than countries which have not implemented the TRR. This is consistent with the overall expectation that revenues would decrease more with the TRR because termination revenues would be much smaller. However,

[30] See annex, section 5.1 for more details about the sources.

this analysis at the group level hides important divergences within each group (see annex, section 8.29)[31].

Figure 25 - Revenues from the mobile market (base 100 in 2009)[32]



Source: TERA analysis & GSMA Intelligence

Investments

The 2009 IA foresaw that the TRR would enhance efficient investments in the mobile market. It can be observed (see Figure 26) that investments after 2009 have been increasing for all groups until 2013, especially for the Early Pure LRIC Group, whereas investments were pretty stable before the TRR was issued. However, investments have shrunk since 2013 for the Early Pure LRIC Group, and since 2014 for the Late Pure LRIC Group, while the 2009 IA forecasted an increase of investments after the implementation of the TRR.

The evolution of investments has in practice been higher for countries which have implemented the TRR early. Overall, the level of investment has been declining more since 2009 in the No Pure LRIC group but the difference between the 3 groups is low in 2015. These observations would therefore tend to support the initial 2009 IA. In 2009, the total investments of EU countries were at 13.924 billion of euros, and in 2014 at 17.337 billion of euros. However, this analysis at the group level hides important divergences within each group (see annex, section 8.29)[33].

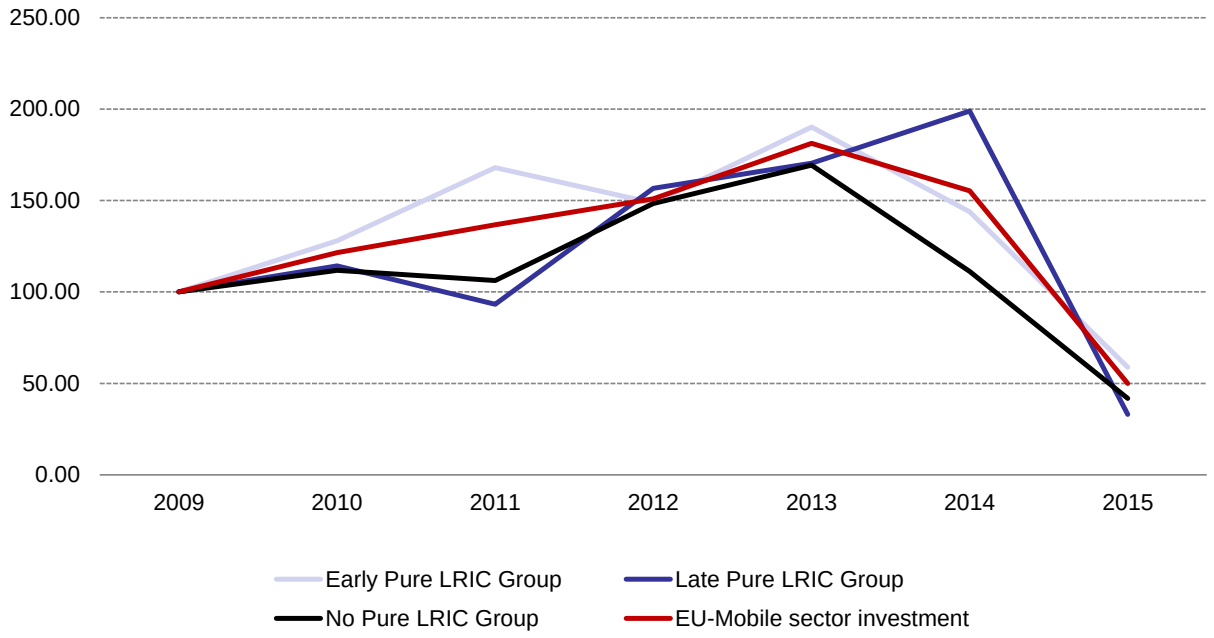
In any case, one could not conclude that the TRR has had a negative impact on investment levels, otherwise the "No Pure LRIC Group" would show great performances in terms of investment in the mobile sector.

[31] NB: it is to be noted that countries that have been the most significantly impacted by the 2009 financial crisis are present in each group: Spain, Italy and Portugal in the Early Pure LRIC Group, Croatia and Greece in the Late Pure LRIC Group, Cyprus and Ireland in the No Pure LRIC Group (source: TERA Consultants based on Eurostat data).

[32] Conclusions would remain the same if the base year is 2012.

[33] An analysis has been conducted to compare whether investments in 4G had been stronger in some group of countries compared to other but no apparent conclusion could be drawn.

Figure 26 - Investments in the mobile market (base 100 in 2009)[34]



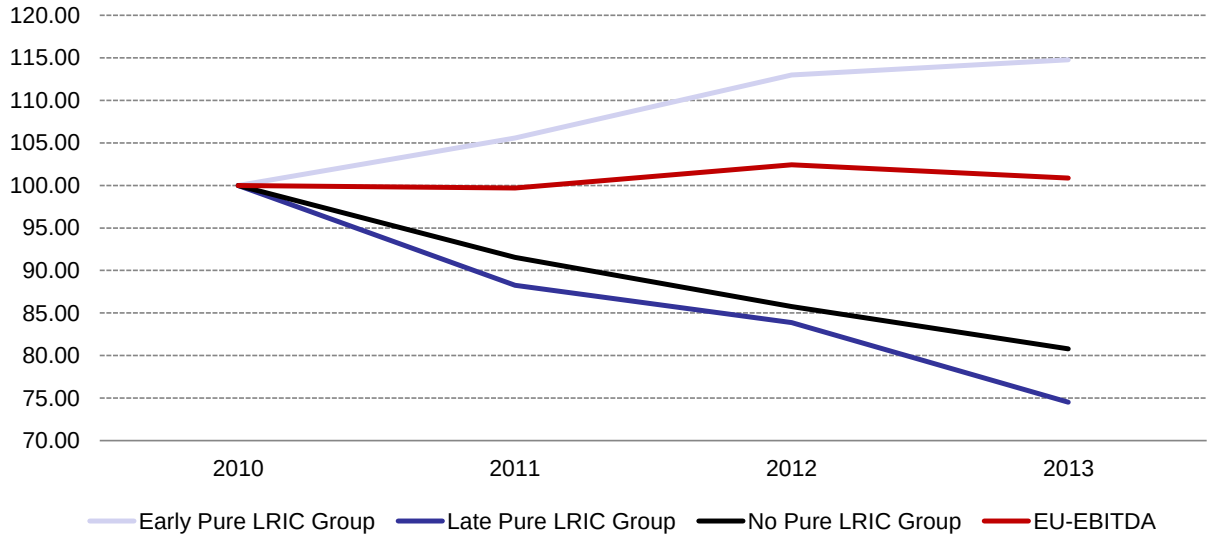
Source: TERA analysis & GSMA

EBITDA

According to the 2009 IA, both the EBIT and the EBITDA of European mobile operators were supposed to decline after the implementation of the TRR. The EBITA of mobile operators declined for the Late and No Pure LRIC Groups while the EBITDA of the Early Pure LRIC Group has been increasing between 2010 and 2013 (see Figure 27). The EBITDA of the Early Pure LRIC Group also remained higher than the other groups since 2010 which could tend to indicate that the expectations of the TRR were not correct.

[34] Conclusions would remain the same if the base year is 2012.

Figure 27 - EBITDA of mobile market (base 100 in 2009)[35]



Source: TERA analysis & Buddecom reports

HHI/ Level of concentration

One of the key implications of the TRR described in the 2009 IA was the increase in the level of competition in the mobile market in Europe with the decline of the biggest operators' advantage due to reduced on-net/off-net price differentials vis-à-vis smaller operators.

The level of concentration, as measured by the HHI[36], can provide indications on the level of competition. The level of concentration was already decreasing before 2009, but this decrease speeded-up for the Late and No Pure LRIC Groups after 2009 while the level of concentration of the Early Pure LRIC Group remained stable until 2010 and then started decreasing (see Figure 28 which displays the HHI – a decreasing HHI means an increasing level of competition).

In 2013, the HHI of the Early and Late Pure LRIC groups fell below the HHI of the No Pure LRIC Group. 2013 is also the beginning of implementation of the Pure LRIC in the two former groups. The surge of the No Pure LRIC Group's HHI is a consequence of two important mergers in Ireland between O2 and Three[37] and in Germany between O2 and E-Plus[38]. Without these two countries, the HHI would be lower than the Early Pure LRIC Group HHI (but this group also experienced some mergers in the past[39]). One could argue that the lack of implementation of the TRR in the No Pure LRIC Group has made small operators more fragile which have then been acquired by larger operators.

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[35] Conclusions would remain the same if the base year is 2012.

[36] The HHI is the Herfindahl Hirschman Index, calculated with market shares available in the EC reports, which evaluates the amount of concentration in the market of a given country. This index corresponds to the sum of the squared market shares of all operators. Therefore, the greatst value the index can reach is 1, and stands for a unique operator present in a given country. The smaller values of HHI then correspond to the greater competition.

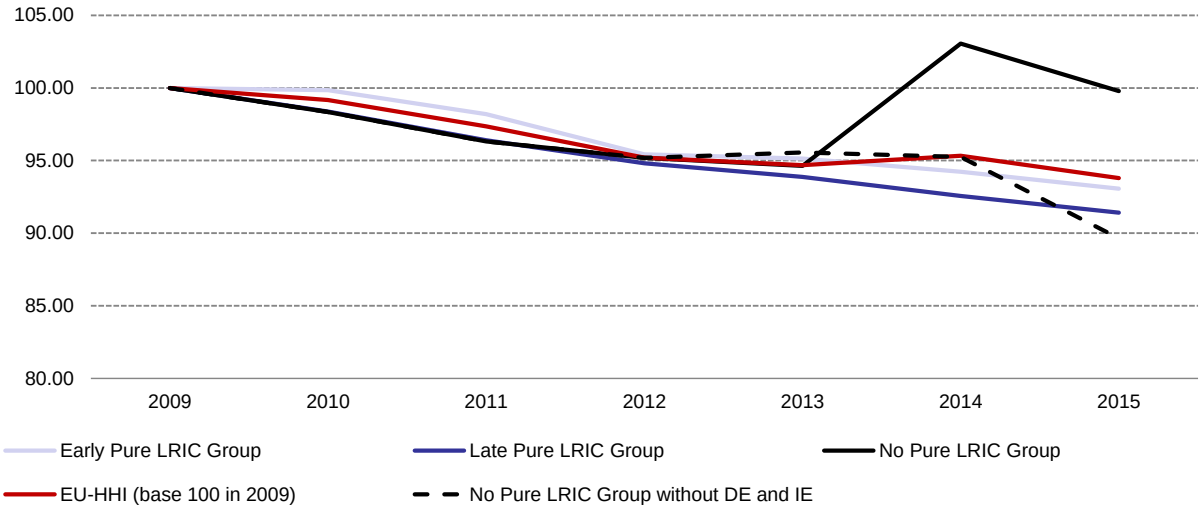
[37] *Source: http://www.irishtimes.com/business/technology/o2-becomes-three-as-rebrand-gets-underway-1.2126057*

[38] *Source: https://www.telefonica.de/fixed/news/5631/telefonica-deutschland-completes-acquisition-of-e-plus-group.html*

[39] Since 2013, the only merger that occured was in Austria, and does not have a great impact on the global HHI of the Early Pure LRIC Group which includes way more MS than the No Pure LRIC Group.

In any case, it also clear that MTRs fell significantly in all countries (including those which did not implement the TRR, see section 3.1.2) and therefore the fact that market concentration decreased a lot in all countries except those that experienced mergers is likely to be linked to MTRs decreases.

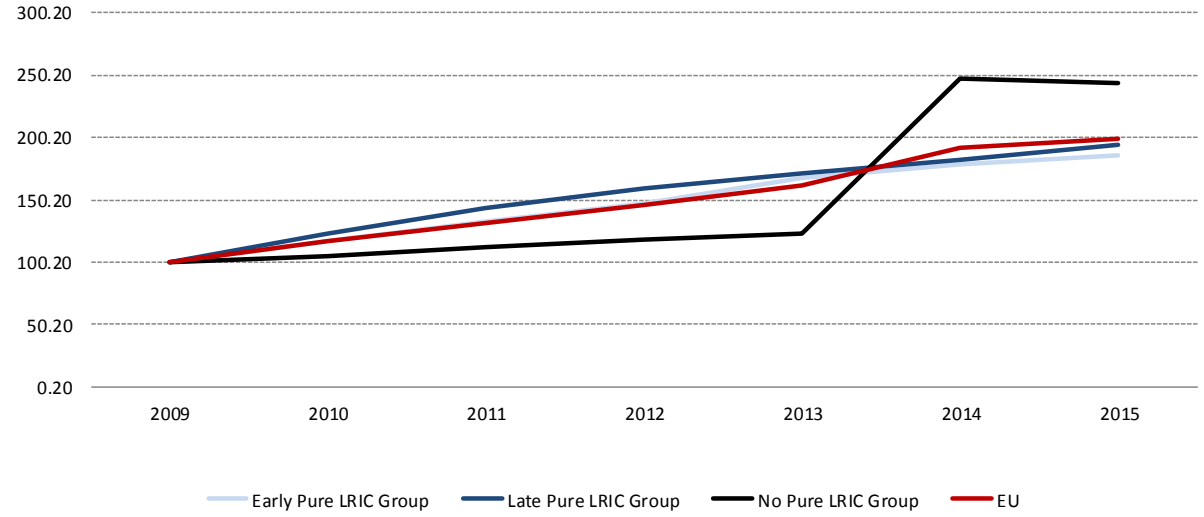
Figure 28 - Herfindahl Hirschman Index (base 100 in 2009)[40]



Source: TERA analysis & EC Reports

Figure 29 shows the evolution of the market share of the smallest operator of each country in 2005. It can be observed that the market shares of these operators have been constantly increasing since 2010 for all groups, showing the increasing competition since the TRR was issued.[41]

Figure 29 – Trend of smaller operators' market shares (base 100 in 2009)



Source: TERA analysis & EC Reports

[40] Conclusions would remain the same if the base year is 2012.

[41] The sudden growth of the No Pure LRIC Group is related to the two mergers that occured in Germany and Ireland in 2013 described previously.

Penetration rate

With respect to the evolution of the penetration rate, the penetration rate in terms of number of SIM cards and the penetration rate in terms of unique subscribers can be considered. The latter should better reflect the true penetration rate.

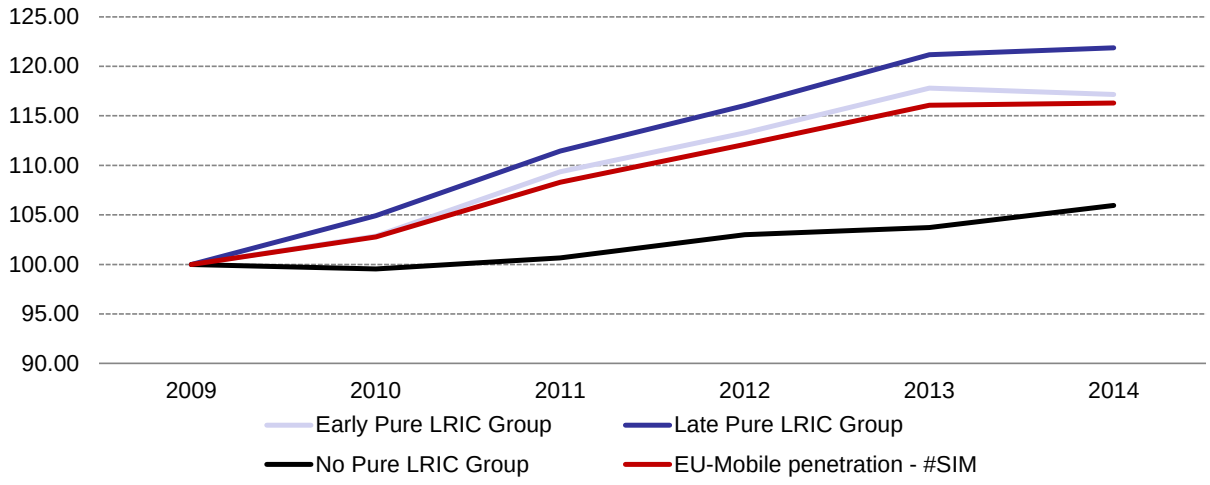
The 2009 IA compared the European situation to the US mobile market where lower termination rates generated an increase in the penetration rates, although some analysis attributed the growth to the attractiveness of innovative service models, especially prepaid options.

Be it in terms of the number of SIM or in terms of the number of unique subscribers, the penetration rate increased more in countries that implemented the pure LRIC lately compared to the countries that implemented the pure LRIC early and the penetration rate increased more for the countries that implemented the pure LRIC early compared to the countries which did not implement the TRR (see Figure 30 and Figure 31). The gap between countries which implemented the pure LRIC early and countries which did not implement the TRR is however very small in terms of unique subscribers. The higher increase of the penetration rate for the countries that implemented the TRR late is probably mainly due to the fact that these countries had lower penetration rates in 2009 than other countries.

In 2009, the penetration rate in terms of SIM cards for the EU28 was 122%, and it grew to 140% in 2014.

Since the penetration rate of the two groups that implemented the Pure LRIC has been growing faster than the No Pure LRIC Group, the forecasts of the 2009 IA seem to be right about the increase of penetration rate allowed by the TRR.

Figure 30 - Penetration rate in terms of SIM cards (base 100 in 2009)[42]



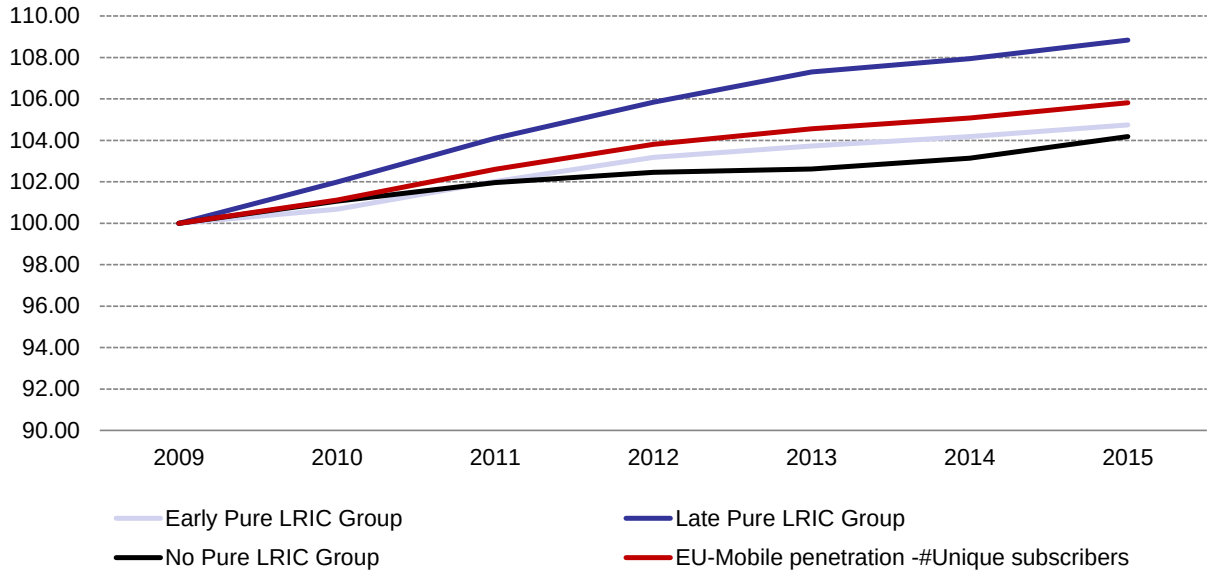
Source: TERA analysis & EC reports

It is however interesting to observe that the situation of the three groups is very different when the number of SIM or the number of subscribers is considered for the penetration rate. In 2009, the average penetration rate in terms of unique subscribers was 73.4%, and grew to

[42] Conclusions would remain the same if the base year is 2012.

77.5% in 2015. This shows that each group has experienced different variations of the ratio of SIM per subscriber.

Figure 31 - Penetration rate in terms of unique subscribers (base 100 in 2009)[43]



Source: TERA analysis & GSMA Intelligence

It is to be noted that countries within each group have homogeneous situations (see annex, section 8.29)[44]. In any case, one could not conclude that the TRR has had a negative impact on mobile penetration and the opposite is much more likely to be true.

Traffic

The 2009 IA foresaw an increase of the mobile traffic for 2011 of 11% with the implementation of the TRR, and 6% without the implementation. The actual evolution of mobile traffic (in terms of number of minutes of calls) can be observed and compared with the forecasts of the 2009 IA[45].

A constant increase can be observed for all groups since 2009 (see Figure 32). The Late Pure LRIC Group has had the strongest increase of the three groups between 2009 and 2014 (+45%), the No Pure LRIC Group has had the weakest (+12%) and the Early Pure LRIC Group has been close to the EU average (+35%). However, the traffic growth for the three groups has been smaller than before 2009. On the other hand, compared to the 2009 IA forecasts (+6% with the Baseline Scenario and +10% under the Recommended Approach between 2009 and 2011), the mobile traffic in Europe has grown faster (+15% between 2009

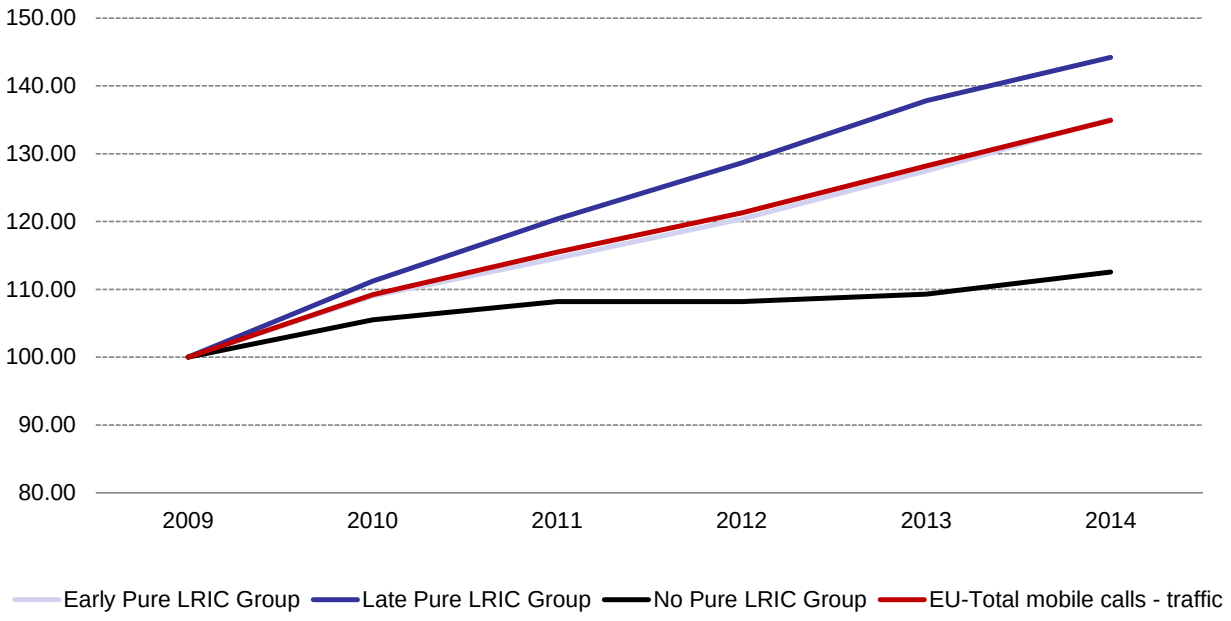
[43] Conclusions would remain the same if the base year is 2012.

[44] An analysis has been conducted to compare whether investments in 4G had been stronger in some group of countries compared to other but no apparent conclusion could be drawn.

[45] Mobile traffic is measured in terms of minutes of mobile call per year provided by the NRAs answering our questionnaire sent by the European Commission.

and 2015 at a European level). It is also clear that it was correct to assume that the traffic would grow faster with the implementation of the TRR since countries which implemented it have experienced a greater increase than those which did not implement the TRR.

Figure 32 - All mobile calls – traffic (base 100 in 2009)[46]



Source: TERA analysis & NRAs replies to questionnaire

Retail prices

Retail prices cannot be observed at a disaggregated level because of the lack of information with respect to retail prices[47].

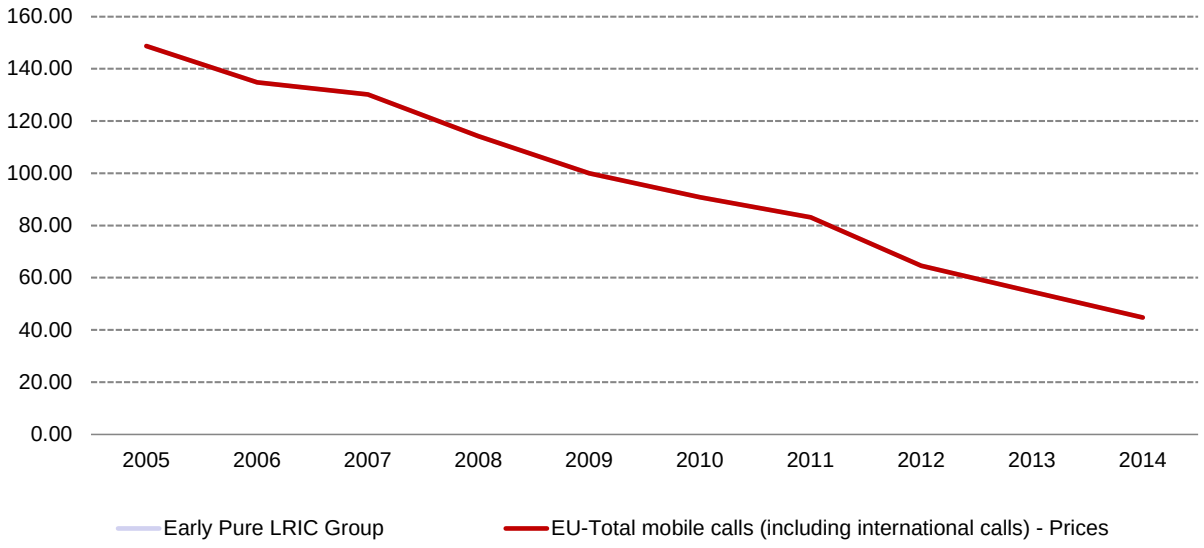
Retail prices were expected to decline by 11% with the baseline scenario, or 19% with the recommended approach between 2009 and 2012 according to the 2009 IA. A 16% yearly decline actually occurred during this period leading to a 71% decline between 2009 and 2015 (see Figure 33).

Given the fact that the data concerning retail prices were only provided by countries from the Early Pure LRIC Group, it can be said that the forecasts of the 2009 IA about the Recommended Approach were correct. In particular, an increase in retail prices (or even lower decrease in retail prices compared to past trends) cannot be observed which means that the waterbed effect did not happen.

[46] Conclusions would remain the same if the base year is 2012.

[47] Since very few NRAs answer that part of the questionnaire, prices can only be observed on a European level, instead of the groups approach followed by the study.

Figure 33 - Prices of all mobile calls (base 100 in 2009)



Source: TERA analysis & NRAs replies to questionnaire

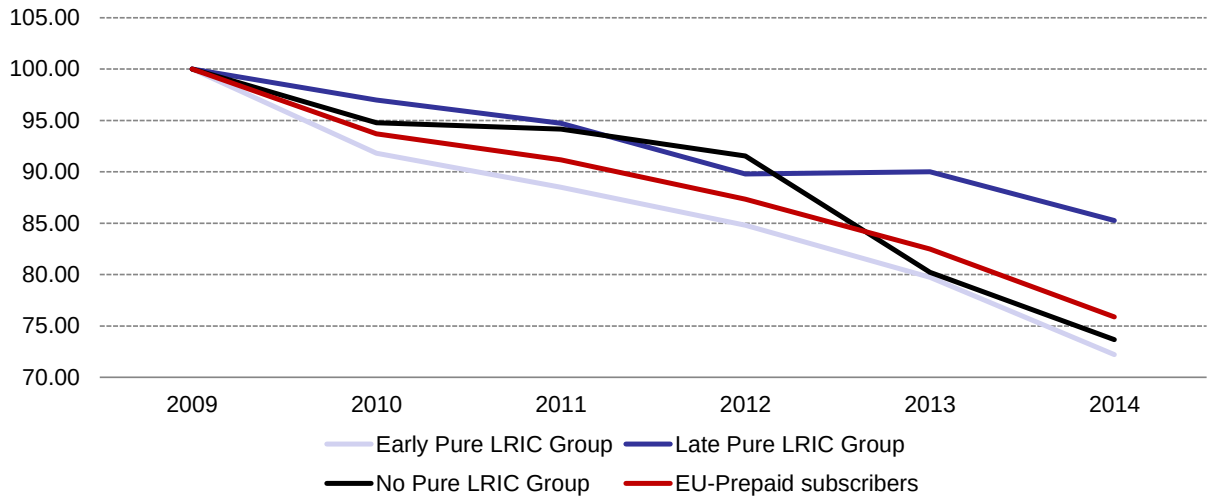
The decrease in retail prices associated with the decrease in revenues observed in Figure 25 contradicts the theory of the waterbed effect. If the waterbed effect had occurred, retail prices and/or revenues would have remained stable or increased.

Share of prepaid customers

The share of prepaid customers, observed in Figure 34 conceals wide differences among the countries of the EU. However, overall, all countries experienced a significant decrease in the share of prepaid customers. The 2009 IA foresaw that the TRR would reduce those differences with a decline of the prepaid subscriptions based on several analyses. In 2009, the share of prepaid customers in the EU28 was 50%, and declined to 39% in 2014.

Before the TRR, the decrease in the share of prepaid customers was however higher than it has been since the TRR. Countries which implemented the pure LRIC approach early faced the greater decrease in the share of prepaid customers. However, when considered since 2012, the no Pure LRIC group experienced the highest decrease.

Figure 34 - Prepaid rate in terms of subscribers (base 100 in 2009)



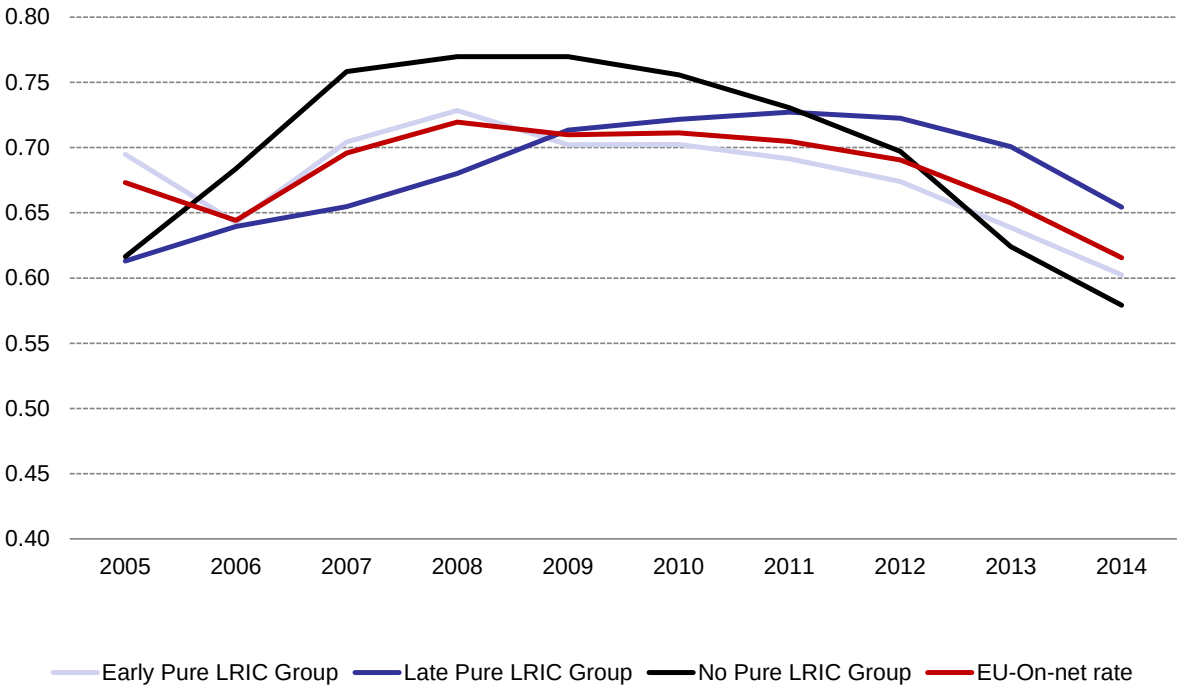
Source: TERA analysis & EC Reports

Share of on-net calls

The share of on-net calls has been dropping in all countries with the decrease of MTRs (see Figure 35). The decrease has been slower for countries that implemented the TRR late.

Before 2009, the on-net calls rate was increasing in Europe due to the lack of flat calls offers without on-net/off-net differentiation. With the emergence of innovative offers from the operators, the share of on-net calls rate has been decreasing for all groups since 2009 with the lowest level for the Early and No Pure LRIC Groups. Overall it can be noticed that the share on-net calls has been decreasing on the European level especially since 2012, approximately when the MS started implementing the TRR.

Figure 35 – On-net calls rate (%)



Source: TERA analysis & NRAs replies to questionnaire

Development of new offers

In the 2009 IA, the decrease of the level of MTRs was also supposed to ease the appearance of new retail offers:

> *"Reducing termination rates to the incremental cost of providing this service should therefore provide operators with greater scope for offering various flat-rate packages as a lower wholesale cost will reduce their exposure in the event of a significant increase in usage at the retail level."*[48]

In the context of this study, NRAs have been asked whether they observed changes in the retail mobile offers, in terms of flat rate or all-net offers, and whether it could be imputed to the TRR. Figure 36 summarizes those answers on two specific features of mobile offers in Europe: on-net/off-net price differentiation and flat rate offers[49] before and after the TRR was issued.

Before the TRR, according to NRAs, a differentiation between on-net and off-net calls was present in all countries. Since the TRR was issued, the differentiation has been lowered in all countries, and even disappeared in some MS: more than half of NRAs report that these offers disappeared. About the existence and appearance of flat rate offers before and after the TRR, it is commonly accepted that the number of flat rate offers has been increasing since the TRR, although they already existed in many countries before 2009: they are present in every country today while they were only available in a small number of MS before the TRR was issued.

[48] Impact Assessment.

[49] Offers with a flat rate, whatever the usage.

Because these offers (with less on-net/off-net price differentiation or with flat rates) appeared before the TRR and are present in countries which have not implemented the TRR, these developments cannot be fully attributed to the TRR. However, it is obvious that low MTRs have helped a lot in these offers to be possible. Most MS considered lowering MTRs as a key factor for these evolutions of the market, such as NRAs of Poland, Portugal, Romania, Austria or Belgium[50].

Figure 36 - Evolution of retail offers in mobile markets (NRAs having answered the questionnaire only)

Country	On-net/Off-net differentiation before TRR	On-net/Off-net differentiation after TRR	Flat rate offers before TRR	Flat rate offers after TRR
Austria	Yes	No	No	Yes
Bulgaria	Yes	No		
Czech Republic		Yes	No	Yes
Germany	Yes	No	A few	Yes
Denmark			No	Yes
Greece	Yes	Decreasing	A few	Increasing
Spain	Yes	No	A few	Yes
Finland	Yes	Decreasing	Yes	Increasing
France	Yes	No	A few	Increasing
Croatia	Yes	No		
Hungary	Yes	No	No	Yes
Italy	Yes	No		
Lithuania			Yes	Increasing
Luxembourg	Yes	Yes, but decreasing	Yes	Yes, increasing
Latvia	Yes	No	No	Yes
Netherlands			No	Yes
Poland			No	Yes
Portugal	Yes	Decreasing		Yes
Romania	Yes	Decreasing		Yes, increasing
Slovakia	Yes	Yes, but decreasing		
Share of countries[51]	100% Yes	56% No	14% Yes	100% Yes

[50] See annex, section 0.

[51] The percentage is calculated on the basis of the countries which answered the questionnaire. All blanks correspond to the absence of answer to the questionnaire.

Source: TERA analysis & NRAs replies to questionnaire

Conclusions for the mobile market impact assessment

Most of the metrics observed for this part of the study have approximately followed the forecasts of the 2009 IA, such as revenues decreasing as foreseen, penetration rate increasing as planned or the investments increasing as predicted with a few exceptions. The concentration in the mobile markets has been decreasing allowing a decrease in retail prices, and an increase in mobile traffic.

The share of prepaid customers decreased and the share of on-net calls also, which is the consequence of the development of flat rate offers and the disappearance of offers differentiating prices for on-net and off-net calls.

When comparing the countries which have implemented the TRR with countries which have not implemented the TRR it appears that for operators in those countries:

- **Revenues have decreased faster in countries which implemented the TRR,**
- **But investments have been higher potentially reflecting the need to invest more in order to differentiate against competitors,**
- **Margins (before amortization) have decreased less in countries which implemented the TRR,**
- **The level of concentration has decreased more in countries which implemented the TRR (but significant mergers occurred in the group of countries where the TRR has not been implemented),**
- **Penetration rates have increased faster in countries which implemented the TRR.**

However, these observations cannot be considered as the direct consequence of the TRR. First because many other factors influence the mobile markets in Europe. Second because the situation within the group of countries is sometimes very heterogeneous, except for mobile penetration (see annex, section 8.29). Third, because countries which did not implement the TRR have seen their MTRs decreasing too.

In any case, even if a causal link cannot be established, these positive trends are clear and at a minimum it can be concluded that the TRR did not have negative effects on the market, especially with respect to the level of investments, otherwise, very different situations would have been observed with the No Pure LRIC Group. On the contrary, low MTRs have helped in the development of new offers and the decrease in offers with price differences between on-net calls and off-net calls.

The decrease in retail prices associated with the decrease in revenues contradicts the theory of the waterbed effect. If the waterbed effect had occurred, retail prices and/or revenues would have remained stable or increased.

Figure 37 - Review of the forecasts of the 2009 IA

Metrics	Foreseen in the 2009 IA	Observed since 2009	Difference with the 2009 IA
Revenues	-98 billion euros in 2011	-10 billion euros in 2011	Reduction of revenues as anticipated, although it was not as important as expected.
Investments	Increase	Increased at first, then declined from 2013	Declining investments since 2013
EBITDA	Decline	Decline	/
#SIM Penetration rate	Increase	Increase	/
#Unique subscribers penetration rate	Increase	Increase	/
HHI	Decrease in the HHI level	Greater decrease in the HHI in countries that have implemented the pure LRIC	/
Prepaid/Postpaid rate	Decrease of prepaid subscriptions	Decrease of prepaid subscriptions	/
Traffics	Increase of mobile traffic	Increase of mobile traffic	/
Retail Prices	-19,4%	-35,5%	Greater reduction of retail prices than anticipated

Source: TERA analysis

4.1.2 Fixed Impact Assessment : former and updated findings on market metrics

For the fixed market like for the mobile market, the 2009 IA considered two possible scenarios: with or without the TRR. The study compares those assessments with the current state of the market for multiple metrics defined in the table below.

Figure 38 - Metrics definition[52]

Metrics	Sources	Definition/Assumptions
Revenues	EC progress report & GSMA	Revenues from fixed sector in million €
Investments	EC progress report & GSMA	Investments from fixed sector in million €
Fixed line penetration	BEREC (Eurostat)	Penetration in terms of number of main fixed telephony lines
Retail prices	NRAs answers to questionnaire	The price of a minute of call
Traffics	NRAs answers to questionnaire	The number of minutes of call per year

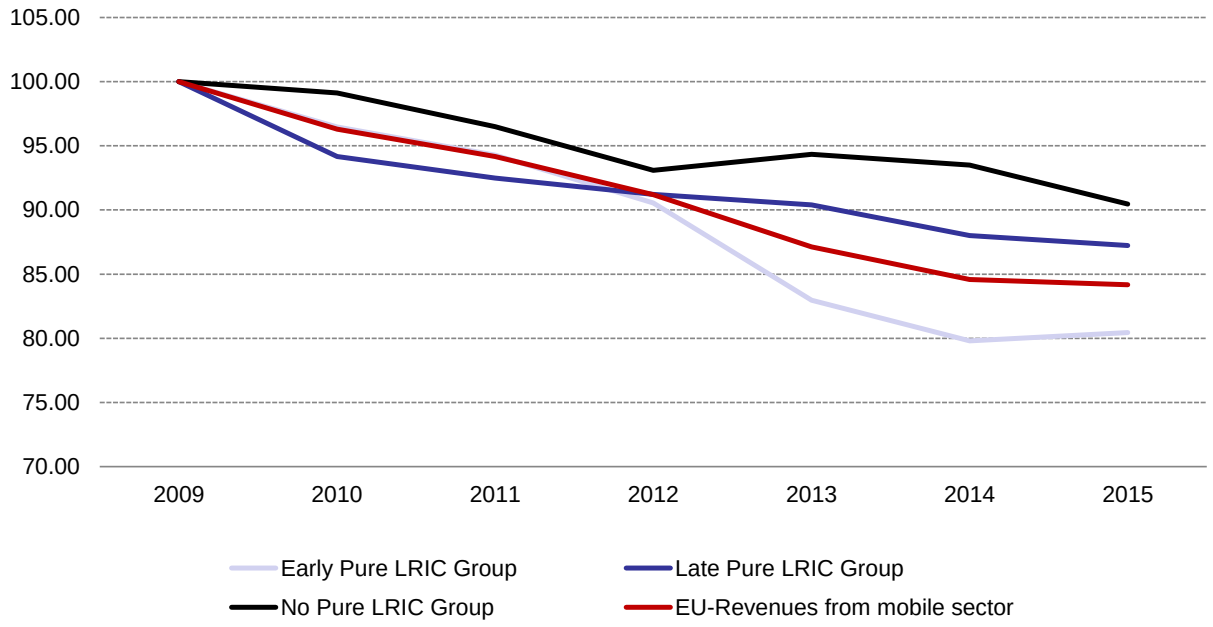
Source: TERA analysis

Revenues

The 2009 IA foresaw that whether the Member States adopt the TRR or not, the revenues should not be affected by the implementation. All revenues indeed started to experience a slow decline between 2010 and 2012 (see Figure 39). In 2013 the revenues of the Early and No Pure LRIC Groups remained stable, while the revenues of the Late Pure LRIC Group kept on decreasing. However, the TRR causality is difficult to prove in this case due to the effects of the economic downturn and due to the fact that voice call revenues represent a relatively small share of revenues compared to fixed subscription revenues, TV revenues, broadband revenues and leased lines revenues.

[52] See annex, section 5.1 for more details about the sources.

Figure 39 - Revenues from the fixed sector (base 100 in 2009)[53]



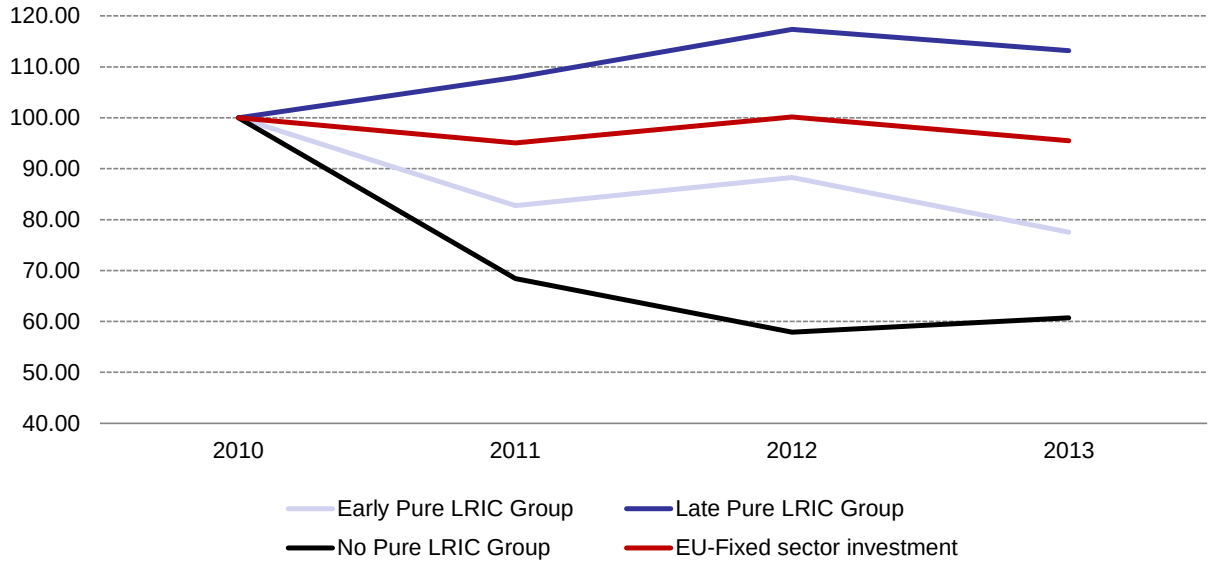
Source: TERA Consultants analysis & Eurostat

Investments

One of the key implications of the TRR was the improvement of efficient investments, especially in the mobile market though. In the fixed market, investments of the majority of the Member States actually shrunk between 2010 and 2011, especially for the countries of the Early and No Pure LRIC Group (see Figure 40). On the other hand, investments increased in the countries of the Late Pure LRIC Group. Again, the TRR causality is difficult to prove in this case due to the effects of the economic downturn, the different plans in terms of fibre deployments (that can potentially be at different stages for the different groups studied here), etc.

[53] Conclusions would remain the same if the base year is 2012.

Figure 40 - Investments from fixed sector (base 100 in 2009)



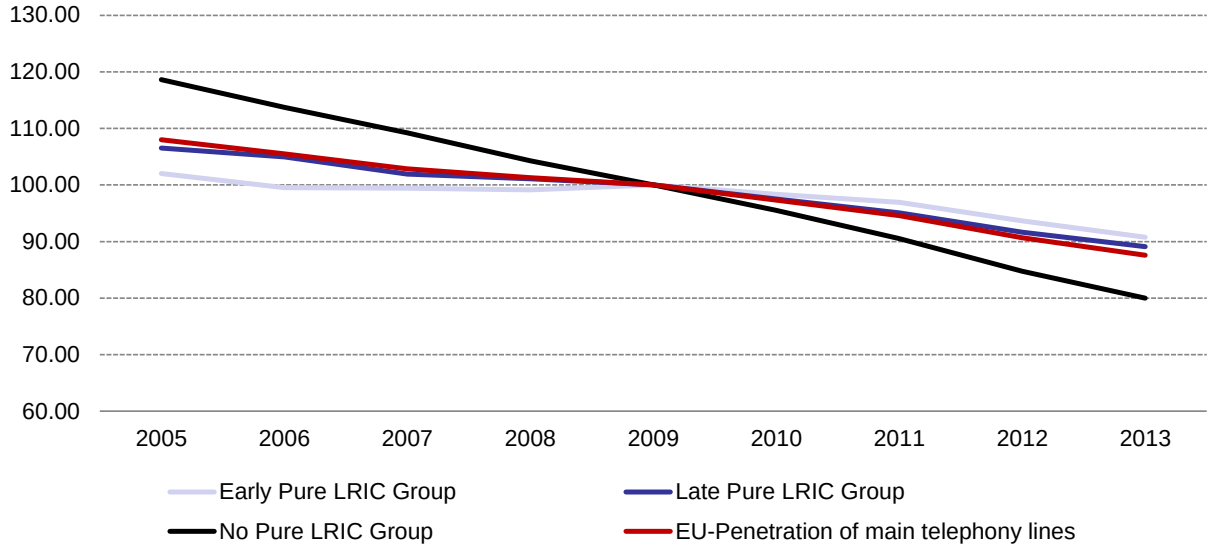
Source: TERA Consultants analysis & BEREC

It is also to be noted that less recent data is available for fixed investments compared to mobile investments.

Penetration rate

Before the TRR was issued, the penetration of main telephony lines was already decreasing. It kept on decreasing a bit faster after 2009 for all groups (see Figure 41). The decrease was faster in countries which did not implement the TRR. However, the situation is very heterogeneous amongst MS of each group.

Figure 41 - Penetration of main telephony lines (base 100 in 2009)[54]



Source: TERA Consultants analysis & Eurostat

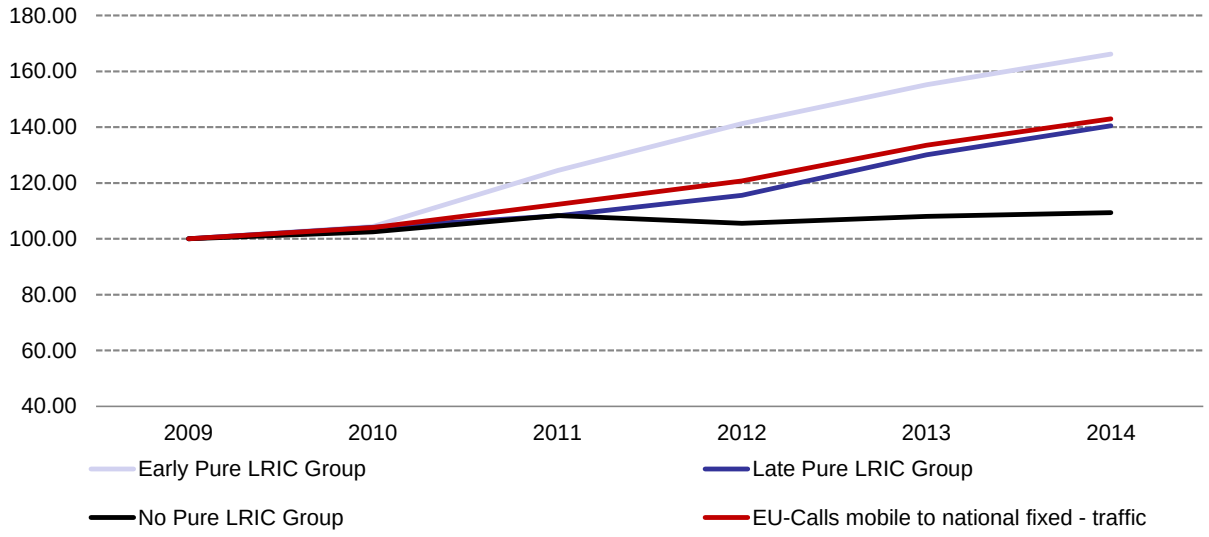
[54] Conclusions would remain the same if the base year is 2012.

Traffic terminating on fixed networks

Compared to the other metrics above which are likely to be only slightly influenced by the TRR, the amount of calls from mobile to fixed networks is directly impacted by the TRR. Low FTRs should drive more calls to fixed networks. It is interesting to note that calls to fixed networks have increased a lot in countries which have implemented the TRR, especially those which implemented it early. For these latter countries, the increasing trend started much before the actual implementation of the TRR but it is noted that FTRs decreased a lot from 2009, despite the fact that these countries did not yet implement the TRR (see Figure 42). For countries which did not implement the TRR, the volume of calls to fixed networks has been very stable.

This tends to highlight the positive impact of the TRR on the level of traffic to fixed networks.

Figure 42 - Mobile calls to national fixed – traffic (base 100 in 2009)



Source: TERA Consultants analysis & NRAs replies to questionnaire

Conclusions for the fixed market impact assessment

The forecasts of the 2009 IA, although it was more focused on the mobile market, were correct about the evolution of revenues for the fixed sector which have been slightly declining since 2009. On the other hand, investments in the fixed sector have decreased, whereas the TRR was expecting an increase, but this decline does not seem linked to the TRR.

However, the impact of the TRR on the fixed sector is rather more difficult to evaluate than the mobile sector, because the voice service holds a small importance compared to broadband services for example. Also, citizens in Europe use more their mobile phones to make calls compared to their fixed phones[55]. FTRs have also always been

[55] According to the European Commission financial indicators, in 2012, 64.1% of calls were originated from mobile and the remaining from fixed.

much lower than MTRs. Therefore any impact of FTRs on the fixed market is likely to be small relative to other factors and thus difficult to observe.

The main noticeable impact is however the strong increase in mobile calls to fixed networks in countries which have implemented the TRR.

According to the NRAs[56], flat rate and all-net offers are now pretty common in the fixed markets, although few exceptions persist such as Bulgaria and Slovakia[57]. At the European level, most NRAs agree that the reduction of FTRs was one of the drivers of the appearance of new retail offers and the reduction of retail prices, but denied the fact that it was the only factor.

[56] NRAs' answer to the questionnaire issued in the context of this study.

[57] In both Bulgaria and Slovakia, flat rates and all-net offers are still not very common according to the NRAs of these two countries.

4.2 Updated Impact Assessment - consumers and social welfare

When issuing the 2009 IA, not only did the EC evaluate the impact of the TRR on the previously presented metrics but it also measured its impact on the consumers and producers surpluses and on the social welfare[58]. These assessments were conducted by considering the fact that consumers are sensitive to retail prices (measured with price elasticity) and that termination rates are passed through from the wholesale level to the retail level (measured with pass-through rates). The EC compared two scenarios: a situation whereby the TRR would not be followed by any MS ("baseline scenario") and a situation whereby the TRR would be followed by all MS ("recommended approach").

The Dutch regulator ACM also ran an assessment of social welfare comparing LRAIC+ and Pure LRIC in 2013.[59] It followed a similar approach as the one of the EC in its 2009 IA except that it includes some improvements: better consideration of cost savings for producers due to lower MTRs/FTRs outpayments, possibility to assess network externalities, possibility to assess the waterbed effect. As a consequence, this latter model has been used.

The results presented hereafter have been calculated running the ACM model for the 2013-2015 period at the European level based on the actually observed TRs' reduction and rates, only considering price elasticities and pass-through rates at first, then considering all effects (network externalities and existence of a waterbed effect).

Six years after the issuance of the TRR and having collected metrics describing fixed and mobile markets in the EU, the 2009 IA is hereafter updated using the ACM model, first for mobile markets (see section 4.2.1), then for fixed markets (see section 4.2.2) and finally for the whole fixed + mobile market (see section 4.2.3).

4.2.1 Mobile Impact Assessment: findings on consumers and social welfare

The initial 2009 IA was conducted for the 2009-2012 period, with the following assumptions: a -0.50 own-price elasticity and a 0.33 pass-through rate considering different available studies[60].

Additional studies or assessments of price elasticities and pass through-rate have been published. [61] They lead to an update of the values used in 2009: a -0.40 own-price elasticity

[58] The consumer surplus is the difference between the price consumers would be willing to pay for a call, and the price they are actually paying for that call. On the other hand, producer surplus is the difference between the amounts that producers benefit from selling at a market price that is higher than what they would have been willing to sell it for.

[59] https://www.acm.nl/nl/publicaties/publicatie/11831/Besluit-marktanalyse-vaste-en-mobiele-gespreksafgifte-2013-2015/

[60] Most available studies have found relatively moderate price elasticities. Hausman, for example, finds an own-price elasticity for mobile-originated calls of -0.5 to -0.6 in the US. In a study on the Australian mobile market, Access Economics reports a price elasticity of -0.8. Summarizing the results from different studies by DotEcon, Frontier Economics and Holden Pearmain, in its 2003 report on the charges for terminating calls from fixed and mobile networks, the UK Competition Commission reports own-price elasticities for mobile calls ranging between -0.48 and -0.65. (Impact Assessment, page 21).

[61] Frontier economics (-0.3) https://www.frontier-economics.com/documents/2014/06/importance-of-price-elasticities-in-the-regulation-of-mobile-call-termination-frontier-paper.pdf

and a 0.50 pass-through rate have been used for the calculation. The changes in producers' and consumers' surpluses are assessed for the 2013-2015 period comparing the evolution from the 2012 F/MTRs to the 2013, 2014 and 2015 Recommended Approach and the Baseline Scenario F/MTRs. The order of magnitude of the impact on the social welfare remains similar after 2013 every annum. The changes in total producers' and consumers' surpluses and social welfare (fixed and mobile) are provided for the period 2013-2015 in section 4.2.3.

For the mobile market it can be observed that (see Figure 43):

- There is a decrease by -4.80 billion of euros for the producer surplus in the Recommended Approach (-1.93 billion of euros per annum, -1.72 billion of euros per annum for the 2009 IA) and by -3.06 billion of euros for the producer surplus in the Baseline Scenario (-1.02 billion of euros per annum, -1.14 billion of euros per annum for the 2009 IA),
- There is an increase by 5.44 billion of euros for the consumer surplus in the Recommended Approach (1.81 billion of euros per annum, 2.29 billion of euros per annum for the 2009 IA) and by 3.29 billion of euros for the consumer surplus in the Baseline Scenario (1.10 billion of euros per annum, 1.57 billion of euros per annum for the 2009 IA),
- There is an increase by 0.64 billion of euros for the social welfare in the Recommended Approach (0.21 billion of euros per annum, 0.57 billion of euros per annum for the 2009 IA) and by 0.24 billion of euros for the social welfare in the Baseline Scenario (0.08 billion of euros per annum, 0.43 billion of euros per annum for the 2009 IA).

The figure below shows the producers' surplus, the consumers' surplus and the social welfare for:

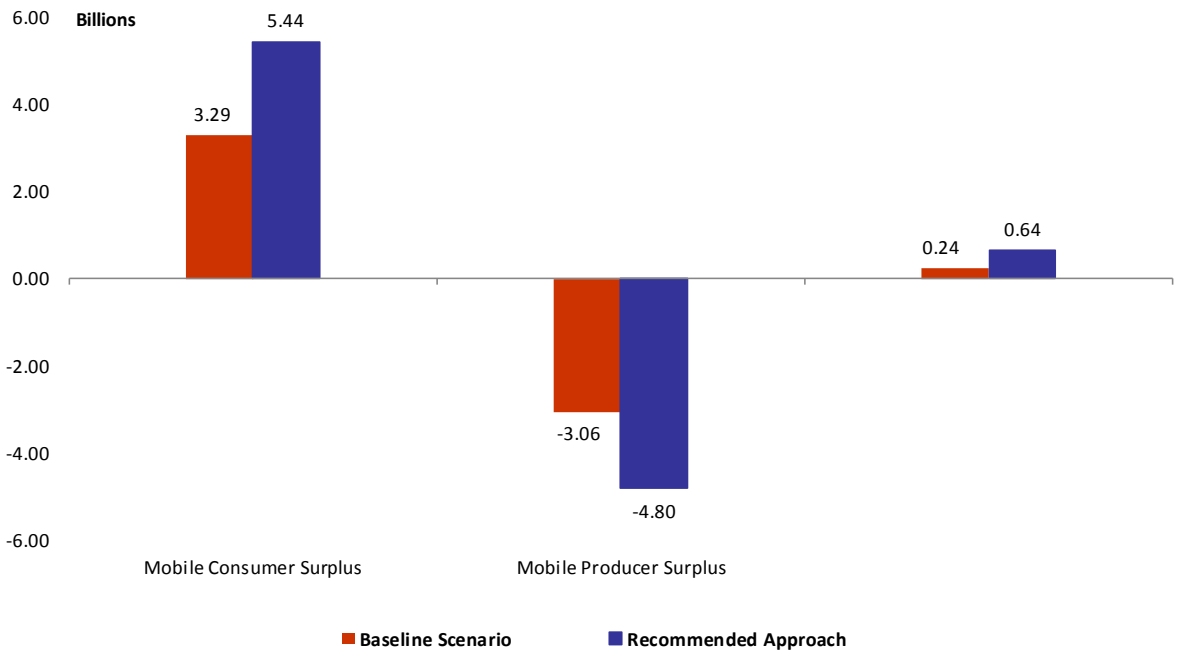
- The baseline scenario: using the average F/MTRs of the countries which did not implement the TRR,
- The recommended approach scenario: using the average F/MTRs of the countries which implemented the TRR.

SSRN study (-0.85) http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2195068

Vodafone New Zealand (-0.09) http://www.comcom.govt.nz/dmsdocument/9048.

Wik 2010 report (-0.6).

Figure 43 - Total change in producers' and consumers' surpluses in mobile markets 2013-2015 (billion €)



Source: EC & TERA Consultants analysis

4.2.2 Fixed Impact Assessment : findings on consumers and social welfare

For fixed markets, the 2009 IA has been made for the 2009-2012 period, with the following assumptions: a -0.30 own-price elasticity and a 0.20 pass-through rate. These assumptions are different from those used for mobile markets (see section above): for own-price elasticity (-0.30 for fixed against -0.40 for mobile) in order to reflect the fact that fixed services are generally considered to be more inelastic than mobile services and for the pass-through rate (0.20 for fixed against 0.33 for mobile) in order to reflect the fact that competitive forces are generally considered to be weaker on the fixed markets than on their mobile counterparts.

For this update of the impact assessment, the own-price elasticity is assumed to be the same as in the 2009 IA (-0.3, in the absence of new studies) and the pass-through rate is increased proportionally to the mobile value to 0.33. The following chart shows the results for the calculation over the 2013-2015 period.

For the fixed market it can be observed that (see Figure 44):

- There is an increase by 2.18 billion of euros for the producer surplus in the Recommended Approach (0.73 billion of euros per annum, -3.21 billion of euros per annum for the 2009 IA) and by 0.98 billion of euros for the producer surplus in the Baseline Scenario (0.33 billion of euros per annum, -1.67 billion of euros per annum for the 2009 IA). This is mainly generated by the savings in terms of MTRs outpayments for fixed operators.
- There is an increase by 1.86 billion of euros for the consumer surplus in the Recommended Approach (0.62 billion of euros per annum, 2.51 billion of euros per

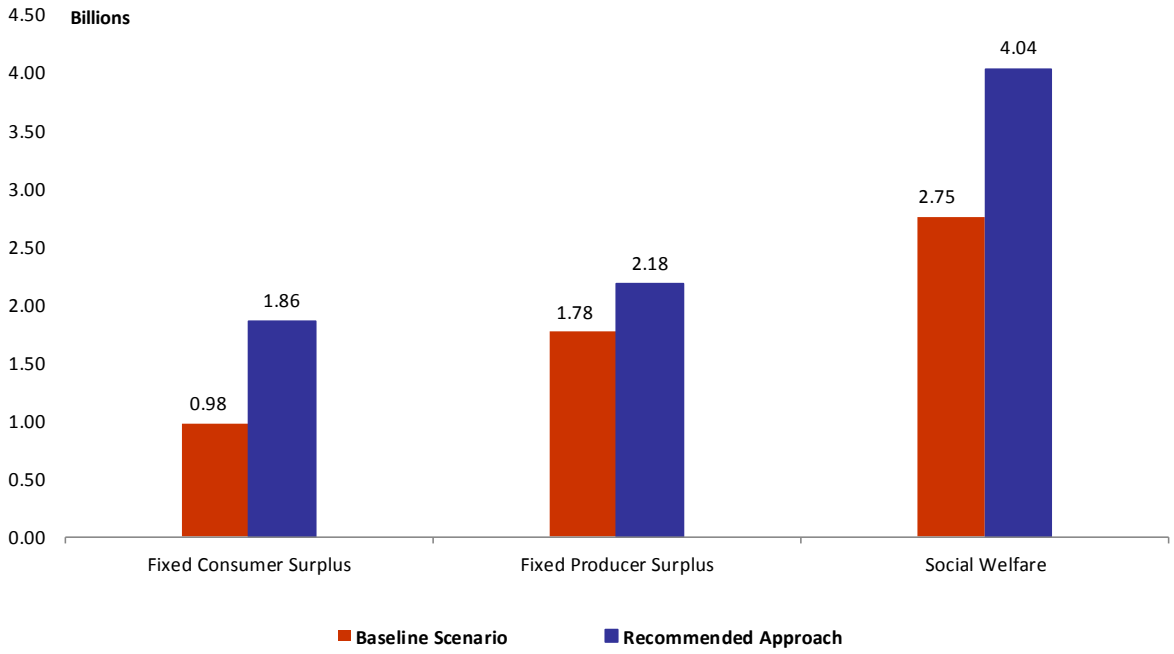
annum for the 2009 IA) and by 0.98 billion of euros for the consumer surplus in the Baseline Scenario (0.33 billion of euros per annum, 1.31 billion of euros per annum for the 2009 IA),

- There is an increase by 4.04 billion of euros for the social welfare in the Recommended Approach (1.35 billion of euros per annum, -0.69 billion of euros per annum for the 2009 IA) and by 2.75 billion of euros for the social welfare in the updated Baseline Scenario (0.92 billion of euros per annum, -0.36 billion of euros per annum for the 2009 IA).

The figure below shows the producers' surplus, the consumers' surplus and the social welfare for:

- The baseline scenario: using the average F/MTRs of the countries which did not implement the TRR,
- The recommended approach scenario: using the average F/MTRs of the countries which implemented the TRR.

Figure 44 - Total change in producers' and consumers' surpluses in fixed markets 2013-2015 (billion €)



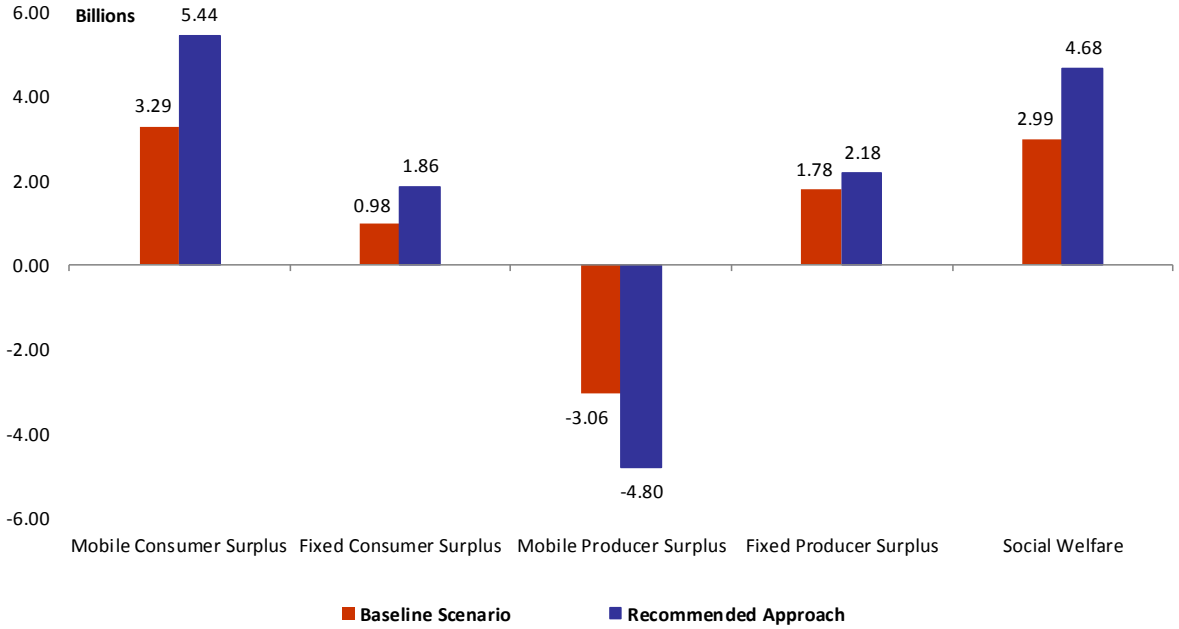
Source: EC & TERA Consultants analysis

4.2.3 Main conclusions

The impact of the TRR can be observed for both fixed and mobile sector with different effects. Whereas the TRR tends to improve social welfare in the fixed market, its impact on the mobile market is rather more neutral with positive effects on consumer surplus and negative effects on producer surplus. The total impact of the TRR on social welfare is however clearly positive.

The calculation has been made for the 2013-2015 period to provide a long timeframe of analysis. The figure below shows the results of this analysis.

Figure 45 – 2013-2015 Social Welfare changes (in billion €)



Source: EC & TERA Consultants analysis

Conclusions are generally similar to the 2009 IA except that the decrease in MTRs and FTRs generates more savings for producers and especially fixed producers compared to what was anticipated in 2009. Also, whatever the pass-through rate assumed, the results remain similar, the fixed producer surplus decreasing when the pass-through increases (see annexes, section 7.3 for sensitivity analyses).

The update of the impact assessment confirms the conclusions reached at the time of the TRR.

4.2.4 Indirect impact

The model for the assessment of consumers' and producers' surpluses also enables to assess the impact of additional effects[62], which are less direct[63]:

- The waterbed effect: when prices are pushed down on only one side of the market (Termination rates), resulting in a re-balancing of prices on the other side (subscriptions prices) - much like a waterbed would react if you were to push down one side of it, and set at 1[64].

[62] The values of waterbed effect and externalities are those previously used by the ACM to run their model.

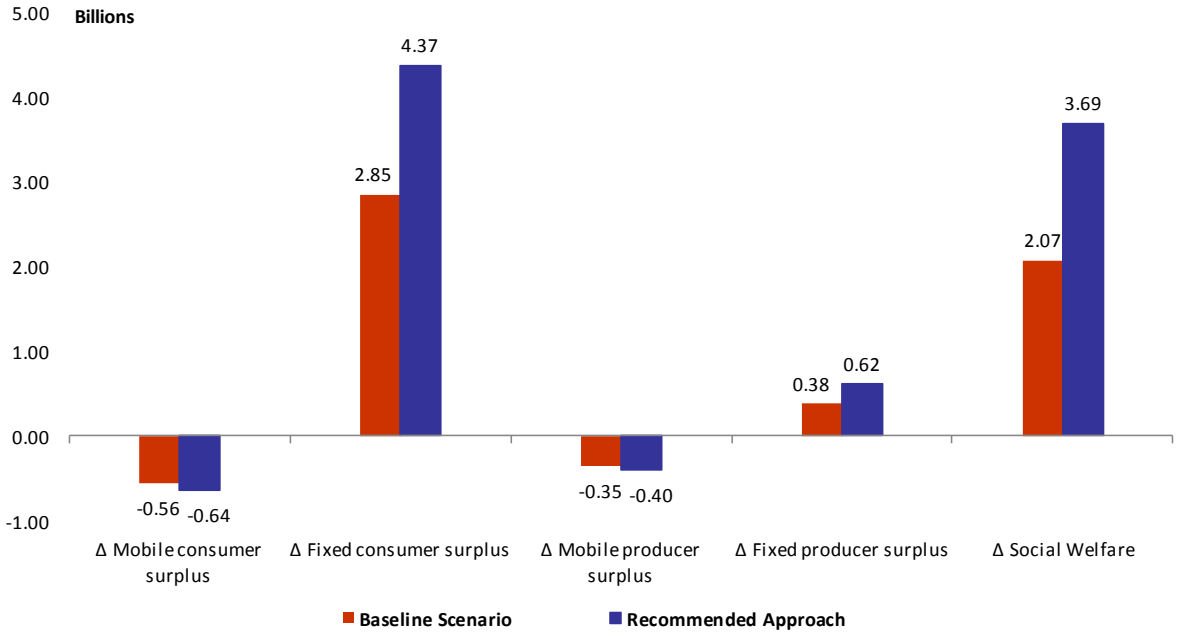
[63] The calculation method and how these factors are taken into account are detailed in annex (see section 0).

[64] 1 is the highest possible value of waterbed effect. This has been set at 1 in order to provide a sensitivity analysis of the waterbed effect since it has been previously shown (see section 4.1.1 with revenues and retail prices) that there was no evidence of the existence of the waterbed effect.

- Call externalities and cross-market externalities: Factors whose benefits and costs are not reflected in the market price of goods and services, and set at 0.2[65].

Figure 46 shows the findings on fixed and mobile producers' and consumers' surpluses considering waterbed effect only. It can be observed that the impact of the waterbed effect is rather negative on mobile consumer surplus and fixed producer surplus, and is rather positive on fixed consumer surplus and mobile producer surplus compared to the former findings (see Figure 43 and Figure 44).

Figure 46 – Social Welfare with waterbed effect, without externalities 2013-2015 (billion €)



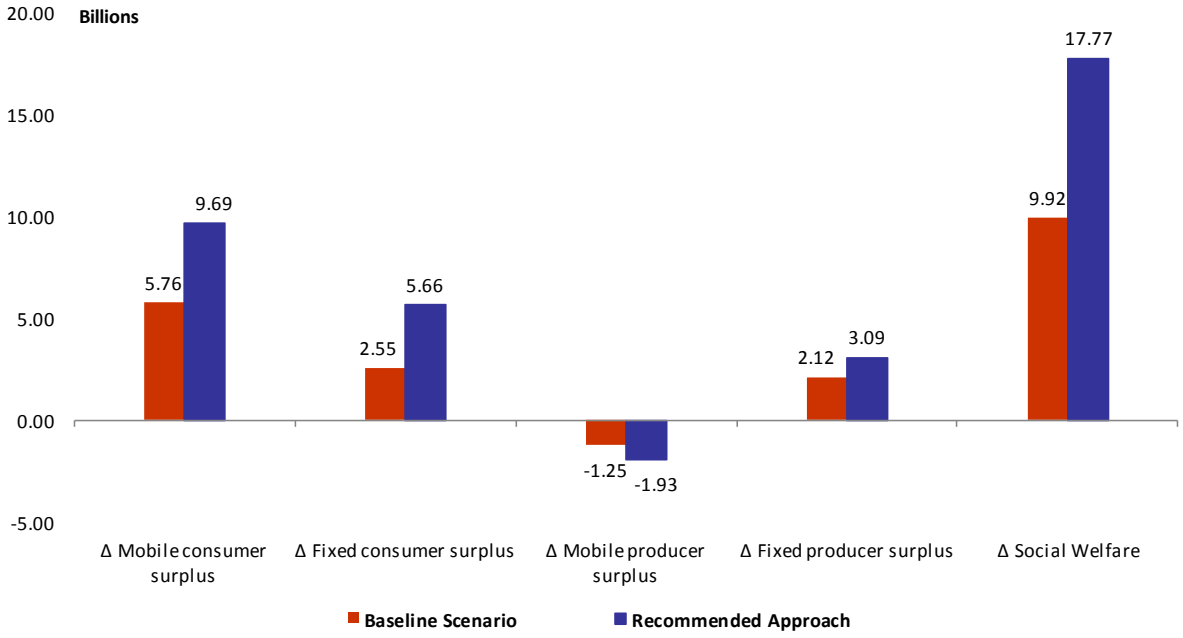
Source: EC & TERA Consultants analysis

However, there has been no evidence of a waterbed effect when lowering F/MTRs as seen in the previous section of the report.

Externalities are difficult to assess in a robust way but their magnitude can be significant and can increase significantly the benefit when the TRR is implemented because more calls are made and therefore more externalities can be expected. Figure 47 only takes into account call externalities and cross-market externalities. It can be observed that this effect is slightly positive on fixed producer and consumer surpluses and mobile producer surplus and very positive on mobile consumer surplus.

[65] This is ACM's assessment of the call and network externalities.

Figure 47 – Social Welfare with externalities, without waterbed effect 2013-2015 (billion €)



Source: EC & TERA Consultants analysis

4.3 Additional costs and benefits from the TRR since its adoption in 2009.

The previous sections have analysed the direct and indirect "predictable" possible impacts of the TRR on fixed and mobile markets. However, there may be additional costs and benefits which had not been anticipated. In order to identify these potential additional implications, NRAs have been asked whether they had identified such additional costs and benefits[66].

In the following section, several additional costs and benefits are identified either identified by NRAs or by TERA.

4.3.1 Additional benefit: Assessment of the entrance of new MVNOs

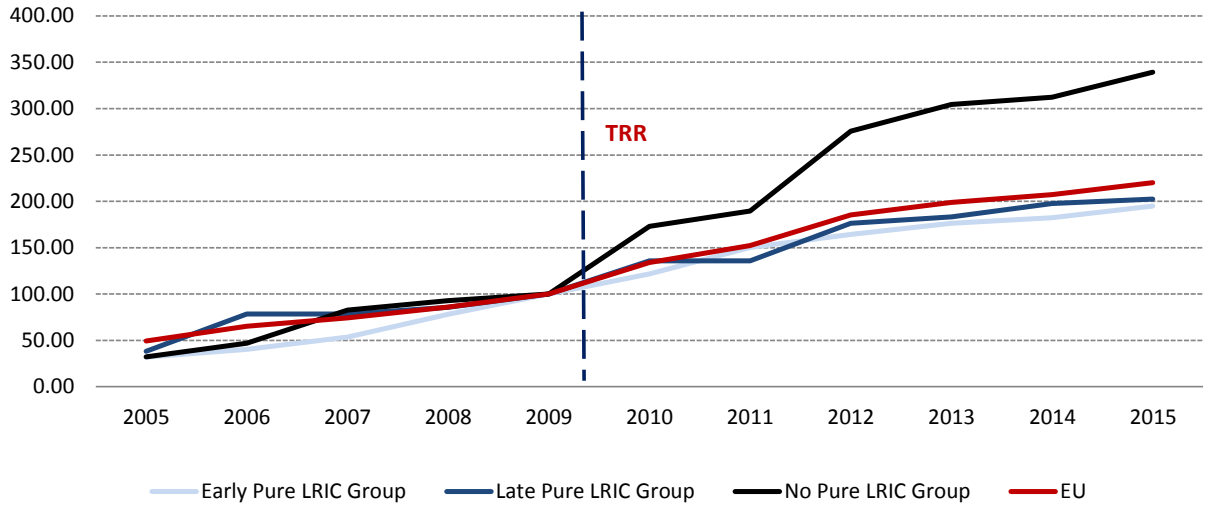
According to one regulator, one of the additional benefits from the TRR is the increase of the competition allowed by lower MTRs. Low termination rates would indeed put new entrants and small operators on a level playing field with large incumbent operators, since they have a larger share of outgoing calls compared to other operators. The evolution of the number of MVNOs over the years following the TRR can be studied to identify whether the TRR had any impact on this[67]. The evolution of MNOs market entry has not been analysed because MNO entry is strictly related to spectrum availability for example and MTRs and FTRs are unlikely to be the main reason for MNO market entry.

The number of MVNOs has been constantly increasing in the EU since 2005, especially after the issuance of the TRR in 2009. While the number of MVNOs did not increase significantly in Early and Late Pure LRIC countries, it has been increasing significantly for the No Pure LRIC Group (it is reminded that MTRs decreased also significantly for the No Pure LRIC Group). It can also be noted that there are fewer countries in the No Pure LRIC Group than the two other groups, therefore the significant number of MVNOs in Germany has an important impact on the evolution of this metric for the No Pure LRIC Group. There are now twice as many MVNOs in Europe as in 2009 when the TRR was issued (see Figure 48). The fact that the number of MVNOs increased faster in the No Pure LRIC Group minimises however the impact of the TRR. The late decrease of MTRs in the Late Pure LRIC Group as opposed to the earlier (but weaker) decrease of MTRs in the No Pure LRIC Group may explain the lower impact for this group of countries.

[66] The questionnaire sent by the Commission asked to the NRAs their thoughts about the additional costs and benefits from the TRR that were unexpected and may not have been anticipated in 2009.

[67] The GSMA Intelligence database provides information about live, closed and merged MVNOs. GSMA classified MVNOs in multiple categories of which have been studied: Discount MVNOs whose main proposition is low-cost services and Telecom MVNOs whose offering forms part of a range of telecom services such as fixed-line phone and broadband internet.

Figure 48 – Number of live Telecom MVNOs (base 100 in 2009)



Source: TERA Consultants analysis & GSMA

For all MVNOs in general, it can be observed that their number has been increasing since 2005, but follows a faster growing trend since the TRR was issued in 2009. This tends to confirm the assumption that the TRR enhanced the level of competition in European mobile markets, allowing new-entrants and small operators to compete with larger operators. While several factors can potentially explain the growth in the number of MVNOs in Europe, the importance of MTRs for MVNOs is such that the TRR can be considered as one of the main factors.

4.3.2 Additional benefit and cost: Development of cost models has improved NRA capabilities[68]

Developing cost models capable of calculating the cost of terminating calls on a fixed or on a mobile network on a pure LRIC basis has a cost. However, this is also the opportunity for NRAs to increase their knowledge of the electronic communications sector by getting a greater understanding of:

- Costs and cost drivers,
- Evolution of costs over time,
- Technological changes,
- Relative importance of the different services supported by fixed and mobile networks,
- Etc.

The development of cost models has probably enabled NRAs to increase their knowledge of the sector. It is noted however that several NRAs already had their own cost models either to calculate the cost of other services or to calculate the cost of call termination on a LRAIC+ basis.

[68] Not raised by NRAs.

In addition to that, these models can be used to assess the cost of other services, such as call origination, SMS and data for mobile networks or leased lines, broadband, TV, call origination for fixed networks.

4.3.3 Additional cost: Asymmetric implementation across countries

The most common negative effect observed by NRAs is related to the asymmetric implementation of the TRR in the EU and the fact that non-EEA countries have much greater MTRs. Seven regulators reported an increase of the prices for calls outside the European Economic Area because of the too high TR applied by those countries. In Portugal and Czech Republic, ANACOM and CTU were forced to adapt their regulation in order to allow the operators to set the TR applied to non-EEA operators at a higher level to fix the discrepancies caused by the Pure LRIC implementation. This is discussed in the next section of the report.

Furthermore, according to the three NRAs, the asymmetry can also be observed in the EU between the countries that adopted the Pure LRIC approach and those which did not. This additional cost is measured in the next section of this report.

5 Impact on trade of the asymmetric implementation of the TRR

The TRR is a recommendation and not a decision or a directive. As long as NRAs take utmost account of the recommendation, they have the possibility to decide not to implement the TRR. As a consequence, several MSs have not yet implemented the TRR (MS of the "No Pure LRIC group" in the previous sections). In its TRR, the EC also foresaw a transition period, to allow the MS to implement Pure LRIC, and an extended period for less well-resourced NRAs. This has led to significant implementation timelines differences among the countries that have implemented the TRR.

These factors resulted in an asymmetric implementation of Pure LRIC among the MSs, and important FTR and MTR differences (see section 3). This lack of harmonization can have an impact on trade between MS at the detriment of those applying the Pure LRIC approach (being compensated with low TRs for the use of the network) and at the benefit of those not applying the Pure LRIC approach (being compensated with high TRs for the use of the network).

To assess the interconnection balance between countries due to this lack of harmonization, it is necessary to compare two scenarios:

- The **"real scenario"** using current termination rates to assess the actual financial flows between MS with respect to call termination,
- A **"counterfactual scenario"** assuming that all MS have been using the Pure LRIC approach since 2013 to calculate TRs.

The difference between those two scenarios enables to assess how the asymmetric implementation of the TRR can impact the interconnection balance between countries. The methodology is first explained (section 5.1), and then the results of this analysis are presented (section 5.2).

5.1 Methodology

In order to calculate the interconnection balance between all MS, multiple metrics are required:

- The level of FTRs and MTRs for each year and for each country for both the real and the counterfactual scenario (these have been extensively discussed in section 3);
- The incoming and outgoing (both from domestic users and inbound roamers) international traffic by destination for each year and each country for both the real and the counterfactual scenario.

While the total outgoing international traffic is generally available for each country, the current outgoing international traffic by destination or by origination is rarely available and has been assessed on the basis of inputs from NRAs[69] and extrapolated when NRAs have not provided inputs[70]. This extrapolation is based on statistics on exportations[71]. These statistics were used

[69] France and the Netherlands have provided detailed information.

[70] The traffics between the different Member States have been requested in the questionnaire sent by the EC but a very limited number of Regulatory Authorities have been able to provide a traffic analysis providing details on the

as a proxy to determinate the amount of minutes of the total outgoing traffic to international from a country to all the other countries of EU[72] as they proved to be a better proxy than for example statistics on diasporas[73] (see annex, section 6.7).

For incoming roaming traffic, the total incoming roaming traffic of each country[74] is split by origin of visitors using statistics on the number of nights spent by non-residents (depending on their origin)[75].

In the counterfactual scenario, 2015 TRs of all countries that have applied the TRR have been used from 2013 (to remove the impact of the delayed implementation). It is to be noted that in 2015, all glide paths are over for these countries. Furthermore, for the countries which have not yet applied the TRR, the annual average TR of the Early Pure LRIC Group has been used from 2013. This allows measuring the difference between the current situation, with asymmetric implementations of the TRR, and this counterfactual scenario where all countries applied the Pure LRIC approach at the same time.

Only impact on operators' interconnection balance is considered because impact at the retail level is considered small since operators do not often differentiate international retail call prices by destination within Europe (sometimes by group of countries).

5.2 Assessment of interconnection balances

5.2.1 Interconnexion balances for all European countries

The interconnection balance between two countries is assessed as the difference between incoming calls multiplied by the corresponding termination rate, and the outgoing calls also multiplied by the corresponding termination rate. This assessment has been calculated between 2010 and 2015 for all countries of the EU28, including non-EEA countries in order to reflect better the impact of the TRR. For all countries, the sum of the interconnection balances with the 27 other MSs has then been calculated, with both the TR of the Current Situation and the TR of the Counterfactual Scenario (for 2013, 2014 and 2015 only since the TRR was implemented only from 2013).

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countries of destination. Most NRAs have however provided the aggregated total international fixed or mobile outgoing traffics (In the case the information on the total international traffic was missing, the average ratio between total calls and international calls has been calculated for all countries where the information was available, and applied to the country for which the information was missing. For the few countries where the total national traffic was also missing, the ratio between the population and the total traffic has been calculated for all countries and applied the same way).

[71] *Eurostat import export intra EU –* The data about exportations was not available for Hungary.

[72] E.g. if there are for a given country 1,000,000 euros of total exportations to EU-countries of which 50,000 euros to Belgium, it will be assumed that 5% of the international traffic originated from this country is terminated in Belgium.

[73] It is probable that the majority of the international traffic is generated by businesses rather than households.

[74] This was assessed from the report 2009 on roaming on public mobile telephone networks which provides the number impact assessment of policy options in relation to the commission's review of the functioning of regulation (ec) no 544/2009 of the european parliament and of the council of 18 june of minutes of retail voice calls made by roamers in 2009. This value has been extrapolated until 2015 (using the trend of international traffic) and it has been assumed that the incoming roaming traffic was equal to this.

[75] *http://appsso.eurostat.ec.europa.eu/nui/show.do - Recensement européen*

Since the statistics on tourism were missing for a few countries,[76] the analysis has been conducted with, and without roaming traffics. All results are presented without roaming at first, then including roaming.

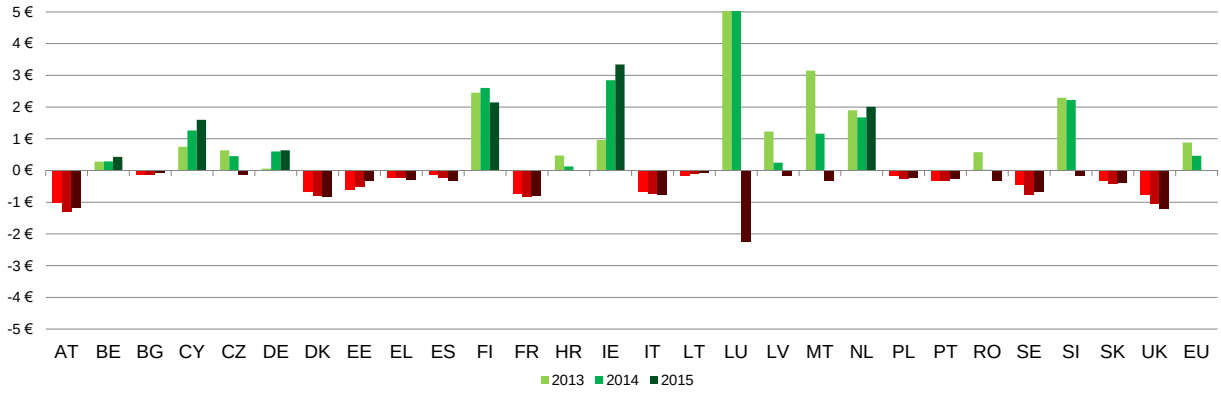
For the years 2013, 2014 and 2015 the interconnection balance in €/inhabitant[77] can be calculated to identify the countries which have benefited and the countries which have suffered from the asymmetric implementation of the TRR.

Although the choice of the methodology (with or without roaming) slightly impacts the results, it can be observed that Austria, Bulgaria, Denmark, Estonia, Greece, Latvia, Spain, France, Italy, Poland, Portugal, Sweden, Slovakia and the United Kingdom which implemented the TRR in 2013 are the countries that are the most negatively impacted by the asymmetric implementation. While in absolute value the amount of loss may seem significant (loss of several times 10 million of euros per annum, see annex section 6.7), the impact per inhabitant is low, generally less than €1.

On the other hand, Slovenia, Luxembourg, Ireland, Malta, the Netherlands and Finland, which all belong to Late and No Pure LRIC Groups have positive balances, greater than €1 per inhabitant and per month. Luxembourg has the highest level of positive interconnection balance per inhabitant (16.49€ in 2013 and 7.34€ in 2014) due to very high MTRs before 2015 but the significant decrease of MTRs in 2015 makes that this high positive balance has now been reversed in the most negative balance in 2015 (-2.25€ in 2015). Same happens for Malta and Slovenia. In 2013, the impact of asymmetric implementation for Germany was barely positive, due to the high MTRs set in the majority of the MSs of the Late Pure LRIC Group. However in 2014 and 2015, when those MSs did implement the Pure LRIC approach whereas Germany still had not, the impact of asymmetric implementation begun to be positive. In absolute value, Germany has the highest positive interconnection balance in 2014 and 2015.

If the general trend seems to be the reduction of discrepancies as will be observed in the next paragraphs, it can still be noticed that the asymmetric implementation of the TRR did deteriorate the interconnection balance of the countries which implemented it first.

Figure 49 - Impact of the asymmetric implementation of the TRR on interconnection balances per inhabitant – (in euros)



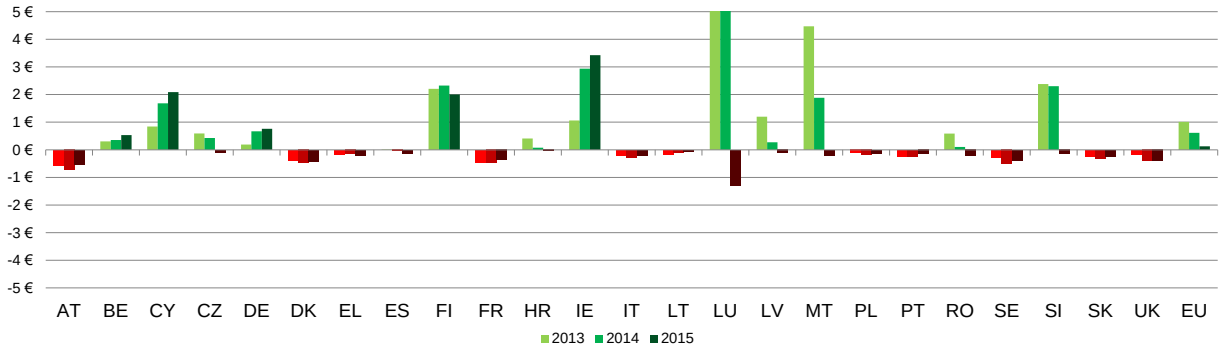
Source: TERA Consultants analysis

[76] The roaming data is not available for Bulgaria, Estonia and Netherlands.

[77] Results are provided per inhabitant and not per mobile user because this includes traffic to fixed networks.

The calculation has also been conducted including roaming traffics. The results are very similar to the chart without roaming traffics.

Figure 50 - Impact of the asymmetric implementation of the TRR on interconnection balances per citizen – With roaming (in euros)

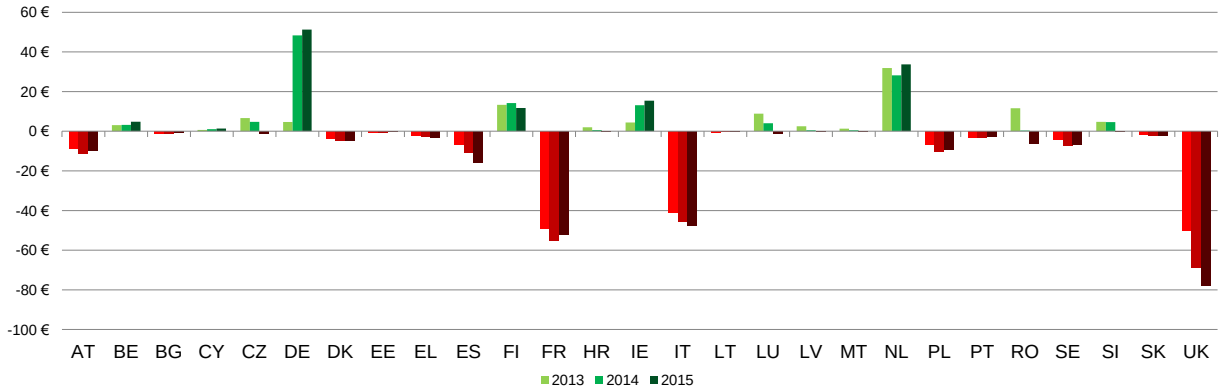


Source: TERA Consultants analysis

The following figures show the total value of interconnection balances for each country (in millions of euros):

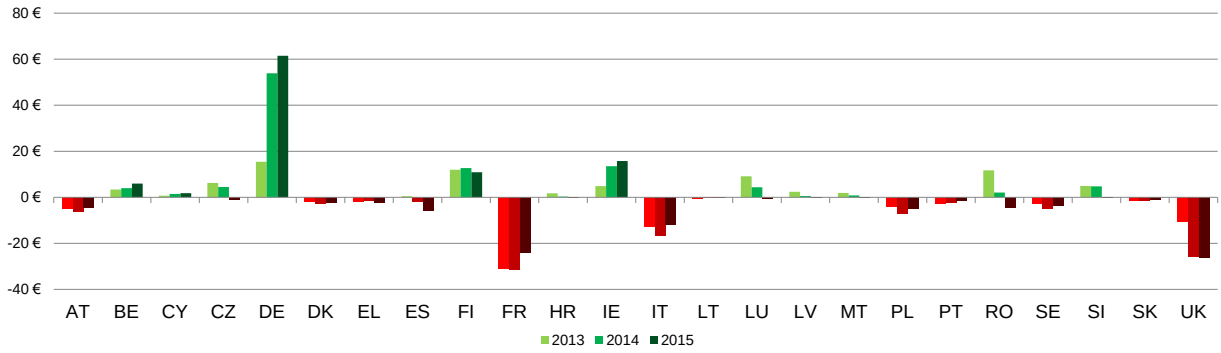
- Without roaming and without taking into account price elasticity (see **Error! Reference source not found.**);
- With roaming and without taking into account price elasticity (see **Error! Reference source not found.**);

Figure 51 – Impact of the asymmetric implementation of the TRR on interconnection balances – Without roaming (in million euros)



Source: TERA Consultants analysis

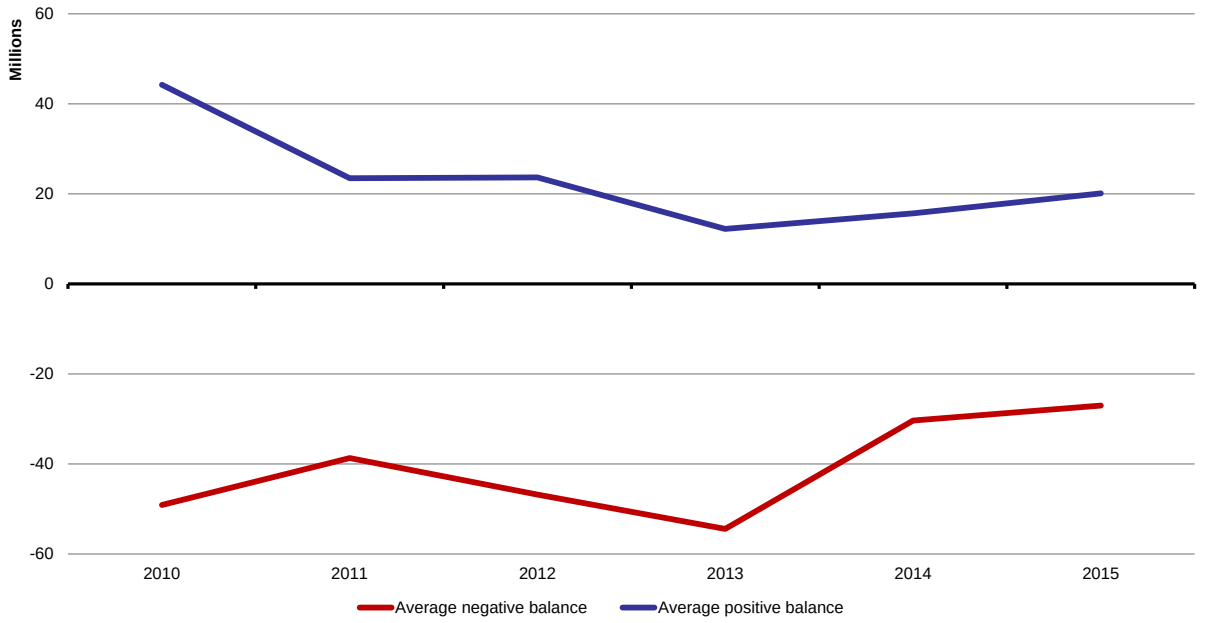
Figure 52 – Impact of the asymmetric implementation of the TRR on interconnection balances – With roaming (in million euros)



Source: TERA Consultants analysis

The TRR has however enabled to reduce the financial impact balances between the MSs caused by high and heterogeneous MTRs/FTRs. By comparing the average interconnection balance of countries with a negative balance and the average interconnection balance of countries with a positive balance, it appears that interconnection balances (positive and negative) have been divided by around 2 between 2010 and 2015 (see Figure 53).

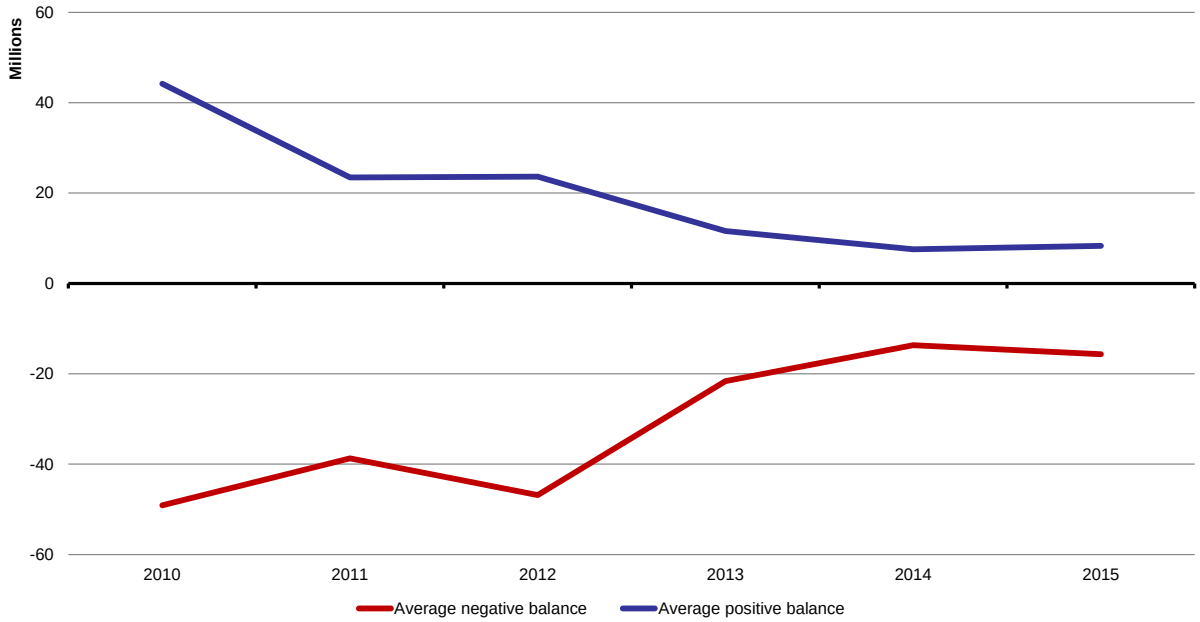
Figure 53 – Evolution of the average interconnection balances in the Current Situation (in million euros) for countries with negative balances and countries with positive balances



Source: TERA Consultants analysis

However, if the TRR had been followed by all NRAs since 2013, the average interconnection balances would have been divided by around 4 (see Figure 54).

Figure 54 – Evolution of the average interconnection balances in the Counterfactual Scenario (in million euros) for countries with negative balances and countries with positive balances



Source: TERA Consultants analysis

The implementation of the TRR also leads to asymmetries with non-EEA countries. Little data is available on traffic from and to non-EEA countries. However, using assumptions of the actual MTRs in non-EEA countries[78] and considering the fact that outgoing and incoming traffic to and from non-EEA countries is equivalent, it is possible to assess the order of magnitude of the interconnection balance. For EU with non-EEA countries, the interconnection balance is negative at around 100 million of € every year: 110 million of € in 2013 and 2014, 160 million of € in 2015.

5.2.2 Interconnection balances of the most impacted countries

In this part of the study, a country-by-country assessment of the interconnection balance of the countries the most impacted by the TRR is conducted. This assessment includes both fixed and mobile traffics, and roaming traffic. It has been made for the 2015 year using the same assumptions as the previous part of the study.

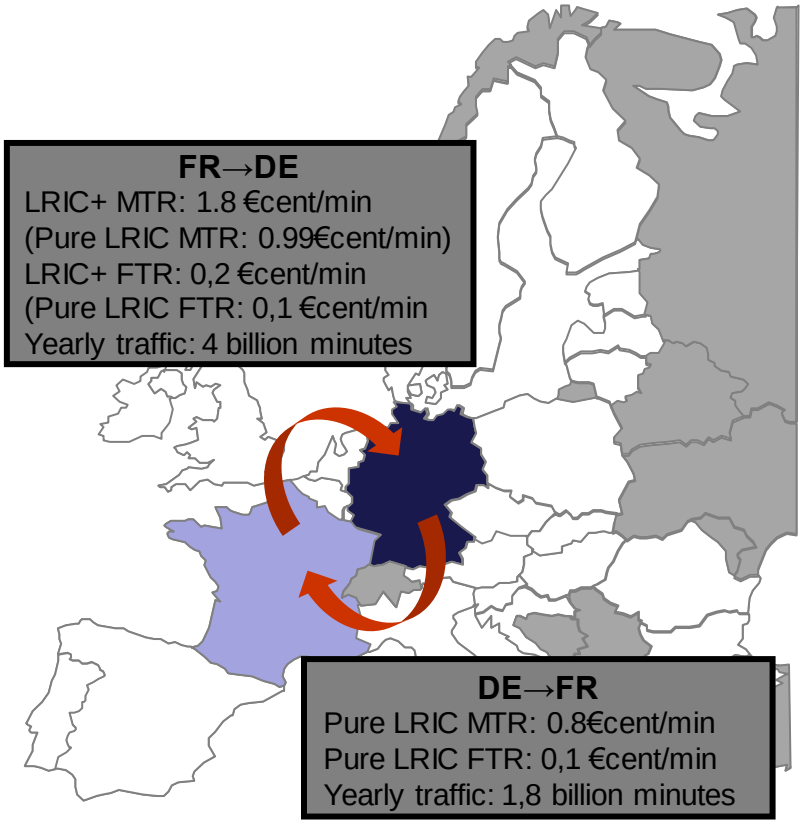
5.2.2.1 *France and Germany*

In France, the TRR has been implemented for both mobile and fixed markets in 2013. Germany has not yet implemented the TRR. FTRs and MTRs are therefore higher in Germany than in France. In the scenario with current TRs, there was a monetary transfer of 28.8 million of euros from France to Germany in 2015, whereas in the counterfactual scenario with all

[78] The analysis is conducted with mobile traffic only (because FTRs have not been collected). For MTRs, data is collected from the report OECD Digital economy 29 may 2015 and the values are in €cts/min: Australia: 3.03, Chile 2.64, Iceland: 1.27, Israel: 1.40, Japan: 4.26, Korea: 2.34, Mexico: 1.85, New Zealand: 2.69, Switzerland: 6.53, Turkey: 1.04 and USA: 0.06. Also the mobile traffics were assessed using EU NRAs replies and statistics on exportations as proxys, like for EU countries.

MTRs and FTRs set on Pure LRIC, this monetary transfer would have been twice lower at 12.3 million of euros from France to Germany. The asymmetric implementation of the TRR therefore deteriorates the interconnection balance of French operators with German operators by 28.8-12.3=16.5 million of euros in 2015.

Figure 55 – Interconnection balance between France and Germany

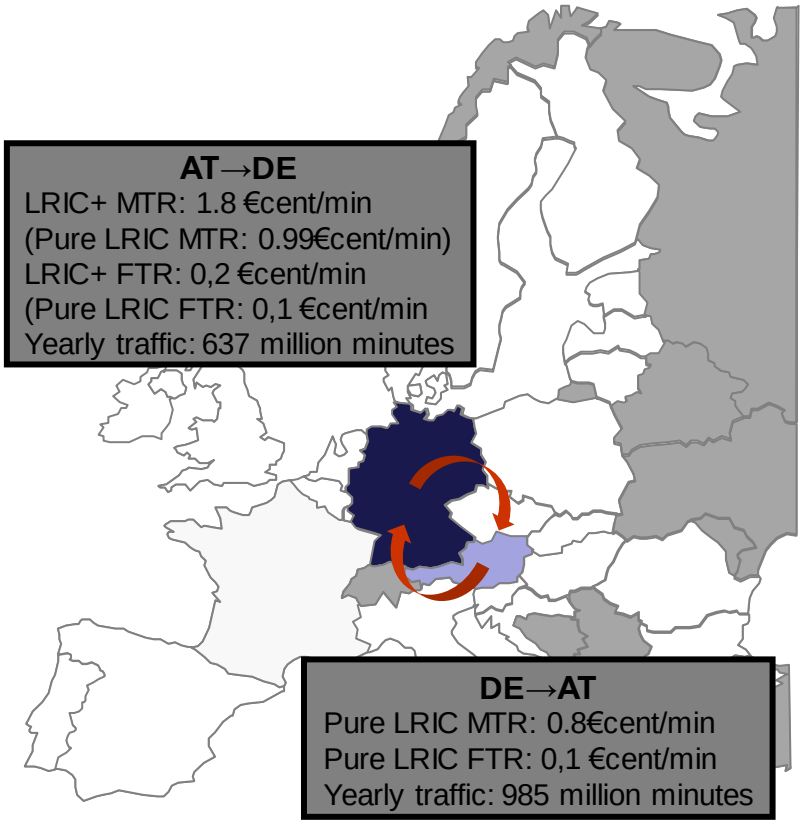


Source: TERA Consultants analysis

5.2.2.2 *Austria and Germany*

In Austria, the TRR has been implemented in both mobile and fixed sectors in 2013 while Germany has not yet implemented the TRR. In the scenario with current TRs, there is a monetary transfer of 4.2 million of euros from Austria to Germany in 2015, whereas with all MTRs and FTRs set on Pure LRIC, this monetary transfer would have been €147,000. The asymmetric implementation of the TRR therefore deteriorates the interconnection balance of Austrian operators against German operators by 4.2-0.147=4.05 million of euros in 2015.

Figure 56 – Interconnection balance between Austria and Germany



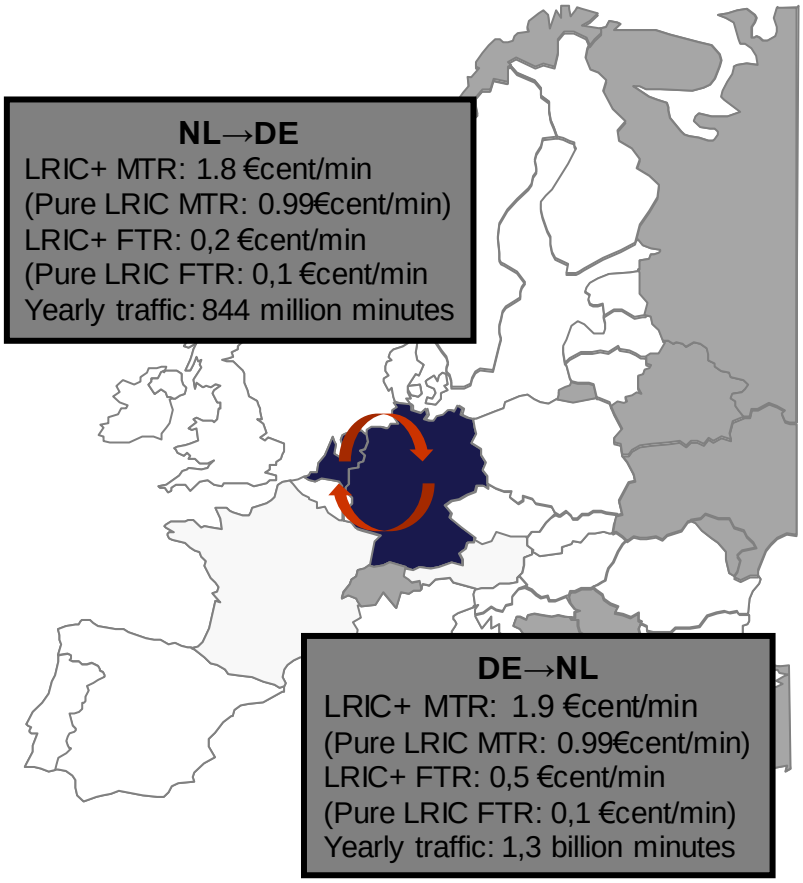
Source: TERA Consultants analysis

5.2.2.3 *Germany and Netherlands*

In both Germany and Netherlands, the TRR has not been yet implemented. MTRs and FTRs are therefore among the highest in Europe for these two countries. In the scenario with current TRs, there is a monetary transfer from Germany to the Netherlands of 5.1 million of euros in 2015 against only 1.1 million of euros if the TRR had been applied by the two countries. In this case the asymmetric implementation of the TRR costed 4 million of euros to German operators.[79]

[79] This does not include roaming traffics which are not available for Netherlands.

Figure 57 – Interconnection balance between Germany and Netherlands

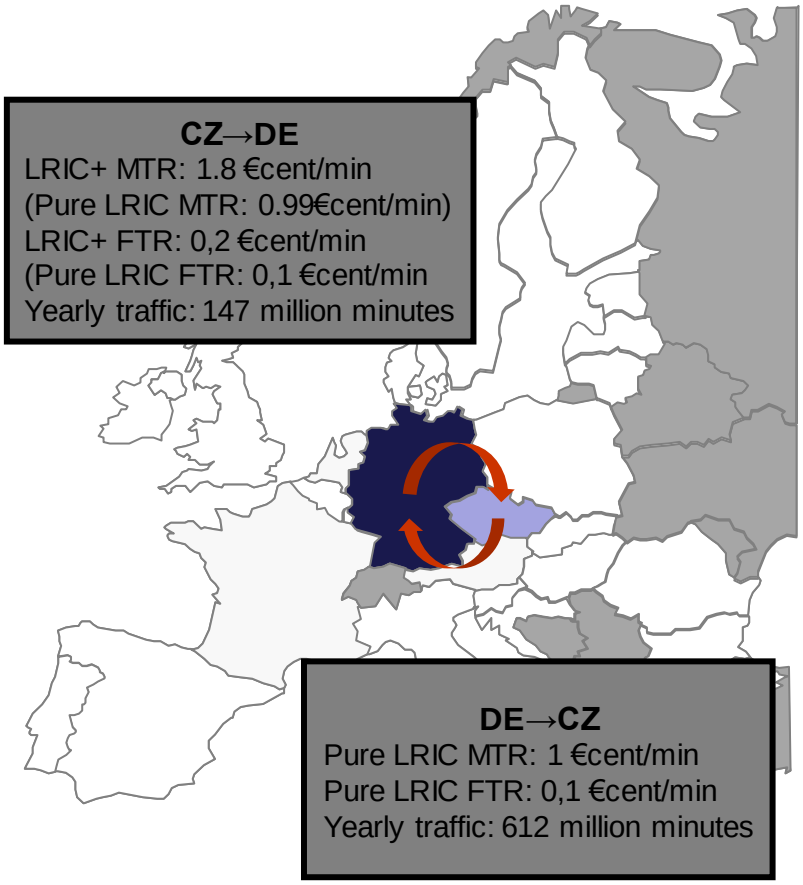


Source: TERA Consultants analysis

5.2.2.4 *Czech Republic and Germany*

In Czech Republic, the TRR has been applied in 2013 for MTRs and in 2014 for FTRs while, the TRR has not been yet implemented by Germany. MTRs and FTRs are therefore higher in Germany than in Czech Republic. In the scenario with current TRs, there is a monetary transfer from Germany to Czech Republic of €488,000. In the counterfactual scenario, if the TRR had been applied for all countries, there would have been a monetary transfer from Germany to Czech Republic of 1.4 million of euros. The asymmetric implementation of the TRR therefore deteriorated the interconnection balance of Czech Republic with Germany by slightly less than a million of euro in 2015.

Figure 58 – Interconnection balance between Czech Republic and Germany



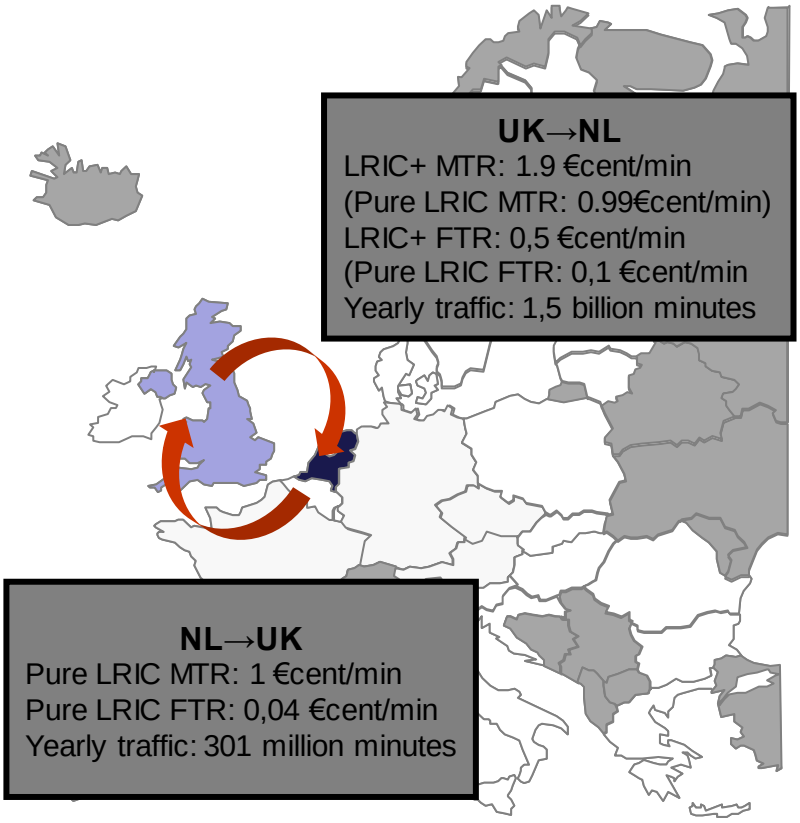
Source: TERA Consultants analysis

5.2.2.5 *Netherlands and United Kingdom*

In the United Kingdom, the TRR has been implemented in 2013 for the mobile sector, and 2014 for the fixed sector. The TRR has not been yet implemented in Netherlands. MTRs and FTRs are therefore higher in Netherlands than in the United Kingdom. In the scenario with current TRs in 2015, there is a monetary transfer from the UK to the Netherlands of 2.5 million of euros, whereas it would have been equal to 547,000 euros if the TRR was applied in all countries.[80] It can then be assessed that the asymmetric implementation of the TRR deteriorated the interconnection balance of UK operators against Dutch operators by 2 million of euros in 2015.

[80] This does not include roaming traffics which are not available for Netherlands.

Figure 59 – Interconnection balance between Netherlands and United Kingdom



Source: TERA Consultants analysis

5.3 Conclusion

The implementation of the TRR reduced the financial impact of the interconnection balances between MS as the MTRs/FTRs are lower and less heterogeneous among the MS. The interconnection balance represents in general between 0.1% and 1% of operators' revenues[81]

However, the asymmetric implementation of the TRR had a negative financial impact on all MS that implemented it early to the benefit of MS having implemented the TRR later or not at all. This benefits and losses remain overall up to a maximum several 10 million of euros in absolute value and maximum €1 or €2 per inhabitant and per year.

[81] TERA Consultants analysis.

6 Scope for further EU-wide harmonization of the methodology and parameters used to derive pure BU-LRIC costs for fixed and mobile network operators.

Given the existence of 28 national markets for electronic communications in the European Union, one of the main objectives of the regulatory framework at the Union level is to remove the entry barriers to creating a truly internal market in order to encourage the creation of and the level of investment by pan-European businesses.

As was demonstrated in section 3, the TRR has provided further harmonisation in Europe with respect to the level of FTRs and MTRs. However, in practice, some divergences can be observed, not only on the level of FTRs and MTRs (since the levels of FTRs and MTRs can be explained by local circumstances) but also on the methodology to calculate FTR and MTR. Therefore, there may be some scope for further harmonisation of the modelling approaches to estimating the costs of fixed and mobile termination. The EC has requested TERA Consultants to identify further areas of harmonization. Therefore this section:

- First describes typical steps followed in pure LRIC cost modelling and parameters which sometimes vary from a country to another and how these parameters influence the results (see section 6.1),
- Second identifies areas where further harmonization is possible: for FTRs, for MTRs and for pricing issues (see section 6.2).

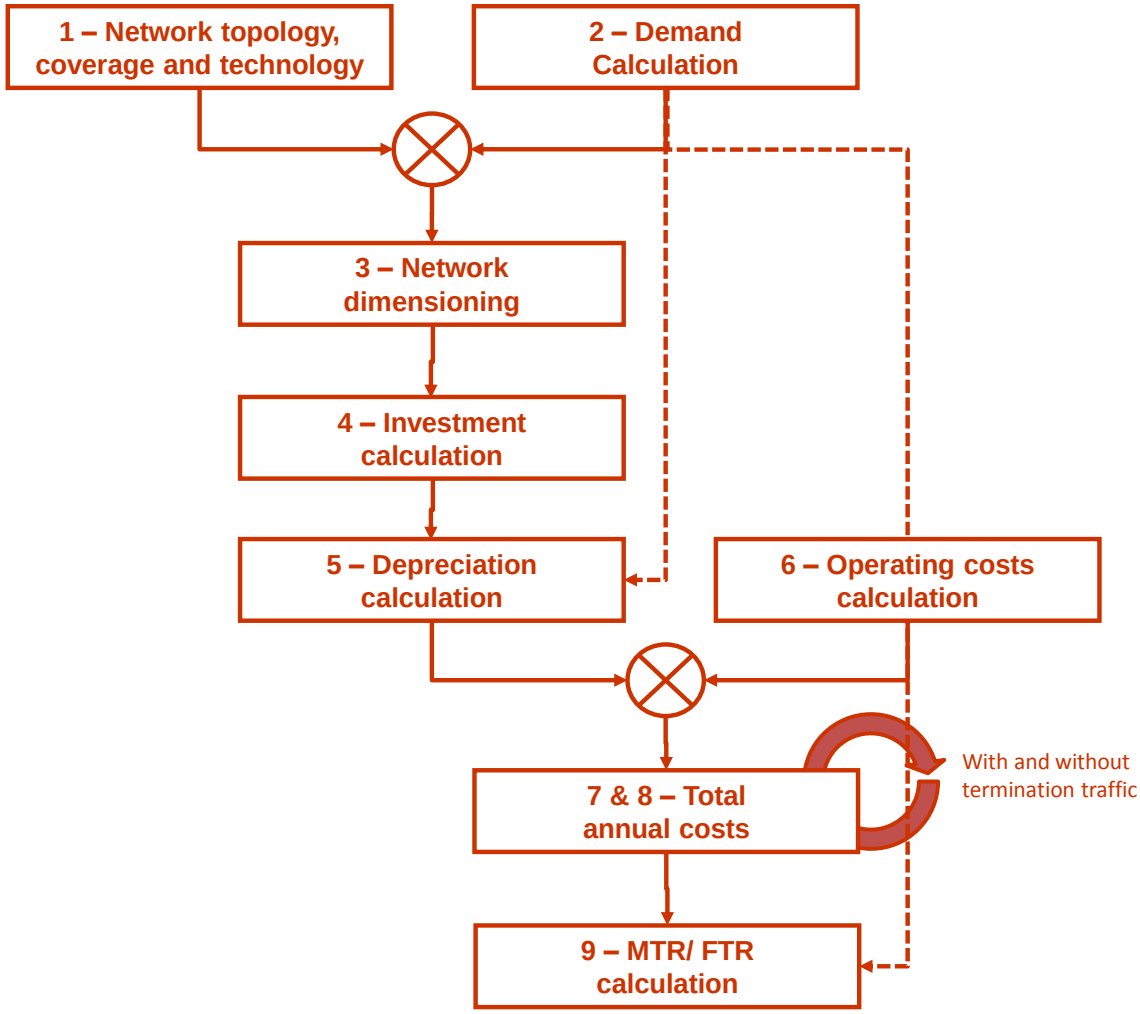
6.1 TR cost modelling steps

The typical steps followed by NRAs in pure LRIC cost modelling for FTRs and MTRs are as follows:

1. It is first necessary to define the technologies, network topology and coverage of the modelled network.
2. The network must be dimensioned to fulfil a given level of demand. The 2nd step consists in determining this demand. The demand can be expressed in terms of number of customers, number of minutes of call (yearly or at peak hour), number of calls, amount of data traffic (in Mbps or in MBytes), etc. The demand is the actual demand but also the forecasted demand (because cost models are forward looking).
3. Using the demand (step 2) and knowing the network topology (step 1), the number of assets required to fulfil the demand is determined, based on dimensioning rules. The outcome of this third step is a network inventory (year by year).
4. The number of assets required is multiplied by the unit price of assets to determine the corresponding level of investment.
5. The investment is depreciated to obtain a yearly cost.
6. The operating costs needed to run the network are also calculated. This generally includes costs which are specific to termination traffic.
7. Operating costs and depreciated investment costs are summed to get total annual costs.
8. The level of total annual costs is calculated with or without termination traffic (the total annual cost is greater with termination traffic).

9. The difference in annual costs is then divided by the total termination traffic to get the pure LRIC cost of one minute of termination.

Figure 60 – Typical steps to calculate FTRs and MTRs



Source: TERA Consultants

These steps are not necessarily exactly the ones followed by a modeller but conceptually they all need to be conducted.

For each step, several options are available to the NRAs. The TRR provides some guidance for some steps but as described in the table below, many remain available to NRAs.

The two tables below describe for each of the nine steps the recommendations of the TRR (if any) and the options that remain available for the modeller. The first table is about MTRs calculation and the second FTRs calculation. The last three steps described above are very straightforward and therefore there is no real option available. Therefore only the six first steps are detailed below.

Table 2 – Options available for NRAs at the different steps of the MTR cost modelling exercise

Step	Topics for each step	TRR recommendation	Choices to be made by the NRA
1 – Network topology and technology definition	Access technology 2G/3G/4G	*"The cost model should be based on efficient technologies available in the time frame considered by the model. Therefore the core part of both fixed and mobile networks could in principle be Next-Generation-Network (NGN)-based. The access part of mobile networks should also be based on a combination of 2G and 3G telephony."* (article 4)	NRAs can model 2G & 3G, 2G & 3G & 4G, or 4G only. For 3G, there are different releases available: R99, HSDPA, HSPA+, HSUPA, etc.
	Frequencies available	*"To the extent that additional spectrum acquired to provide wholesale call termination is included in the cost model, NRAs should review any objective cost differences regularly, taking into account, inter alia, whether on a forward-looking basis additional spectrum is likely to be made available through market based assignment processes which might erode any cost differences arising from existing assignments or whether this relative cost disadvantage decreases over time as the volumes of the later entrants increase".* (article 9)[82]	Many types of frequencies are potentially available but not necessarily in all countries and for all operators in a given country: 700 MHz, 800 MHz, 900 MHz, 1,800 MHz, 2,100 MHz, 2,600 MHz, etc. The size of blocks attributed to the operators can vary from a country to another.
	Use of single RAN or not	No recommendation	More and more operators replace traditional base stations by single-RAN base stations (which can support at the same time 2G, 3G and 4G technologies) at a cheaper overall cost
	Coverage	No recommendation	NRAs can use actual operators coverage or use coverage

[82] Article 9 rather describes the possible acceptable reasons why costs may differ from an operator to another but this article shows that it is possible to consider forward-looking spectrum assignments.

			planned by operators or use coverage as planned in the licenses
	Backhaul medium	No recommendation	Base station backhaul options can be microwave, leased lines or owned fibre. Owned fibre is generally used in urban areas but inside a given country, operators can have very different strategies: typically the subsidiary of the incumbent will rely on leased lines while other operators will rely more on microwaves
	Core technology	"*The cost model should be based on efficient technologies available in the time frame considered by the model. Therefore the core part of both fixed and mobile networks could in principle be Next-Generation-Network (NGN)-based."* (article 4)	The core network can be a full NGN network but can also be a mix of TDM and NGN, especially because voice is often provided on circuit mode over mobile networks. A transition from TDM to NGN can also be envisaged.
	Voice interconnection technology	No recommendation	Interconnection with other operators for voice can be made on the basis of the TDM technology or IP technology
	Fully new operator or existing operator	No recommendation	There are many options for NRA: either they model a fully new operator or they model an operator which entered the market when licenses were granted in the country. They can also decide to model each operator in the country (but in this case, rates cannot be symmetric). Finally, they can decide to model an integrated fixed-mobile operator or a mobile only operator.
2 – Demand calculation	Number of minutes, SMS and data	No recommendation	This is probably one of the choice which is the most straightforward since this consist in applying the generic operator market share to the total traffic of each service in the country.

			In case real operators are modelled, real operators' traffics are used.
	Traffic at busy hour	No recommendation	The traffic at busy hour is generally obtained from the number of minutes, SMS and data to which is applied a factor. However, it can also be directly obtained from operators, which ensures more realistic results. Or it can be obtained for each base station in the country.
	Generic operator definition	*"the recommended approach is to set that scale at 20 % market share. It may be expected that mobile operators, having entered the market, would strive to maximise efficiency and revenues and thus be in a position to achieve a minimum market share of 20 %. In case an NRA can prove that the market conditions in the territory of that Member State would imply a different minimum efficient scale, it could deviate from the recommended approach"* (annex)	The generic operator can have a 20%, 25% or 33% market share or even different market shares for different technologies (i.e. 50% on GSM but 33% on 3G[83])
	Forecasts	No recommendation	Forecasts for traffic can be based on operators' forecasts, on past trends, on studies (Cisco VNI studies for data for example) or can take into account the fact that lower MTR will drive more incoming traffic (using data on price elasticities)
	Modelling period	No recommendation	Modelling period can be 1 year, 2 years, 3 years, 4 years, 5 years, etc.
	Choice of the increment	*"Within the LRIC model, the relevant increment should be*	The increment can be all incoming traffic (SMS, voice) or

[83] Such an approach was observed in the model developed by PTS in Sweden.

		defined as the wholesale voice call termination service provided to third parties" (article 6)	only voice incoming traffic or only domestic voice incoming traffic
3 – Network inventory calculation	Geotypes definition	No recommendation	Defining geotypes is an important step in cost modelling. A geotype is a group of areas in a given country which have similar features in terms of network dimensioning. Inside a given geotype, areas typically have similar population densities and topographic features. Some countries have 3 geotypes (urban, suburban, rural), some have more geotypes (to include mountains, seaside, etc.).
	Cell radii	No recommendation	The cell radius is the maximum distance from the base station to which a call can be made. The cell radius depends on the frequency used and on the geotype definition. This can be obtained by operators in the country (but this can differ from an operator to another) or this can be obtained from propagation models. This can also be the result of the calibration step (see below) if NRAs wish to make sure the model derives results that are consistent with reality.
	Overcapacity factors	No recommendation	Assets are rarely used at their maximum capacity and NRA can use different values here. Overcapacity factors measure the maximum percentage of use of a given asset (a TRX, a BTS, a 3G carrier, etc.) meaning that one equipment should for example be only at maximum 60% or 80% of its capacity. This parameter can have significant impact on pure LRIC calculations because the higher overcapacity is, the

			more the number of assets will vary with traffic.
	Routing factors	No recommendation	Depending on the network topology, the routing factors determine which assets are used by which service. The choice here is closely related to the choice of the network topology (step 1) and if the network topology is precisely determined, then there is one unique way to determine routing factors
	Traffic dimensioning rules for 2G	No recommendation	Dimensioning rules for 2G are quite homogeneous and simple but some parameters can still vary a little bit (maximum number of TRX[84] per base station or blocking probability[85] for example)
	Traffic dimensioning rules for 3G	No recommendation	Dimensioning rules for 3G traffic are standardised but from one operator to another choice of supplier, choice of technology release can vary and hence dimensioning rules can vary. Also, because NRAs do not take their decision at the same time, the selected technology can vary from a NRA to another
	Traffic dimensioning rules for 4G	No recommendation	Dimensioning rules for 4G traffic are standardised but from one operator to another choice of supplier, choice of technology release can vary and hence dimensioning rules can vary. Also, because NRAs do not take their decision at the same time, the selected technology can vary from a NRA to another

[84] TRX is the abreviation for transceiver, which is a device comprising both a transmitter and a receiver in 2G.

[85] Blocking probability is the chance that a customer will be denied service due to lack of resources. TERA has observed that in some countries the modelled blocking probability was 1% while in others it was 2%.

	Calibration	*"NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly"* (article 3)	NRAs can decide to calibrate or not the model to match the number of sites and assets of existing operators. NRA can also compare the results with accounting data. NRA can also decide not to compare at all results with reality
4 – Investment	Unit prices of assets	No recommendation (except that the operator should be efficient)	NRAs can decide to use the cheapest unit prices of the different national operators, or to use average prices, or to use benchmark information
	Site rental or acquisition	No recommendation	NRAs can assume sites are owned or rented or a mix of the two. National operators may have very different strategies
	Network sharing	No recommendation	NRAs can assume that assets are not shared, or that sites are partly shared or that RAN are partly shared. For strategic reasons, national operators may have a proportion of shared sites which is lower than the efficient level
	Spectrum costs	*"The costs of spectrum usage (the authorisation to retain and use spectrum frequencies) incurred in providing retail services to network subscribers are initially driven by the number of subscribers and thus are not traffic-driven and should not be calculated as part of the wholesale call termination service increment. The costs of acquiring additional spectrum to increase capacity (above the minimum necessary to provide retail services to subscribers) for the purposes of carrying additional traffic resulting from the provision of a wholesale voice call termination service should be included on the basis of forward-looking opportunity*	NRAs can fully exclude spectrum costs or include some part of spectrum costs (related to additional capacities needed)

		costs, where possible". (annex)	
5 – Depreciation	Asset lifetime	No recommendation	Asset lifetimes can be provided by supplier or by the operators' accounts or through benchmark. They tend to be similar from a country to another
	WACC	No recommendation	The CAPM approach is generally used but the approaches used to calculate parameters are often different
	Price trend	No recommendation	Price trends can be derived by observing the evolution of asset prices purchased by national operators or by using generic values (typically -5% per annum for active assets, inflation for passive assets)
	Depreciation approach	*"The recommended approach for asset depreciation is economic depreciation wherever feasible."* (article 7)	Pure economic depreciation (requiring long run forecasts), tilted annuity, tilted annuity formula adjusted (to provide more stable price evolution) can be used
6 – Operating costs	Wholesale commercial costs calculation	*"the additional spectrum costs and wholesale commercial costs directly related to the provision of the wholesale termination service to third parties would also be taken into account"* (annex)	Wholesale commercial costs can be calculated as a percentage of other costs or extracted from the operators' accounts
	OPEX as a percentage of CAPEX or functional area calculation or bottom-up calculation	No recommendation	OPEX can be calculated as a percentage of CAPEX, based on a bottom-up approach for some assets (floor space, power, etc.), based on an assessment of the number of staff required, or extracted from top-down information (potentially compared between operators of the country)
	Trend of OPEX	No recommendation	OPEX can increase with inflation, decrease with productivity, remain stable because inflation and productivity gains compensate

			each other

Source: TERA Consultants

Table 3 - Options available for NRAs at the different steps of the FTR cost modelling exercise

Step	Topics for each step	TRR recommendation	Choices to be made by the NRA
1 – Network topology and technology definition	Number of nodes and node location	No recommendation	This aspect is closely related to the choice of the generic operator (see below). In case, the generic operator has the size and footprint of the incumbent, a NRA can choose to rely on the existing node location of the incumbent (scorched node approach) or on newly defined nodes (scorched earth approach). Also the number of layers in the network can vary (it will typically be greater in a larger country).
	Backhaul and backbone structure	No recommendation	There are several ways to design a backhaul or a backbone. It can be with point-to-point links, with daisy chains, with rings, etc. This can vary from an operator to another in a given country.
	Backhaul medium	No recommendation	MDF/exchange backhaul can be microwave or fibre.
	Core technology	*"The cost model should be based on efficient technologies available in the time frame considered by the model. Therefore the core part of both fixed and mobile networks could in principle be Next-Generation-Network (NGN)-*	The core network can be a full NGN network but can also be a mix of TDM and NGN if NGN is not significantly deployed in the country[86]. In a NGN network, several types of technologies are available with either a full IP topology or a topology with IP

[86] For example, in Ireland, ComReg calculated in its 2012 decision a FTR rate based on a progressive migration from PSTN to NGN: *"For FTRs, the pure LRIC approach will be implemented based on an updated bottom-up ('BU') model based on a pure LRIC cost methodology for an efficient fixed network in Ireland. This should be based on a full TDM network from July 2013 to June 2014, with the PSTN evolving to a hybrid NGN network of IP switching and PSTN interconnectivity for the following two years. The FTR for the third year is based on the assumption that the fixed network is primarily an IP-based network".* (https://www.comreg.ie/_fileupload/publications/ComReg12125.pdf).

		based." (article 4)	routers in the core and edge parts of the network and Ethernet switches at the aggregation level[87]. Also, it is possible to model WDM or to consider that a new operator would have larger fibre cables and would not need WDM assets (except for long distance links).
	Voice interconnection technology and layers	No recommendation	Interconnection with other operators for voice can be made on the basis of the TDM technology or IP technology There can also be several layers of interconnection
	Fully new operator or existing operator	No recommendation	There are many options for NRA: either they model a fully new operator or they model an operator which entered the market several years ago (e.g. when fixed markets started being liberalised). They can decide also to model an integrated fixed-mobile operator or a fixed only operator (therefore with no mobile backhaul traffic supported by the network).
2 – Demand calculation	Traffic supported by the network	No recommendation	The network generally supports at least voice, broadband and leased lines but it can also support TV services, VoD, etc.
	Traffic at busy hour	No recommendation	The traffic at busy hour is generally obtained from the number of minutes, broadband customers and leased lines customers to which are applied a factor which measures the amount of traffic at peak hour (for example average number of kbps per broadband customer

[87] See pages 64, 65 and 66 of the following document for a description of these layers: https://erhvervsstyrelsen.dk/sites/default/files/media/endelig-modeldokumentation.pdf

			at peak hour). However, it can also be directly obtained from operators, which ensures more realistic results. The two approaches can be equivalent if the factors are provided by the operators.
	Generic operator definition	"*NRAs should take into account that in fixed networks operators have the opportunity to build their networks in particular geographic areas and to focus on high-density routes and/or to rent relevant network inputs from the incumbents. When defining the single efficient scale for the modelled operator, NRAs should therefore take into account the need to promote efficient entry while also recognising that under certain conditions smaller operators can produce at low unit costs in smaller geographic areas. Furthermore, smaller operators that cannot match the largest operators' scale advantages over broader geographic areas can be assumed to purchase wholesale inputs rather than self-provide termination services."* (annex)	The choice here is probably one of the most complex to do for NRAs. NRA can choose to model an operator with the same scale as the incumbent or with a smaller scale but a smaller footprint or with a smaller scale but a same footprint. This choice is linked with the choice on the number of nodes and nodes location.
	Forecasts	No recommendation	Forecasts for traffic can be based on operators' forecasts, on past trends, on studies (Cisco VNI studies for data for example) or can take into account the fact that lower FTR will drive more incoming traffic
	Modelling period		Modelling period can be 1 year, 2 years, 3 years, 4 years, 5 years, etc.
	Choice of the increment	"Within the LRIC model, the relevant increment should be defined as the wholesale voice call termination service provided to third parties"	The increment can be voice incoming traffic or only domestic voice incoming traffic

		(article 6)	
3 – Network inventory calculation	Geotypes definition	No recommendation	NRA can assess the bottom-up network inventory at a detailed level for each node of the network (each and every MDF/exchange) or at a more aggregated level (the level of geotypes: urban, suburban, rural, etc.). Inside a given geotypes, each MDF/exchange has the same type of assets. In the latter case (use of geotypes), NRA have to define different types of geotypes which can vary from a country to another.
	IMS[88]	No recommendation	Cost of the IMS (hardware and software) are sometimes considered as fully fixed, as variable to the number of customers or as variable to the traffic. The assessment of traffic-sensitive and non-traffic sensitive costs of the IMS is one of the most important steps since it drivers most of the costs of the pure LRIC FTR (see section 6.2.1).
	Overcapacity factors	No recommendation	Assets are rarely used at their maximum capacity and NRA can use different values here. There can also be some resilience in the network
	Routing factors	No recommendation	Depending on the network topology, the routing factors determine which assets are used by which service. The choice here is closely related to the choice of the network topology (see step 1) and if the network topology is precisely determined, then there is one unique way to determine routing

[88] IMS is the IP Multimedia Subsystem. This is a system which enables to provide managed voice services over IP networks.

			factors
	Network dimensioning	No recommendation	There are many assets which need to be dimensioned: fibre cables, WDM, IP routers, Ethernet switches, IMS server, gateways, DSLAM, etc. For each asset, several dimensioning rules are available because there are different types of suppliers available.
	Calibration	"*NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly"* (article 3)	NRAs can decide to calibrate or not the model to match the number of assets of existing operators. NRA can also compare the results with accounting data
4 – Investment	Unit prices of assets	No recommendation	NRAs can decide to use the cheapest unit prices of the different national operators, or to use average prices, or to use benchmark information
	Network sharing	No recommendation	NRAs can assume that some assets are shared with other operators or that this is not the case
5 – Depreciation	Asset lifetime	No recommendation	Asset lifetimes can be provided by supplier or by the operators' accounts or through benchmark. They tend to be similar from a country to another
	WACC	No recommendation	The CAPM approach is generally used but the approaches used to calculate parameters are often different
	Price trend	No recommendation	Price trends can be derived by observing the evolution of asset prices purchased by national operators or by using generic values (typically -5% per annum for active assets, inflation for passive assets)
	Depreciation	*"The recommended approach*	Pure economic depreciation

	approach	*for asset depreciation is economic depreciation wherever feasible."* (article 7)	(requiring long run forecasts), tilted annuity, tilted annuity formula adjusted (to provide more stable price evolution) can be used
6 – Operating costs	Wholesale commercial costs calculation	*"the additional spectrum costs and wholesale commercial costs directly related to the provision of the wholesale termination service to third parties would also be taken into account"* (annex)	Wholesale commercial costs can be calculated as a percentage of other costs or extracted from the operators' accounts
	OPEX as a percentage of CAPEX or functional area calculation or bottom-up calculation	No recommendation	OPEX can be calculated as a percentage of CAPEX, based on a bottom-up approach for some assets (floor space, power, etc.), based on an assessment of the number of staff required, or extracted from top-down information (potentially compared between operators of the country) The OPEX derived from the accounts can eventually be adjusted for inefficiencies (e.g. maintenance OPEX can be adjusted for the lower number of faults that would occur in the modelled 'new' network as compared to the real 'old' network.)
	Trend of OPEX	No recommendation	OPEX can increase with inflation, decrease with productivity, remain stable because inflation and productivity gains compensate each other

Source: TERA Consultants

These tables above highlight the fact that NRAs have to take several decisions before calculating the costs of MTRs and FTRs which also means that it is very likely that NRAs can take divergent decisions from a country to another. There is therefore some room for further harmonization. Some topics have been discussed in the TRR and the European Commission provided some recommendations but NRAs can sometimes choose to slightly deviate because of local circumstances (for example, some NRAs may not decide to model a full NGN network because migration to a full NGN is far from being completed). In the context of the Article 7

procedure, the European Commission had the opportunity to comment on some of the topics above and about the lack of consistency between Member States:

- About wholesale commercial costs for FTRs (step 6 – operating costs above), the European Commission observed that these costs represent generally between 0% and 20% of the FTR and was therefore concerned by the fact that wholesale commercial costs represented 75% of the FTR in Austria[89] and in Luxembourg[90].
- The European Commission issued comments to the Greek NRA because it had modelled an efficient operator which would need several years to reach an efficient target scale (step 2 – demand calculation). The European Commission clarified the TRR in saying *"Accordingly, the modelled efficient operator is to be considered as one who is already present on the market and has achieved an efficient level of operations. Such approach would best ensure promotion of efficiency, sustainable competition and maximise consumer benefit in line with Article 13 of the Access Directive."*[91]
- The European Commission also commented on the issue of the number of layers of interconnection being modelled for FTRs[92] (step 1 – network topology and technology definition).
- The European Commission pointed out the need to model the 4G technology in recent cases in Croatia[93] and in Luxembourg[94] (step 1 – network topology and technology definition):
    - *"The Commission acknowledges the ILR's view that the fact that mobile operators in Luxembourg are unlikely to roll-out voice over LTE (the 4G technology used to provide voice services) before the end of 2016 implies that 4G would have a negligible impact on the cost of terminating mobile voice calls. However, the BU-LRIC model developed by the ILR adequately reflects the design of a mobile network used to provide all mobile services relevant to end-users over the forward-looking period (e.g. mobile broadband, text messages or voice calls). Thus, the Commission believes that excluding 4G technologies in the network design of the cost model (even if these are not specifically used to provide voice services) could ultimately have a knock-on impact on the estimated cost of mobile voice termination".*

[89] Commission Decision concerning Case AT/2014/1618: Call termination on individual public telephone networks provided at a fixed location in Austria.

[90] Commission Decision concerning Case LU/2014/1682: Wholesale call termination on individual public telephone networks provided at a fixed location in Luxembourg.

[91] Commission Decision concerning Case EL/2014/1563: Call termination on individual public telephone networks provided at a fixed location.

[92] Commission Decision concerning Case SE/2013/1517: Changes to remedies concerning markets for (i) voice call origination, (ii) voice call termination on individual fixed telephone networks, (iii) wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location, (iv) wholesale broadband access.

[93] Commission Decision concerning Case HR/2015/1709: Wholesale voice call termination on individual mobile networks in Croatia.

[94] Commission Decision concerning Case LU/2015/1712: Wholesale voice call termination on individual mobile networks.

The BEREC also had the opportunity to comment on the increment definition (step 2 – demand calculation above) in a Czech case: *"ČTÚ's calculated incremental costs represent the incremental costs of termination traffic originated in Czech Republic and do not contain international incoming traffic that is terminated Czech Republic. According to BEREC this would probably lead to higher incremental costs per minute because of neglecting economies of scale. Also this might not reflect the size of the increment as defined in the Recommendation, i.e. the wholesale termination to third parties, irrespective of the location of origination".*[95]

In addition to these cost modelling issues, the European Commission had also the opportunity to identify several pricing issues which would require more consistency at the European level. Outside the fact that some NRAs decided not to apply the pure BU-LRIC approach, it can be noted, among the countries which have followed the pure BU-LRIC approach:

- The European Commission commented on late implementation of the TRR[96] and especially the use of glide path in the case of late implementation.
- The European Commission commented on lack of transparency, for example in Italy[97].
- The European Commission commented several times on the decision taken by some NRAs to allocate costs no more recovered by FTRs (when moving to the pure LRIC approach) to other regulated products (such as WLR or call origination)[9899]. This issue is not directly related to MTRs and FTRs but rather to other regulated fixed products.
- The European Commission commented several times on the choice to apply a single FTR or MTR value over several years (calculated as an average for example) or to apply different rates every year (direct outcomes of the model)[100101] ("single average price cap" versus "different annual price caps").
- The European Commission criticised the choice made by the NRA in Luxembourg to choose the maximum value among a range of possible value for MTRs because of the inherent uncertainty related to MTR calculation[102]: *"The ILR explains that its choice of the maximum value scenario to set the mobile termination price cap is driven by the inherent uncertainty surrounding the true costs of termination. In this sense, ILR*

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95 http://berec.europa.eu/files/document_register_store/2013/1/BoR_(13)_04_BEREC_opinion_CZ-2012-1392_2013.01.21.pdf

96 For example, Commission Decision concerning Case HU/2013/1506 – Call termination on individual public telephone networks provided at fixed location in Hungary.

97 Commission Decision concerning Case IT/2015/1768: Wholesale voice call termination on individual mobile networks in Italy.

98 Commission Decision concerning Case HU/2013/1506 – Call termination on individual public telephone networks provided at fixed location in Hungary.

99 Case BG/2013/1410: Call termination on individual public telephone networks provided at a fixed location in Bulgaria.

100 Commission Decision concerning Case HR/2015/1709: Wholesale voice call termination on individual mobile networks in Croatia.

101 Commission Decision concerning Case LU/2014/1682: Wholesale call termination on individual public telephone networks provided at a fixed location in Luxembourg.

102 Commission Decision concerning Case LU/2015/1712: Wholesale voice call termination on individual mobile networks.

prefers to adopt the highest termination cost delivered by its cost model to ensure that all termination costs will be covered by the price cap adopted".

- The European Commission criticised the use of a glide path in countries which implemented the TRR early but then updated the calculations and calculated a much lower rate than before and considered an adjustment period was needed[103].

6.2 Areas of further harmonization

6.2.1 Areas of further harmonization for FTR calculation

The calculation of FTRs might be made much simpler compared to the approach currently followed by NRAs as a consequence of the TRR. This is because termination traffic represents a very small share of the total network traffic (the total network traffic is made of broadband traffic, leased lines traffic, TV traffic and voice traffic which includes the termination traffic) and that most of network assets are insensitive to the removal of termination traffic. This could lead to much further harmonization.

To understand this, it is necessary to understand what are the different types of fixed core network costs and which ones are likely to be incremental to the termination traffic:

1. Many assets are insensitive to traffic:
    - Either because they are sensitive to the number of customers, such as MSANs or other access nodes,
    - Or because their capacity is very high. For example, fibre cables and trenches are insensitive to termination traffic since fibre cables in the core network generally have several dozens of fibre and the capacity of one single fibre can be significantly increased by WDM capabilities.
2. The cost of network nodes such as WDM nodes, Ethernet switches or IP routers can vary with the traffic. When traffic increases for example, more nodes can be needed in a given location and, more likely; more ports at each node can be needed. The typical capacity of a port is a multiple of 1 Gbps or a multiple of 10 Gbps.
3. IMS (hardware or software) are the network assets managing in a centralised manner the voice service in an NGN network.
4. Interconnection gateways costs. Interconnection gateways are the points of interconnection with other networks (which means the gateways where incoming traffic enters the network).
5. Wholesale commercial costs specific to termination[104]. This category includes for example the billing costs and the cost of the staff responsible for dealing with other operators' relationships.

[103] Commission Decision concerning Case UK/2015/1706: Voice call termination on individual mobile networks in the United Kingdom.

[104] This type of cost is not a network cost but is incremental to the termination traffic.

Out of these 5 categories, the last 3 categories are driving all or the almost all the pure LRIC cost of fixed termination. Indeed, assets insensitive to traffic are by definition excluded from the pure LRIC cost calculation. And network node costs can be traffic sensitive in theory but in practice the capacities of these assets are such that the pure LRIC of these assets is null or almost null.

An example is used to illustrate this latter statement. Nodes (Ethernet, IP or WDM) in a core network aggregate different number of customers and therefore different sizes of traffic: access nodes such as DSLAM aggregate a small number of customers (typically several thousands) and core nodes aggregates the greatest number of customers. Let us take the following assumptions which are illustrative but overall realistic:

- Nodes which cost depend on the traffic have ports with capacities which are either multiple of 1Gbps or multiple of 10 Gbps;
- Penetration rate for voice: 100%;
- Penetration rate for broadband: 100%;
- Throughput used by a voice call: 100 kbps;
- Percentage of incoming traffic: 25%;
- Percentage of customers calling at peak hour: 5%;
- Peak throughput for broadband: 200 kbps (for all customers);
- Percentage of leased lines with 100 Mbps speed: 0.1%;
- IPTV channels: 200;
- Size of an IPTV channel: 2Mbps;
- Percentage of users watching different channels at peak hour: 10%. This means that the traffic is a given area is the minimum of 200x 2 = 400 Mbps and 10% x 2 x number of customers.

The traffic generated by each service at the busiest hour of the network can be calculated on the basis of these assumptions. The total busy hour traffic can be also calculated.

Table 4 – Illustrative example of the traffic generated by each service at the busy hour for different sizes of

Number of customers aggregated by the network node	Busy hour voice traffic (Mbps)[105]	Busy hour broadband traffic (Mbps)[106]	Busy hour leased lines traffic (Mbps)[107]	Busy hour TV traffic (Mbps)[108]	Total busy hour traffic (Mbps)[109]
100	0.5	20	10	20	50.5

[105] Calculated as: number of customers x 5% x 100 kbps.

[106] Calculated as: number of customers x 200 kbps (the value of 200kbps already takes into account the fact that not all customers are using broadband at peak hour).

[107] Calculated as: number of customers x 0.1% x 100 Mbps.

[108] Calculated as: minimum of 200 x 2Mbps and number of customers x 10% x 2Mbps.

[109] Calculated as the sum of the other columns.

1,000	5	200	100	200	505
10,000	50	2,000	1,000	400	3,450
100,000	500	20,000	10,000	400	30,900
1,000,000	5,000	200,000	100,000	400	305,400
10,000,000	50,000	2,000,000	1,000,000	400	3,050,400

Source: TERA Consultants

These assumptions and calculations enable:

- to determine the share of incoming traffic at busy hour for different sizes of network nodes,
- to determine whether removing incoming traffic enables to avoid costs,
- to determine the probability for incoming traffic to generate avoidable costs.

The illustrative example shows that (see Table 5):

- incoming voice traffic generates a very small proportion of the busy hour traffic (less than 1%);
- in the example, the incoming voice traffic generates incremental costs only for the largest nodes (10 million of customers, which does not exist in the European Union because there is not just one core node per country and the highest number of lines in Europe is 30 millions);
- the probability for incoming traffic to generate incremental traffic is:
  - very small for small network nodes,
  - around 10% for nodes aggregating 1 million of lines,
  - is 100% for nodes aggregating 10 million of lines.

  However, for nodes aggregating 1 or 10 million of lines, the unit cost (cost of the incremental assets divided by incoming voice traffic) is extremely low because the number of incoming voice minutes is very high for these nodes.

Table 5 – Illustrative example of the traffic generated by each service at the busy hour for different sizes of

Number of customers aggregated by the network node	Incoming traffic at busy hour (Mbps)[110]	Share of incoming traffic (%)[111]	Size of the required link (1 Gbps or 10 Gbps)[112]	Does incoming traffic generates avoidable costs (Y/N)[113]	Probability for incoming traffic to generate incremental costs (%)[114]

[110] Calculated as: voice busy hour traffic x 25%.

[111] Calculated as: incoming voice busy hour traffic divided by total busy hour traffic.

[112] If total busy hour traffic is lower than 1 Gbps, then 1Gbps, otherwise 10 Gbps.

[113] When removing incoming traffic, does the number of 1Gbps or 10 Gbps assets changes?

[114] Calculated as: incoming voice busy hour traffic divided by required size of the link.

100	0.1	0.2%	1	No	0%
1,000	1.3	0.2%	1	No	0%
10,000	12.5	0.4%	10	No	0%
100,000	125.0	0.4%	10	No	1%
1,000,000	1,250.0	0.4%	10	No	13%
10,000,000	12,500.0	0.4%	10	Yes	100%

Source: TERA Consultants

Details of pure LRIC fixed network cost models have been found for 3 countries and enable to confirm this analysis above (see Table 6): network node pure LRIC costs represent between 0 and 3% of FTR in Denmark, France, Luxembourg and Netherlands.

Table 6 – Distribution of pure LRIC costs in 4 countries where information is available

Country	Denmark[115]	France[116]	Netherlands[117]	Austria[118]	Luxembourg[119]
Wholesale commercial costs (%)	6%	0%	0%	75%	77%
Interconnection gateways (%)	93%	0%	0%	?	23%
IMS (%)	0%	97%	100%	?	0%
IP, Ethernet, WDM nodes (%)	1%	3%	0%	?	0%
Total cost (c€/min)	0.05	0.05	0.16	0.11	0.13

Source: TERA Consultants

As a consequence, it could be envisaged to recommend that FTRs recover only the 3 following categories of costs:

- **wholesale commercial costs specific to termination;**
- **avoidable interconnection gateway costs;**
- **avoidable IMS costs.**

[115] LRAIC cost model available on DBA's website.

[116] ARCEP, Modèle technico-économique des coûts d'un opérateur fixe générique efficace en France, 12 November 2013.

[117] Commission decision concerning case NL/2012/1284: Call termination on individual public telephone networks provided at fixed location in the Netherlands.

[118] Commission decision concerning Case AT/2013/1457: Call termination on individual public telephone networks provided at fixed location in Austria.

[119] http://www.ilr.public.lu/communications_electroniques/encadrement_tarifaire/M2_M3_reglement_motivation_reg.pdf

The advantage of recommending that FTRs should recover only the 3 categories of costs mentioned above is that:

- It avoids having to calculate the other network costs which represent probably 90 to 95% of the cost modelling efforts;
- It enables to focus more on the 3 categories of costs mentioned above which are extremely important for the calculation of FTRs. As identified by the European Commission in the aforementioned Austrian case and as shown in the table above, there can be significant discrepancies in the calculation of these 3 cost categories. However, it would seem simple to harmonize the calculation of these 3 values:
    - Wholesale commercial costs are mainly made of staff costs. The number of Full Time Equivalent (FTE) dedicated to incoming wholesale commercial activities could be estimated and could even be harmonize at the EU level. Each NRA would then just need to multiply this number of FTE by the relevant national FTE cost and to divide by the number of national incoming minutes.
    - IMS costs are considered as non-traffic related in some countries (related to the number of customers for example or fully fixed) and traffic related in others. This is difficult to explain because suppliers are international suppliers and the fact that costs are traffic or not traffic dependent should be easy to determine. Harmonisation for this type of costs would seem very important.
    - Interconnection gateways would probably need to be modelled on a bottom-up basis for each country.

It is to be noted that focusing on these 3 cost categories will still require defining an appropriate scale for the generic operator.

Also, most NRAs still need to develop a bottom-up LRIC cost model to calculate the cost of other NGN based regulated wholesale services which share the same assets as call termination. For these wholesale services which a detailed assessment of core network costs is necessary (call origination, bitstream, wholesale leased lines, etc.). This is the case of Luxembourg, Ireland, Sweden, Denmark, etc. In these cases, the recommendation would be less relevant but it would help in making sure the 3 cost categories above are adequately assessed.

Considering Table 6 above, it is expected that the FTR level would reach 0.05 c€/min with such a recommendation. This is the value calculated in Denmark and France and this is the value that would have been observed in Austria with a lower level of wholesale commercial costs. This value may be greater in smaller countries because of the presence of lower economies of scale (for wholesale commercial costs for example).

To increase even further harmonisation a model skeleton could be built and used by each NRA which would fill it to calculate the costs relevant for its own country. From a practical point of view, if the design of the model task is performed at the European level rather than at the Member State level, it could be envisaged to use a generic model that would be common to all Member States and could only be fine-tuned at the country level for parameters that are

country specific and are unlikely to be homogenised among Member States: traffics and subscriber bases, coverage obligations, spectrum availability, unit costs of assets that are country specific (e.g. trenches that require significant man work as wages are significantly heterogeneous among EU28 countries).

6.2.2 Areas of further harmonization for MTRs calculation

The situation is more complex for MTsR because much more network costs are traffic related. This can be the case for example for base stations and transmitters/receivers and backhaul.

However, some areas of further harmonization can be identified.

The following table lists the possible recommendations which could be made to further guide NRAs and further harmonize calculations, having considered:

- Previous European Commission decisions in the context of the Article 7 procedure,
- New technological developments (such as use of Single-RAN, VoLTE, 4G, etc.),
- TERA's review of several bottom-up LRIC mobile network cost models developed by NRAs.

The appropriateness of these recommendations would have to be discussed with the industry.

Table 7 – Options available for NRAs at the different steps of the MTR cost modelling exercise and possible recommendations

Step	Topics for each step	Further recommendations
1 – Network topology and technology definition	Access technology 2G/3G/4G and VoLTE	NRAs should model an operator using 2G, 3G and 4G (it is unlikely that a new entrant would deploy 4G only because of the time needed for all mobile phones to be compatible with the 4G technology and because of the existence of the Single RAN technology) VoLTE should be included in the modelling[120].
	Frequencies available	Existing operators may not have the same types and quantities of spectrum. Therefore, this is difficult to make any recommendation on this subject
	Use of single RAN or not	Single RAN should be modelled. By the time a new recommendation is issued, Single RAN will probably be widely used.
	Coverage	Existing operators may not have the same coverage and licenses may require different levels of coverage.

[120] This is consistent with Ofcom's view: *"We recognise that VoLTE is at an early stage of development and its costs are still uncertain, however, the evidence we have is consistent with VoLTE being deployed by MCPs during the control period and so we have included it in the 2015 MCT model. We consider VoLTE to be an "efficient technolog[y] available in the timeframe considered by the model", as envisaged in paragraph 12 of the 2009 EC Recommendation." (http://stakeholders.ofcom.org.uk/binaries/consultations/mobile-call-termination-14/statement/MCT_Draft_Statement.pdf).*

		Therefore, this is difficult to make any recommendation on this subject
	Backhaul medium	Existing operators and licenses may not have the same type of backhaul. Therefore, this is difficult to make any recommendation on this subject
	Core technology	A mix of TDM and NGN should be recommended because of the presence of circuits and packet technologies in the Radio Access Network
	Voice interconnection technology	TDM interconnection seems still to be the main technology used for interconnection and should therefore be recommended
	Fully new operator or existing operator	Conceptually, a new operator is more appropriate and this should be made clear Given the large development of fixed-mobile convergent offers, it seems preferable to model an integrated fixed-mobile operator (which can lead to a further reduction of wholesale commercial costs)
2 – Demand calculation	Number of minutes, SMS and data	No need for any recommendation since NRAs only have to take actual figures here
	Traffic at busy hour	To make sure the results of the model are realistic, NRA should be required to compare the calculated busy hour traffic with existing operators values
	Generic operator definition	It could be possible to further specify the market share of the generic operator with for example 20% for a 4 operators market, 25% for a 3 operators market, etc.
	Forecasts	It could be possible to specify that - Domestic voice and SMS traffic should follow past trend - International voice and SMS traffic should take into account changes in the roaming rate regulation (Roaming Like At Home) - Data traffic should be based on a defined list of studies (such as Cisco VNI[121], Ericsson[122])
	Modelling period	Modelling period should be 3 years (duration of market analysis cycle)
	Choice of the increment	The increment should be incoming voice traffic (domestic and international) as noted by the BEREC. For the avoidance of doubts, SMS traffic is not part of

[121] http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html

[122] http://www.ericsson.com/mobility-report

		the increment.
3 – Network inventory calculation	Geotypes definition	While this is typically an area where NRA should decide the most relevant geotypes for their country, an homogeneous definition of geotypes in Europe could be relevant.
	Cell radii	This parameter is very important. Discussions with operators and the use of existing models should enable to define common cell radii for each geotype and for each frequency.
	Routing factors Overcapacity factors Traffic dimensioning rules for 2G, 3G and 4G	For all these technical parameters, discussions with main network suppliers would enable to define a list of parameters to be used by NRAs. Several parameters should be available for a given technology since there can be several releases of this technology. NRA would then have to choose the technology and release which are the most relevant for the country (for example based on what national operators are planning to deploy).
	Calibration	NRA should be required to make sure the network inventory is calibrated with real network inventories (in particular, an efficient operator should have no more than the number of base stations of existing operators in each geotype, all other things being equal)
4 – Investment	Unit prices of assets	This should be collected by NRAs as costs can vary from a country to another. However, for assets purchased from international suppliers, a database of unit price used in the models could be constructed to make sure unit prices used by NRAs remain comparable.
	Site rental or acquisition	Existing operators may not have the same strategy from a country to another or even with a given country. Therefore, this is difficult to make any recommendation on this subject.
	Network sharing	Existing operators may not have the same strategy from a country to another or even within a given country. Therefore, this is difficult to make any recommendation on this subject. However, a minimum level of sharing could be recommended to send right signals.
	Spectrum costs	The 2009 TRR left some room for manoeuvre on the inclusion of spectrum costs. It would be useful to issue

		further recommendations: - Based on the practices of NRAs. For example Ofcom did not include spectrum costs[123]. It could be useful to collect NRA practice on this subject. - Considering the fact that spectrum is more and more allocated for data and that spectrum is allocated by blocks of size of at least 5 MHz in general this makes it barely variable to termination traffic.
5 – Depreciation	Asset lifetime	Based on cost models already published, it could be possible to define a list of asset lifetimes (or a range) for each asset. There is no apparent reason for asset lifetimes to differ significantly from a country to another
	WACC	There are parallel workstreams on the WACC in Europe
	Price trend	Based on cost models already published, it could be possible to define a list of price trends (or a range) for each asset. There is no apparent reason for price trends to differ significantly from a country to another (with the exception of price trends related to labour costs)
	Depreciation approach	It should be made clear that a pure economic depreciation with long term calculations should be developed. This would ensure a smoother evolution of MTR

[123] For example, in the UK Ofcom decided not to include spectrum : *"The reason pure LRIC could include some contribution to spectrum is that if termination volumes were zero, then this might entail a MCP avoiding having to purchase (or reducing) its current spectrum holdings. For a given amount of spectrum, more capacity can be provided by increasing the size of the network (i.e. increasing the number of base stations and/or traffic-handling capacity at base stations). Alternatively, for a given size of network (i.e. a fixed number of base stations), more capacity can be provided if more spectrum is deployed. However, we noted that the implementation of pure LRIC in the MCT cost model meant that we did not have to include an explicit estimate of spectrum costs.*

However, at the margin, the willingness to pay for additional spectrum required to deliver a given amount of traffic would be no more than the network costs otherwise required (i.e. if network equipment rather than spectrum were used to provide the additional capacity). As our MCT cost model determines pure LRIC based on the network costs with and without termination volumes, it explicitly measures the avoided network costs for the traffic increment in question (i.e. MCT provided to other CPs). Viewed in this way, changes in spectrum value should have no impact on the pure LRIC of MCT." (http://stakeholders.ofcom.org.uk/binaries/consultations/mtr/statement/MCT_statement_Annex_6-10.pdf (§A9.8-9)

This approach raises controversy among players operating in the UK, for example Vodafone:

"It noted that a minimum amount of spectrum would be necessary to provide a coverage network, so this minimum amount would not have to vary with additional traffic volumes provided over that network. But any additional spectrum above this level must be incremental to traffic volumes. It was concerned that we had not appropriately considered incremental spectrum costs and the opportunity cost of spectrum – which it thought likely to be particularly important when calculating pure LRIC. It argued that an accurate estimate would require modelling the trade-off between the amount of spectrum used and the cost of additional network roll-out." (http://stakeholders.ofcom.org.uk/binaries/consultations/mtr/statement/MCT_statement_Annex_6-10.pdf (§A9.18)).

6 – Operating costs	Wholesale commercial costs calculation	Wholesale commercial costs are mainly made of staff costs. The number of Full Time Equivalent (FTE) dedicated to incoming wholesale commercial activities could be estimated and could even be harmonize at the EU level. Each NRA would then just need to multiply this number of FTE by the relevant national FTE cost and to divide by the number of national incoming minutes.
	OPEX as a percentage of CAPEX or functional area calculation or bottom-up calculation	This should be collected by NRAs as the OPEX can vary from a country to another.
	Trend of OPEX	Based on cost models already published, it could be possible to define a list of OPEX trends (or a range) for each asset. There is no apparent reason for OPEX trends to differ significantly from a country to another

Source: TERA Consultants

It is difficult to estimate what would be the impact of this further harmonization on the level of MTRs, especially as the impact is likely to be very different from a country to another. Also, the level of MTRs is related to the amount of densification base stations (those used to absorb incremental traffic) versus coverage base stations (those used to cover the country) which can vary significantly from a country to another. However, among the list of recommendations above, some should automatically lead to a reduction of MTRs:

- Increase of data traffic over time and implementation of a pure economic depreciation approach,
- Modelling of Single RAN,
- Implementation of a minimum level of network sharing.

TERA Consultants had had the opportunity to test the modelling of Single RAN and observed it would lead to a decrease by 10% of MTRs. Wholesale commercial costs represent between 0% and 20% of MTRs. A more consistent and detailed assessment of these costs could lead to a decrease to a median value of 10%. Finally, if 10% of sites are shared and network sharing leads to a decrease of costs by 50% for costs that represent 50% of MTRs, then the impact of network sharing would be 2.5%. Overall, a decrease by at least 10 to 20% of pure LRIC MTRs could be observed, leading to most pure LRIC MTRs being comprised between 0.5 c€/min and 1 c€/min. However, more important would be that pure LRIC MTRs would probably further converge.

To increase even further harmonisation a model skeleton could be built and used by each NRA which would fill it to calculate the costs relevant for its own country. From a practical point of view, if the design of the model task is performed at the European level rather than at the Member State level, it could be envisaged to use a generic model that would be common to all Member States and could only be fine-tuned at the country level for parameters that are country specific and are unlikely to be homogenised among MSs: traffics and subscriber

bases, coverage obligations, spectrum availability, unit costs of assets that are country specific (e.g. trenches that require significant man work as wages are significantly heterogeneous among EU28 countries). It is to be noted that TERA Consultants built for the EC in 2016 a model skeleton to assess roaming costs in EU28 countries.

6.2.3 Areas of further harmonization for pricing issues

In addition to these cost modelling recommendations for FTRs and MTRs, the European Commission may need to issue further pricing recommendations which would enhance harmonization. In accordance with previous European Commission decisions in the context of the Article 7 procedure, this should include:

- The absence of glide path or “adjustment period”,
- The requirement to apply different annual price caps,
- A recommendation on the allocation of costs no more recovered by FTsR (when moving to the pure LRIC approach) to other regulated products (such as WLR or call origination).
- The requirement not to choose the maximum value among a range of possible value for MTR but a central estimate.
- The requirement to apply symmetric rates.

5 Appendix 1 – Sources & terminology

5.1 Sources

The table below lists all the sources of information that have been used in preparing this report.

Table 8 – Sources of information used to prepare the report

Source	Type of Source	Information provided
BEREC	Annual and biannual termination rates benchmark snapshot	Levels of termination rates, dates of implementation of methodology cost (Pure LRIC, LRAIC+, Benchmark…)
European Commission	Annual progress reports on European electronic communications market	Levels of termination rates, revenues, investments, market shares, number of subscribers – Information available per country
NRAs	Replies to questionnaire sent by the EC	Traffics, retail prices, number of subscribers, offer structure, convergence of fixed and mobile, on-net/off-net price differentiation
GSMA Intelligence	Database	Number of unique subscribers, investments, market shares
Buddecom	Report on the countries' markets	EBIT, EBITDA, context about the countries' markets

Source: TERA Consultants

5.2 Country groups

Table 9 – Country groups for mobile markets

Name	Definition/Scope
Early Pure LRIC	Group of countries which set MTRs based on the TRR before the end of 2013: Austria; Belgium; Bulgaria; Czech Republic; Denmark; Spain; France; Italy; Lithuania; Poland; Portugal; Sweden; Slovakia; United-Kingdom
Late Pure LRIC	Group of countries which set MTRs based on the TRR after the end of 2013: Greece; Croatia; Hungary; Luxembourg; Malta; Romania; Slovenia
No Pure LRIC	Group of countries not following the TRR yet (when the report was written): Cyprus; Germany; Estonia; Finland; Ireland; Latvia; Netherlands

Source: TERA Consultants

Table 10 – Country groups for fixed markets

Name	Definition/Scope
Early Pure LRIC	Group of countries which set FTRs based on the TRR before the end of 2013: Austria, Belgium, Denmark, France, Malta, Portugal, Slovakia
Late Pure LRIC	Group of countries which set FTRs based on the TRR after the end of 2013: Czech Republic, Greece, Spain, Croatia, Hungary, Ireland, Italy, Luxembourg, Latvia, Romania, Sweden, Slovenia, United Kingdom
No Pure LRIC	Group of countries not following the TRR yet (when the report was written): Belgium, Cyprus, Germany, Estonia, Finland, Lithuania, Netherlands, Poland

Source: TERA Consultants

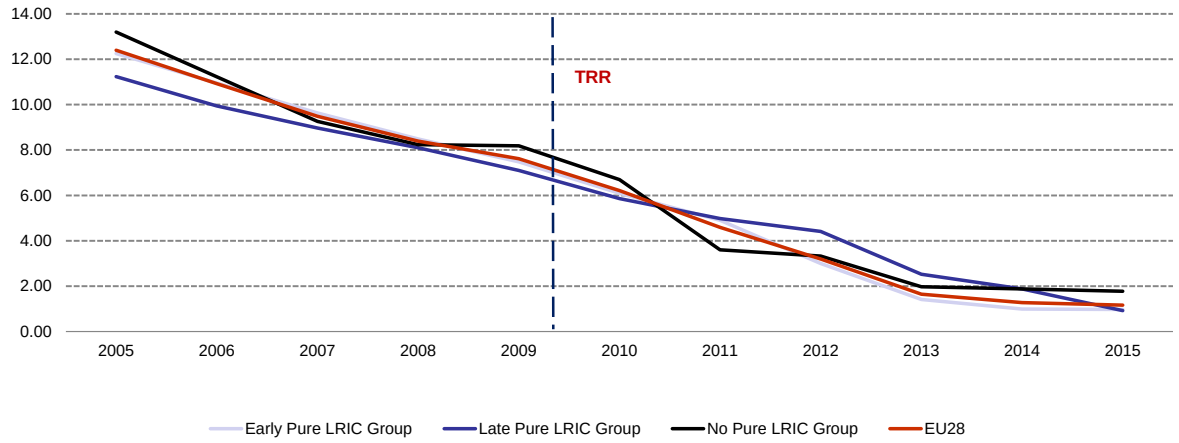
6 Appendix 2 – Further analyses

6.1 Evolution of weighted average MTRs

Weighted averages are presented in Figure 61. This enables to calculate average MTRs which take into account the respective sizes of the countries' markets in terms of subscribers. The MTR values found in the BEREC reports are weighted for each country by the subscribers' market shares of the different operators. Furthermore, the values are the average of peak and off-peak MTRs. This average has been weighted by the number of SIM cards given by the EC reports and financial analysis for each Member State.

Weighted averages of all groups have been constantly declining between 2005 and 2015, bottoming out as well since 2013. By the end of 2015, the No Pure LRIC Group has the highest MTR (1.780EURcts/min) twice as large as the Early Pure LRIC Group's average (0.975EURcts/min). The Late Pure LRIC group has now the same level of MTRs has the Early Pure LRIC group.

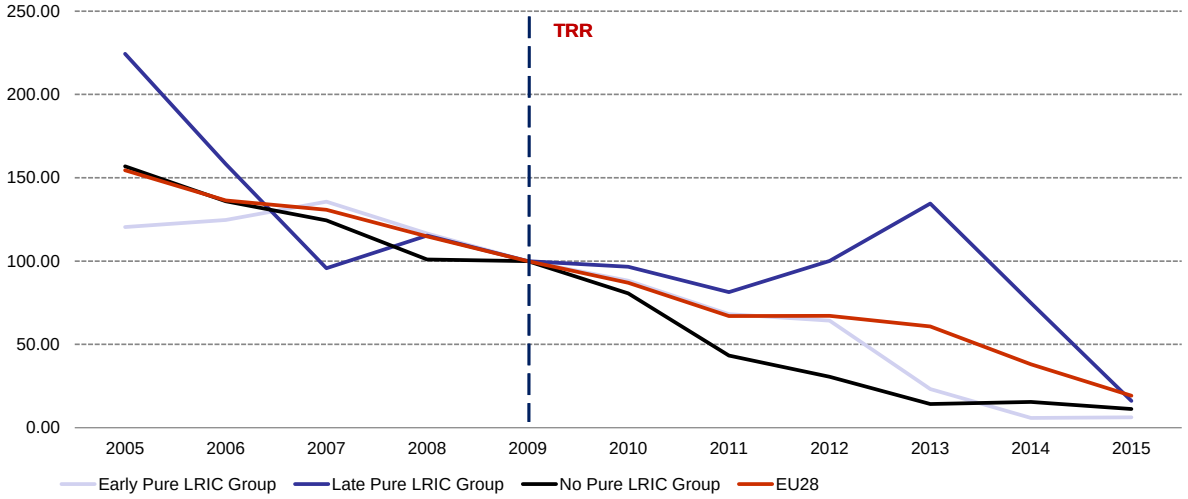
Figure 61 - Weighted average MTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

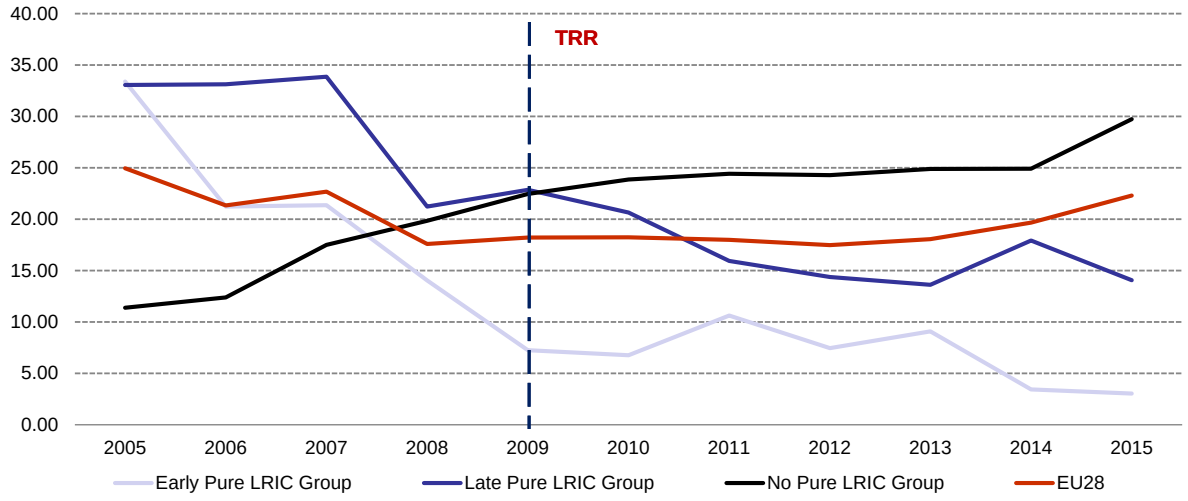
6.2 Standard Deviation in relative value

Figure 62 – Standard deviation of MTRs (base 100 in 2009)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 63 – Standard deviation of FTRs (base 100 in 2009)

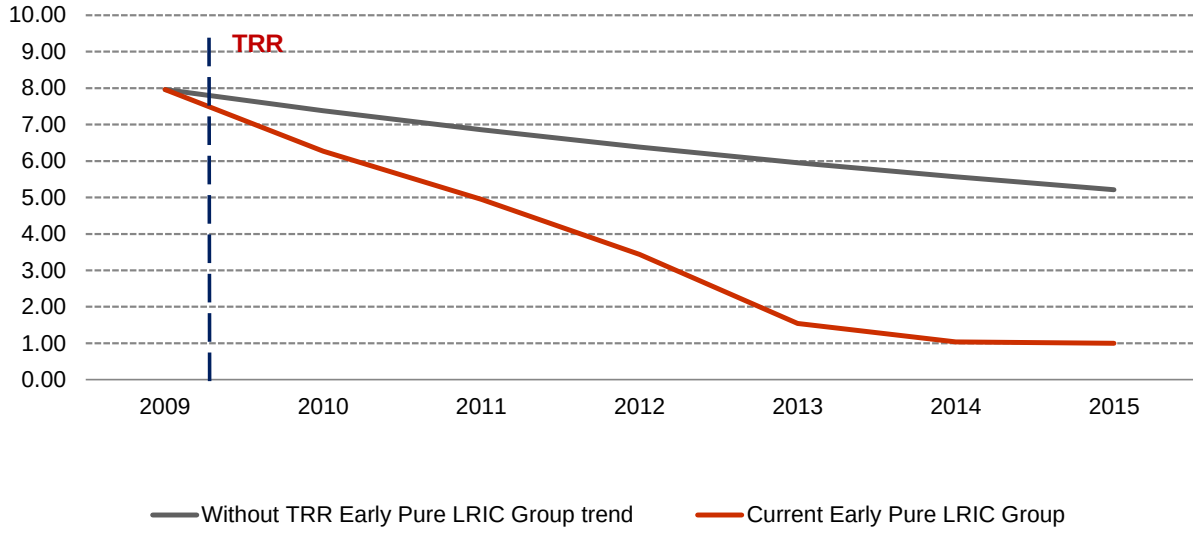


Source: TERA Consultants analysis, BEREC & EC reports

6.3 What would have been the level of MTRs absent the TRR?

Figure 64 compares the Pre-TRR trend of the Early Pure LRIC Group and the actual levels of Early Pure LRIC Group's MTR. The trend is roughly similar to the "all groups" one.

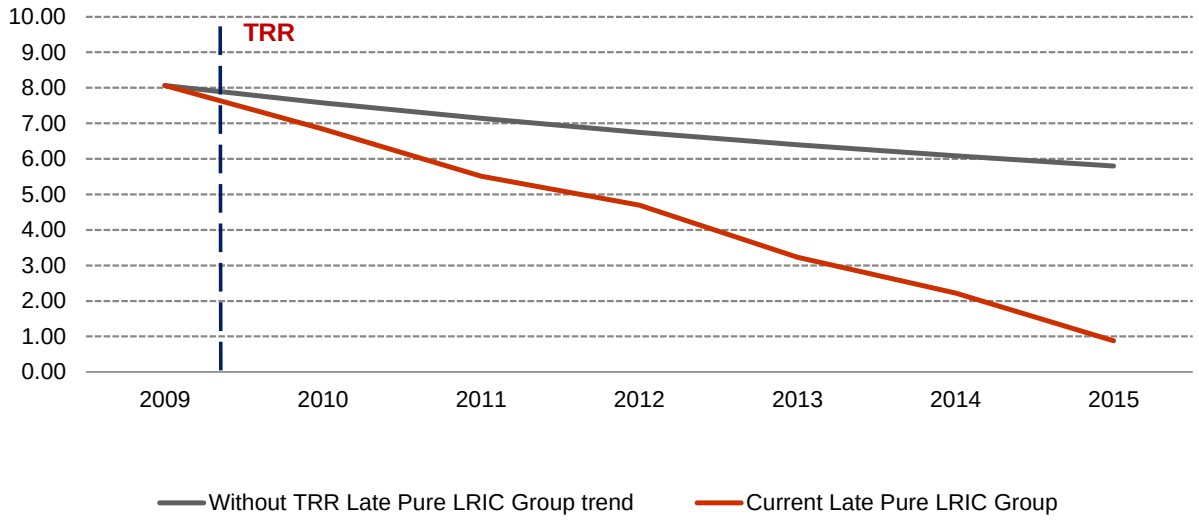
Figure 64 - Without TRR Early Pure LRIC Group MTR trend (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 65 highlights the comparison between the Pre-TRR MTR trend of the Late Pure LRIC Group and the current Late Pure LRIC Group average MTR. In this case as well, the Pre-TRR trend generates MTRs which are higher than the actual MTRs. This underlines that for the "Late Pure LRIC group" as well, the decline of the MTRs has speeded up between 2009 and 2013 as compared to the pre-TRR pace, even though the TRR was not implemented yet.

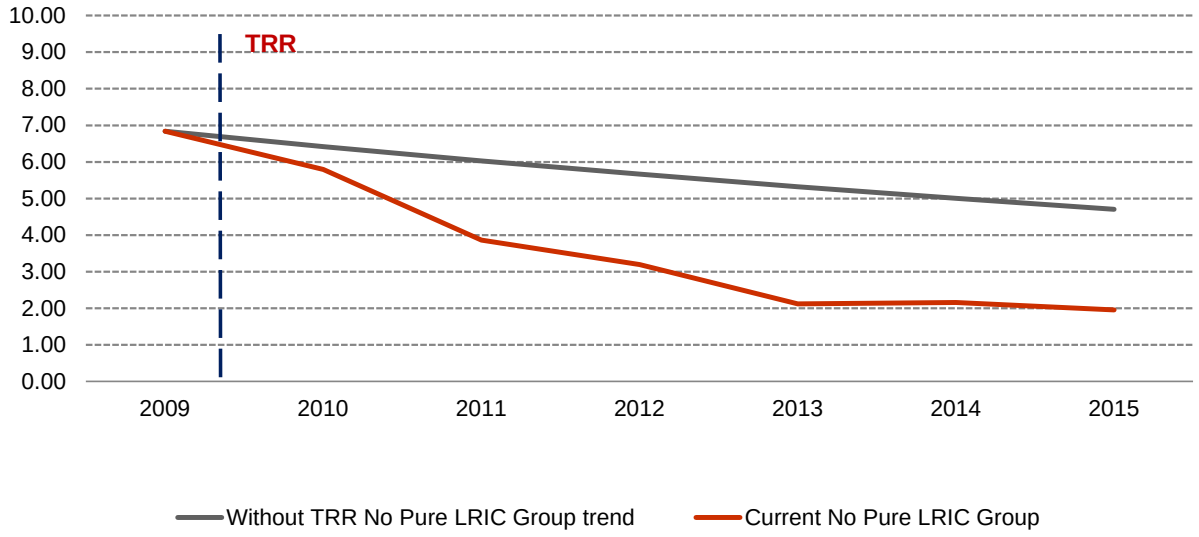
Figure 65 - Without TRR Late Pure LRIC Group MTR trend (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 66 shows the Pre-TRR MTR trend of the No Pure LRIC Group and the actual MTR levels for this Group. Since 2013, the average MTR for this group has begun bottoming-out and is closer to the Pre-TRR trend than other groups.

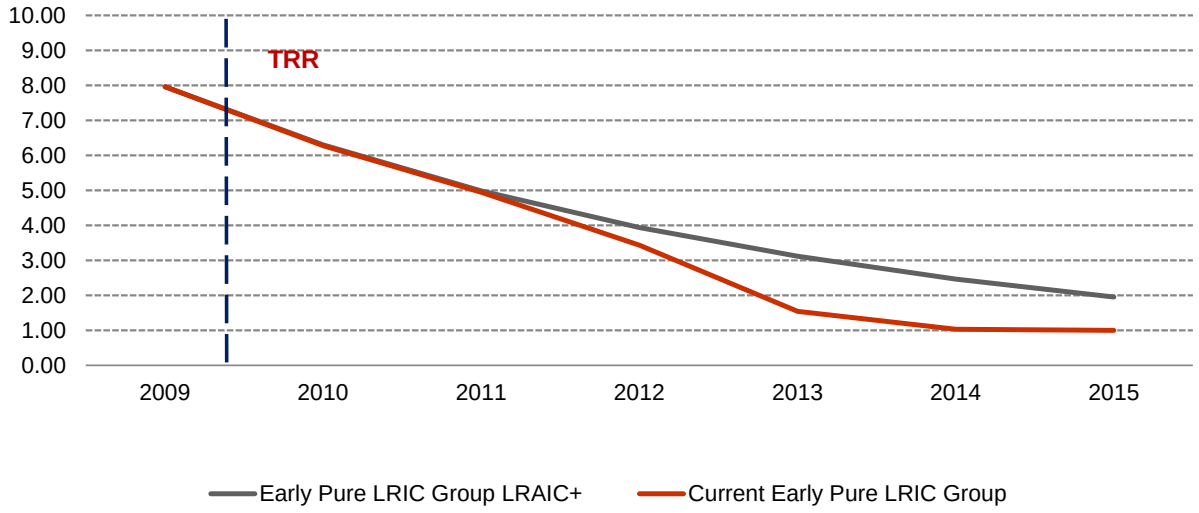
Figure 66 - Without TRR No Pure LRIC Group MTR trend (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 67 displays the Early Pure LRIC Group's current MTR and LRAIC+ calculation. Both curves were at a similar level until 2011 when all the Member States started implementing Pure LRIC. Therefore the current MTR is lower since 2012 among the countries of the Early Pure LRIC Group with a 1.01EURcts/min average MTR in 2015 for 1.85EURcts/min if the LRAIC+ approach had been followed.

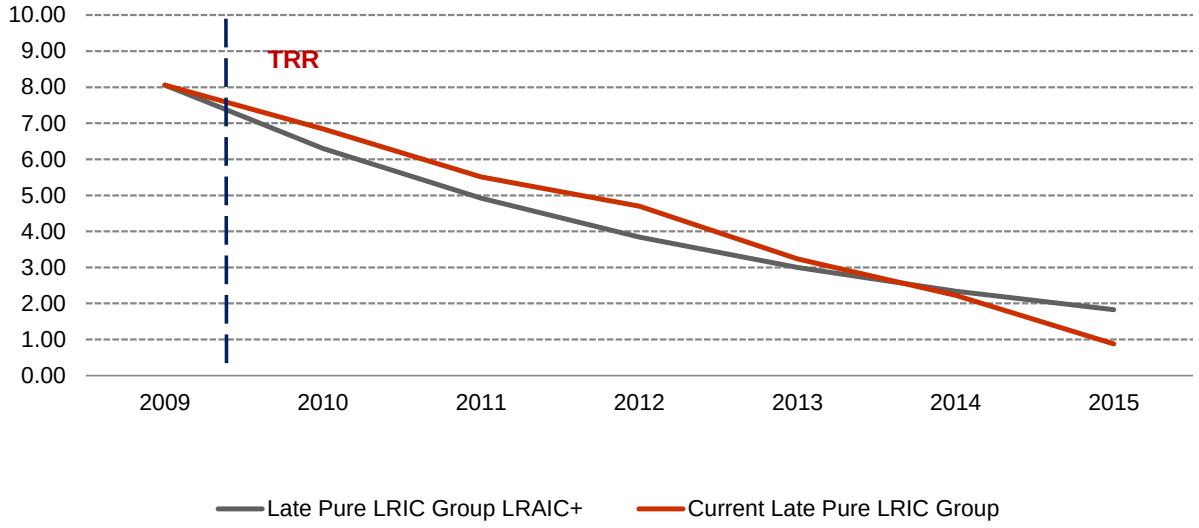
Figure 67 - Early Pure LRIC Group LRAIC+ MTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 68 shows the current MTR and the LRAIC+ MTR calculated between 2009 and 2015 for the Late Pure LRIC Group. The current MTR has been slightly above the LRAIC+ assessment until 2013, and fell below in 2014, year corresponding to the beginning of the implementation of Pure LRIC by the Member States of this group. In 2015, the LRAIC+ average MTR for this group (1.96EURcts/min) is twice the current MTR (0.88EURcts/min).

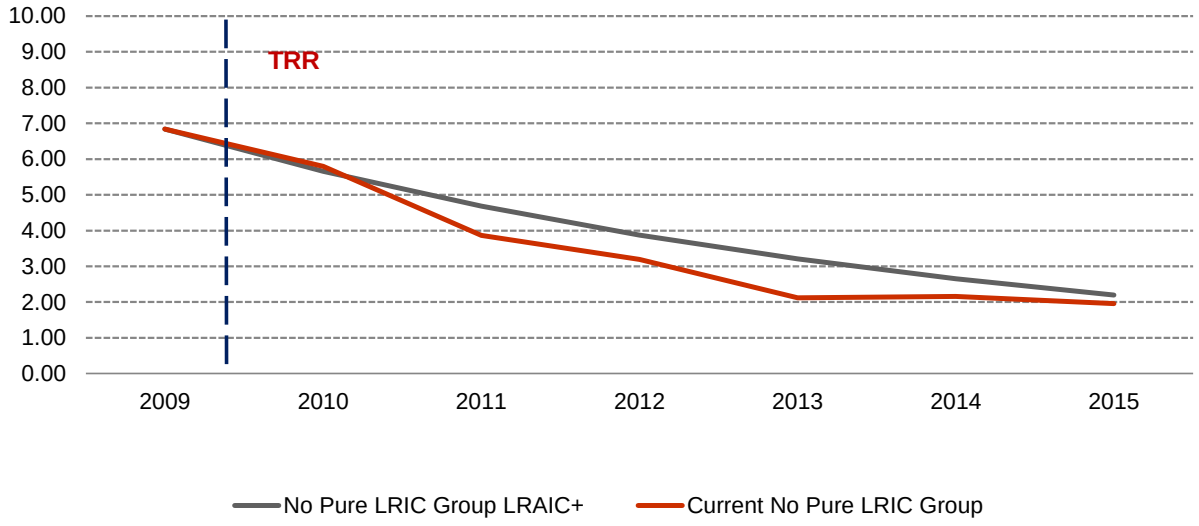
Figure 68 - Late Pure LRIC Group LRAIC+ MTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 69 shows the No Pure LRIC Group's current MTR and the corresponding LRAIC+ MTR. The two curves are very similar from 2009 to 2015 with an exception in 2013 when the current MTR decreased faster. The current MTR then bottomed-out allowing the LRAIC+ MTR to close the gap, with very comparable values in 2015: 1.61EURcts/min for the current MTR and 1.75EURcts/min for the LRAIC+ MTR.

Figure 69 - No Pure LRIC Group LRAIC+ MTR (EURcts/min)



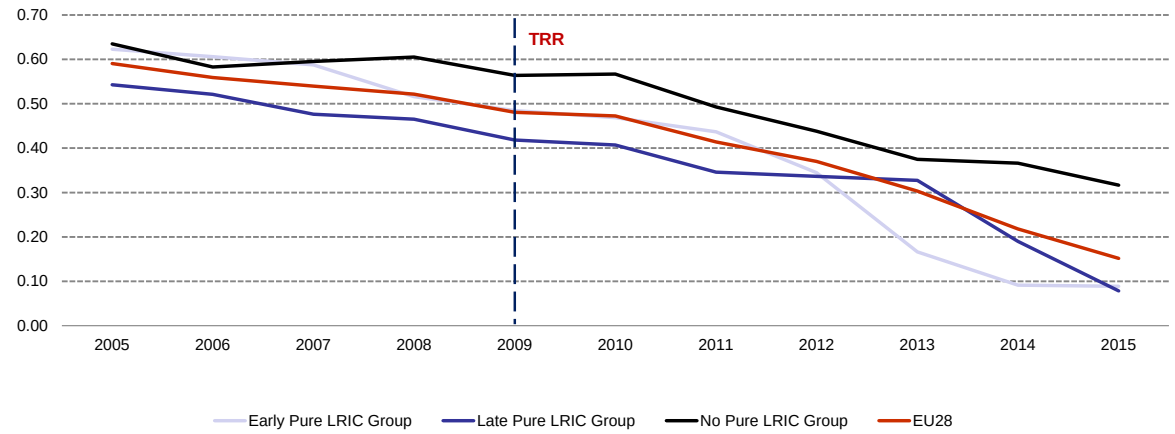
Source: TERA Consultants analysis, BEREC & EC reports

6.4 Evolution of weighted average FTRs

The weighted averages presented in Figure 70 follow the same trend as the flat averages: a steady decline between 2005 and 2012 for all the groups, then a faster decrease respectively after 2011 and 2013 for the Early and Late Pure LRIC Groups. The FTRs of the No Pure LRIC group also decreased faster than the flat average after the TRR, from 2010 to 2015. It can also be observed that the weighted averages levels are circa half the flat averages FTRs ones (Early Pure LRIC Group from 2005 to 2015, Late Pure LRIC Group in 2015, No Pure LRIC

Group since 2013). This highlights the fact that high FTRs are common mostly in less-populated countries.

Figure 70 - Weighted FTR average (EURcts/min)

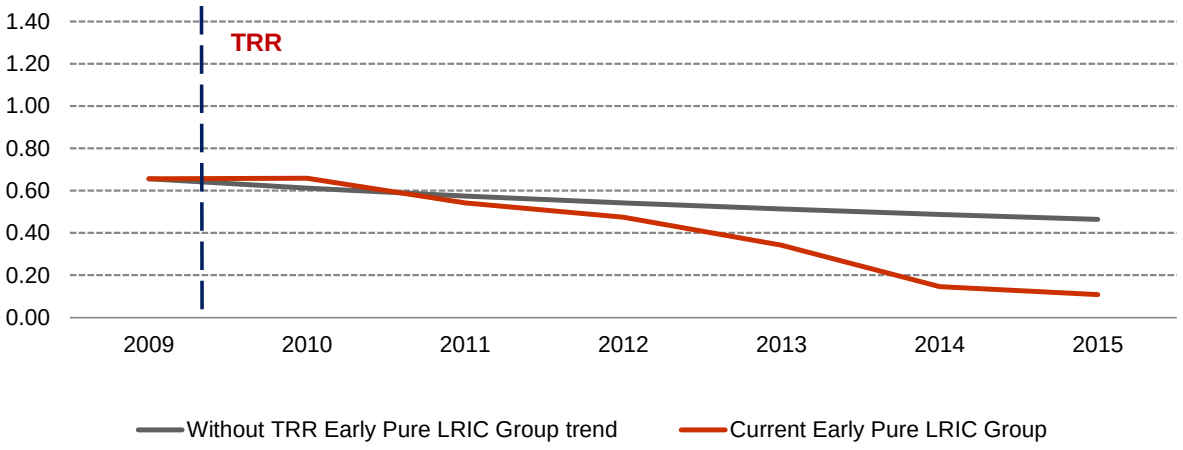


Source: TERA Consultants analysis, BEREC & EC reports

6.5 What would have been the level of FTRs absent the TRR?

Between 2009 and 2011, the FTRs generated by the Pre-TRR trend and the Early Pure LRIC Group actual FTR have been roughly similar, with a very slight increase for the Early Pure LRIC Group FTR in 2010 since Pure LRIC had not been implemented by then. However, the Early Pure LRIC Group FTR fell down below the FTR generated by the Pre-TRR trend in 2011 and the gap has been growing between 2011 and 2014. Due to the implementation of the TRR by the countries of this Group by the end of 2013, the difference between the two curves has stopped widening in 2014, and has been remaining constant ever since, as shown in Figure 71.

Figure 71 - Without TRR Early Pure LRIC Group trend (EURcts/min)

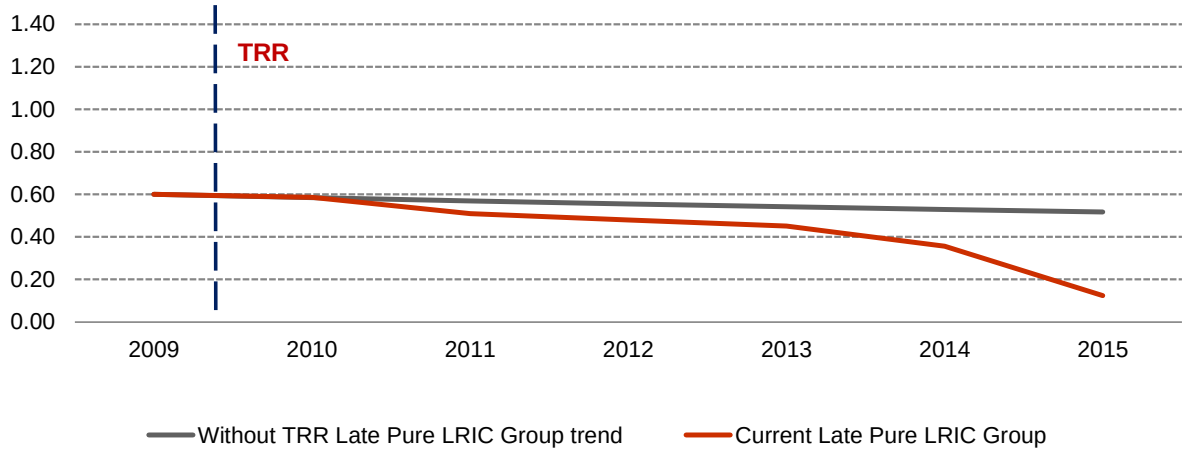


Source: TERA Consultants analysis, BEREC & EC reports

Figure 72 shows the comparison between the FTR generated by the Pre-TRR Late Pure LRIC Group FTR trend and the actual levels of FTR for this group. The current FTR of the Late Pure LRIC Group has fallen slightly below the pre-TRR trend in 2011 and the gap has been remaining fairly constant until 2013. However, since 2014 this gap has been widening

following the progressive implementation of the TRR by the MS of this group, showing the impact of the TRR.

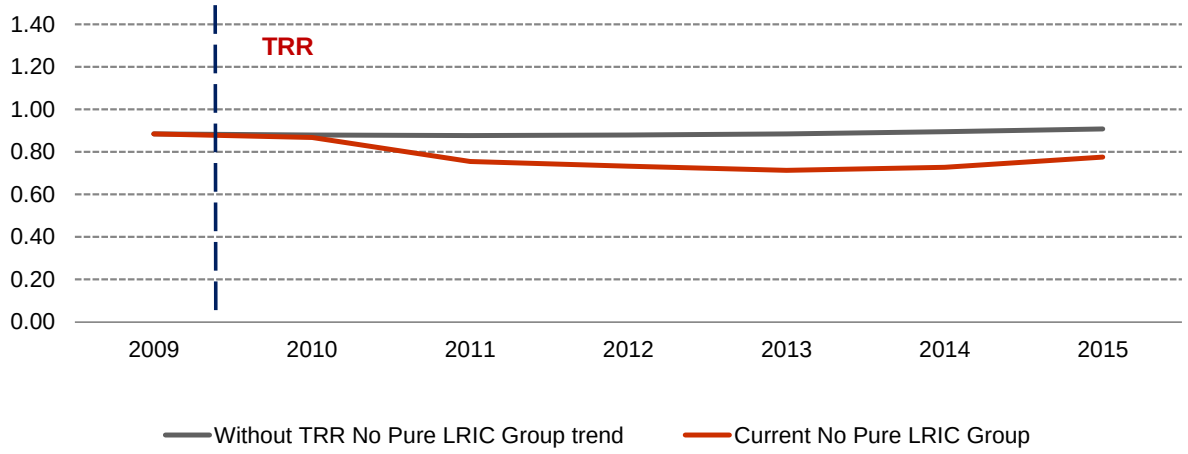
Figure 72 - Without TRR Late Pure LRIC Group trend (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 73 compares the FTR generated by the Pre-TRR trend of the No Pure LRIC Group and their current average FTR. Even though the actual FTRs have been slightly lower than the Pre-TRR trend (by less than 0.03EURcts) between 2010 and 2015, both curves are very similar over this period: whereas the gap has been widening for the Early and Late Pure LRIC Groups after 2011, it has been remaining constant from 2011 to 2015 for the No Pure LRIC Group. The TRR did of course not have the same impact for the No Pure LRIC Group as the one observed for the other groups.

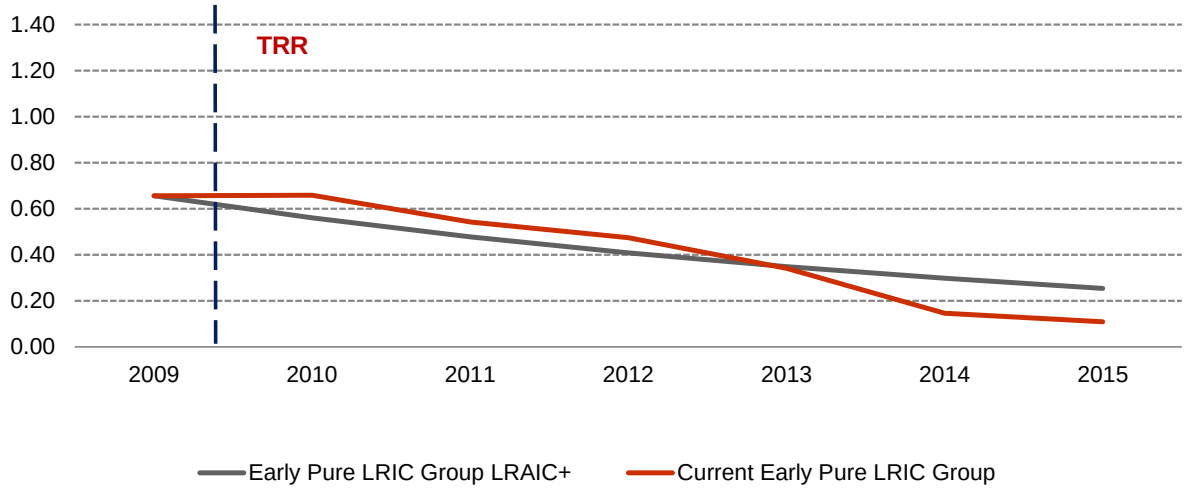
Figure 73 - Without TRR No Pure LRIC Group trend (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

Figure 74 shows the levels of FTR and the (assessed) LRAIC+ MTR for the Early Pure LRIC Group. Since no value was available for this group, the EU average rate of decrease has been used and applied to the 2009 FTR. The values of the LRAIC+ assessment have been below the levels of FTR between 2009 and 2013 and have been above ever since. The impact of the TRR can be observed here as the Member States of the Early Pure LRIC Group started implementing Pure LRIC in 2013 which corresponds to the start of the decline of the current FTR compared to the LRAIC+ MTR.

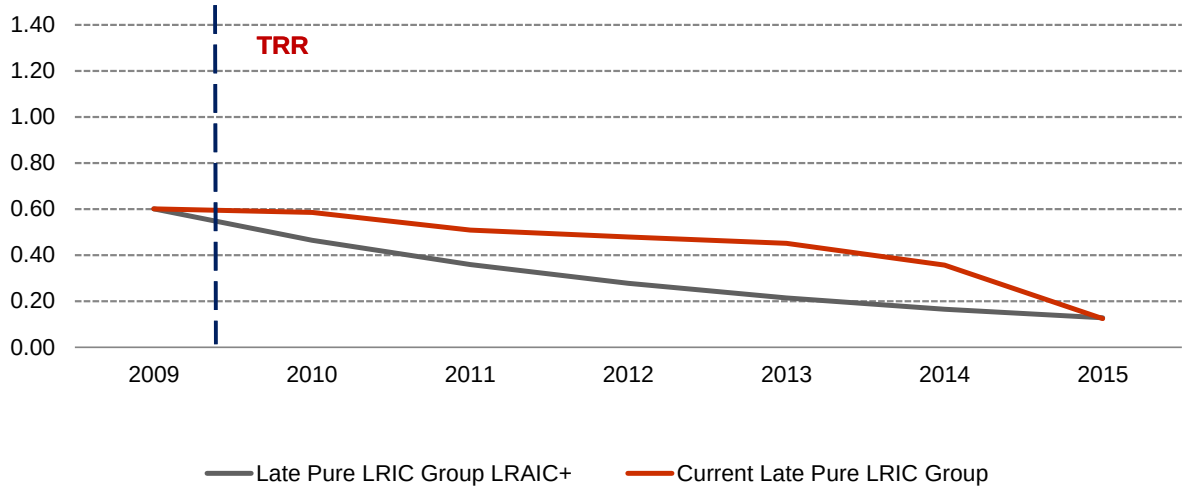
Figure 74 - Early Pure LRIC Group LRAIC+ FTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

The level of FTR is compared to the LRAIC+ FTR for the Late Pure LRIC Group in Figure 75. For this group, the levels of FTR have been constantly above the LRAIC+ assessment since 2009. However, since 2015 (which corresponds to the period when Member States of this group started implementing Pure LRIC) the levels of FTR are equivalent to the LRAIC+ assessment.

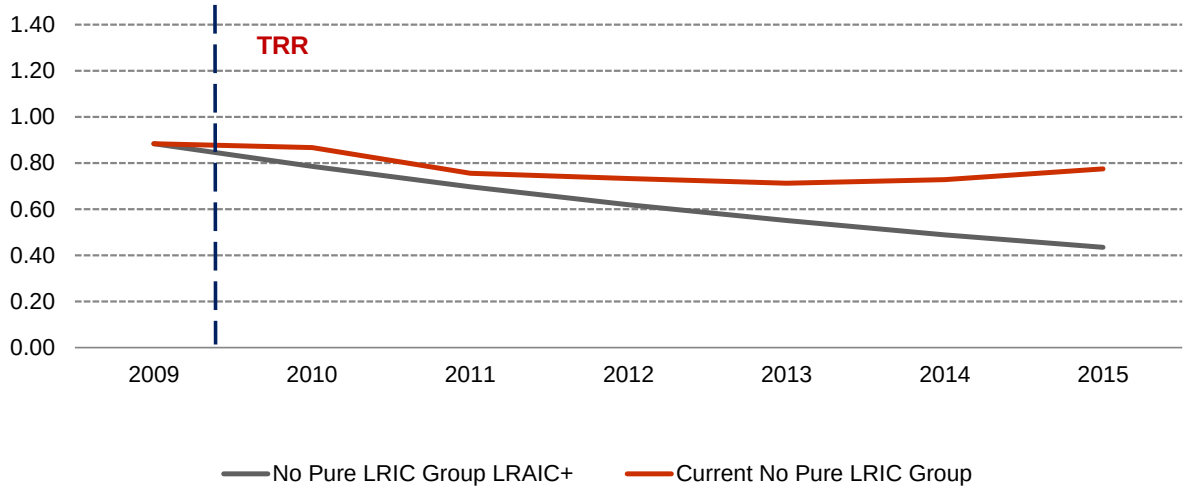
Figure 75 - Late Pure LRIC Group LRAIC+ FTR (EURcts/min)



Source: TERA Consultants analysis, BEREC & EC reports

The same analysis has been conducted for the No Pure LRIC Group, displayed in Figure 76. The levels of FTR has been constant since 2009, as the Member States of this group did not implement the Pure LRIC approach, whereas the LRAIC+ FTR assessment has been declining since 2009, remaining below the FTR levels over this period.

Figure 76 - No Pure LRIC Group LRAIC+ FTR (EURcts/min)

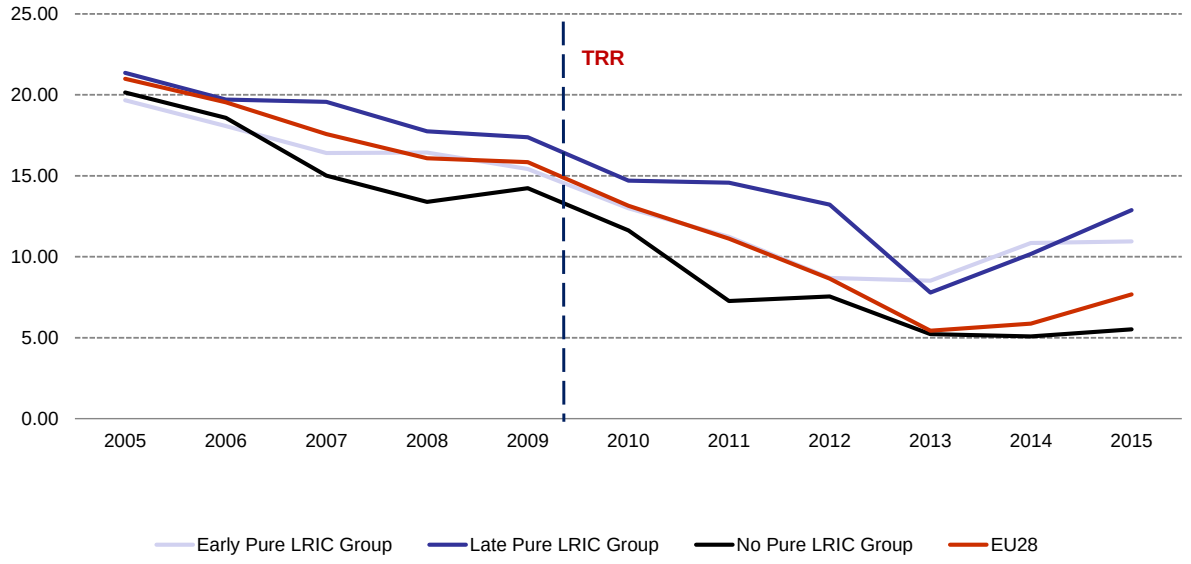


Source: TERA Consultants analysis, BEREC & EC reports

6.6 Evolution of the MTR/FTR ratio

Figure 77 below shows the weighted MTR/FTR ratio calculated for the three groups. The termination rates have been pondered by the population of each country in terms of fixed lines and number of SIM cards. The MTR/FTR ratio is declining for the three groups between 2005 and 2012, the Early and No Pure LRIC Groups being at very similar levels and Late Pure LRIC Group remaining constantly higher until 2013. Then from 2012 for the Early Pure LRIC Group, and 2013 for the Late Pure LRIC Group, the ratio has been increasing again, while the No Pure LRIC Group's ratio has been steady. Those results can be explained by the very low levels of FTR for both Early and Late Pure LRIC Groups compared to the No Pure LRIC Group, while levels of MTR remained more similar for the three groups. Overall the difference has been decreasing since 2005 and since the TRR was issued in 2009.

Figure 77 - Weighted MTR/FTR ratio



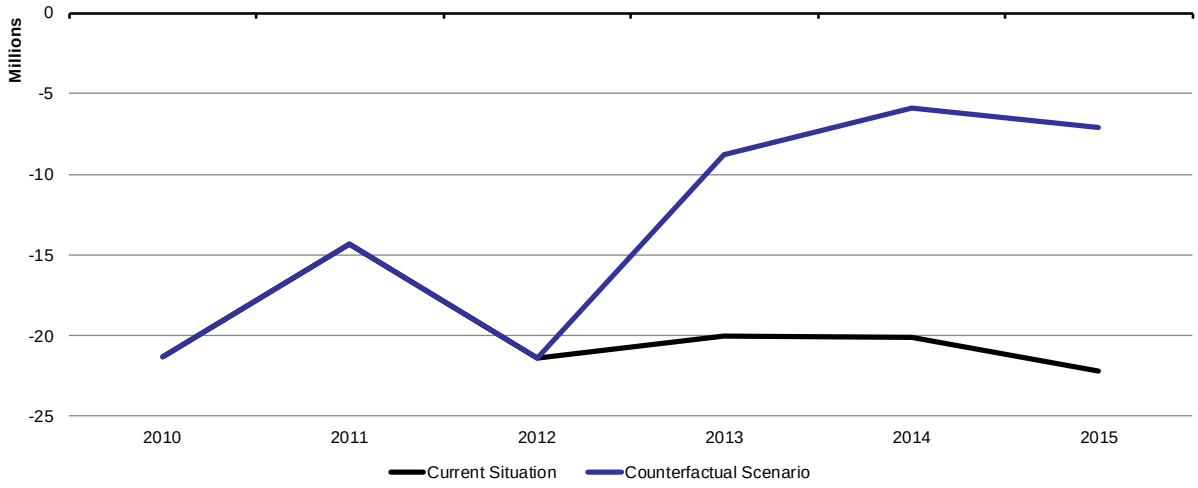
Source: TERA Consultants analysis, BEREC & EC reports

6.7 Impact of the asymmetric implementation of the TRR per group of countries

In order to assess more precisely which group of countries are negatively impacted by the asymmetric implementation of the TRR, and which countries benefit from it, an analysis of the average interconnection balance for each group (Early Pure LRIC / Late Pure LRIC / No Pure LRIC) has been conducted. For each scenario, the current interconnection balance ("Current Situation"), and the interconnection balance of the counterfactual balance ("Counterfactual Scenario") are assessed and compared.

The Early Pure LRIC Group is first analysed in Figure 78. The average interconnection balance of this group has been negative and around -15 million euros and -20 million euros between 2010 and 2012, then with the implementation of the TRR and the general reduction of TR, it was divided by almost four between 2012 and 2014 in the case of the Counterfactual Scenario, but remained at -20 million euros in the Current Situation. This highlights the fact that the MS from this group (Italy, France and UK) suffered from the asymmetric implementation of the TRR.

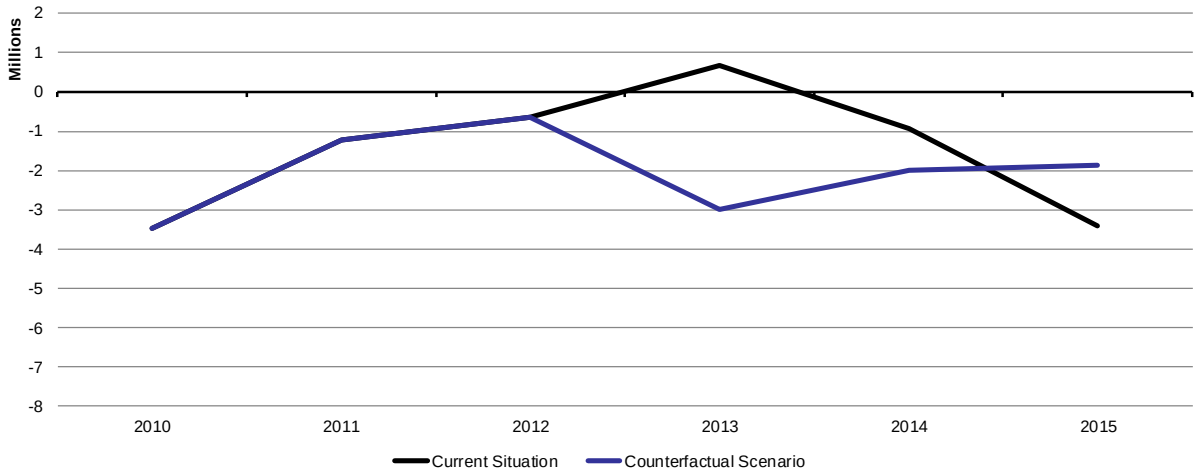
Figure 78 - Average interconnection balance of the Early Pure LRIC Group (in million euros)



Source: TERA Consultants analysis

The Late Pure LRIC Group is then analysed in Figure 79. It follows a different trend than the Early Pure LRIC Group. The average Interconnection balance of this group has been relatively steady between 2010 and 2012, then started decreasing in 2013 in the case of the Counterfactual Scenario, and kept on increasing in the Current Situation (this even became positive because this group benefited from the fall of MTRs in the Early Pure LRIC Group). In 2014 those two trends are reversed and in 2015, the interconnection balance of the Late Pure LRIC Group is actually lower in the case of the Current Situation than the Counterfactual Scenario. The MS of this group arguably took profit of the asymmetric implementation of the TRR, in 2013 and 2014. In 2015 however, the balance has been at a lower level.

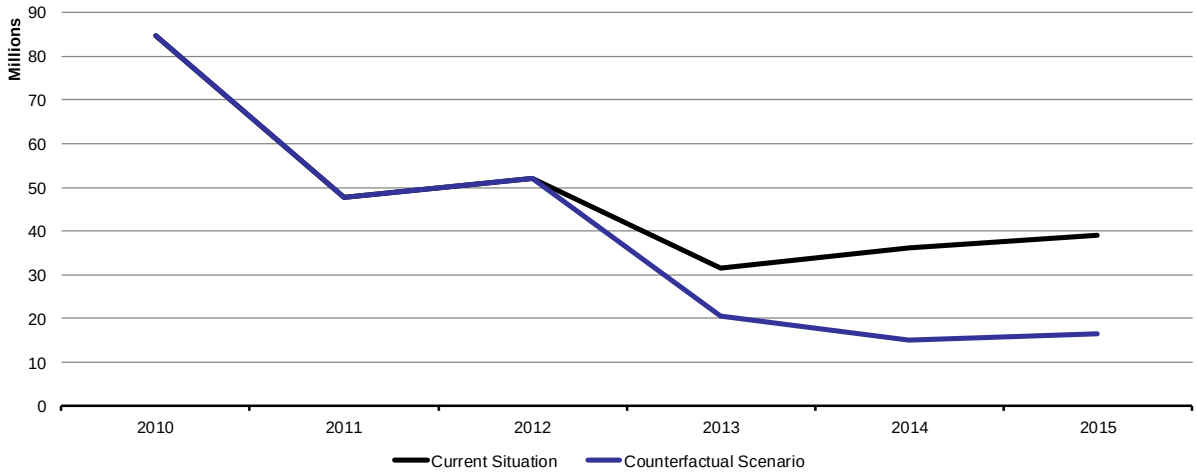
Figure 79 - Average interconnection balance of the Late Pure LRIC Group (in million euros)



Source: TERA Consultants analysis

In Figure 80, the average interconnection balance of the No Pure LRIC Group is analysed between 2010 and 2015. It started at a very high level in 2010 (90 million euros), but has kept on decreasing over the past five years. When comparing the different scenarios in 2013, 2014 and 2015, it can be observed that the interconnection balance in the Current Situation has been constantly above the Counterfactual Scenario from 2013 to 2015. It can then be concluded that the MS of this Group also profited from their non-implementation of the TRR.

Figure 80 - Average interconnection balance of the No Pure LRIC Group (in million euros)



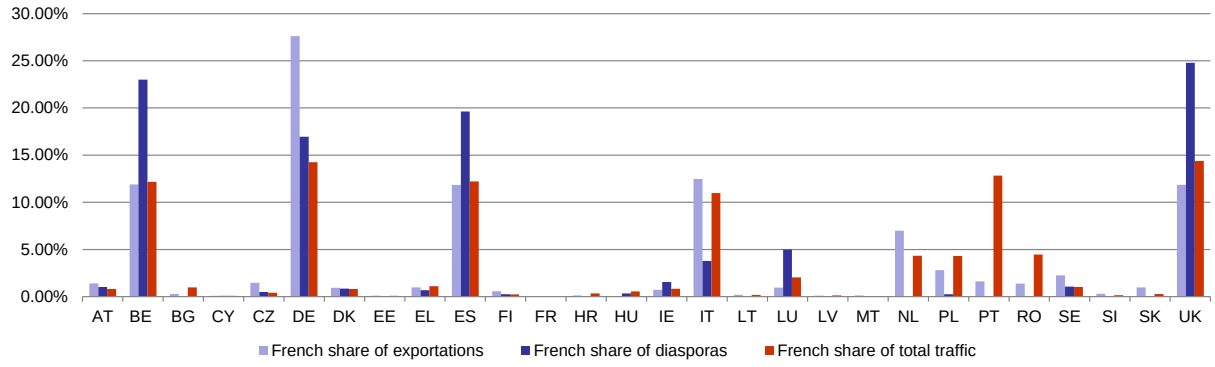
Source: TERA Consultants analysis

6.8 Estimation of the distribution of international traffic per destination

The French NRA and the Dutch NRA have provided information about the distribution of international calls per destination (i.e. per country) or per origin. Since distribution of international calls needs to be known for each country (and not only France and the Netherlands) to assess the levels of interconnection balance, it is necessary to find one or several indicators to distribute the number of minutes of calls to/from international destinations. Two indicators have been tested: the distribution of diasporas of each countries in other EU countries (the underlying assumptions being that international calls are generated by people living in a given country but having their families in another country) and the distribution of exportations (the underlying assumptions being that there are more calls between countries which have more economic exchanges as measured for example by the level of exportations).

Figure 81 shows how the distribution of international calls for France compares with the distribution of exportations and the distribution of diasporas (which is not available for all countries). Except for Germany, Portugal and Romania, the level of exportations seems to be a very good driver of international calls and much better than diasporas.

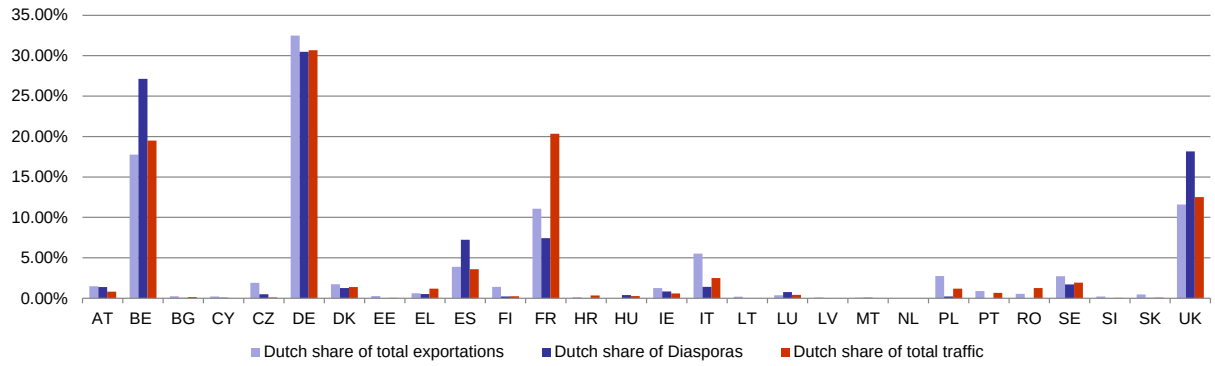
Figure 81 – Distribution of exportation and diasporas for France



Source: TERA Consultants analysis, Eurostat data

Figure 82 shows how the distribution of international calls for the Netherlands compares with the distribution of exportations and the distribution of diasporas (which is not available for all countries). Except for France, the level of exportations seems to be a very good driver of international calls and much better than diasporas.

Figure 82 - Distribution of exportation and diasporas for the Netherlands



Source: TERA Consultants analysis, Eurostat data

7 Annex 3 – Social welfare calculation

7.1 Determining the impact of lower TR on social welfare

This annex presents how the impact on consumer surplus, producer surplus and social welfare is determined in this report.

The model used is the extension of the ACM[124] model, and its different steps are detailed below.

If one has to summarize it, it could be said that:

- A fall in termination rates (TRs) leads to lower retail prices;
- A fall in retail prices leads to higher levels of traffic.

For the producer (the fixed and mobile operators):

- These two effects (lower retail price and higher level of traffic) are combined to calculate the impact on profit for the producer on the voice call market;
- The evolution of traffic and TRs rates are used to calculate the impact at the wholesale level.

For the consumers:

- The retail price and traffic effects are combined to calculate the new consumer surplus.

7.1.1 The social benefit: a difference between two possible social welfares

The social welfare evolution is calculated for two scenarios. The first scenario is what would have happened if every country had followed the 2009 EC recommendation and the second scenario is what would have happened without this recommendation[125].

Hence the theoretical benefit of the recommendation is the difference between the two evolutions of the Social Welfares (SW).

$$Social\ benefit = [SW(post\ scenario2) - SW(pre\ scenario2)] - [SW(post\ scenario\ 1) - SW(pre\ scenario\ 1)]$$

But because the initial situation is the same in both scenarios, the social benefit is simply:

$$Social\ benefit = SW(post\ scenario\ 2) - SW(post\ scenario\ 1)$$

In each scenario the social welfare is calculated in the same way, the only differences among the inputs are the values of Fixed and Mobile Termination Rates (FTRs and MTRs).

7.1.2 How a social welfare is calculated?

A total social welfare has two components: the producer surplus and the consumer surplus. It is reminded that, in the economic theory, the producer surplus is defined by the net profit of

[124] Authority for Consumers and Markets, the Dutch regulatory entity.

[125] Technically, scenario one is using the *pure LRIC* cost model while scenario two is using the *LRAIC+* cost model.

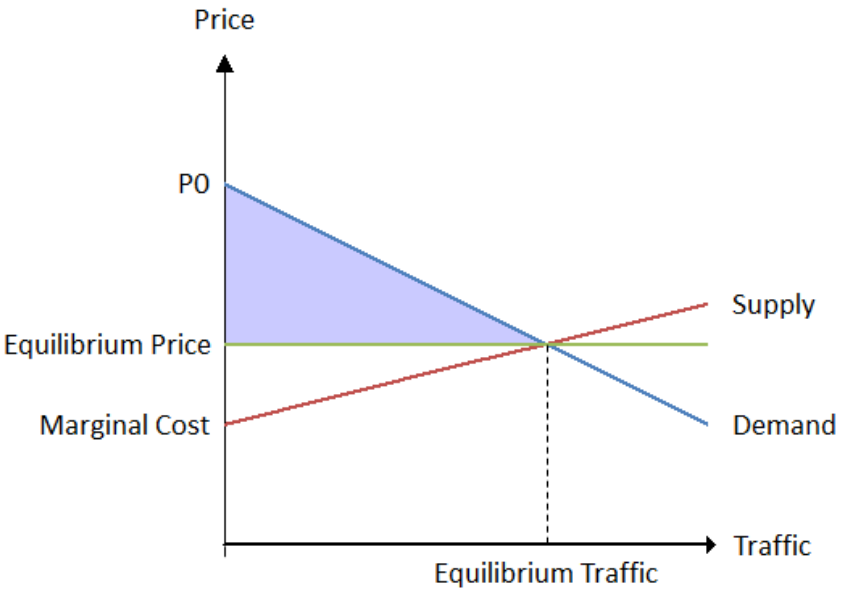
the producer while the consumer surplus is the monetary utility of the good he buys, that is the difference between what the consumer is willing to pay to obtain it and what he actually pays (the current price).

The model separates the fixed and mobile markets. Since the surplus and social welfare are calculated with the same approach, only the social welfare of the mobile market is explained below. However it should be noted that, due to cross market traffic, mobile and fixed markets are not only impacted by termination rates variation on their respective market but also by termination rate variations on the other market.

7.1.2.1 *The consumer surplus*

The graph below summarizes what the consumer surplus is:

Figure 83 – The consumer surplus (blue area)



Source: TERA Consultants

The consumer surplus is exactly the area of the colored triangle, which is half the area of a rectangle. Indeed P0 is the limit price for a positive demand of traffic: that is the maximum price the consumer is willing to pay.

$$Consumer\ surplus = 0{,}5 * Traffic * [\ Price\ (traffic = 0) - Actual\ Price\ ]$$

The main assumption is that the demand curve is linear, like in the graph above. It enables to easily calculate the slope of the curve, using the initial price elasticity of the demand which is an input parameter. More precisely, it can be shown that:

$$Slope = Initial\ Price\ /\ (Initial\ Traffic * Initial\ Elasticity)$$

When the (negative) slope of the curve is known, the price intercept P0 is calculated as follows:

$$Price(traffic = 0) = P0 = Initial\ Price - Slope * Initial\ Traffic$$

Once P0 has been determined, the consumer surplus can be calculated. For one scenario it has to be calculated twice: first with the initial value of traffic and price, and then with the new

values of these variables. The social benefit of the scenario for the consumer would be the difference between the two results.

To summarize, the different parameters to calculate the three consumer surpluses (initial value, pure LRIC scenario, LRAIC+ scenario) are:

- The initial elasticity (given input);
- The initial retail price per minute and traffic (given input);The evolution of traffic and retail price per minute due to the TR change
- The new retail price per minute and traffic (calculated[126]).

It has to be noted that the retail price per minute used in this calculation are including VAT and that the traffic corresponds to the outgoing traffic[127] (because incoming calls are free).

7.1.2.2 *The producer surplus*

The net profit of a producer (which is its surplus) can be written as:

$$Profit = (Price - Marginal\ Cost) * Traffic$$

Indeed the fixed costs have already been dissipated so they do not affect the result anymore. Here the operators have revenues and costs from two different markets: the retail voice call market and the wholesale termination market.

7.1.2.2.1 The mobile retail voice call market

On this market the price is the (mobile) minute price of call (excluding VAT) and the traffic is the total outgoing traffic[3]. The marginal cost (MC) is more accurately a perceived marginal cost (PMC), which depends of the real and perceived cost of termination. Two types of costs are generated when a call is made: the one for the calling user (1) and the one for the receiving user (2).

In the mobile market, the calling user is a mobile user and the cost (1) for the operator is the marginal cost of an outgoing call.

The second cost (2) depends on where the call is going to. If it is terminating on its own network, the cost is still a marginal cost of the operator (it is the marginal cost of an incoming call[128]). If the called person is on another mobile network, the cost would be the MTR. And finally, if the called person is on a fixed network, it is the FTR.

Hence it is just needed to sum the two main costs (1 and 2) considering that the second one is a traffic-weighted average of three different costs. In summary the perceived marginal cost can be expressed as finally:

$$PMC = MC\ of outgoing\ calls\ + MC\ of\ incoming\ calls * \frac{OnNet\ traffic}{Outgoing\ Mobile\ Traffic}$$

[126] Cf. later in this annex, section 7.1.3

[127] The outgoing traffic is the sum of the mobile to mobile traffic and the mobile to fixed traffic.

[128] Actually in the model the marginal cost of an incoming call and the marginal cost of an outgoing call are set at the same level.

$$+MTR * \frac{OffNet\ traffic}{Outgoing\ Mobile\ Traffic} + FTR * \frac{Mobile\ to\ Fix\ traffic}{Outgoing\ Mobile\ Traffic}$$

Actually in the model the marginal cost of an outgoing call and the marginal cost of an incoming call are set at the same value. This value is very close to the new MTR (because the new MTR was set at the incremental cost which can be considered as close to the marginal cost).

7.1.2.2.2 The wholesale termination market

The operators also make profits (or losses) on the wholesale termination market. It is a small market (because prices are low) but since by definition prices on this market are the termination rates, the different scenario assumptions have a significant impact on the profits.

It should be noted that variations within the wholesale termination market do not affect the total (fixed + mobile) producer surplus. Indeed the sum of all the profits is zero since the market is only composed of financial transfers between the operators. However the surplus is calculated to determine if the fall of TRs has rather benefited to mobile or fixed operators on this market.

The surplus remains equal to the profit. On this market the price is exactly equal to the MTR while the marginal cost is the mobile marginal cost of an incoming call. The traffic is the total traffic involving financial transaction on the mobile wholesale termination market; hence the traffic is the sum of the off-net and fixed-to-mobile traffic.

Once again the result depends on input parameters (the marginal cost and the evolution of MTR) and on the evolution of the traffic.

7.1.3 The evolution of traffic and retail price per minute due to the TR change

7.1.3.1 *Determining the new minute price*

The new retail price per minute is calculated using the decrease in TR and a cost pass-through rate, which is an input parameter.

It has been shown[129] that a reduction of TR results in a drop of the perceived marginal cost (PMC). The fall in perceived cost impacts the final prices. This impact is modeled as:

$$New\ Price = Old\ price + \ Cost\ Pass\ Through\ Rate * (Old\ PMCost - New\ PMCost)$$

Where, using the perceived marginal cost formula:

$$Old\ PMC - New\ PMC = \Delta MTR * \frac{OffNet\ traffic}{Total\ Traffic^{130}} + \Delta FTR * \frac{Mobile\ to\ Fix\ traffic}{Total\ Traffic^{130}}$$

The Cost Pass-Through Rate value is assumed equal to 50% in the model. It means that if the cost of a minute decreases by two cents, the price will only decrease by one cent.

---

[129] Cf. above section 7.1.2.2.1

[130] Here the total traffic is the total outgoing mobile traffic.

7.1.3.2 *And the new traffic*

This evolution of the retail prices per minute has an effect on the traffic. Indeed the fall in prices increases the demand in traffic, but it is necessary to determine by how much the demand is increasing.

When the consumer surplus was calculated[131] it has been assumed that the demand evolves in a linear way with prices. The price when traffic was equal to zero and the slope were also determined as functions of different parameters: the price elasticity of the demand, the initial price and the initial traffic. So the demand function for the new price can be written explicitly as:

$New\ Traffic = A - B * New\ Price$ where A and B are constants, and price includes VAT.

A and B are determined by these equations:

$$A = Initial\ Traffic + B * Initial\ Price \qquad B = price\ elasticity * \frac{Initial\ Traffic}{Initial\ Price}$$

The formula of the traffic can also be written in a more intuitive way:

$$Traffic\ variation = Price\ elasticity\ of\ the\ demand * Price\ variation$$

For the mobile to mobile and the mobile to fixed markets, the price elasticity has been set at 0.5[132]. It means that a 10% decrease in price will result in a 5% increase in volume.

These formulas can be adapted to calculate new mobile to mobile, fixed to fixed, fixed to mobile and mobile to fixed traffics. Indeed the price elasticity changes in each case (as well as the initial traffic and prices).

7.1.4 Going further

This part presents different possible sophistications of the model.

7.1.4.1 *Subscriptions and waterbed effect*

7.1.4.1.1 Determining the evolution of subscription prices and quantity

The main idea of this first extension in the model is that the consumers pay two different products: call minutes and subscriptions. Another market can therefore be considered: the subscriptions market, where consumer and producer surplus can be impacted by the fall in the termination rates.

Indeed one could support the existence of a waterbed effect. This effect is simple to explain: the average revenue per user (ARPU) on voice calls and wholesale terminations is decreasing

[131] Cf. above *The consumer surplus.*

[132] For the fixed to fixed and fixed to mobile markets it has respectively been set at 0.2 and 0.3.

so the operators are raising the subscription prices[133] to maintain a constant overall ARPU. This effect can be written as:

$$New\ price = Old\ price + Waterbed\ effect * \ Revenue^{134}\ variation\ per\ subscription$$

In this extension the waterbed effect on fixed and mobile subscriptions are set to 1[135]. It means that a 1€ decrease in the ARPU on voice calls or wholesale terminations will result in a 1€ increase in the subscription price.

The subscription price variations have an impact on the demand of subscriptions. The demand is modeled as the traffic demand in a linear way with the perceived price of a subscription[136]. The mobile subscription market can be taken as an example. In this example, CSm is the average consumer surplus of a mobile subscription. It can be written that:

$$Number\ of\ subscriptions = C - D * \underbrace{(Subscription\ price - CSm)}_{=\ perceived\ subscription\ price}$$

It is important to understand that the difference between the subscription price and CSm is actually the perceived price of a subscription for the consumer. Indeed CSm is the monetary surplus gained by a consumer for a subscription:

$CSm = \frac{Total\ mobile\ consumer\ surplus\ from\ outgoing\ calls}{Initial\ number\ of\ mobile\ subscriptions}$ where the total mobile consumer surplus is the consumer surplus calculated above[137].

C and D are constant values and can be calculated using, as above, the price elasticity of a subscription:

$$C = Initial\ number\ of\ subscriptions + D * (Initial\ subscription\ price - initial\ CSm)$$

$$D = \ Price\ elasticity\ of\ subscriptions * \frac{Initial\ number\ of\ subscriptions}{Initial\ subscription\ price}$$

It should be noted that price elasticity is here related to the perceived price and not to the displayed price of a subscription. It is an input parameter and has been set at 0.35 for the mobile subscriptions and 0.15 for the fixed subscriptions.

[133] It should be noted that in the following equation the prices are excluding VAT because it is determined from the perspective of the producer.

[134] On the voice calls and termination markets only.

[135] This is the value used by the ACM.

[136] In the following equations the prices are including VAT because they are determined from the perspective of the consumer.

[137] Cf. *The consumer surplus.*

7.1.4.1.2 Determining new consumer and producer surpluses

The new consumer surplus is calculated in the same manner as the consumer surplus without subscription. Let *NS* be the number of subscriptions, then:

$$New\ consumer\ surplus = \ 0{,}5 * \ NS * [\ Perceived\ price(NS = 0) - New\ perceived\ price\ ]$$

The final number of subscriptions NS and the new subscription price have been determined previously. The previous equations give us the last two formulas needed to calculate the consumer surplus:

$$Perceived\ price(NS = 0) = \frac{C}{D}$$

$$New\ perceived\ price = New\ subscription\ price - CSm$$

The new producer surplus is still its profit, it can be calculated as:

$$Profit = (Subscription\ price - Subscription\ net\ marginal\ cost) * Number\ of\ subscriptions$$

The new subscription prices and quantity have been calculated in the previous part. The subscription net marginal cost is the difference between the actual marginal cost (MC) of a subscription (which is a constant input parameter) and the monetary gain per subscription due to voice calls and terminations.

$$Subscription\ net\ marginal\ cost = Subscription\ MC - \ ARPU\ on\ voice\ calls\ \&\ terminations$$

The ARPU on voice calls and terminations is the producer surplus calculated without including subscriptions in the model divided by the number of subscriptions.

7.1.4.2 *Externalities*

Introducing a waterbed effect is questionable because it can be theoretically predicted but in practice there is no evidence of the effect. However the changes implemented to the model in the previous part have provided a new framework, enabling to incorporate externalities.

The main idea of this extension is that the more users there are the more a user values its subscription. Indeed it is assumed that receiving a call is valuable and that a subscription is needed to receive a call. These externalities can be classified in two types: “within” market (mobile to mobile and fixed to fixed externalities) and “cross” market (mobile to fixed and fixed to mobile externalities).

7.1.4.2.1 “Within” market externalities

The two “within” market externalities are similar and as an example the mobile to mobile (M2M) externality is explained below. It actually represents the consumer surplus gained from incoming calls (IC). Hence the result depends on the traffic of incoming mobile calls and on the number of mobile subscriptions (NMS).

With this externality everything but the consumer surplus is calculated in the same way. The externality is a new term added to the consumer surplus, which is calculated as:

$$M2M\ IC\ Surplus\ = \frac{NS}{NS0} * \theta m * Incoming\ mobile\ traffic * \frac{A - 0.5 * Incoming\ mobile\ traffic}{B}$$

θm is the externality term and a constant input. It has been set to 0.2 for both mobile and fixed externalities[138]. It means that an incoming call has a value of 20% of an outgoing call.

7.1.4.2.2 Cross market externalities

There are also cross market externalities such as the fixed to mobile externality. Indeed a mobile subscription also offers the possibility to be called by a fixed line. The matter of this externality is also to internalize the number of fixed subscriptions in the perceived price of a mobile subscription: there is no surplus from possibly calling fixed lines if no one has a fixed line.

Hence the perceived price of a mobile subscription and the demand of mobile subscriptions now depend on the number of fixed subscriptions (NFS):

$$NMS = C' - D' * \underbrace{\left(Mobile\ subscription\ price - CSm + \theta_{fm} * NFS\right)}_{= perceived\ mobile\ subscription\ price}$$

The green term is the externality term. Beside the constants C' and D' are as:

$$C' = C \qquad \text{and} \qquad D' = D - C * \theta_{fm} * Initial\ NFS$$

$\theta_{fm} * NFS$ is the monetary gain for a mobile user of the presence of NFS fixed line. Hence it is a traffic weighted average surplus and θ_{fm} is a constant calculated using this formula (all the variables involved are at their initial values):

$$\theta_{fm} = \frac{1}{NFS} * [\underbrace{\frac{M2F\ traffic}{Outgoing\ mobile\ traffic} * \frac{CSm}{NMS}}_{surplus\ for\ calling\ a\ fixed\ line} + \underbrace{\frac{F2M\ traffic}{Incoming\ mobile\ traffic} * \frac{Extra\ M2M\ CS}{NMS}}_{surplus\ for\ being\ called\ by\ a\ fixed\ line}]$$

The way CSm is calculated has not changed but the names of the variables need to be clarified to prevent any mistake:

$$CSm = \frac{Total\ mobile\ consumer\ surplus\ from\ outgoing\ calls}{Initial\ number\ of\ mobile\ subscriptions}$$

$$= \frac{0{,}5 * Outgoing\ mobile\ traffic * [\ Retail\ minute\ price\ (traffic = 0) - Actual\ retail\ minute\ price\ ]}{Initial\ number\ of\ mobile\ subscriptions}$$

[138] This is the value used by the ACM.

7.1.4.2.3 Determining the final results

At the outset, it should be noted that now the two markets interact dynamically: the number of mobile subscriptions impact the number of fixed subscriptions and reciprocally. Hence the two equations need to be solved simultaneously in a two-equation system.

Once it is done, the new surpluses can be calculated. The formula of the mobile consumer surplus now explicitly includes the within market externality:

$$CS = 0{,}5 * NMS * [Perceived\ price(NMS = 0) - Perceived\ price] + M2M\ IC\ surplus$$

But including this cross market externality (in green) makes the perceived price of a mobile subscription to change. Indeed the externality from the number of fixed subscriptions needs to be added, and the new perceived price is as:

$$New\ perceived\ price = Old\ perceived\ price + \theta_{fm} * NFS$$

This formula enables one to calculate the new total consumer surplus which takes account of all externalities.

Including these externalities makes the number of mobile and fixed subscription to change, and so does the producer surplus, but there is no need to adapt the formulas.

7.1.4.3 *Conclusion*

The main strength of this model is its flexibility. Indeed extensions have been added that can easily be disabled by putting externalities and waterbed values to 0. It also enables the user to quickly check the impact of a specific effect.

Furthermore the model is reliable and is based on real data and economic theory. The inputs have faced a sensitivity analysis and are consistent with the scientific literature. Hence it seems that the results presented in the main report are solid and sincere.

7.2 Assumptions about volumes, prices and number of subscriptions

This annex presents the different assumptions that have been made in order to assess the volumes of traffic at the European level, retail prices for minutes of calls and subscriptions and the number of fixed and mobile subscriptions in each country of the EU28.

All assumptions have been mostly based from data sent by the NRAs, or from Eurostat, BEREC and the GSMA database.

7.2.1 Volumes

In order to assess the amount of minutes of calls in 2013 for all countries of the EU28, the data sent by the NRAs have been used as proxys. 6 NRAs have sent volumes for all types of traffics required for this analysis(total mobile calls, mobile-to-fixed, mobile on-net and off-net, total fixed calls, fixed-to-mobile and fixed on-net and off-net), and 22 have sent their volumes of total mobile and fixed calls (without details per type of call).

To assess the amount of minutes of all mobile and fixed calls, data was available on Eurostat for 2005 and 2006 for all countries. The CAGR[139] calculated with the data from the 22 countries between 2005 and 2015 has then been used to determine the total traffic of the 6 missing countries from 2007 to 2015.

From the countries for which detailed data for all types of traffics was available (from Bulgaria, Czech Republic, Estonia, Croatia, Lithuania and Malta), the average distribution of the total mobile calls and total fixed calls has been calculated and applied to the 22 remaining countries.

7.2.2 Retail prices

In order to update retail prices for the minute of mobile calls, fixed-to-fixed calls and fixed-to-mobile calls, the average retail prices provided by NRAs which shared data about retail prices has been used.

To assess the price of mobile subscriptions, the average ARPU[140] by subscriber available for all countries of the EU28 in the GSMA database has been calculated and weighted by the number of subscriptions, and used as average retail price for subscriptions.

7.2.3 Number of subscriptions

To assess the number of mobile subscriptions, the number of subscribers in terms of SIM cards available in the EC Progress Reports (from 2005 to 2010), then in the Digital Agenda financial indicators, have been used and multiplied by the rate of postpaid subscribers of all Member States also available in the reports from the EC and Digital Agenda.

For the number of fixed subscriptions, the number of fixed-telephony lines has been used.

7.3 Sensitivity analyses on pass-through rates

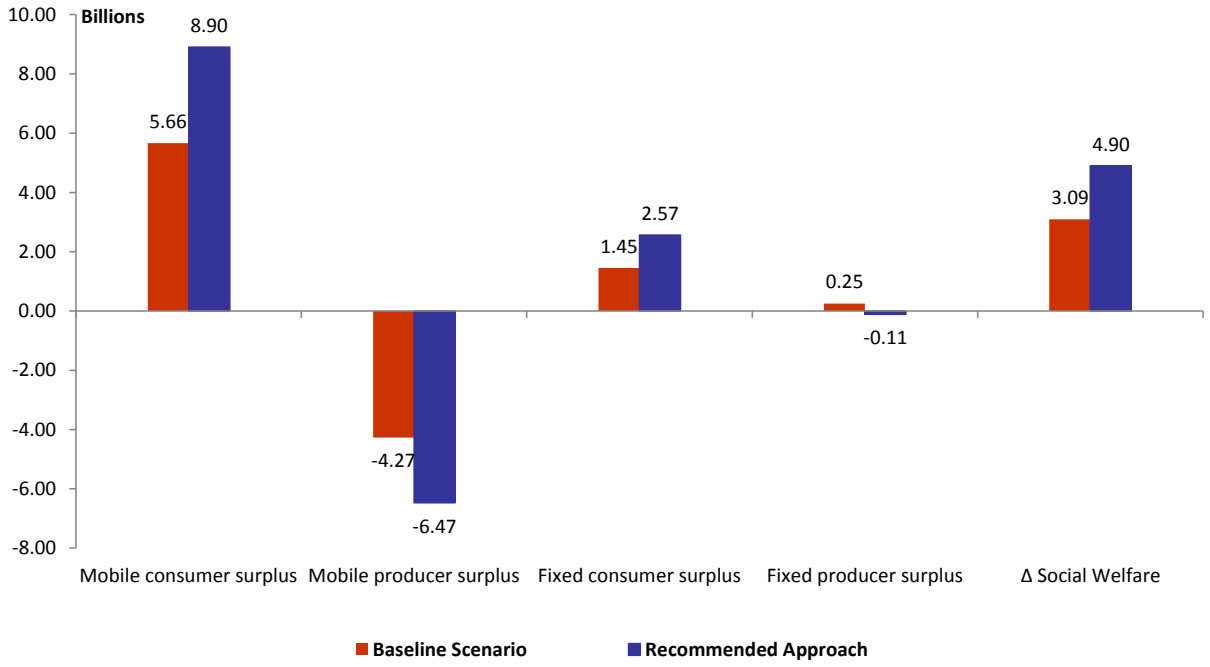
To complement the analysis conducted in section 4.2 of this report, sensitivity analyses considering several values of pass-through have been conducted.

Figure 84 shows the findings of social welfare with a 1 pass-through rate.

[139] Compound Annual Growth Rate.

[140] Average Revenue Per User.

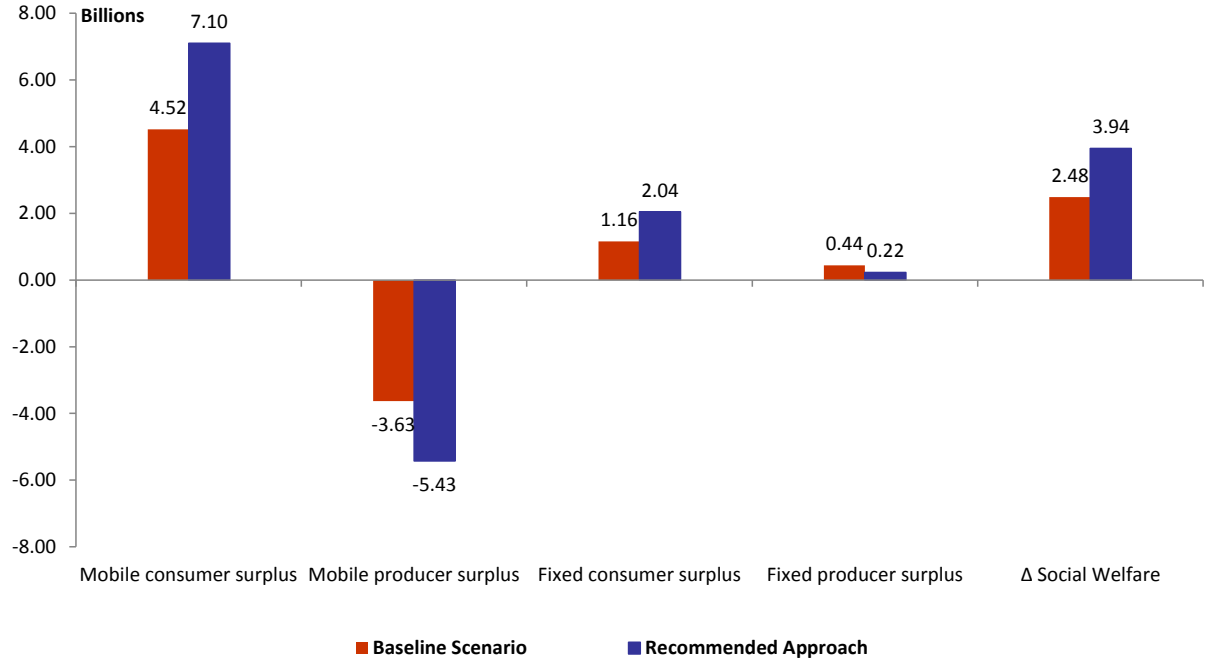
Figure 84 – With a 1 pass-through rate (in billion €)



Source: EC & TERA Consultants analysis

Figure 85 shows the findings of social welfare with a 0.8 pass-through rate.

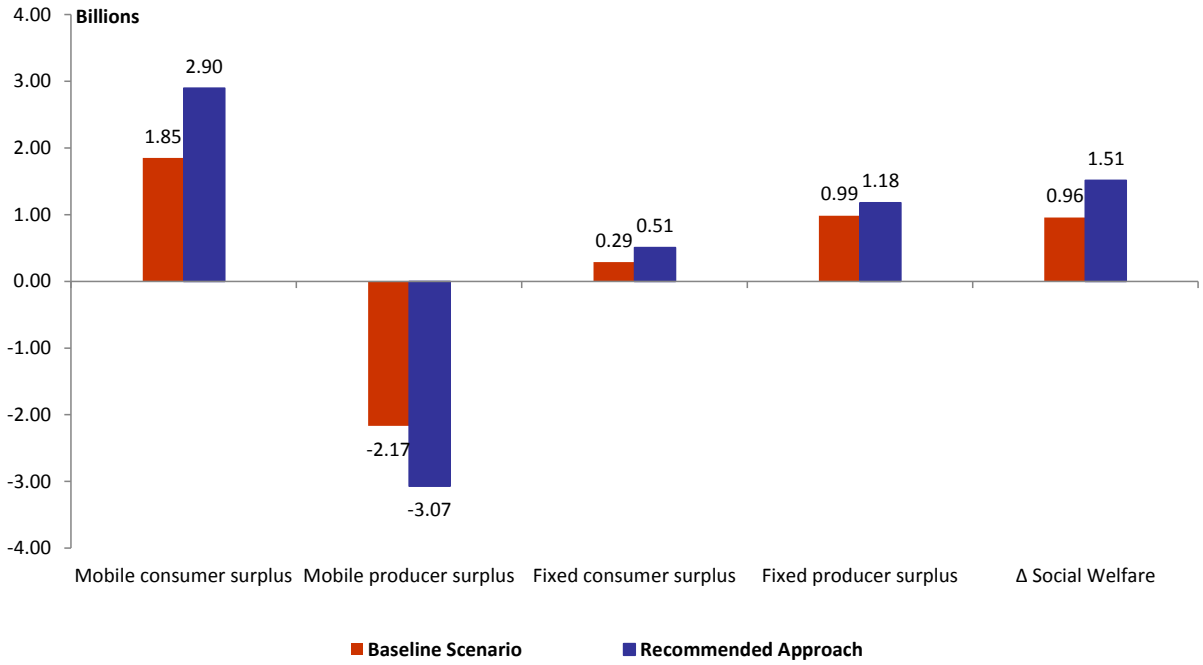
Figure 85 – With a 0.8 pass-through rate (in billion €)



Source: EC & TERA Consultants analysis

Figure 86 shows the findings of social welfare with the EC pass-through rates from 2009.

Figure 86 – With the EC pass-through rate (in billion €)



Source: EC & TERA Consultants analysis

8 Appendix 4 – Per country analysis

In the following analyses, data have been presented by taking 2009 year as reference year. The assigned values for 2009 are equal to 100. Values from other years are expressed in terms of 2009. This aggregation is labelled *"base 100 in 2009*" below. The reason for that is that what matters is not the absolute level of the metrics but whether the TRR has had an impact on the metrics or not.

This is however not the case for termination rates, HHI and on-net rates.

Moreover, in order to compare countries together, metrics representing the average values of each group of countries are also presented. These are simple average values.

Finally, for each country, the analysis is conducted first for mobile markets and then for fixed markets. At the end of each country, a table summarizes how the country behaves compared to countries of the same group.

Figure 87 – Summary of mobile metrics available for each country

Country	Mobile metrics available	Mobile metric not available
Austria	Revenues, investments, HHI, both market penetrations, prepaid share, traffic	Prices, on-net rate
Belgium	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, prices, on-net rate	None
Bulgaria	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, prices, on-net rate	None
Croatia	Revenues, investments, HHI, market penetration in terms of unique subscribers, prepaid share, traffic, on-net rate	Prices, market penetration in terms of number of SIM cards
Cyprus	Revenues, HHI, both market penetrations, prepaid share	Investments, traffic, prices, on-net rate
Czech Republic	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, prices, on-net rate	None
Denmark	Revenues, investments, HHI, both market penetrations, prepaid share, traffic	Prices, on-net rate
Estonia	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Germany	Revenues, investments, HHI, both	Prices

	market penetrations, prepaid share, traffic, on-net rate	
Greece	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Finland	Revenues, investments, HHI, both market penetrations, prepaid share	Traffic, price, on-net rate
France	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Hungary	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Ireland	Revenues, investments, HHI, both market penetrations, prepaid share	Traffic, prices, on-net rate
Italy	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, prices	On-net rate
Lithuania	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Luxembourg	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Latvia	Revenues, investments, HHI, both market penetrations, prepaid share	Traffic, prices, on-net rate
Malta	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Netherlands	Revenues, investments, HHI, both market penetrations, prepaid share, traffic	Prices, on-net rate
Poland	Revenues, investments, HHI, both market penetrations, prepaid share, traffic	Prices, on-net rate
Portugal	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Romania	Revenues, investments, HHI, both market penetrations, prepaid share,	Prices, on-net rate

	traffic	
Spain	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, prices, on-net rate	None
Slovakia	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Slovenia	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
Sweden	Revenues, investments, HHI, both market penetrations, prepaid share, traffic, on-net rate	Prices
United Kingdom	Revenues, investments, HHI, both market penetrations, prepaid share, traffic	Prices

Figure 88 – Summary of fixed metrics available for each country

Country	Fixed metrics available	Fixed metric not available
Austria	Revenues, main telephony lines penetration, traffic	Prices
Belgium	Revenues, main telephony lines penetration, traffic	Prices
Bulgaria	Revenues, main telephony lines penetration, traffic, prices	None
Croatia	Main telephony lines penetration, traffic	Revenues, prices
Cyprus	Revenues, main telephony lines penetration	Traffic, prices
Czech Republic	Revenues, main telephony lines penetration, traffic, prices	None
Denmark	Revenues, main telephony lines penetration, traffic	Prices
Estonia	Revenues, main telephony lines penetration, traffic	Prices
Germany	Revenues, main telephony lines penetration, traffic	Prices
Greece	Main telephony lines penetration, traffic	Revenues, prices
Finland	Revenues, main telephony lines	Traffic, prices

	penetration	
France	Main telephony lines penetration, traffic	Revenues, prices
Hungary	Revenues, main telephony lines penetration, traffic	Prices
Ireland	Revenues, main telephony lines penetration	Traffic, prices
Italy	Revenues, main telephony lines penetration, traffic, prices	None
Lithuania	Revenues, main telephony lines penetration, traffic	Prices
Luxembourg	Revenues, main telephony lines penetration, traffic	Prices
Latvia	Revenues, main telephony lines penetration	Traffic, prices
Malta	Revenues, main telephony lines penetration, traffic	Prices
Netherlands	Revenues, main telephony lines penetration	Traffic, prices
Poland	Revenues, main telephony lines penetration, traffic	Prices
Portugal	Revenues, main telephony lines penetration, traffic	Prices
Romania	Revenues, main telephony lines penetration, traffic	Prices
Spain	Revenues, main telephony lines penetration, traffic, prices	None
Slovakia	Revenues, main telephony lines penetration, traffic	Prices
Slovenia	Revenues, main telephony lines penetration	Traffic, prices
Sweden	Revenues, main telephony lines penetration, traffic	Prices
United Kingdom	Revenues, main telephony lines penetration, traffic	Prices

8.1 Austria

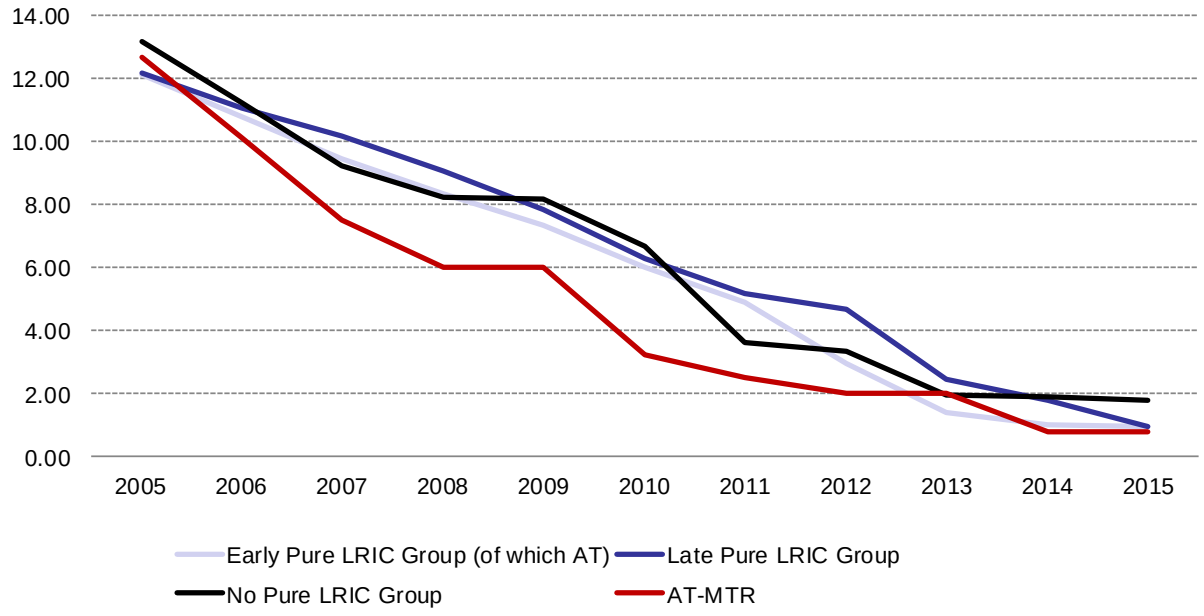
The Austrian telecom market is dominated by the incumbent Telekom Austria, but the past few years have seen the emergence of competitive pressure in the fixed-line and mobile sectors. There are now three mobile operators with A1 (entered in 1992), T-Mobile (entered in 1996) and 3 Austria (entered 2000) which acquired Orange Austria in 2013. There is also a large number of Mobile Virtual Network Operators (MVNOs), including Tele2 (coming back in 2015) with mobile services after having sold its interests to A1 in 2007. Austria adopted the pure LRIC approach in 2013 for both MTRs and FTRs and is therefore allocated to the Early Pure LRIC Group.

8.1.1 Mobile market

8.1.1.1 *Quantitative analysis*

Mobile termination rates (MTRs) in Austria have been lower than all European weighted averages between 2006 and 2012. Indeed Figure 89 shows that Austrian MTRs decreased faster than all other MTRs between 2005 and 2010, then bottomed-out until the implementation of Pure LRIC in 2013, getting divided by two. It has been in 2014 and 2015 at the level of the Early Pure LRIC Group.

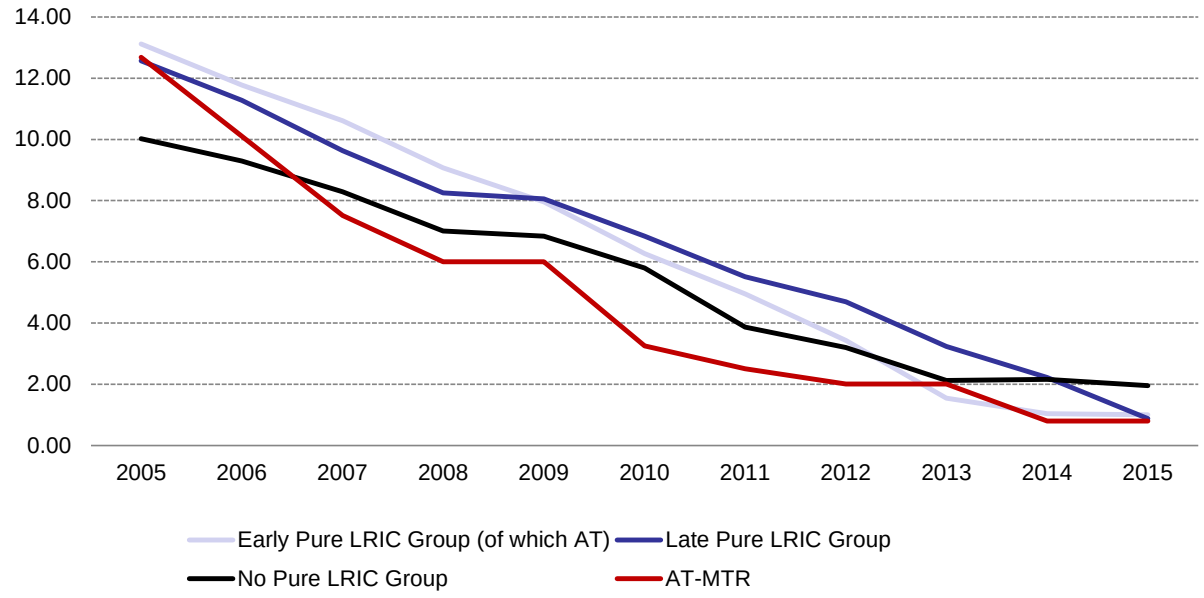
Figure 89 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

When MTRs in Austria are compared with the flat average of each group (Figure 90), it appears that the comparison is the same.

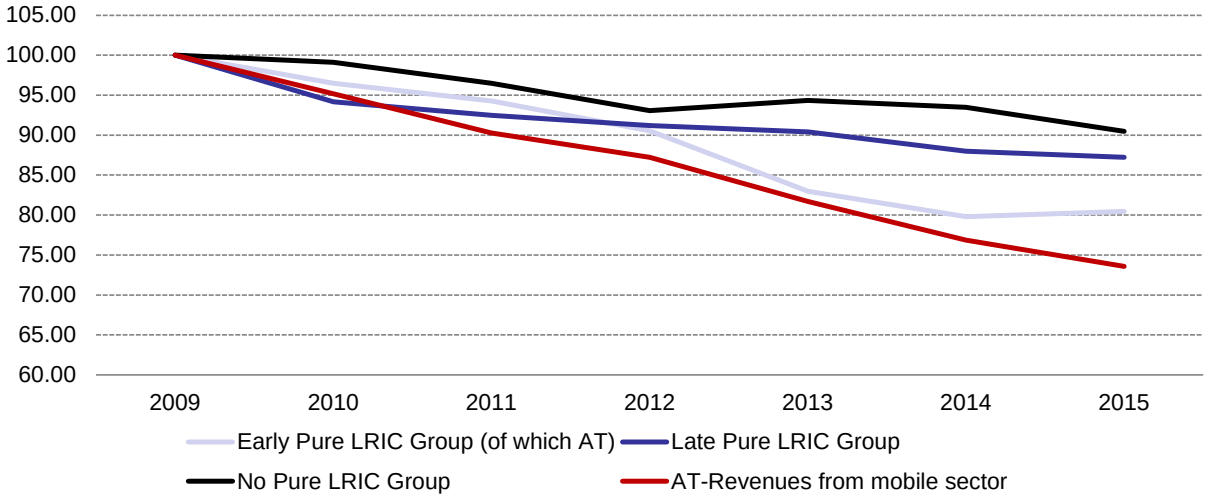
Figure 90 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 91 have been following the same trend as the Early Pure LRIC Group since the TRR was issued in 2009. Whereas all European revenues remained stable between 2014 and 2015, revenues in Austria kept on decreasing.

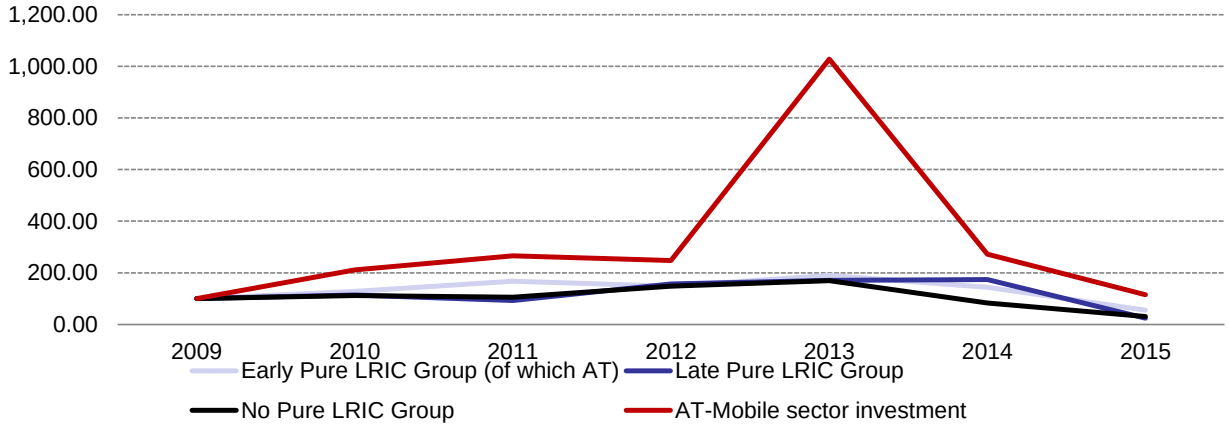
Figure 91 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in the mobile sector have been increasing between 2009 and 2012 in Austria more than at the European level (see Figure 92). In 2013, important investments from 2 out of the 3 Austrian operators (A1 Telekom and T-Mobile) led to multiply by 5 the total investments in comparison to the previous year. Since the TRR was issued, investments in Austria have been increasing more than all groups of MS.

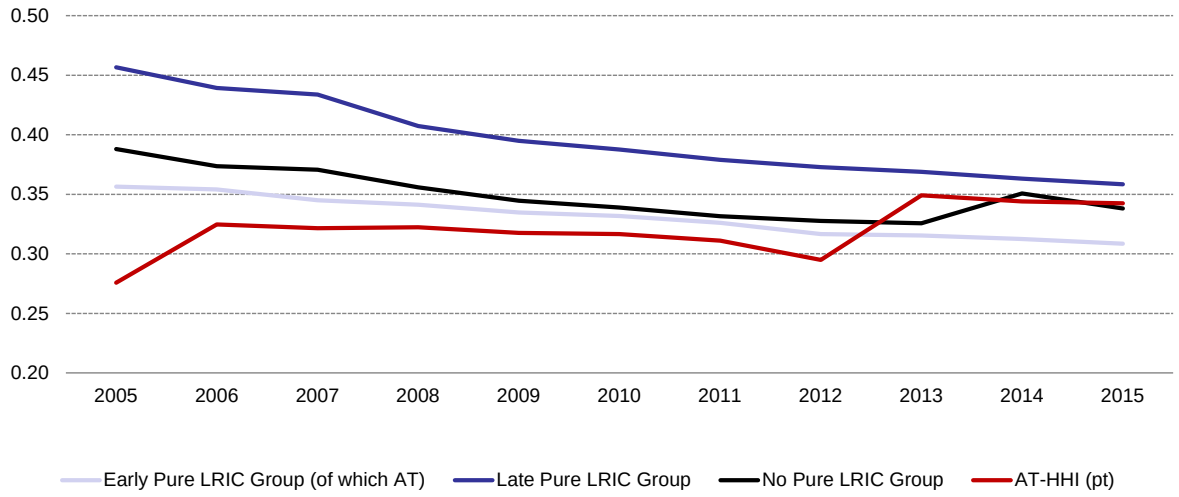
Figure 92 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The Austrian mobile market was served by four operators until the end of 2012, when Orange Austria was bought by Three. Therefore, the HHI presented in Figure 93 has been constant between 2006 and 2011 and increased in 2013 due to the decrease of competition. It then remained steady until 2015. The Austrian HHI has been extremely close to its group average between 2006 and 2012, and is above the Early Pure LRIC Group ever since.

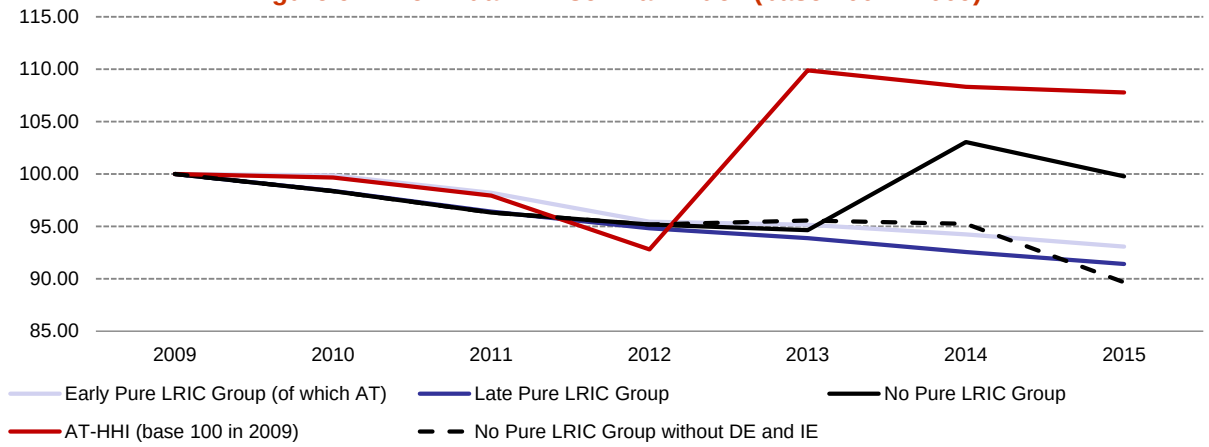
Figure 93 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the lower level of concentration in Austria since 2012 can be noticed in Figure 94: the HHI (as base 100 in 2009) has strongly increased in 2013.

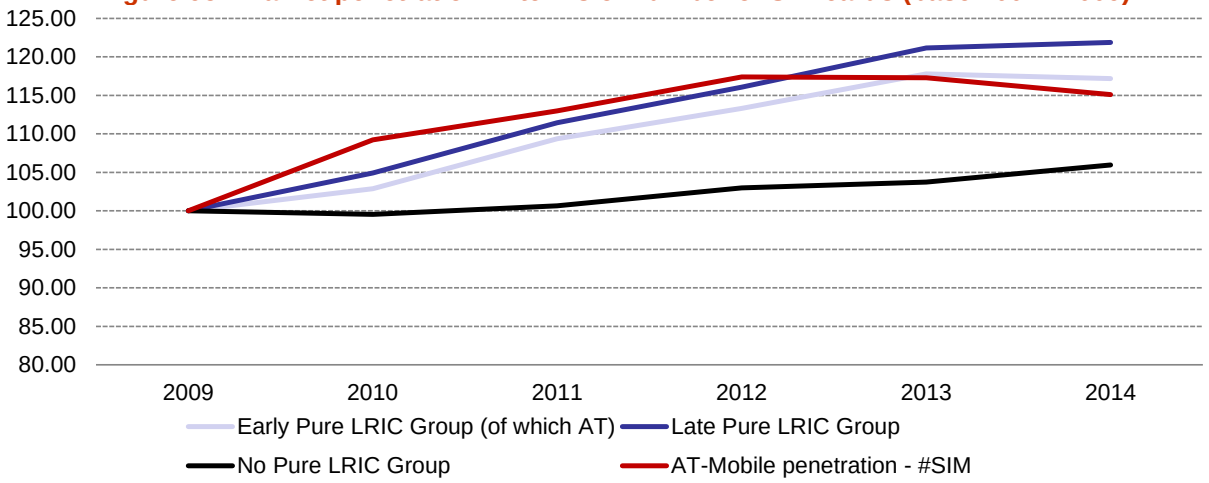
Figure 94 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Austrian market penetration in terms of number of SIM was above the average of the Early Pure LRIC group between 2009 and 2013. It strongly increased between 2010 and 2012 before stabilizing. In 2014, it is now below the level of the Early Pure LRIC Group, although they remain very close as shown in Figure 95:

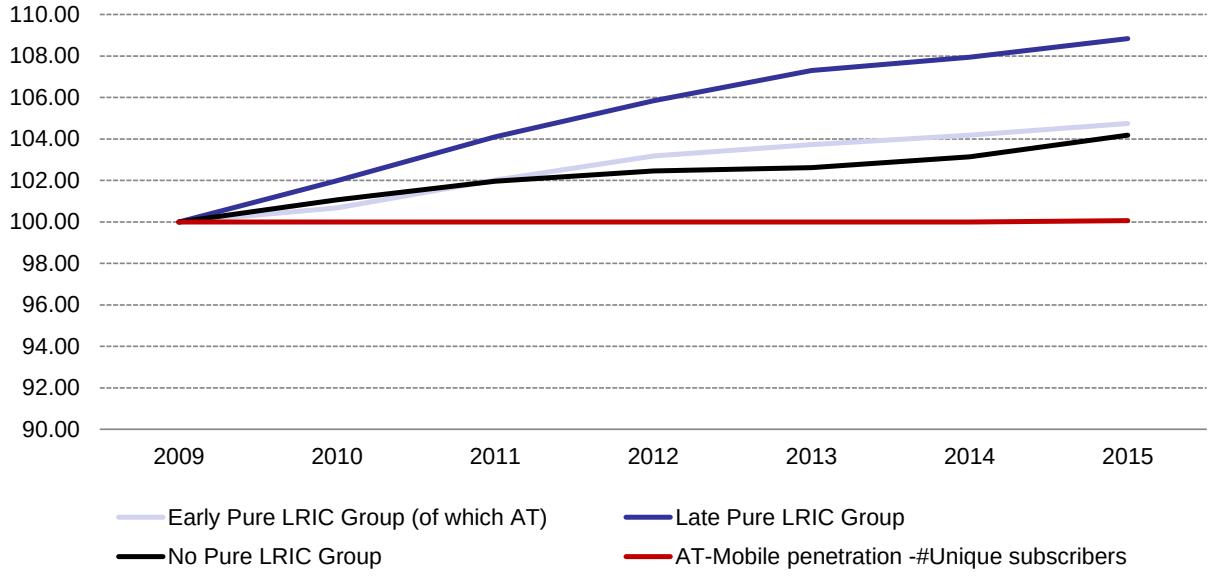
Figure 95 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 96 that the market penetration in terms of unique subscribers in Austria has been extremely steady since 2009 whereas the average Early Pure LRIC Group slightly increased over this period. The Austrian market penetration in terms of unique subscribers is in 2015 a little below its group average.

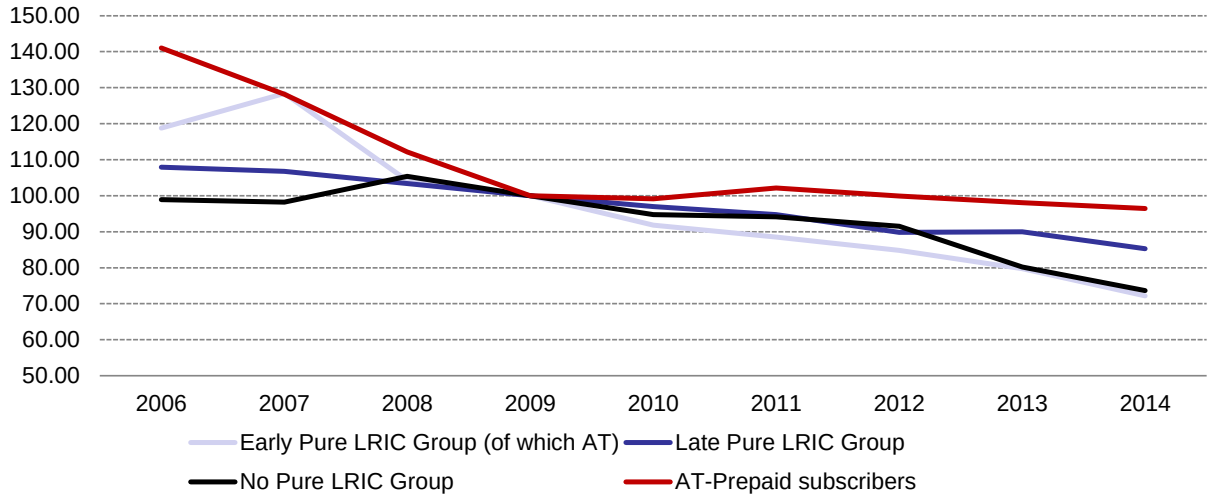
Figure 96 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 97 shows the share of prepaid customers in the mobile market. Between 2009 and 2014, the Austrian prepaid share remained steady whereas all groups kept on decreasing.

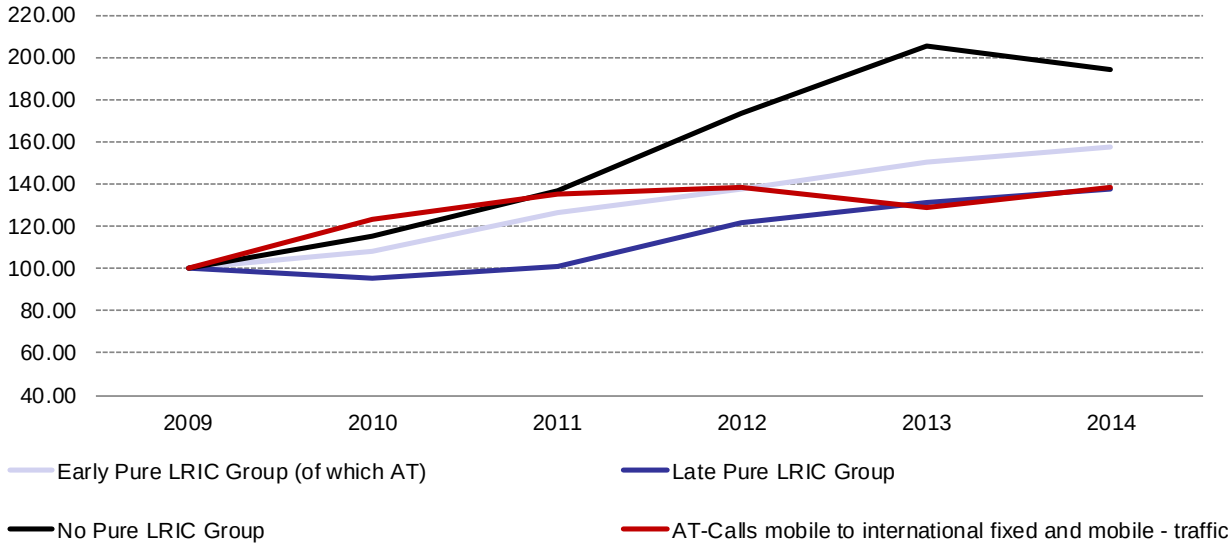
Figure 97 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 98 shows the amount of minutes of mobile calls to international. It can be noticed that for this metrics Austria was slightly above the Early Pure LRIC Group average in 2005 and has been following the same growth between 2005 and 2012. It then decreased in 2013 following the implementation of Pure LRIC.

Figure 98 - Minutes of traffic of mobile to international (base 100 in 2009)



NRAs Replies to questionnaire

8.1.1.2 *Evolution of retail mobile offers*

According the RTR, different changes have been observed in the Austrian retail market over the past few years. Operators primarily offer now bundles with buckets of minutes, SMS and data, and the flat rate products have become dominant since the implementation of Pure LRIC, although it already existed before.

Concerning on-net/off-net differentiation, RTR has observed that this common practice in the past has almost completely disappeared in Austria.

Furthermore, retail prices in general have been decreasing until the merger between H3G and Orange.

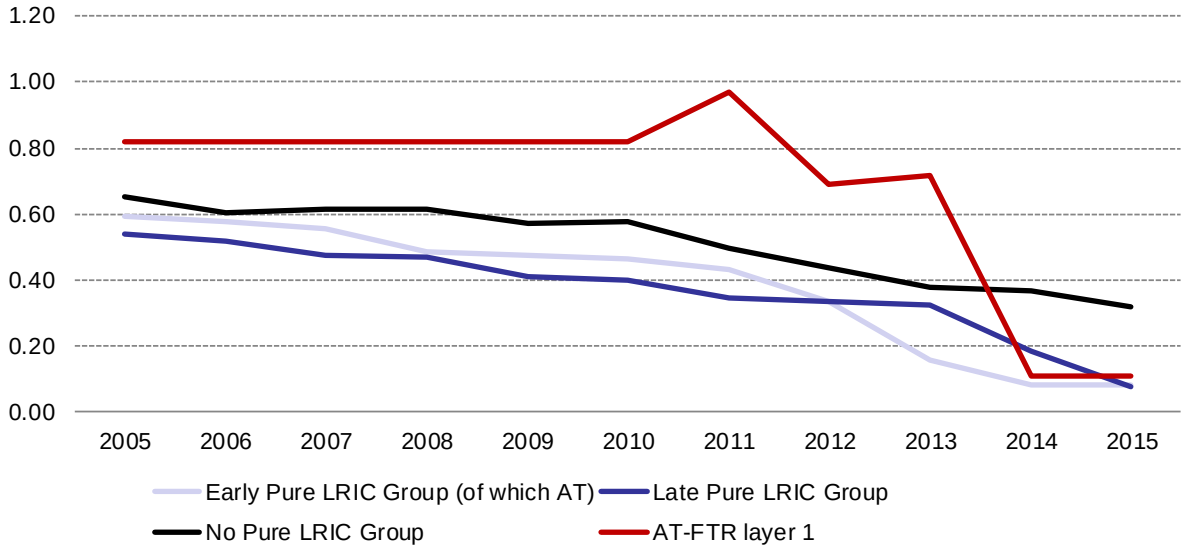
Eventually RTR has noticed that these evolutions were not only caused by lower MTRs, but that low MTRs are an important driver since it lowers the financial risk of such price plans.

8.1.2 Fixed market

8.1.2.1 *Quantitative analysis*

The level of the Austrian FTR has been far higher in average to all countries until 2013. However, the Austrian FTR level became very close to Early Pure LRIC Group average in 2014 when it was set on a Pure LRIC level as presented in Figure 99.

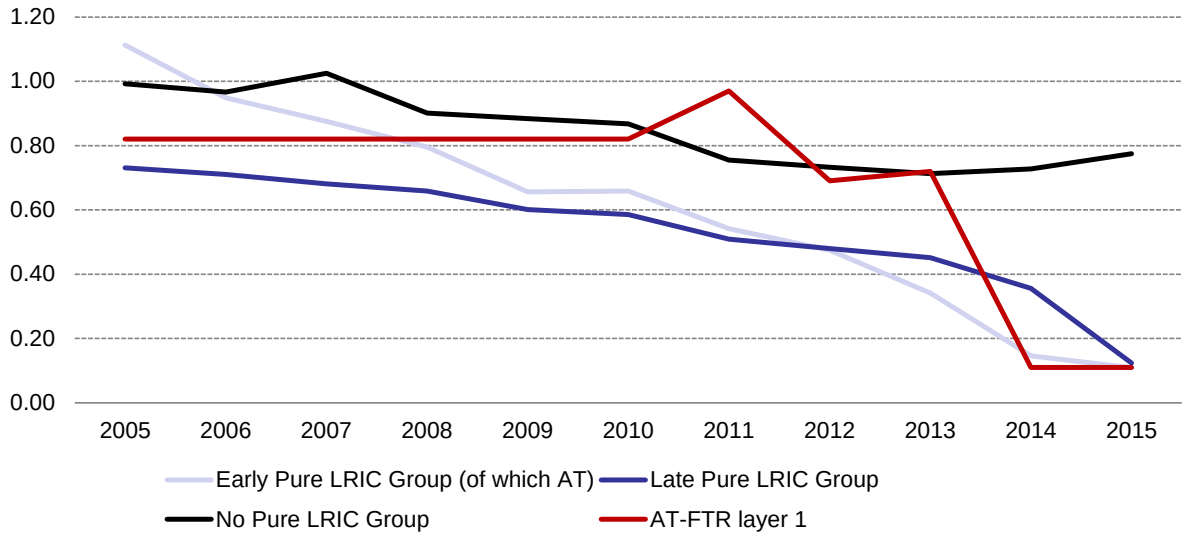
Figure 99 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 100 shows how the Austrian FTR compares with the flat average for the three groups.

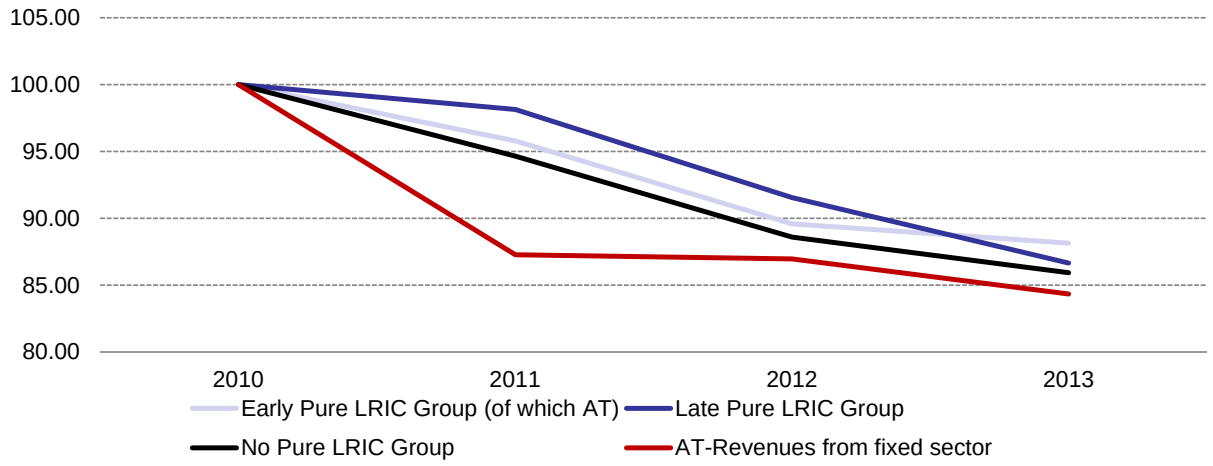
Figure 100 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 101 shows the evolution of revenues from the fixed sector in Austria between 2010 and 2013. Apart from a strong decline between 2010 and 2011, revenues in Austria have been pretty steady, whereas they have been declining since 2010 for all groups. However, the global evolution of revenues in Austria between 2010 and 2013 has slightly equivalent to the No Pure LRIC Group rather than the Early Pure LRIC Group.

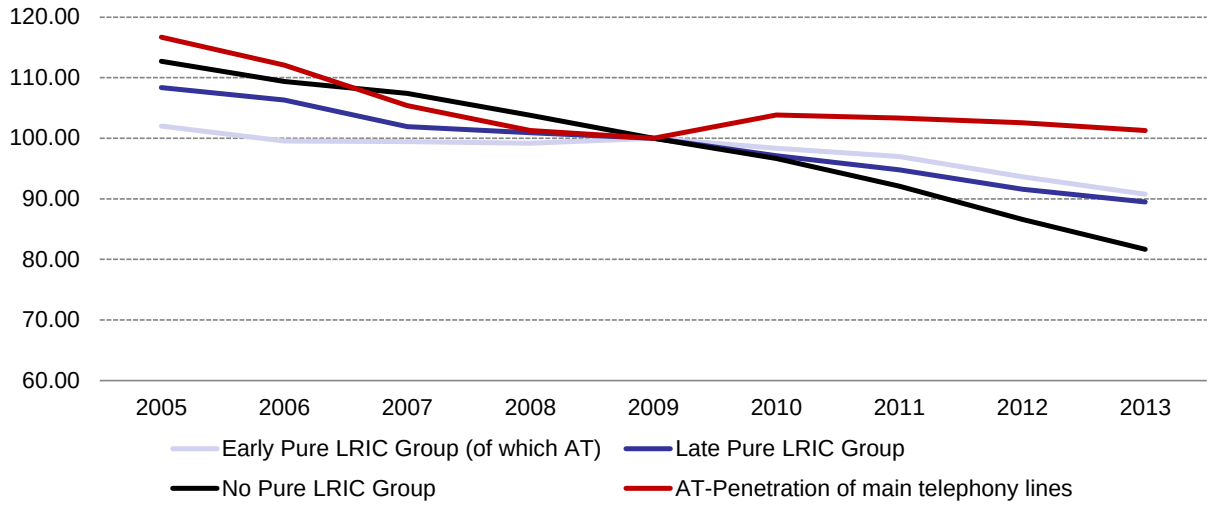
Figure 101 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

Since 2009, the main telephony lines penetration rate has been decreasing much less faster than in other groups.

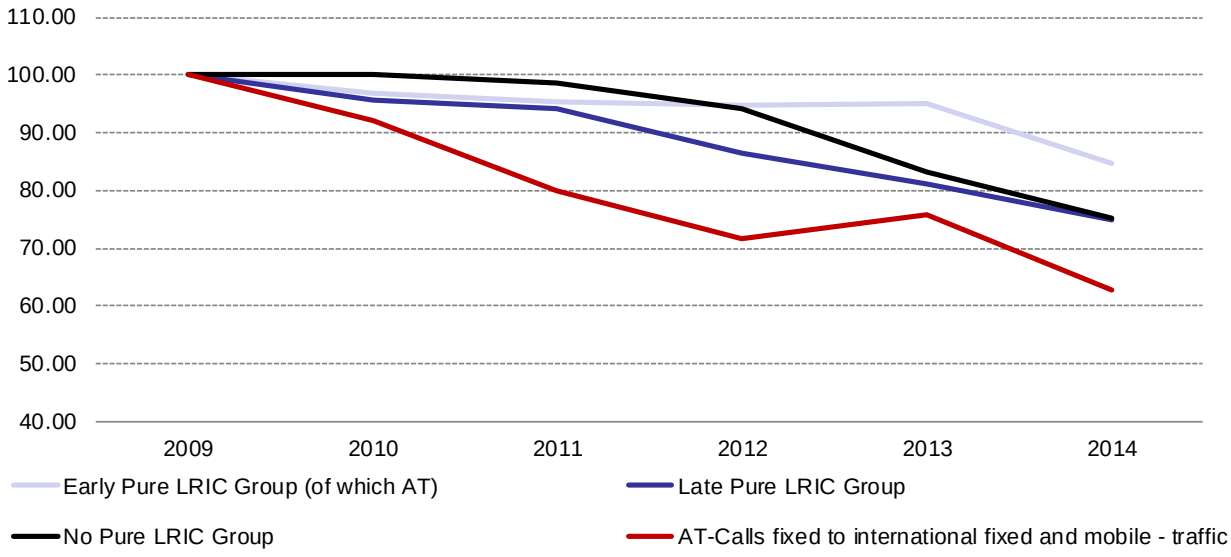
Figure 102 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of fixed national calls to international in Austria, presented in Figure 103, has shown a strong decline between 2009 and 2014 despite a slight increase in 2013. International fixed traffics in Austria have been declining faster than any other group's average.

Figure 103 - Traffic of fixed calls to international (base 100 in 2009)



Source: RTR

8.1.2.2 *Evolution of retail fixed offers*

According to the RTR, retail tariffs for calls from a fixed location have responded only to a limited extent to changes in termination rates. After the implementation of Pure LRIC, most operators left their offers unchanged.

The incumbent however, changed its retail tariffs structure in 2014, making fixed-to-mobile call prices equal to fixed-to-fixed call prices. This was done by lowering price of calls to mobile and increasing calls to fixed. If the impact of Pure LRIC can be observed from the mobile point of view, concerning FTR, the opposite effect occurred in that particular case.

Eventually, RTR noticed that flat rate offers are still uncommon in the fixed network.

8.1.3 Summary

The table below summarizes, for each metric, the difference between Austria and the average metric for the Early pure LRIC Group in order to highlight how Austria is positioned against its pair countries.

Figure 104 - Differences between the Early Pure LRIC Group and Austria for the different metrics

Metrics	Differences between the Early Pure LRIC Group and Austria
Mobile revenues	Bigger decrease since 2013 for Austria compared to the Early Pure LRIC Group
Mobile investments	Investments increased far more for Austria compared to its group average
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards. Lower penetration for Austria in terms of Unique Subscribers

Competition in mobile	Very close to its group average until the merger in 2012. The evolution though is very similar to the Early Pure LRIC Group

Source: TERA Consultants

Figure 105 – Differences between the Early Pure LRIC Group and Austria for the fixed market

Metrics	Differences between the Early Pure LRIC Group and Austria
Fixed revenue	Different evolution than the Early Pure LRIC Group
Traffic	Much faster decrease than all groups
Main telephony lines	Constant whereas all groups declined

Source: TERA Consultants

8.2 Belgium

The Belgium's incumbent is Proximus (formerly Belgacom) and it provides fixed and mobile services. The Belgium's mobile market is served by three MNOs: Proximus (1994), Orange Belgium (1996), previously known as Mobistar before changing its name in May 2016and BASE (1999) bought by Liberty Global's local brand Telenet from KPN in April 2015. Those three operators prevail in the mobile market, Proximus in particular with 40.5% market share in 2015. The competition has been emphasized over the past few years by the growing number of subscribers from MVNO offers, which market share in terms of traffic reached 13% in 2014[141] and 16.5% in 2015[142]. Belgium adopted the pure LRIC approach in 2010. Since its pure LRIC rates have been in place since 1 January 2013, the country has then been ranked in the Early Pure LRIC Group. FTR however was not set on Pure LRIC before August 2016, Belgium has then been ranked in the No Pure LRIC Group for the fixed sector related analysis since the report was written in April 2016.

8.2.1 Mobile market

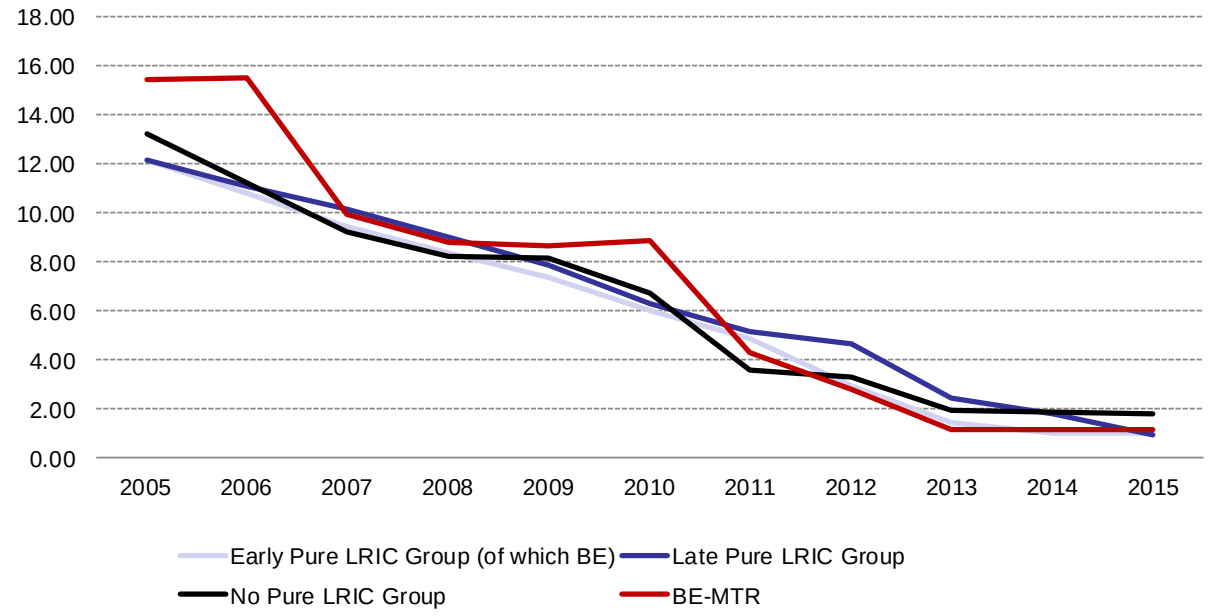
8.2.1.1 *Quantitative analysis*

MTRs in Belgium have been often higher than all groups between 2005 and 2011, and started from a rather high level. Since 2011 however, MTRs in Belgium have been extremely close to the Early Pure LRIC Group's average weighted MTR as noticed in Figure 106.

[141] Source : Buddecom.

[142] Source : Statistical annual report

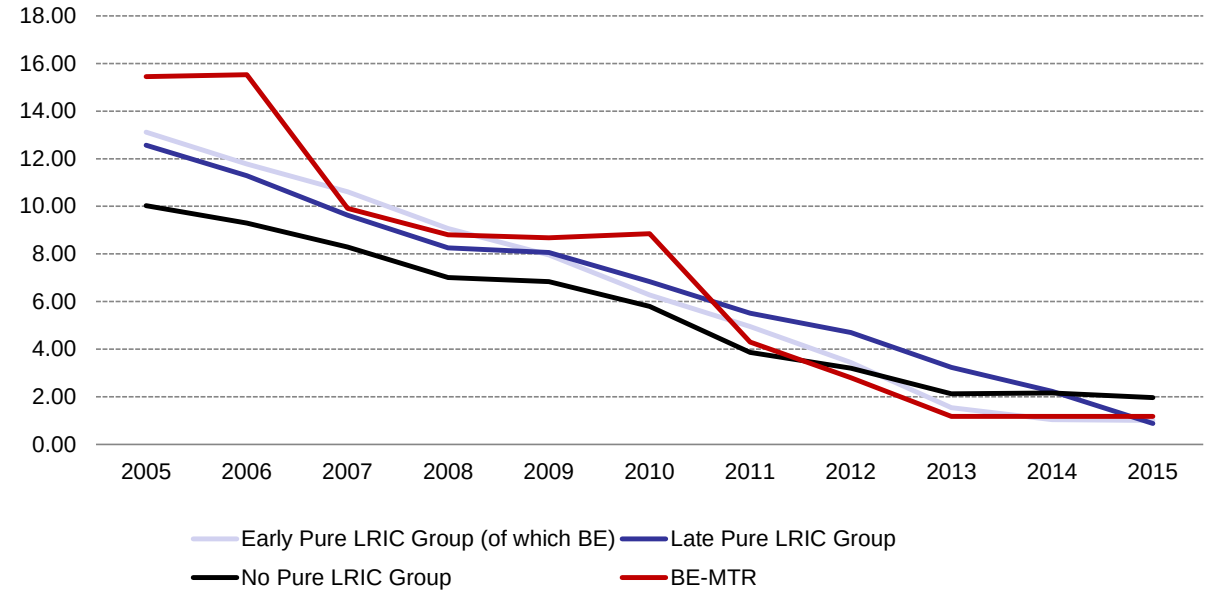
Figure 106 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 107). The trend is approximately the same as the weighted average trend: the MTR in Belgium since 2011 has been very close to the Early Pure LRIC Group.

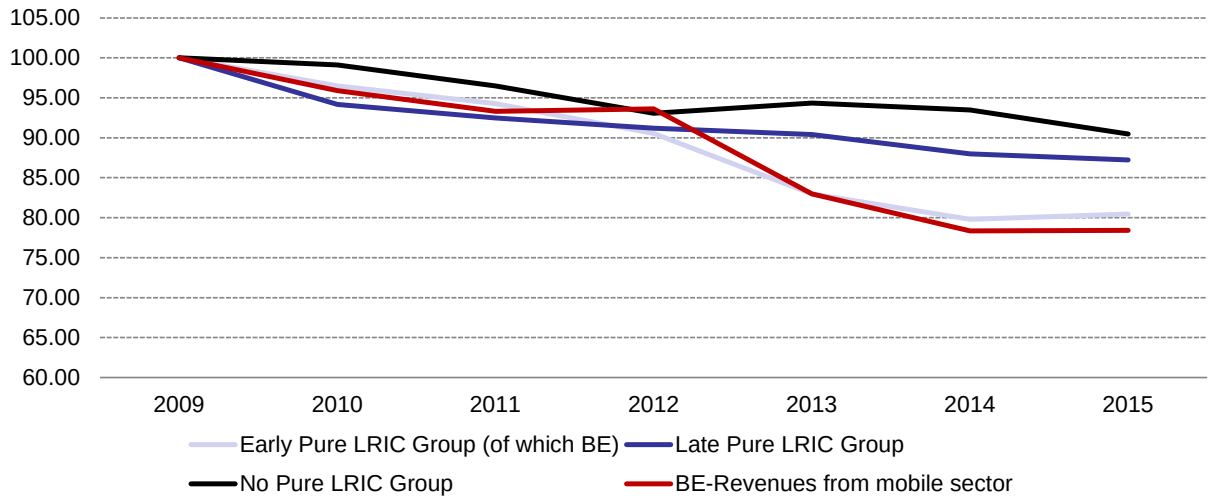
Figure 107 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector (presented in Figure 108) have been slightly decreasing in Belgium, and decreased way faster between 2012 and 2014 right after the implementation of the Pure LRIC approach. Since 2009, the evolution of revenues in Belgium is extremely close to the one of the Early Pure LRIC Group.

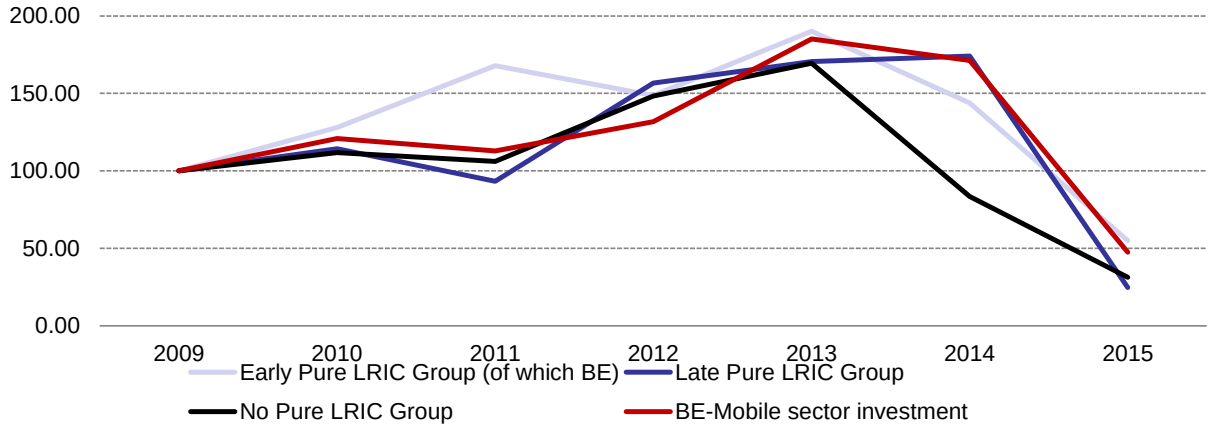
Figure 108 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments (see Figure 109) in the Belgium's mobile sector have been increasing between 2009 and 2013 more similarly to the Late and No Pure LRIC Groups, than the Early Pure LRIC Group. Since 2013 however and the implementation of Pure LRIC, investments fell in Belgium, and in Europe in general.

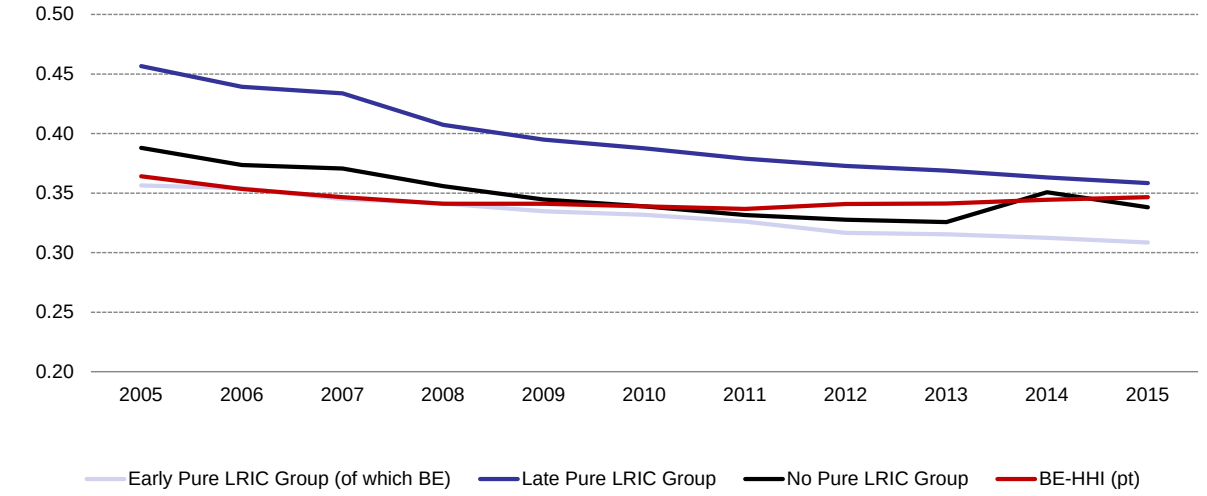
Figure 109 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the Belgian mobile market, all three offering nationwide coverage. The level of competition as measured by the HHI has been extremely constant since 2005 as shown in Figure 110. It has been very close to the Early Pure LRIC Group's average until 2012, and then remained on the same level whereas the average HHI of the Early Pure LRIC Group decreased to a lower level (-5pts).

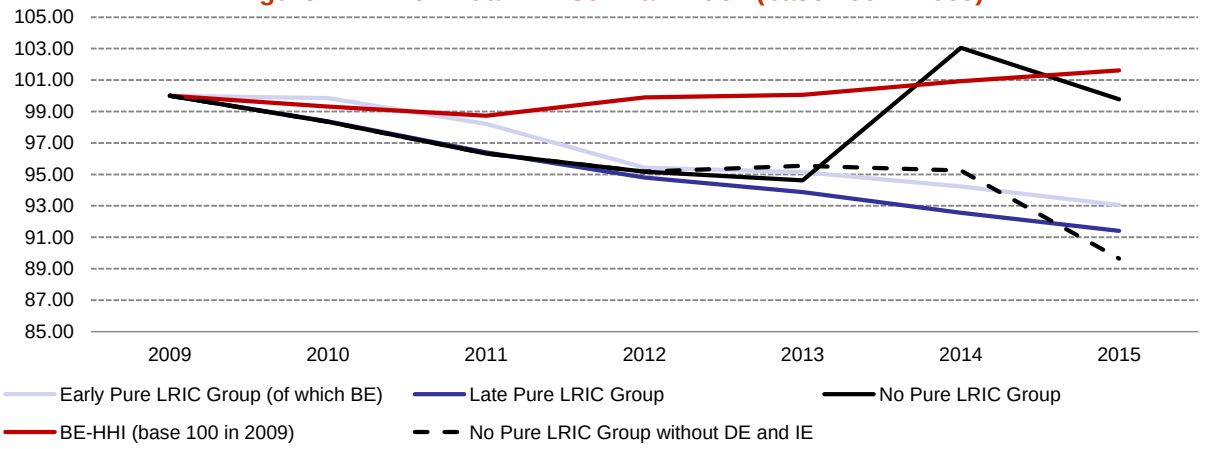
Figure 110 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the level of concentration has not been decreasing in Belgium since 2012 while it decreased for the Early Pure LRIC group (Figure 111).

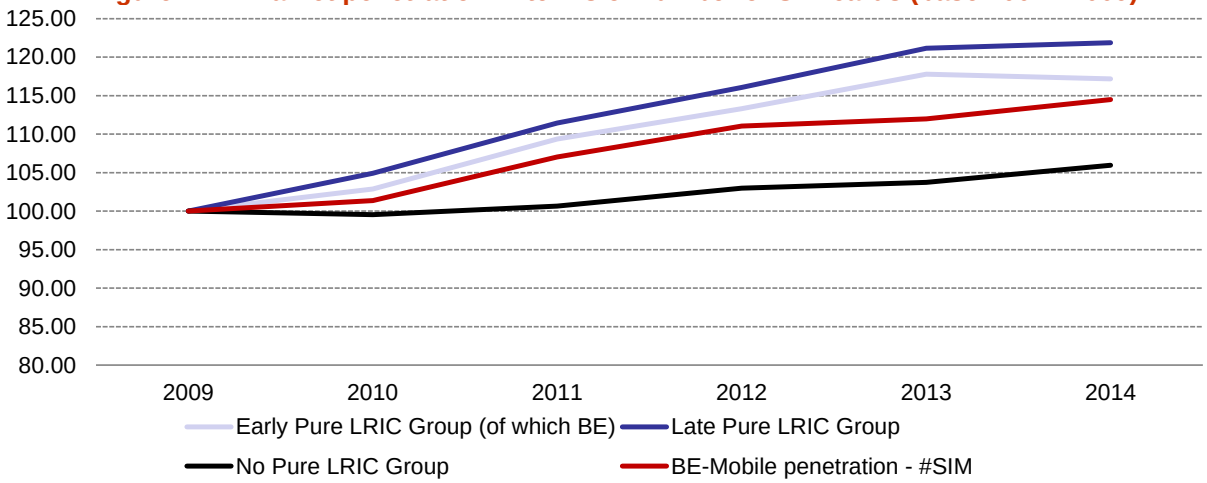
Figure 111 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Belgian market penetration rate in terms of number of SIM has been remaining pretty close between 2009 and 2014 to the average one in Early Pure LRIC group. It strongly increased between 2010 and 2012 before stabilizing. In 2014, it is slightly lower than the level of the Early Pure LRIC Group as shown in Figure 112:

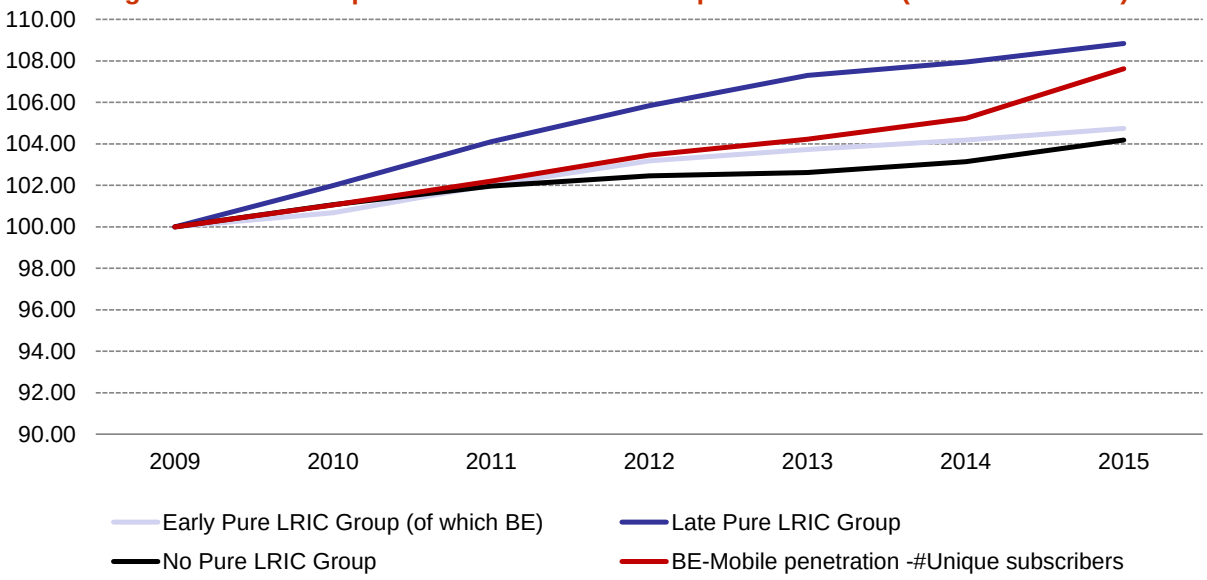
Figure 112 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 113 that the market penetration in terms of unique subscribers in Belgium has been increasing from 2009 to 2015, more than the Early Pure LRIC Group's average.

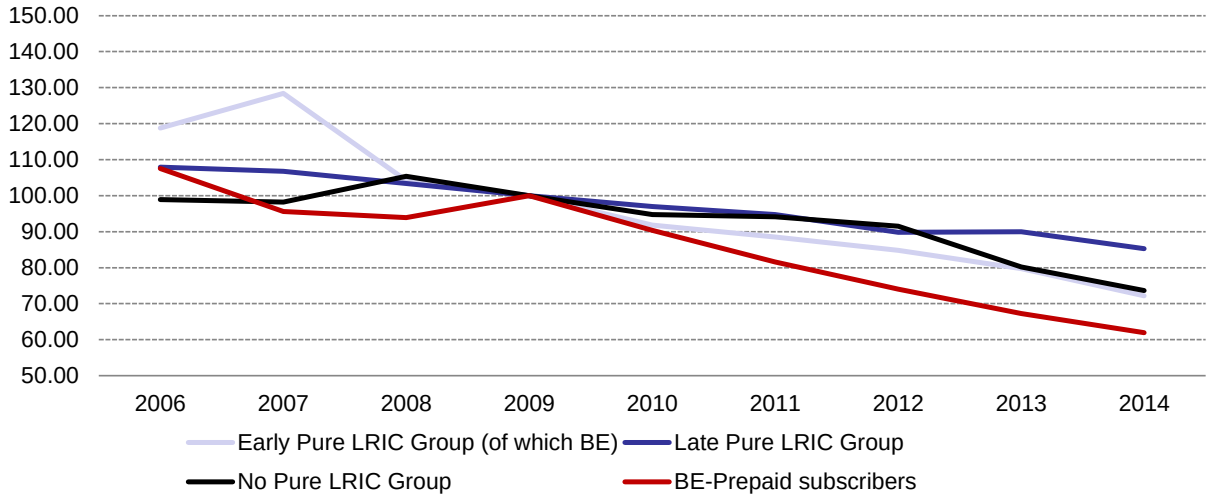
Figure 113 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 114 shows the evolution of the share of prepaid in Belgium. It has been pretty stable between 2006 and 2009, and then decreased faster than all groups after 2009. This faster decline can be explained by a rather high level of the prepaid in 2009 in comparison to other MS.

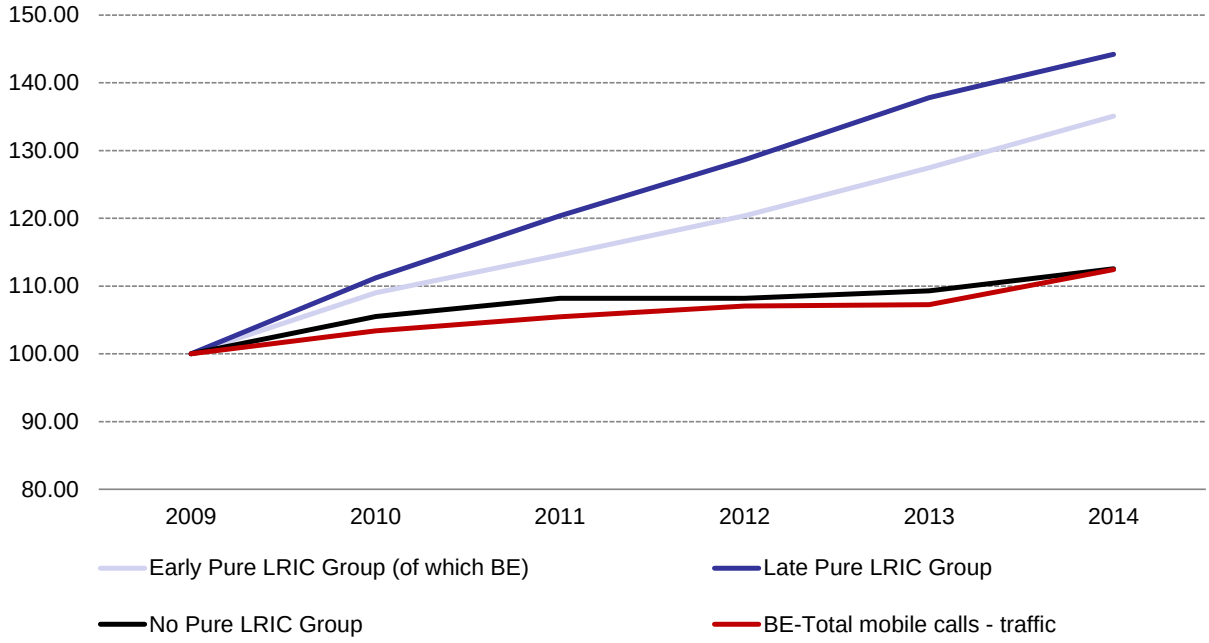
Figure 114 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 115 shows the evolution of the total amount of minutes of mobile calls in Belgium. It can be noticed that the traffic has been constantly increasing since 2009 and has been following a very close trend to the No Pure LRIC Group rather than the Early Pure LRCI group.

Figure 115 - All mobile calls - traffic (base 100 in 2009)

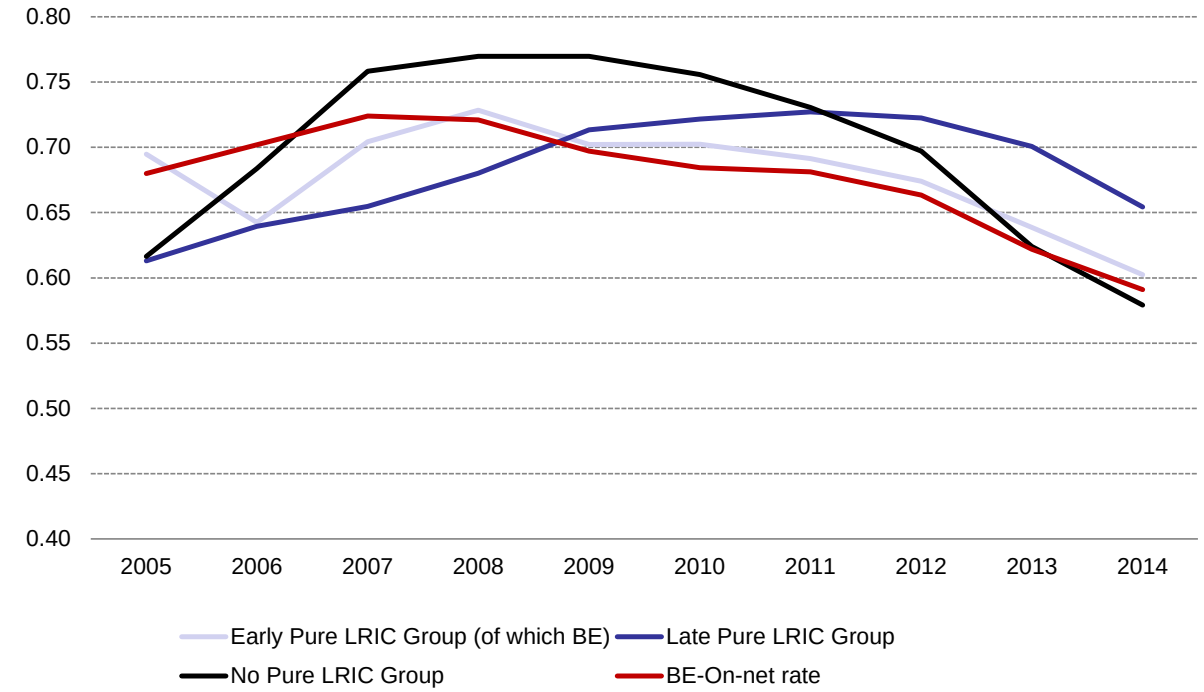


Source: IBPT

Figure 116 shows the share of on-net mobile calls, slowly decreasing since 2008 in a very similar way to the Early Pure LRIC Group. This decrease has been accelerating since 2011, which also corresponds to the implementation of the glide path for the MTR into a Pure LRIC

level. This decrease is consistent with the stable number of minutes of mobile on-net calls and indicates therefore an increase in the number of minutes for off-net calls.

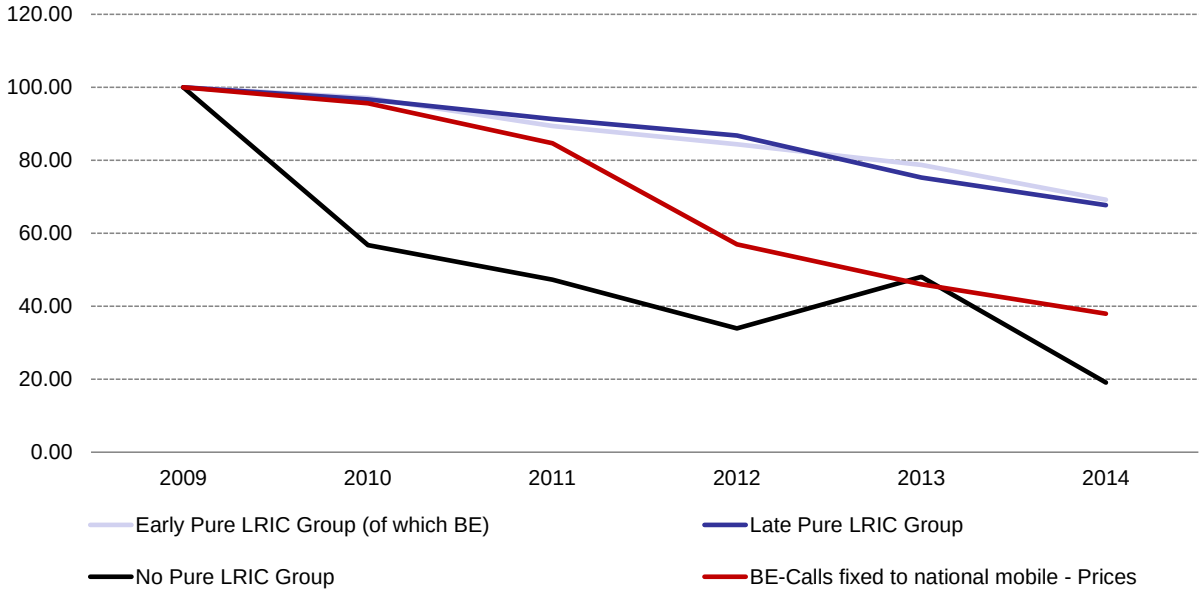
Figure 116 - On-net rate of mobile calls (%)



Source: IBPT

Prices for fixed calls to national mobile have shown a steady decline between 2009 and 2011, similarly to the Late Pure LRIC Group, as shows Figure 117. It decreased faster after 2011, which corresponds to the beginning of implementation of Pure LRIC in Belgium (three years glide path).

Figure 117 - Prices fixed calls to mobile (base 100 in 2009)



Source: IBPT

8.2.1.2 *Evolution of retail mobile offers*

According the BIPT, retail mobile offer prices have been on a downward sloping trend since 2012. This trend has been attributed to the reduction of MTRs, the drop in roaming charges, and the developments in the internal market, triggered by the entry of a new operator offering new kinds of offers.

Additionally, a law came into force where customers could stop each kind of telecom contract after 6 months, without having to pay any compensation. In 2013 and 2014, BIPT noticed a churn which was significantly higher than the years before this law came into effect.

After the “King and Kong” offerings by Telenet, all major operators changed their offers to compete with Telenet’s offers, which included flat fee for fixed and mobile numbers.

Following these evolutions, the on-net/off-net differentiation became rarer, and bundles with unlimited calls made their appearance in 2013.

IBPT has noticed that prices in the mobile market have been constantly dropping ever since.

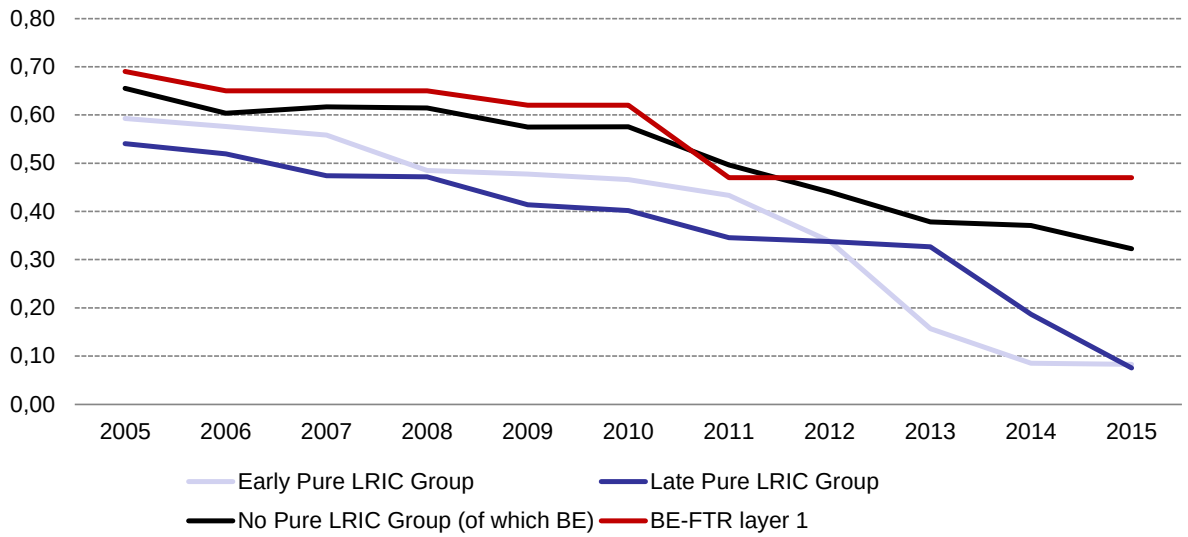
Eventually, BIPT stated that lower MTR was a good driver, although the lower prices in the mobile market were caused by several circumstances within the same year..

8.2.2 Fixed market

8.2.2.1 *Quantitative analysis*

The level of the Belgian FTR has been superior in average to all groups of countries since 2005 with an exception in 2011 following the last reduction of FTRs, as observed in Figure 118. In 2015, the level of FTR is almost five times higher than the Early and Late Pure LRIC Groups weighted averages.

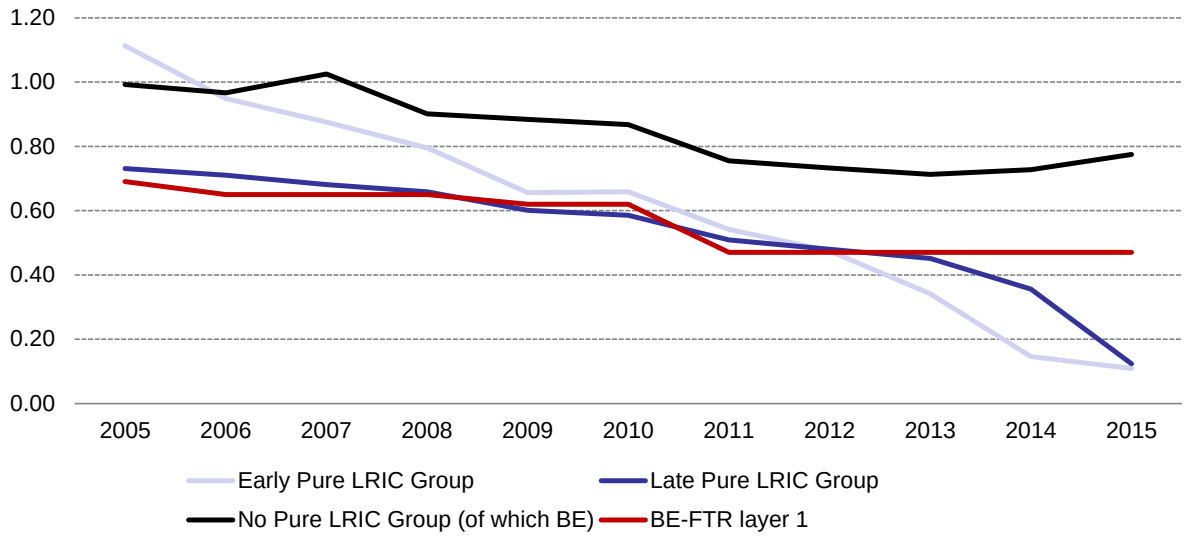
Figure 118 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 119 shows the flat average for the three groups as opposed to the previous figure. The main difference relates to the No Pure LRIC Group average FTR compared to the Belgian FTR level which has been lower since 2005. It has also been closer to the Early and Late Pure LRIC Groups since 2013.

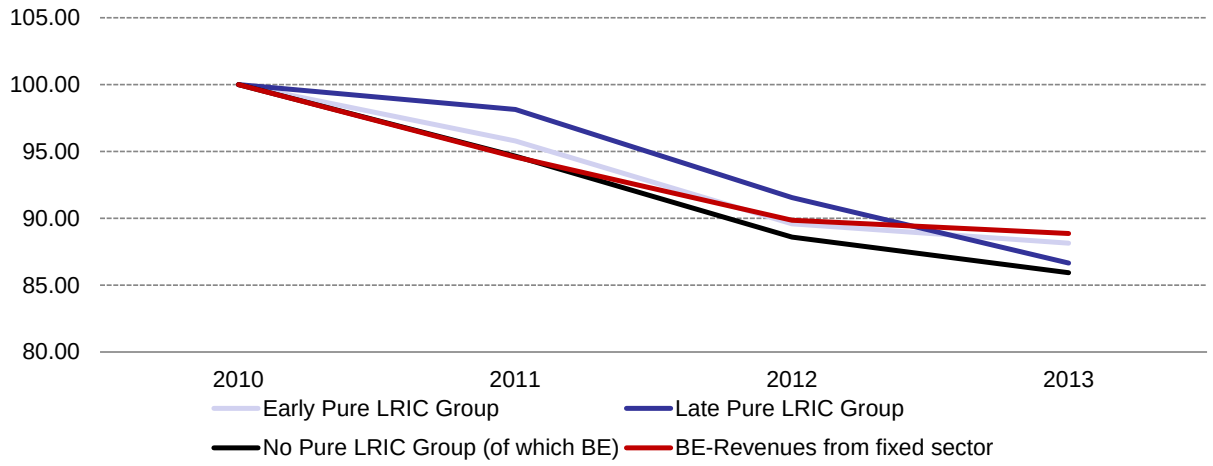
Figure 119 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 120 shows the constant and steady decline of revenues in Belgium and for the three groups. The revenues from the Belgian fixed sector have followed a similar evolution to the Early and No Pure LRIC Groups since 2010.

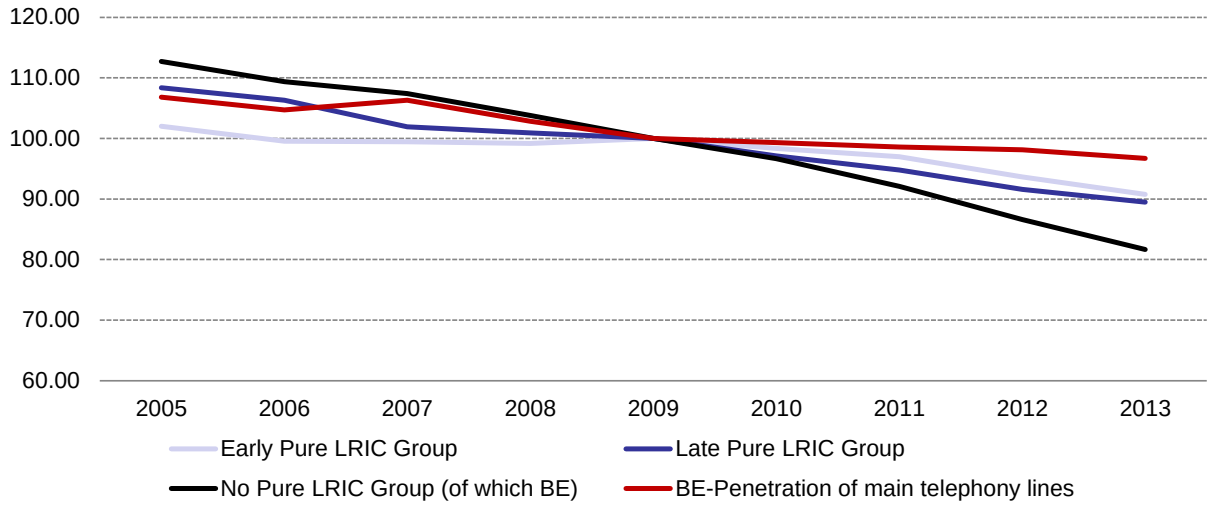
Figure 120 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Belgium has shown a constant and slow decrease since 2005 (except in 2007). Although all other groups have a declining market penetration, market penetration has been decreasing less for Belgium, as can be noticed in Figure 121.

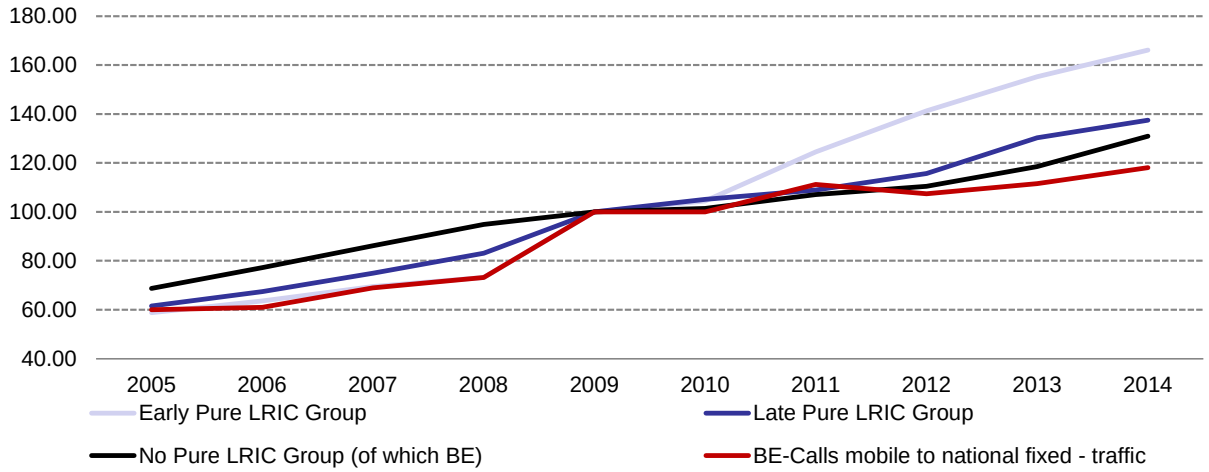
Figure 121 – Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile national calls to fixed in Belgium, presented in Figure 122, has shown a steady increase between 2009 and 2014, pretty close the No Pure LRIC Group evolutions.

Figure 122 – Evolution of the number of minutes of mobile calls to national fixed (base 100 in 2009)



Source: IBPT

8.2.2.2 *Evolution of retail fixed offers*

According to the BIPT, flat rate offers without on-net/off-net differentiation have been commercialized since 2011 in Belgium. Today, there hardly exists any offer still making this distinction[143].

According to the BIPT, because FTR have not decreased since 2011, until decision of August 2015, these evolutions in the retail market would be more imputed to the important decrease of MTRs allowing lower prices for calls to mobile.

8.2.3 Summary

The table below summarizes, for each metric, the difference between Belgium and the average metric for the Early pure LRIC Group for mobile and the No pure LRIC Group for fixed in order to highlight how Belgium is positioned against its pair countries.

Figure 123 - Differences between Belgium and its group

Metrics	Differences between the Late Pure LRIC Group and Belgium
Mobile revenues	Extremely close to the Early Pure LRIC Group's evolutions
Mobile investments	Very close to the Early Pure LRIC Group since 2013 and the

[143] These offers were:

- Proximus (September 2011): Happy Time XL on the retail market for fixed telephony / € 21.49 / month / Free calls in the evening and during weekends/ In Belgium unlimited calls to fixed lines + 1,000 min./month to mobile phones ;
- Numericable Extra / € 21.90 / month / Unlimited calls, 24/24 to Belgian fixed numbers / Unlimited calls in the evening and during weekends to mobile phones (national) ;
- Telenet Freephone Europe (November 2011) / € 21.70 / month / Unlimited calls to Belgian fixed numbers during off-peak hours / 2,000 minutes for calls during off-peak hours to: Mobile numbers in Belgium, Fixed and mobile numbers in Europe, the US and Canada, Fixed numbers in Morocco and Turkey, Free mobile calls with Triiing.

	implementation of Pure LRIC
Mobile retail prices	Decreased more for Belgium than for its group
Mobile penetration	Same trend followed in terms of #SIM cards. Bigger penetration for Belgium in terms of Unique Subscribers
Competition in mobile	Remained stable whereas concentration increased in the Early Pure LRIC Group
On-net rate	Very close to Early Pure LRIC Group

Source: TERA Consultants

Figure 124 – Differences between the No Pure LRIC Group and Belgium for the fixed market

Metrics	Differences between the No Pure LRIC Group and Belgium
Fixed revenue	Very close evolution to the Early Pure LRIC Group rather than No Pure LRIC Group
Traffic	Very close evolution to the No Pure LRIC Group
Main telephony lines	Slower decrease than the No Pure LRIC Group

Source: TERA Consultants

8.3 Bulgaria

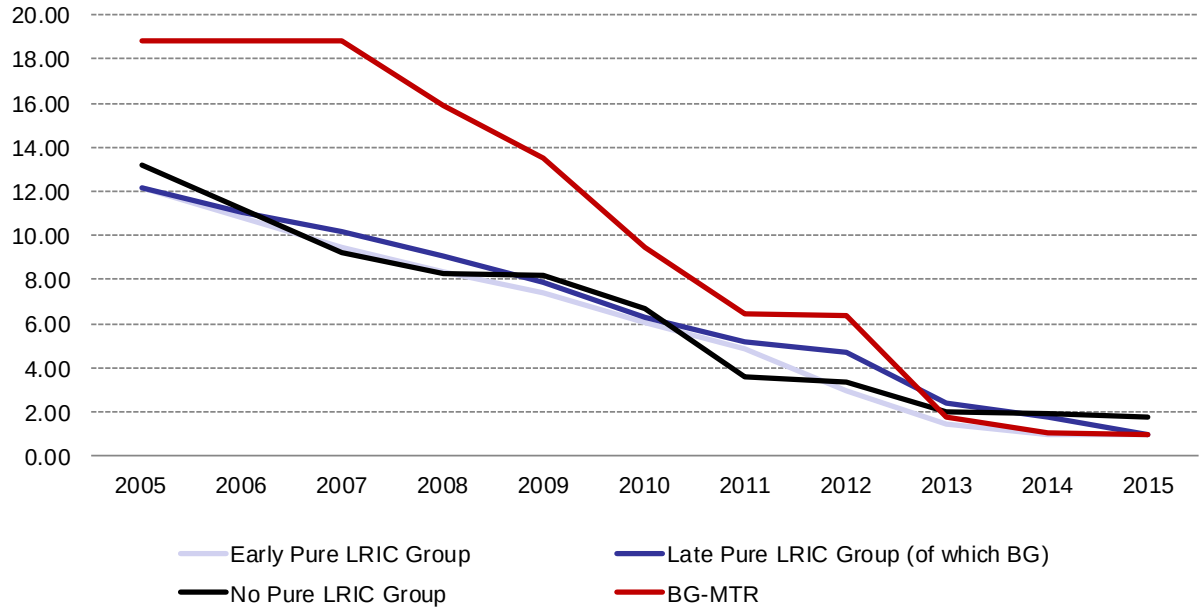
The Bulgaria's telecom market is a 3-players mobile market and has a declining fixed sector. The incumbent Vivacom has been leading the market until it became privatized in 2004, allowing new entrants to compete, though it remains dominant on the fixed market. The three mobile operators are Vivacom (entered in 2005), Mobiltel (entered in 1994) the leader and Telenor Bulgaria (entered in 2001) formerly known as Globul. Bulgaria's regulator CRC decided to adopt the pure LRIC approach for MTRs and FTRs on the 14th February 2013 without any glide path. Prices based on the Pure LRIC approach entered into force on the 1st July of 2013. Because CRC adopted the Pure LRIC approach before the end of 2013, Bulgaria has been allocated to the Early Pure LRIC group for the present analysis for both fixed and mobile.

8.3.1 Mobile market

8.3.1.1 *Quantitative analysis*

MTRs in Bulgaria were among the highest in Europe until 2013. Indeed, Figure 125 shows that Bulgaria's MTR has been constantly remaining higher than all other countries average until the adoption of Pure LRIC in 2013. As MTRs are converging for all countries, in 2015 Bulgaria MTR almost equals the average of the countries which have adopted the Pure LRIC method before and after 2013:

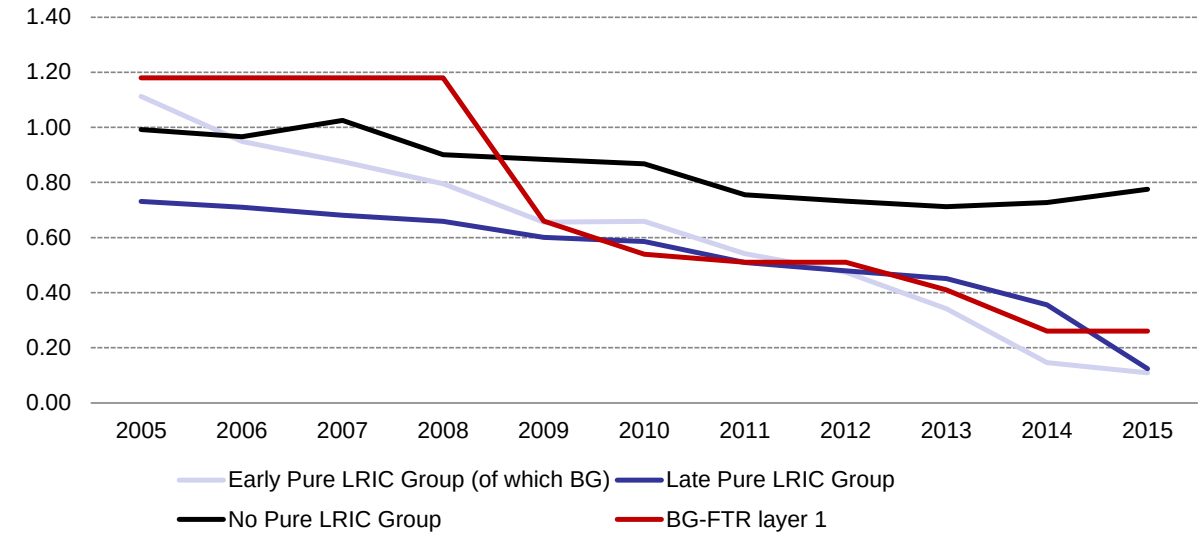
Figure 125 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 126) with the same observations with respect to Bulgaria.

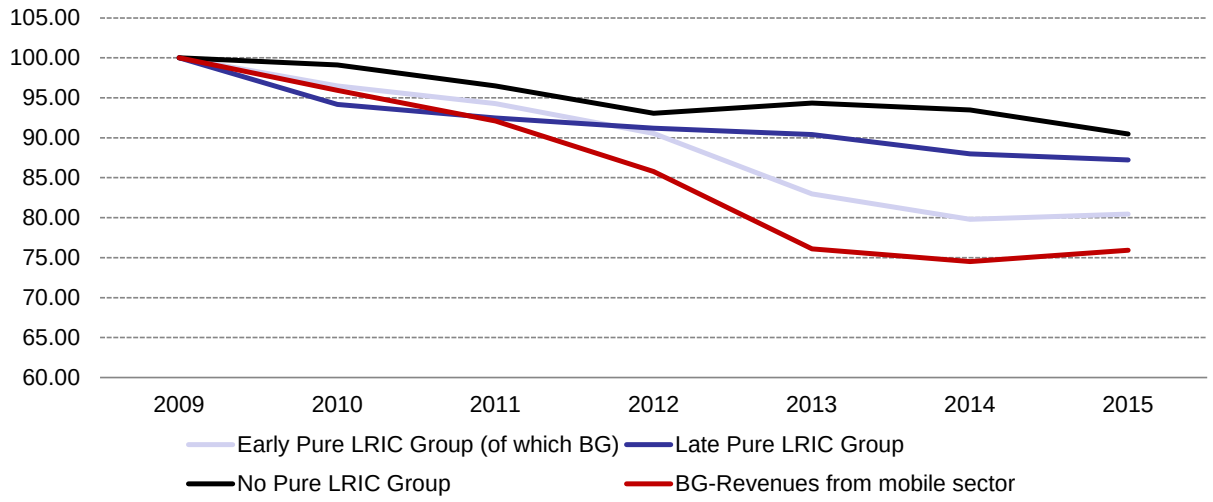
Figure 126 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector (Figure 127) have been increasing from 2005 to 2008 (+35%) then have been decreasing between 2008 and 2013. Mobile revenues have been steady since 2013, following pretty much the European trend, but remaining at a lower level.

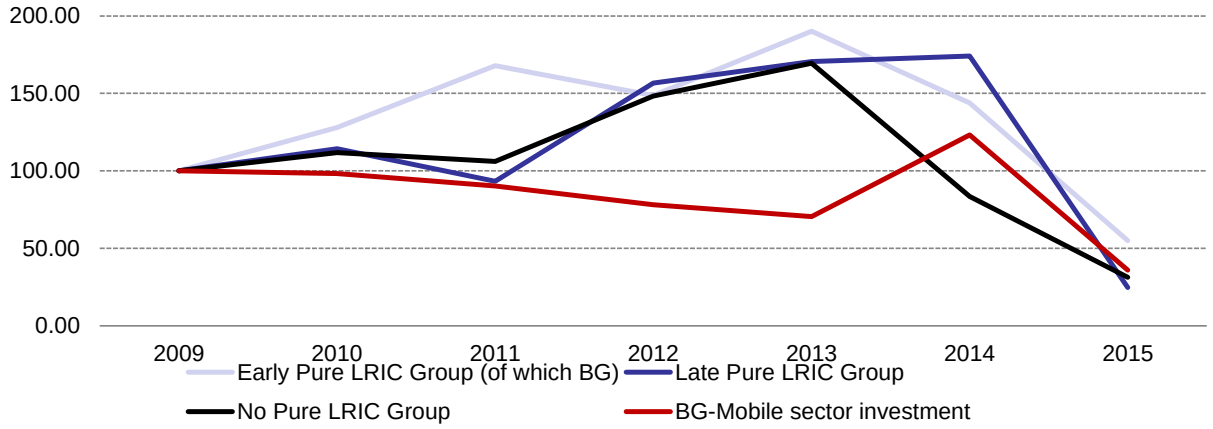
Figure 127 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

As for the revenues, investments (Figure 128) in the mobile sector have also continued to decline, especially in 2015 after a shy increase in 2014. The evolution of mobile investments is relatively different from the Early Pure LRIC Group but mobile investment have decreased less in Bulgaria than the Late Pure LRIC or the No Pure LRIC Group.

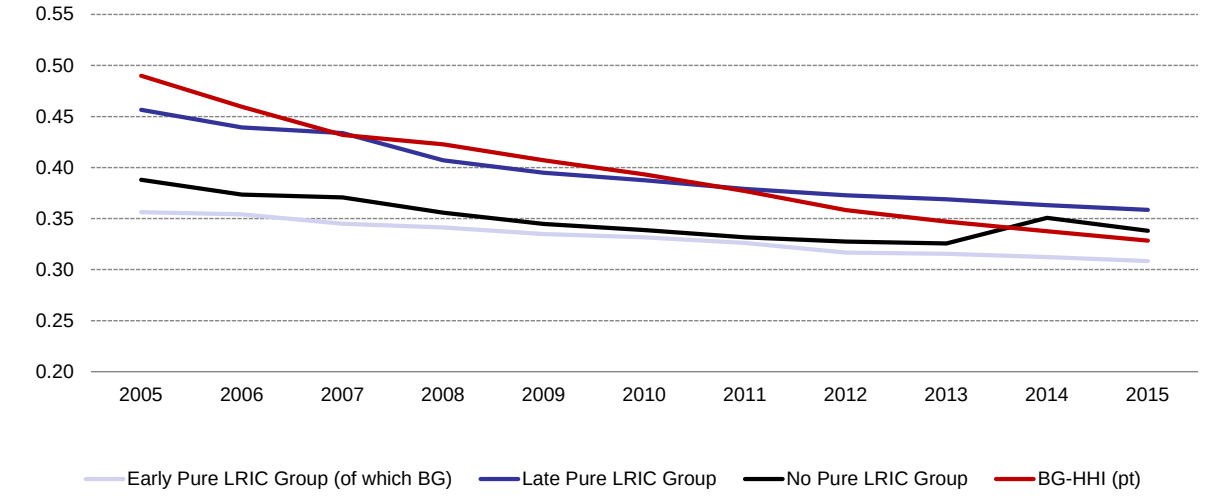
Figure 128 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the Bulgarian mobile market, all three offering nationwide coverage. The improvement in the level of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005, starting three points above the Late Pure LRIC Group curve at 0.49 to reach 0.33 in 2015, three points below its group average.

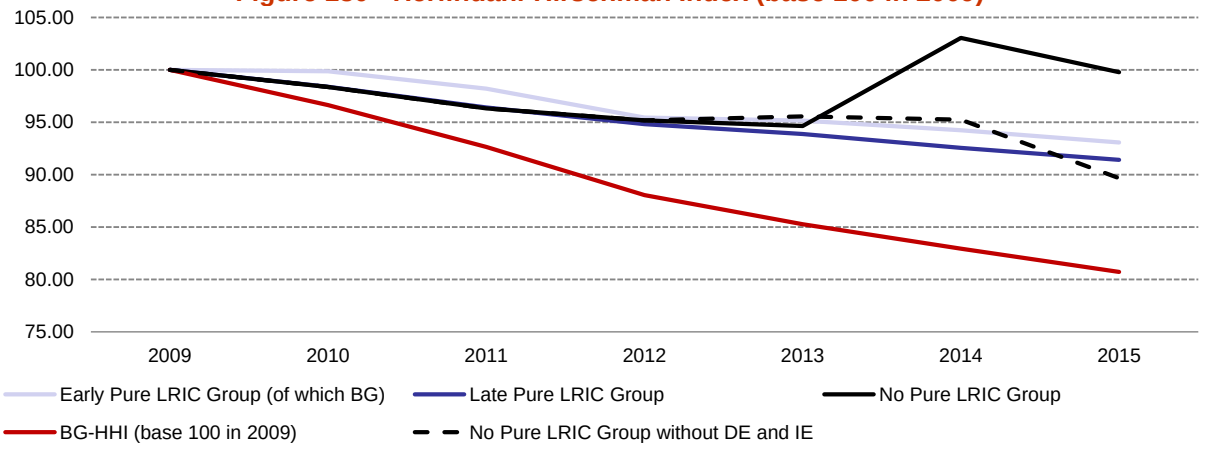
Figure 129 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the lower level of concentration in Bulgaria since 2009 can be noticed in Figure 130: the HHI (as base 100 in 2009) has been continuously dropping and has been decreasing more than the 3 group average.

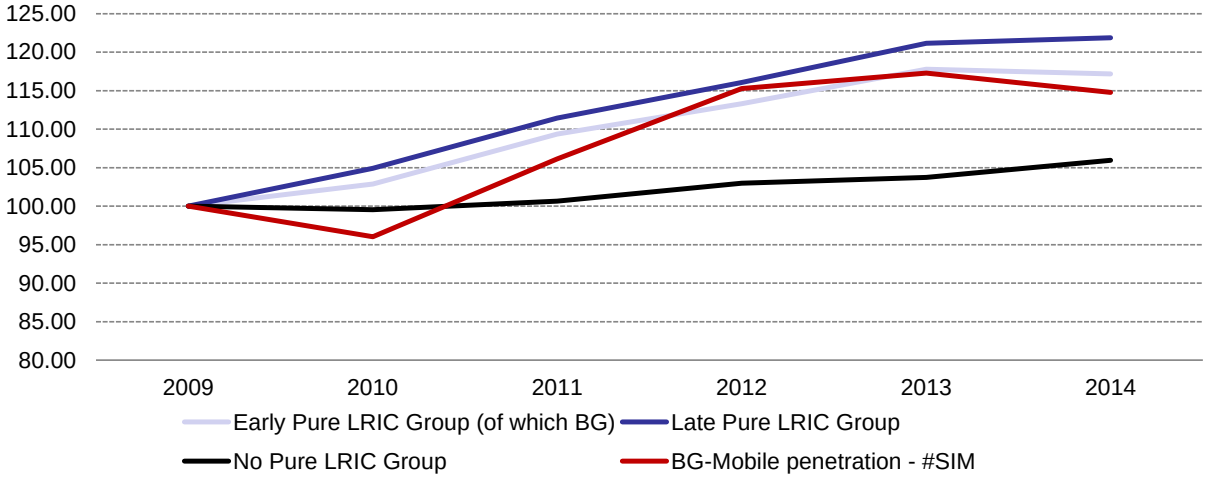
Figure 130 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Bulgarian market penetration in terms of number of SIM has been increasing between 2010 and 2014 at the same trend as the Early Pure LRIC Group.

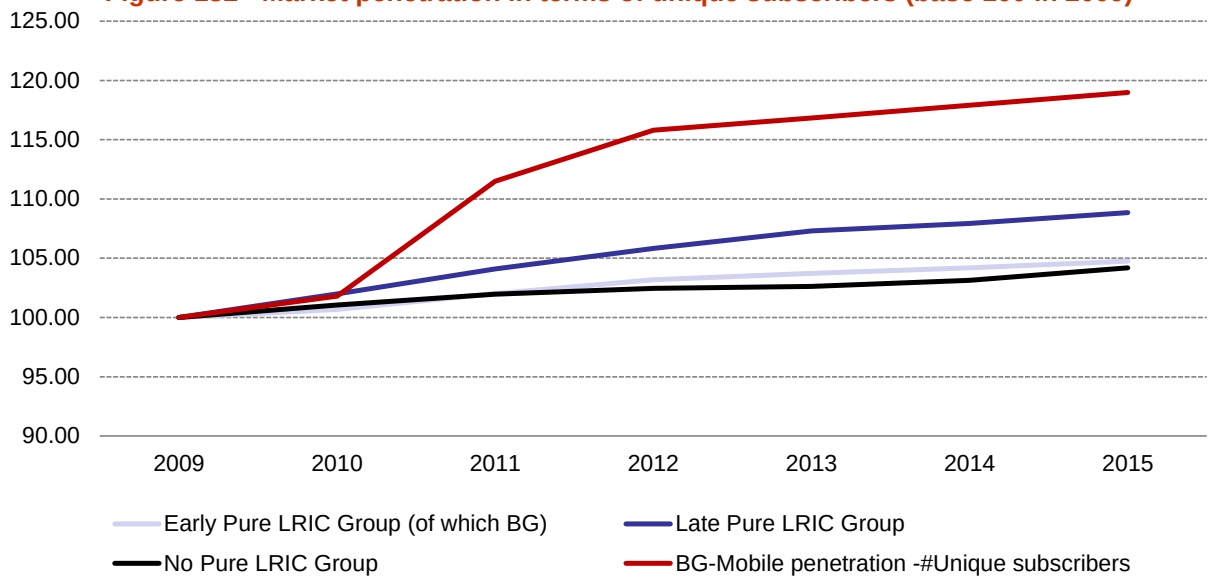
Figure 131 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 132 that the market penetration in terms of unique subscribers in Bulgaria has significantly increased from 2009 to 2012 (+15%) then it has remained quite constant between 2012 and 2015. This is a much greater increase than the Early Pure LRIC group.

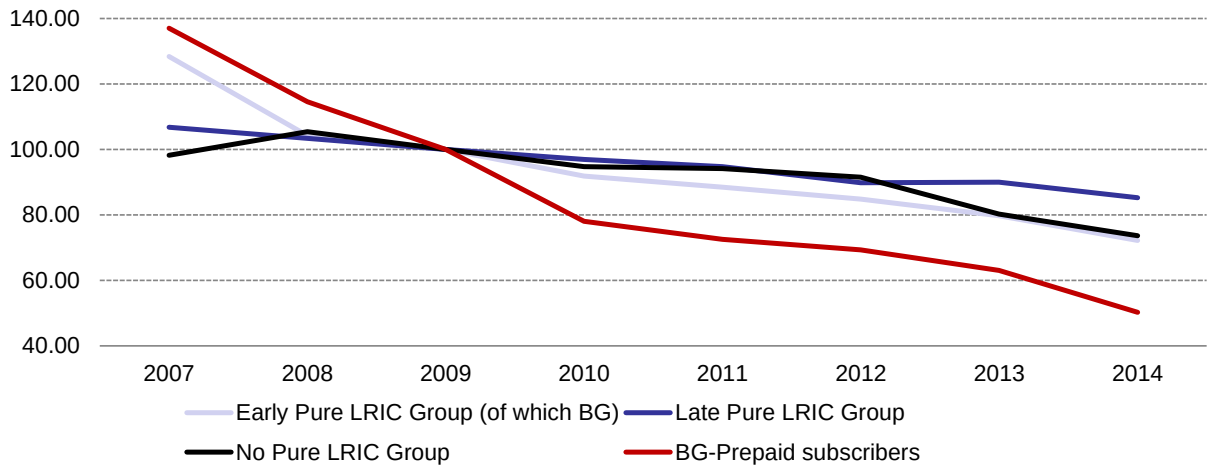
Figure 132 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 133 highlights a significant decrease in the share of prepaid offers in Bulgaria and this decrease has been much greater than the decreases observed in other groups. Among other factors, the adoption of Pure LRIC has probably contributed to accentuate the previous decline of the share of prepaid users. The share of prepaid customer in Bulgaria stands at 22% in 2014.

Figure 133 - Share of prepaid subscribers in the mobile market (base 100 in 2009)[144]



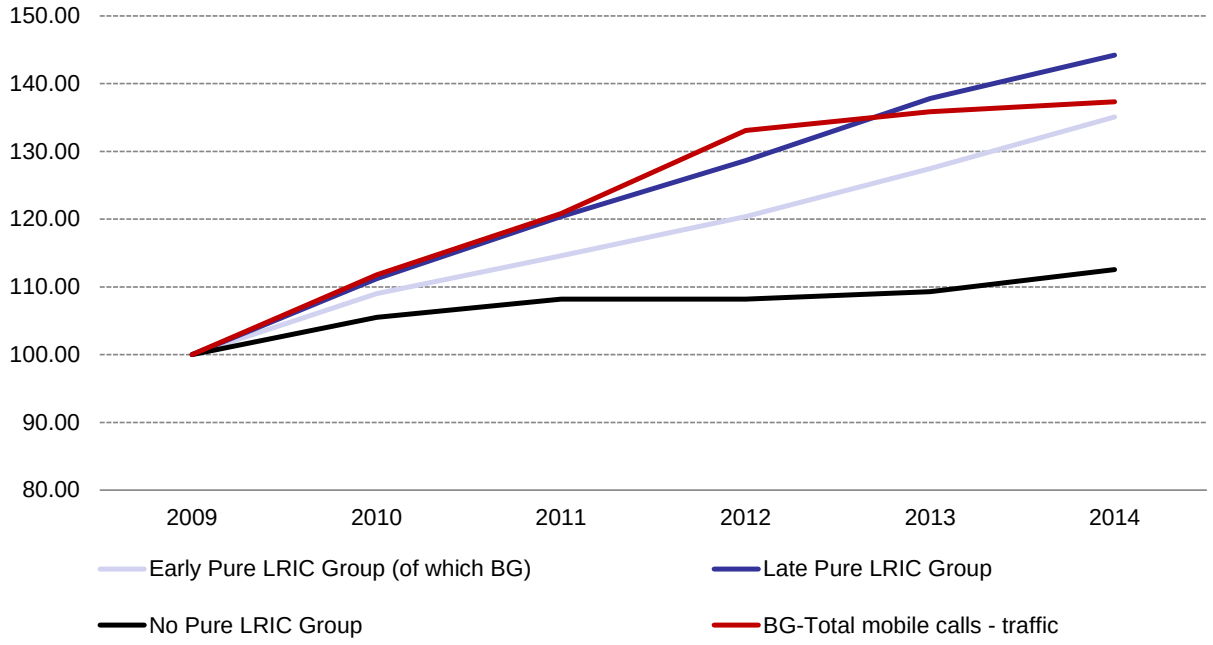
Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 134 shows the evolution of the total amount of minutes of mobile calls. The mobile traffic in Bulgaria has been following a similar evolution to the Late Pure LRIC Group from

[144] For Bulgaria, data is not available for years 2005 and 2006.

2009 to 2012. However its global evolution since 2009 has been closer to the Early Pure LRIC Group between 2009 and 2014.

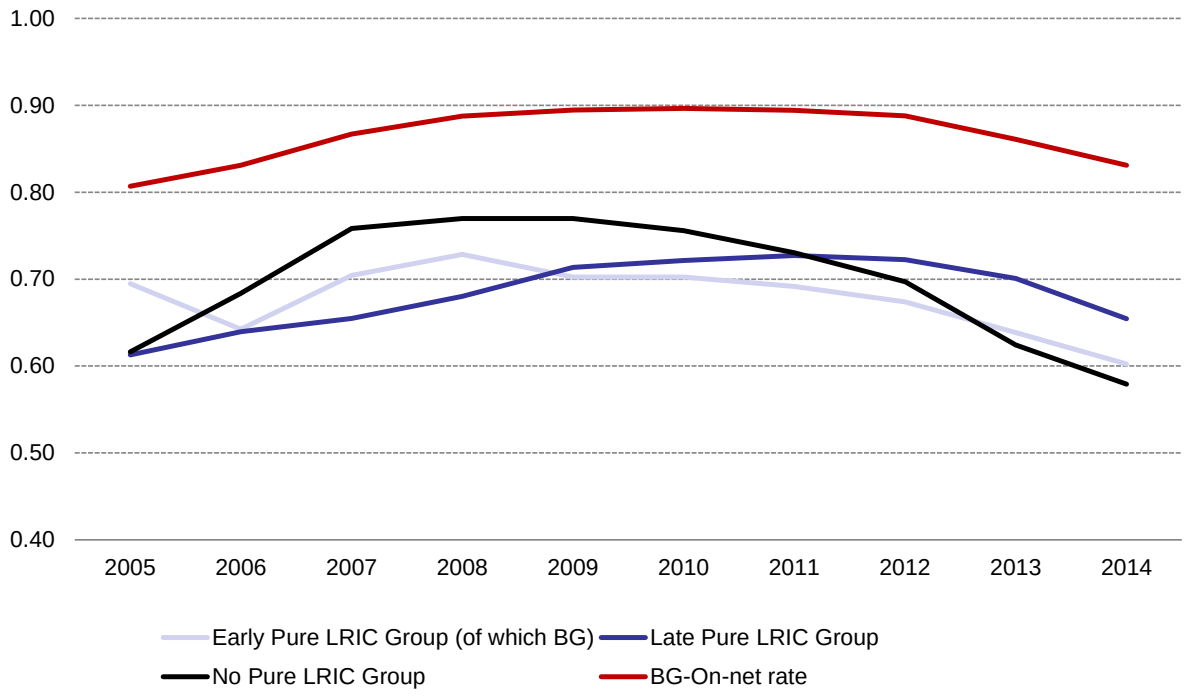
Figure 134 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 135 shows the share of on-net mobile calls, slowly increasing from 2005 to 2008 for Bulgaria before levelling off until 2012 and falling after 2012. The Early Pure LRIC Group average value follows roughly the same pattern, but is way lower than the Bulgarian rate (58% for 85% in 2015). This evolution illustrates what CRC mentioned in the questionnaire submitted by the European Commission: *"the relative share of the on-net traffic continued to decrease at a slower but constant pace".*

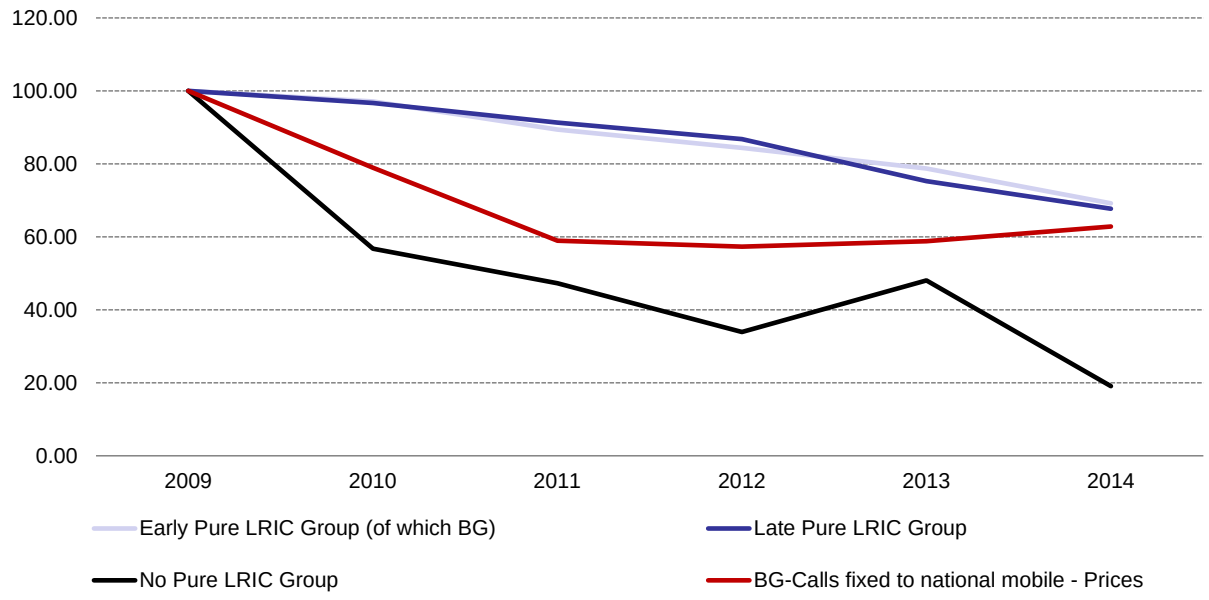
Figure 135 - On-net rate of mobile calls (%)



Source: CRC

Prices for fixed calls to national mobile, influenced by the evolution of MTRs, have shown a steady decline from 2009 to 2011, and have been remaining fairly constant ever since. Their global decline since 2009 is relatively close to the Early and Late Pure LRIC Groups, as shown in Figure 136.

Figure 136 Prices of fixed calls to national mobile (base 100 in 2009)[145]



Source: CRC

8.3.1.2 *Evolution of retail mobile offers*

According to the CRC, the application of transparency and non-discrimination obligations conjoint to the application of wholesale prices based on Pure LRIC model from 2013 have resulted in an improvement concerning discriminatory practices on retail market. Currently, according to the CRC, retail mobile offers are mainly structured as follows:

- a monthly subscription that includes a fixed amount of minutes for calls (including on-net and off-net calls to fixed and other mobile networks). Some of the subscription plans include also minutes for outgoing international calls;
- a flat rate for calls to national networks, applied after depletion of included minutes;
- for the subscription to a new contract or a renewal (for 12 or 24 Months), the end user can purchase a device (handset, tablet) at a discounted price[146].

[145] Data from other countries are not yet available.

[146] CRC also mentionsed several examples of such offers:

- At the beginning of 2012 Mobiltel started offering plans "Active" with flat rate for calls to all national networks after depletion of the minutes included in the subscription (0.29 BGN per minute);
- BTC proposed to its customers in late 2011 the "UniCall" plan with flat rate from 0.25 BGN per minute for calls to all national networks after the depletion of the minutes included;
- Telenor Bulgaria (former Cosmo Bulgaria Mobile) offered also at the beginning of 2012 plans "Globul United" with flat rate from 0.32 BGN per minute for calls to all national networks after the depletion of the minutes included in the monthly subscription.

Furthermore, CRC indicates that the total outgoing traffic is mainly made of minutes included in the monthly subscription (90%). 73.9% of this traffic is on-net, 13.0% is off-net mobile, 2.0% go to national fixed networks, and 1.0% go to international outgoing traffic.

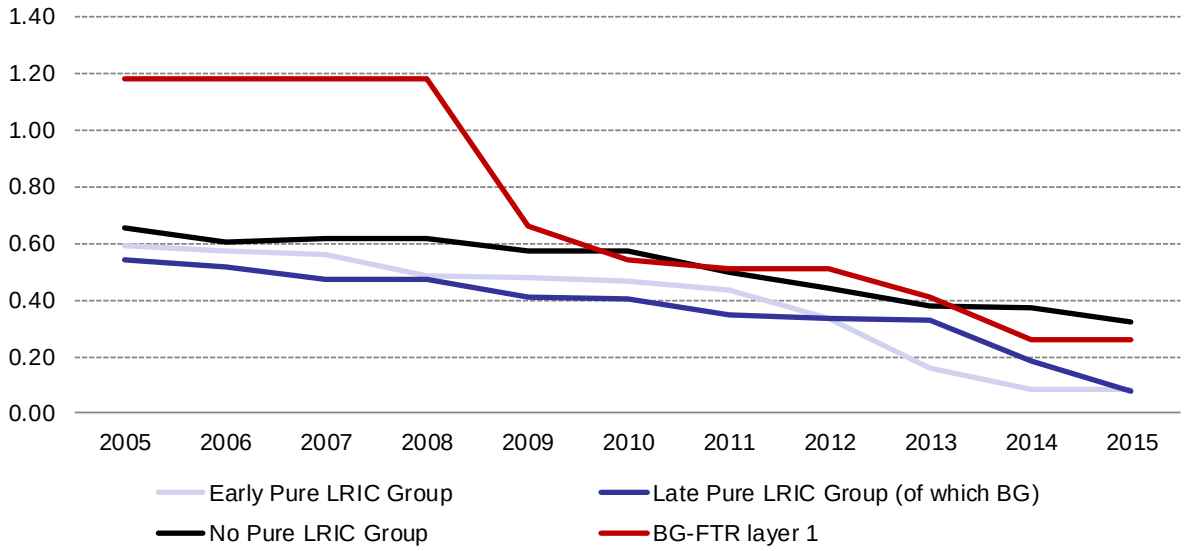
It is important to note that the structure of mobile retail offers previously described has started to change before the adoption of MTR base on Pure LRIC that occurred in mid 2013.

8.3.2 Fixed market

8.3.2.1 *Quantitative analysis*

The level of the Bulgarian FTR has been superior in average to all countries until 2013. However, the Bulgarian FTR level became lower to the No Pure LRIC Group average from 2009. In 2015 the Bulgarian FTR is twice greater than the Early and Late Pure LRIC Groups averages FTRs (~0.13 EURcts/min) as it is presented in Figure 137. However, it should be noted that the fixed termination rate is applied on national level without any differentiation between hierarchy levels.

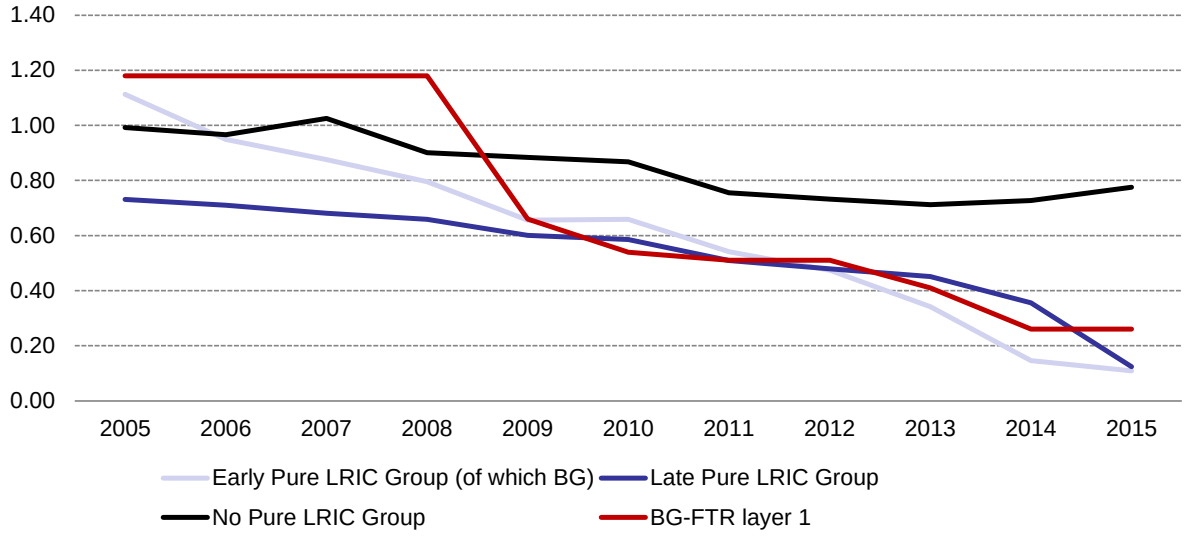
Figure 137 - Fixed termination rates weighted average - layer 1 (EURcts/min)[147]



Source: TERA Consultants from BEREC & EC reports

Figure 138 shows the flat average for the three groups as opposed to the previous figure and shows similar outcomes.

Figure 138 - Fixed termination rates flat average - layer 1 (EURcts/min)

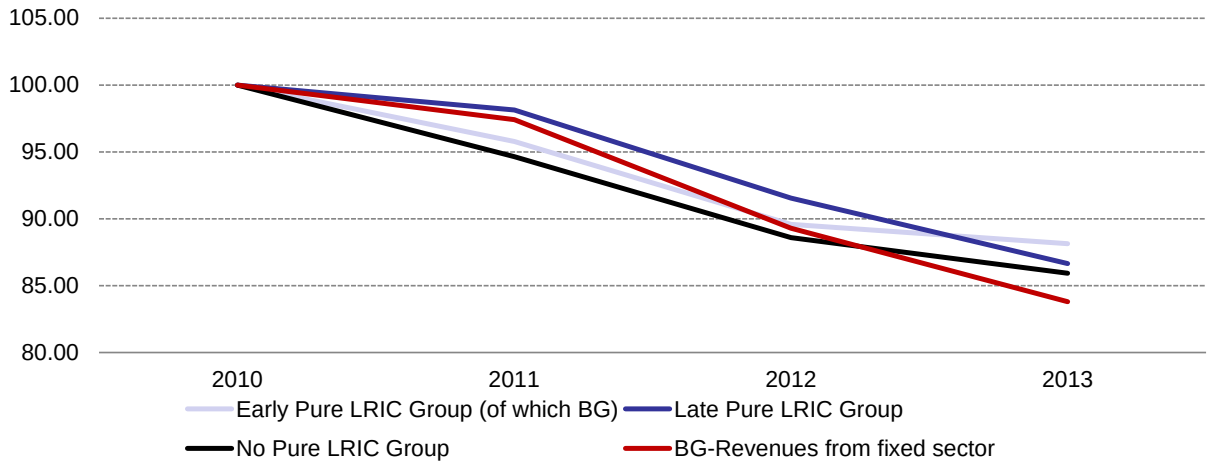


Source: TERA Consultants from BEREC & EC reports

[147] For Bulgaria, datas were not available for years 2005 and 2006.

Figure 139 highlights the fall of revenues from fixed-line market since 2010 for Bulgaria and the 3 groups of countries. In 2013 compared to 2010 Bulgarian revenues have decreased slightly more than the average of its group but have followed a comparable trend.

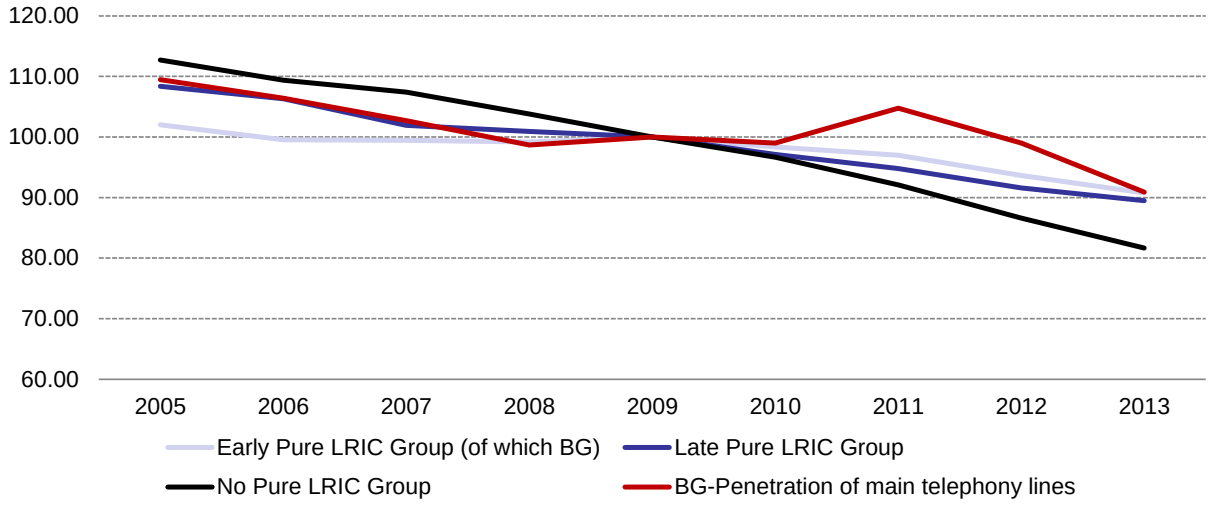
Figure 139 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Bulgaria has shown a constant and slow decrease since 2005 (except in 2011), with an evolution between 2013 and 2009 which is similar to the Early pure LRIC group (Figure 140).

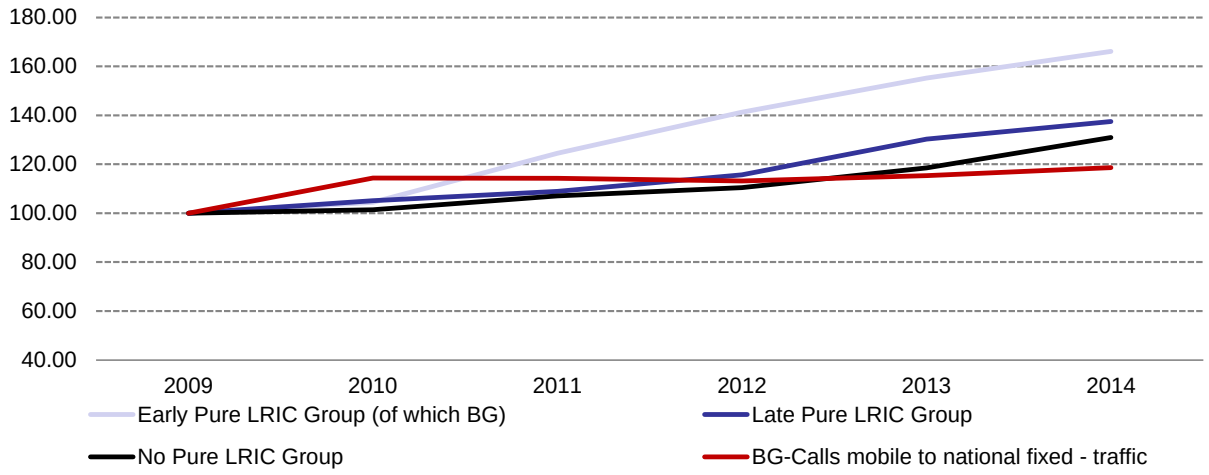
Figure 140 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Bulgaria, presented in Figure 141, has shown a steady trend between 2010 and 2014 similar to the one of the Early Pure LRIC group.

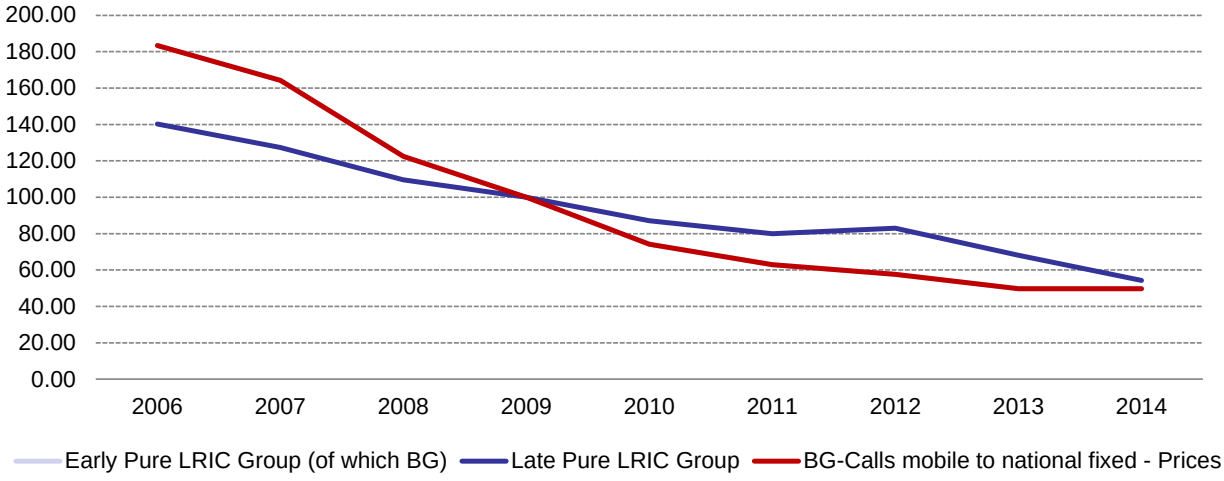
Figure 141 - Traffic of mobile calls to national fixed (base 100 in 2009)[148]



Source: CRC

Figure 142 shows the evolution of retail prices for mobile calls to national fixed. It can be observed that it has been continuously decreasing in Bulgaria, in particular in 2006. Since Bulgaria is the only country with available data for the Early Pure LRIC Group, its prices evolution cannot be compared to the other countries of the Early Pure LRIC. It can however be noticed that the prices have been continuously dropping in Bulgaria, such as the countries of the Late Pure LRIC Group.

Figure 142 - Prices of mobile calls to national fixed (base 100 in 2009)



Source: CRC

8.3.2.2 *Evolution of retail fixed offers*

According to the CRC, the application of transparency and non-discrimination obligations conjoint to the application of wholesale prices based on Pure LRIC model from 2013 have resulted in an improvement concerning discriminatory practices on retail market (such as "*too high rates or asymmetrical rates depending on the origin of traffic*").

Currently, retail fixed offers are mainly structured as follows:

[148] From number of minutes.

- a monthly subscription plan that includes some amount of minutes for calls, including off-net calls (fixed and mobile). Some of the subscription plans include also minutes for outgoing international calls;
- one price for off-net fixed national networks and one price for calls to all national mobile networks after depletion of included minutes[149].

Furthermore, CRC indicates that the total outgoing traffic is mainly made of minutes included in the monthly subscription (73%).

Nevertheless, CRC notices that if the wholesale termination rates affect the average retail price per-minute, there are also other influent factors such as "*the call set-up charge and the period of charging - from 1 or 30 seconds to charging per minute"*.

8.3.3 Summary

The table below summarizes, for each metric, the difference between Bulgaria and the average metric for the Early pure LRIC Group in order to highlight how Bulgaria is positioned against its pair countries.

Figure 143 - Differences between Bulgaria and its group

Metrics	Differences between the Early Pure LRIC Group and Bulgaria
Mobile revenues	Bigger decrease since 2011 for Bulgaria
Mobile investments	Same trend followed
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards. Bigger penetration for Bulgaria in terms of Unique Subscribers
Competition in mobile	Followed the same trend since 2011
On-net rate	Way higher than Late Pure LRIC Group, but very comparable trend

Source: TERA Consultants

Figure 144 – Differences between the Early Pure LRIC Group and Bulgaria for the fixed market

Metrics	Differences between the Early Pure LRIC Group and

[149] CRC also mentioned examples of other type of offers:

- At the end of 2013 the incumbent offered the plan "Vivacom MegaFix", which includes 3,600 minutes on-net fixed calls and calls to First International group and 30 minutes for off-net fixed calls and calls to national mobile networks. The subscription plan also includes a flat rate for calls after depletion of the minutes included in the subscription (0.132 BGN call set-up charge and 0.01 BGN per minute including VAT) for calls to all national fixed and mobile networks and for calls to First International group;
- At the end of 2013 the incumbent offered the plan "Vivacom UniFix", which includes 30 minutes to all mobile and fixed networks in Bulgaria and calls to First International group.

	Bulgaria
Fixed revenue	Close evolution to the Early Pure LRIC Group
Traffic	Much slower increase than the Early Pure LRIC Group
Main telephony lines	Different trend followed than all groups

Source: TERA Consultants

8.4 Croatia

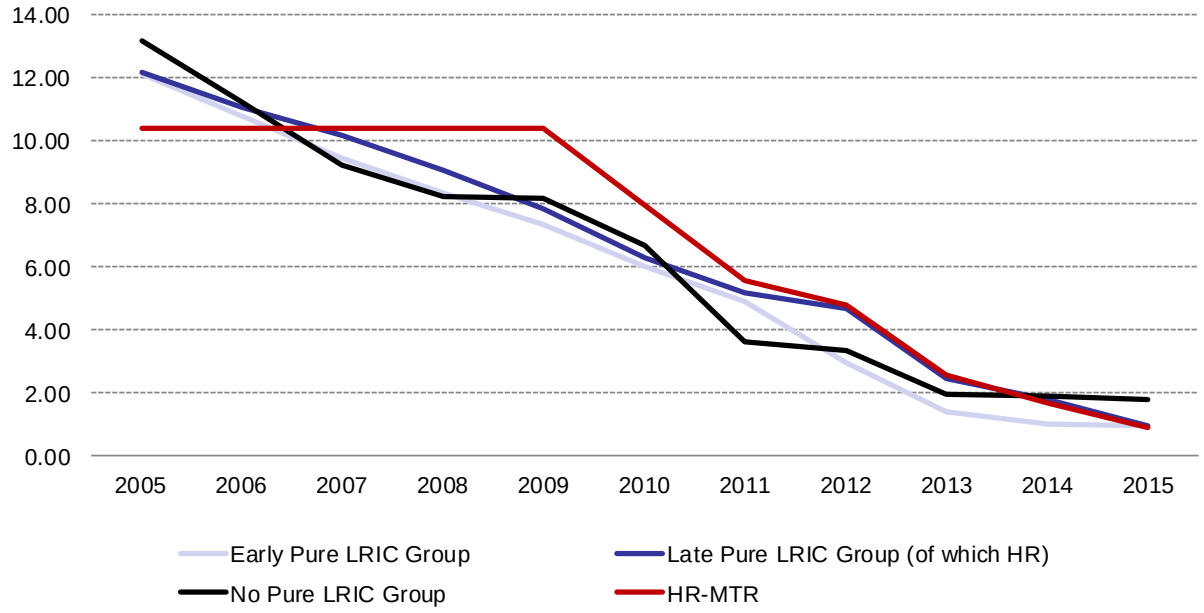
Croatian bid to join the European Union has shaped the country's telecoms market, resulting in the creation of HAKOM, the Croatian regulator, and market liberalization. The mobile market is served by three operators offering voice services, the incumbent Hrvatski Telekom (1998) owned by Deutsche Telekom, Vipnet (1999) and Tele2 (2005), even challenged by Optima Telekom (2004), one of the leading fixed operator in Croatia providing integrated voice services. The Croatian regulator chose to implement the pure LRIC approach for both MTRs and FTRs in 2013 with a one year glide path for FTRs and in 2015 for MTRs.

8.4.1 Mobile market

8.4.1.1 *Quantitative analysis*

MTRs in Croatia have been continuously dropping since 2009, starting above all groups in 2009, and following the same trend as the Late Pure LRIC Group since 2011 In 2015, MTRs in Croatia are at the same level as the Early Pure LRIC Group's weighted average MTR as observed with Figure 145.

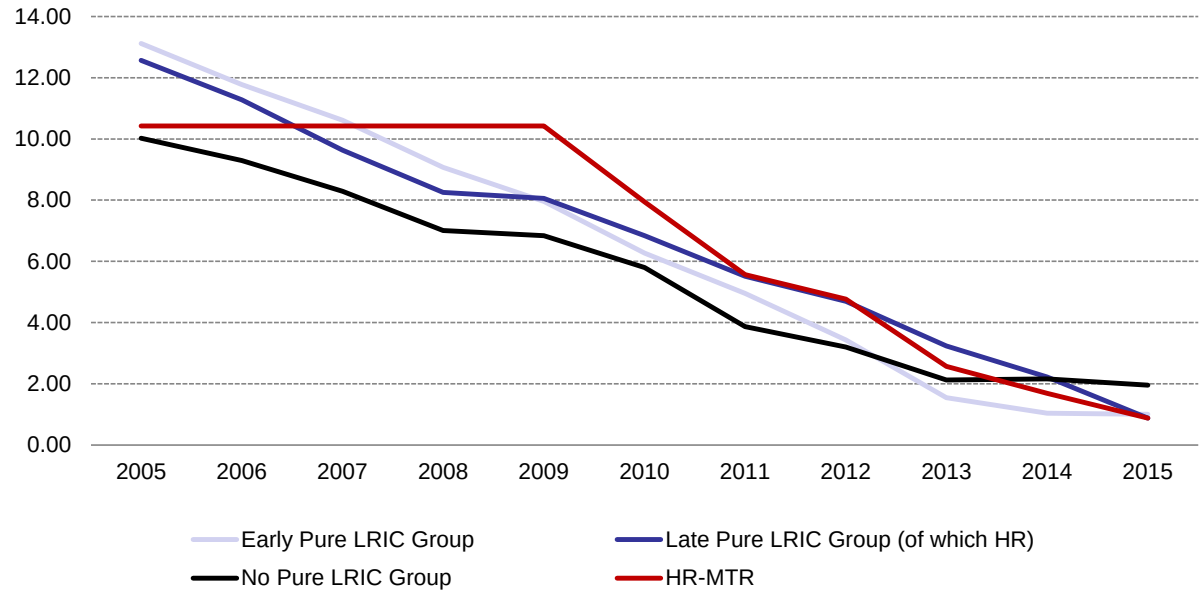
Figure 145 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 146). The trend is approximately the same as the weighted average trend, with Croatian MTR above all groups in 2009, and constantly falling ever since in order to reach a Pure LRIC level in 2015.

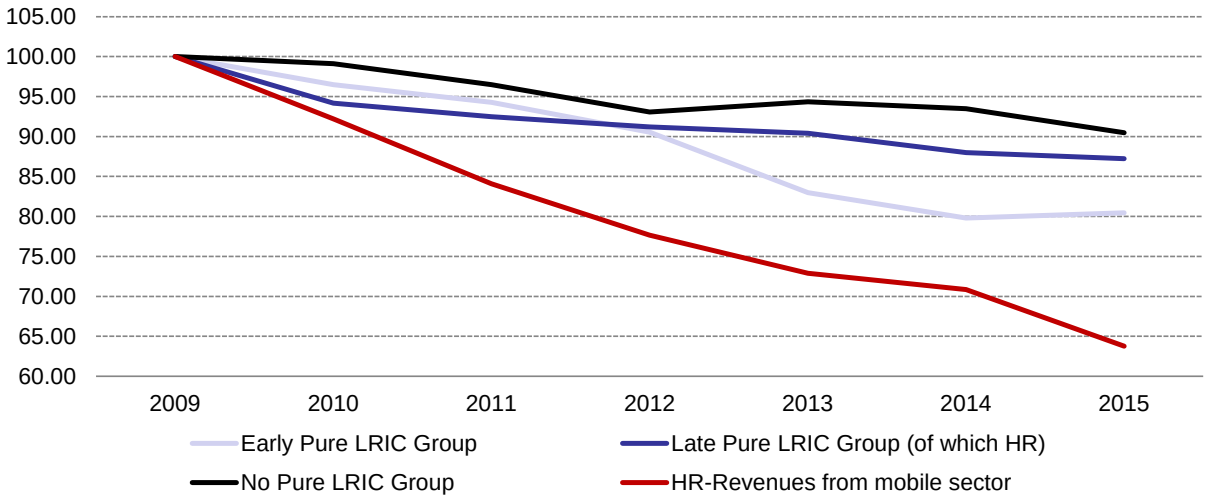
Figure 146 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector in Croatia have been constantly declining from 2009 to 2015, more than any other group, as observed with Figure 147.

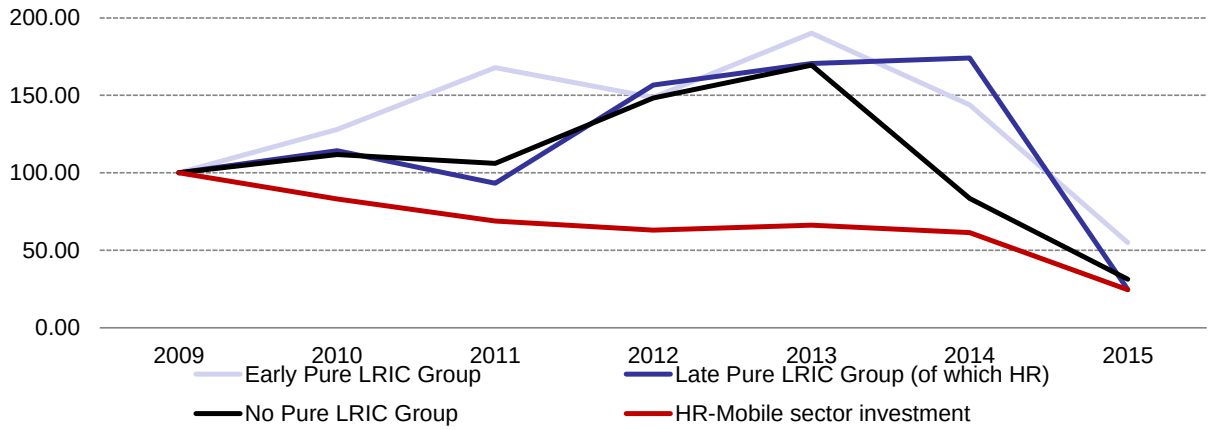
Figure 147 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in the mobile sector in Croatia are then analyzed with Figure 148. It can be observed that they have been decreasing from 2009 to 2015, following no particular group's trend.

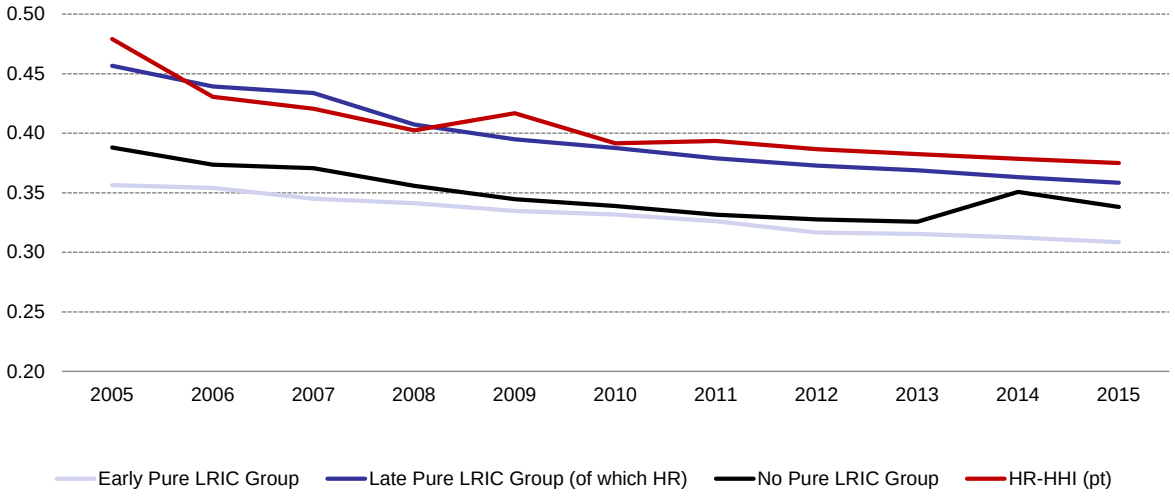
Figure 148 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Croatian mobile market. The improvement of competition in the mobile market can be noticed with the constant but slow decrease of the Herfindahl-Hirschman Index since 2005. However, in 2015 Croatia is still above all groups, facing a higher market concentration than other MS, as observed with Figure 149.

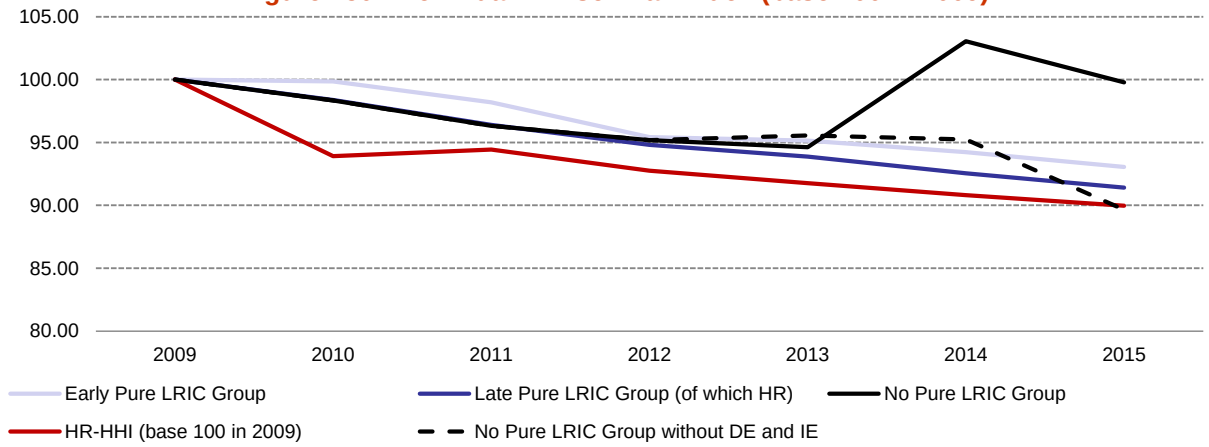
Figure 149 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the increasing level of concentration in Croatia since 2009 can be noticed in Figure 150: the HHI (as base 100 in 2009) has been continuously dropping since 2011, following the Late Pure LRIC Group's trend.

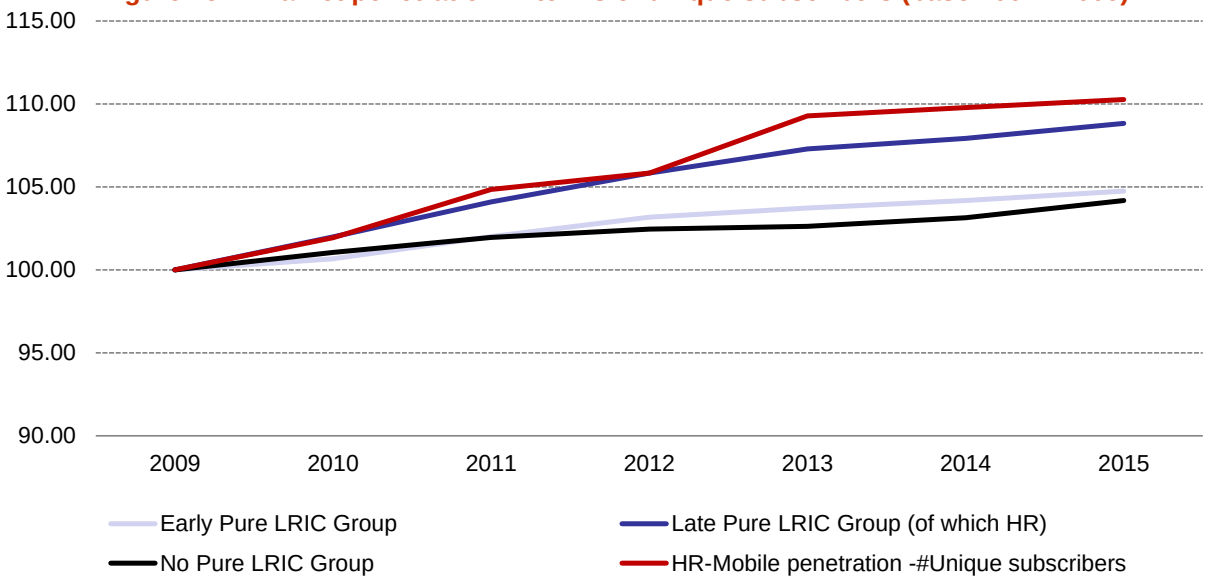
Figure 150 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

Only the market penetration in terms of unique subscribers was available for Croatia. It can be observed with Figure 151 that it has been increasing since 2009 following the path of the Late Pure LRIC Group.

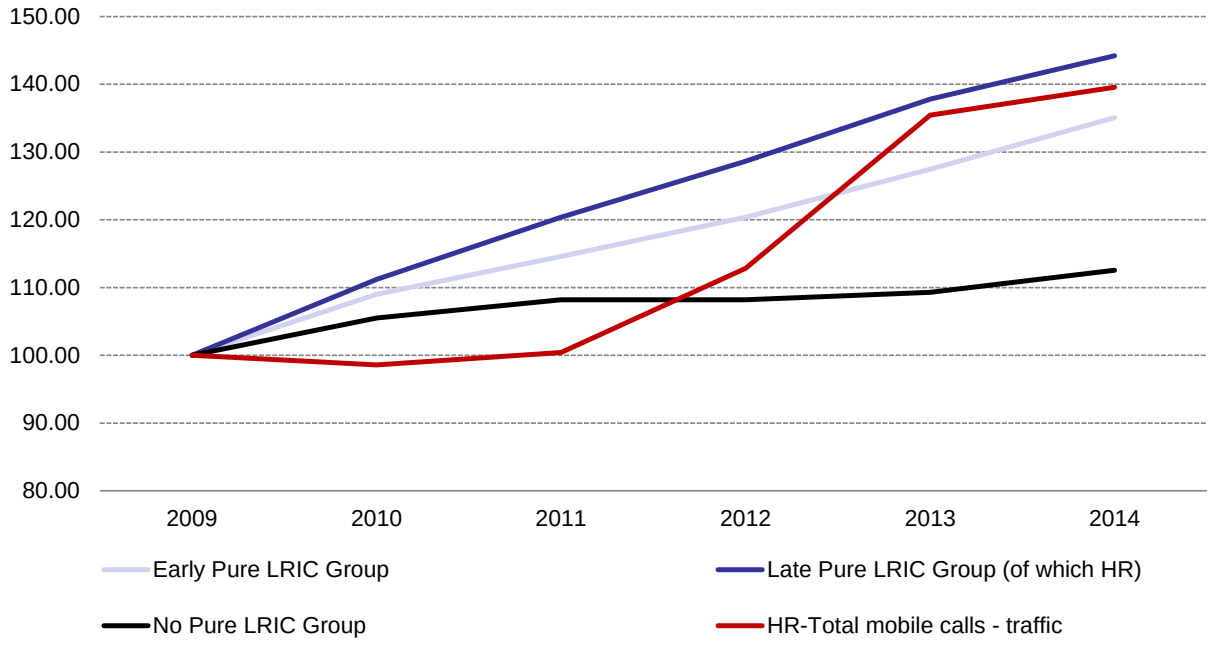
Figure 151 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 152 shows the evolution of the total amount of minutes of mobile calls in Croatia. It has been remaining steady from 2009 to 2011, and then has been considerably increasing from 2012 to 2014. The traffic has observed a different trend from any other group, but its overall growth has been closer to the Late Pure LRIC Group between 2009 and 2014.

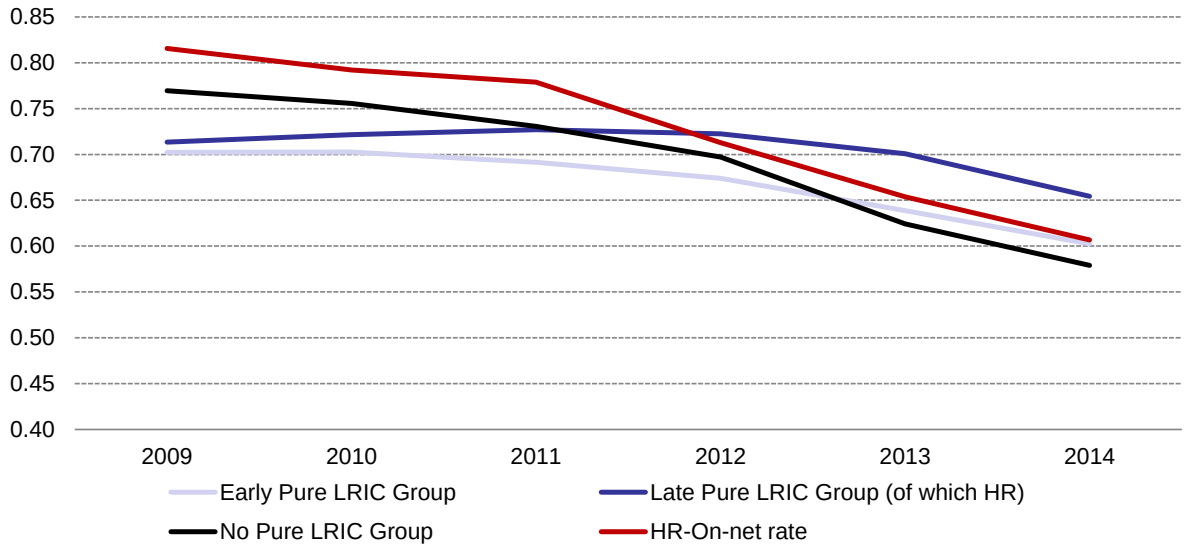
Figure 152 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

In particular, the share of on-net mobile calls in Croatia, analyzed in Figure 153, seems to reflect the reduction in on-net/off-net price differentiation, as it has been continuously falling since 2009, and 2011 especially.

Figure 153 - On-net rate of mobile calls (%)



Source: HAKOM

8.4.1.2 *Evolution of retail mobile offers*

According to HAKOM, retail mobile offers have evolved in Croatia following the European trend, with the decline of on-net/off-net differentiation, and the progressive appearance of flat rate offers.

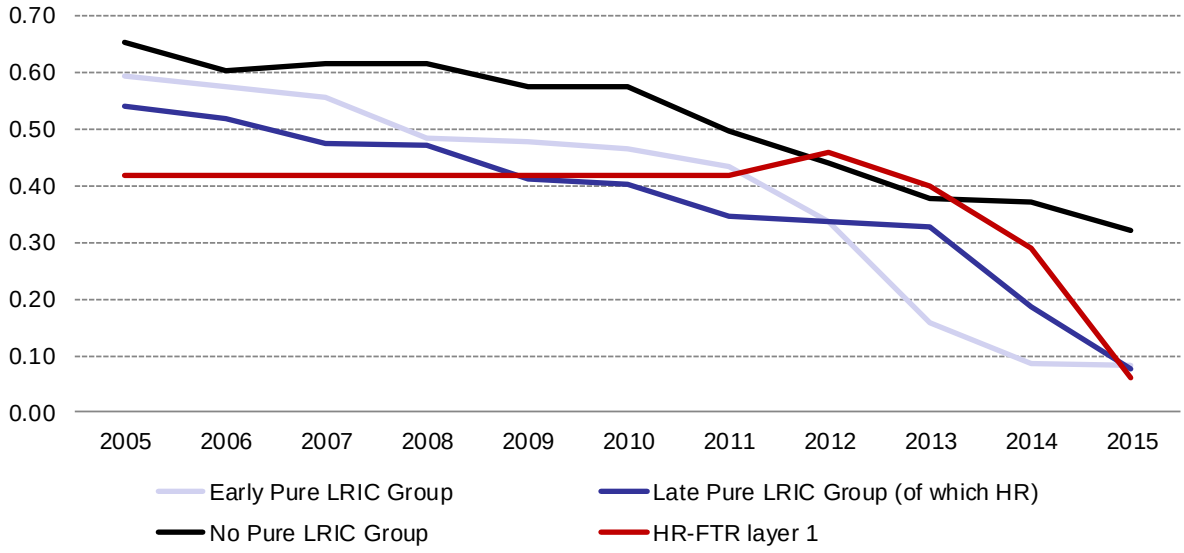
Since Pure LRIC was introduced in Croatia in 2015, HAKOM did not attribute these evolutions to the TRR, but stated that lower MTR in general could be a good driver.

8.4.2 Fixed market

8.4.2.1 *Quantitative analysis*

FTRs in Croatia have followed a similar evolution as MTRs,, but only started decreasing later in 2012 to reach a lower level set on Pure LRIC in 2015, consistent with Late Pure LRIC Group's standards.

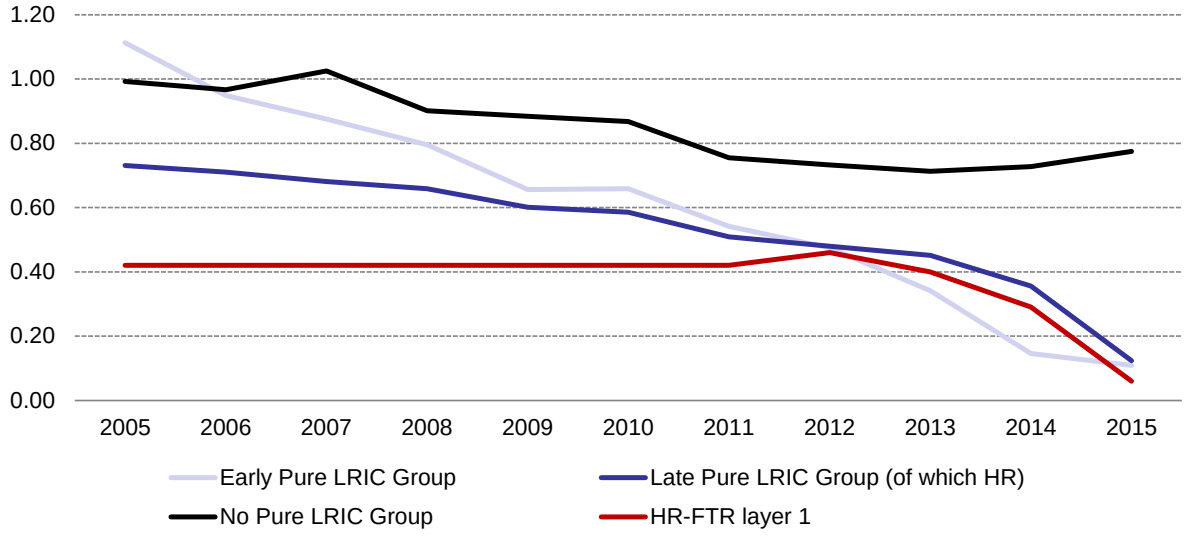
Figure 154 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 155 shows the flat average for the three groups as opposed to the previous figure. It allows observing the relatively low level of the Croatian FTR compared to all other countries in Europe.

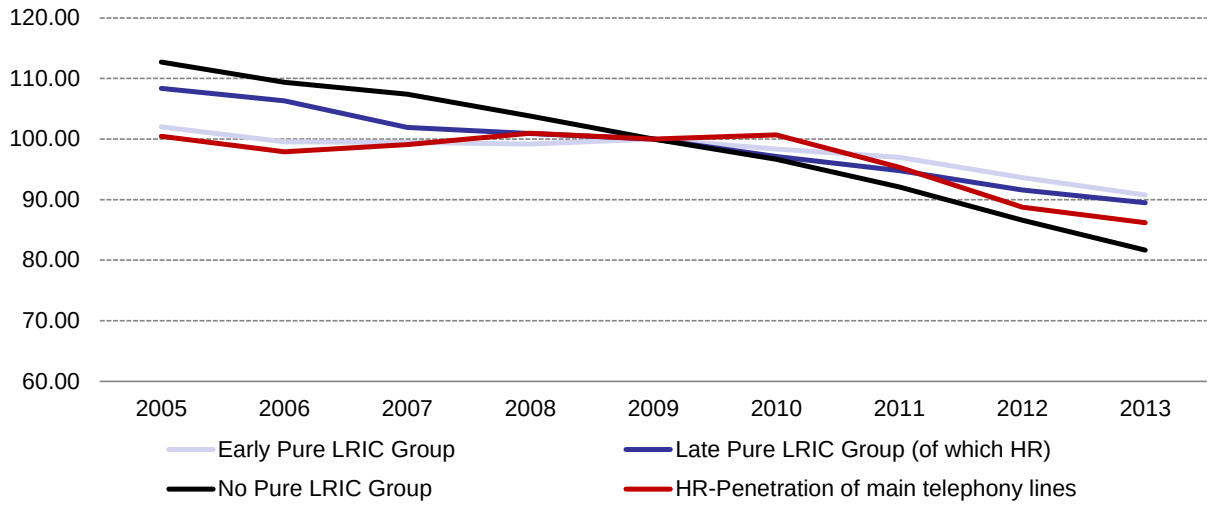
Figure 155 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

The number of main telephony lines in Croatia has shown a constant decrease since 2010, after it has been remaining pretty constant from 2005 to 2010. Its evolution has been pretty similar to the three groups since 2010 as observed with Figure 156.

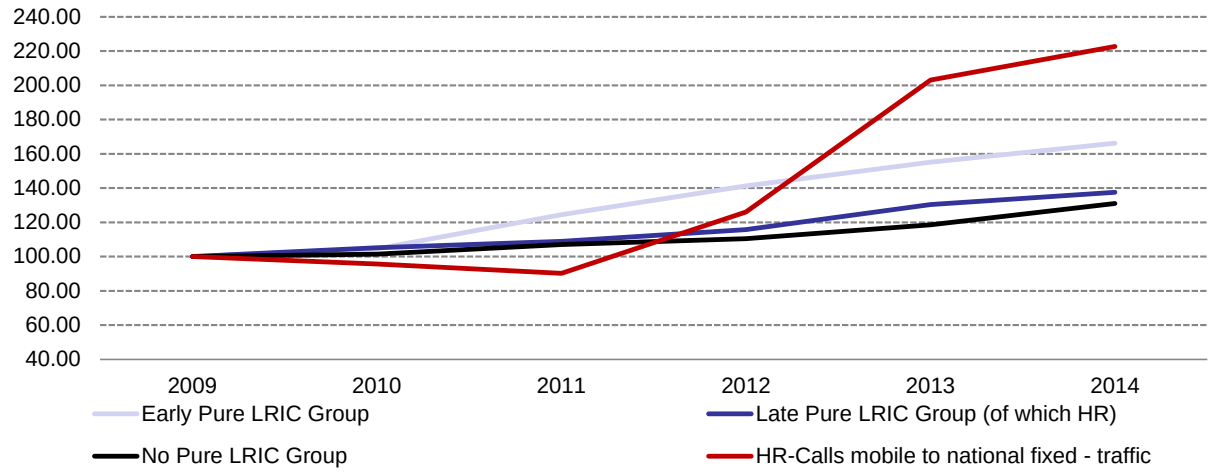
Figure 156 Market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Croatia (which is supposed to be impacted by the level of FTRs), presented in Figure 157, has shown a steady decline between 2009 and 2011 and has been strongly increasing ever since.

Figure 157 Traffic of mobile calls to national fixed (base 100 in 2009)



Source: HAKOM

8.4.2.2 *Evolution of retail fixed offers*

According the HAKOM, retail fixed offers have evolved in Croatia following the European trend, with a decline of on-net/off-net differentiation, and the progressive appearance of flat rate offers.

Since Pure LRIC was introduced in Croatia in 2014, HAKOM did not attribute these evolutions to the TRR, but stated that lower MTR in general could be a good driver.

8.4.3 Summary

The tables below summarize, for each metric, the difference between Croatia and the average metric for the Late pure LRIC Group in order to highlight how Croatia is positioned against its pair countries.

Figure 158 - Differences between Croatia and its group

Metrics	Differences between the Late Pure LRIC Group and Croatia
Mobile revenues	Decreased more than all groups
Mobile investments	Constant decrease since 2009, not following any group's trend
Mobile retail prices	Not available
Mobile penetration	Same trend as Late Pure LRIC Group in terms of unique subscribers
Competition in mobile	Same level and evolution of competition as Late Pure LRIC Group
On-net rate	Higher level than its group

Figure 159 – Differences between the Late Pure LRIC Group and Croatia for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Croatia
Fixed revenue	Not available
Traffic	Much faster increase than all groups
Main telephony lines	Close to the Late Pure LRIC Group

Source: TERA Consultants

8.5 Cyprus

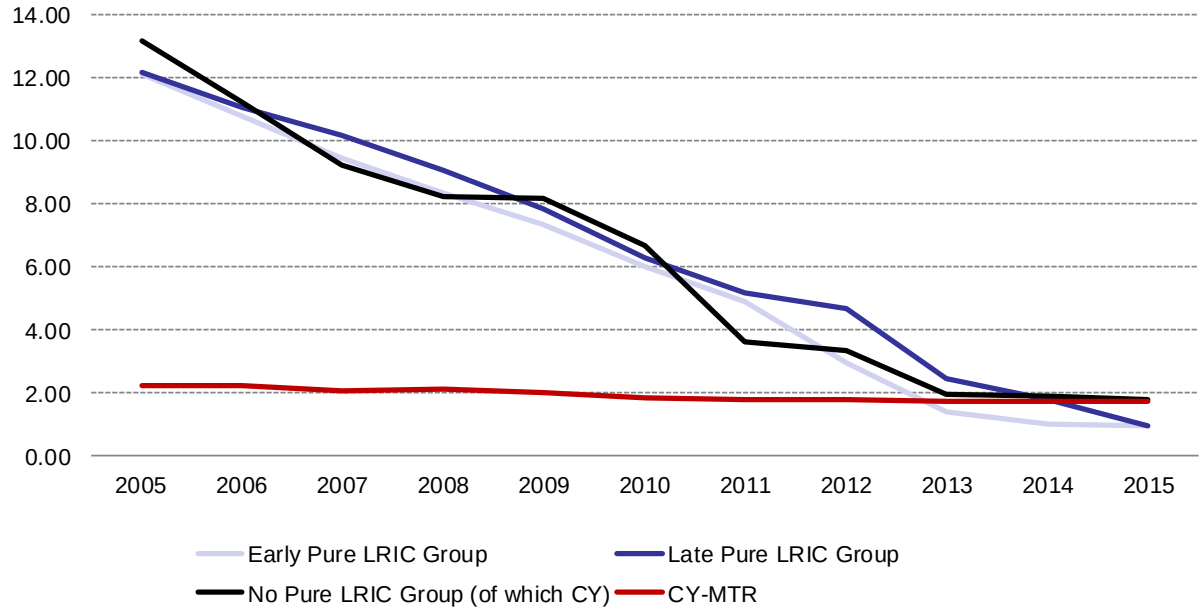
Cyprus' telecom market is dominated by the incumbent CyTA which is fully-owned by the state. The mobile market is a bit more competitive with two operators, Cytamobile (1988) which is CyTA's mobile brand, working with Vodafone as Cytamobile-Vodafone since 2004 and their network partnership agreement, and MTN Cyprus (1994). A new entrant, PrimeTel Mobile appeared in 2011 as an MVNO. Cyprus's regulator OCECPR has not yet applied the pure LRIC approach.

8.5.1 Mobile market

8.5.1.1 *Quantitative analysis*

Mobile termination rates (MTRs) in Cyprus have been extremely lower than all other countries in Europe between 2005 and 2013. MTRs in Cyprus were already at 2EURcts/min in 2005, and actually remained stable ever since, whereas all other countries considerably reduced their MTRs. However, since Cyprus did not implement the Pure LRIC approach, the MTR is now among the highest in Europe, with very close values to the No Pure LRIC Group, as observed in Figure 160.

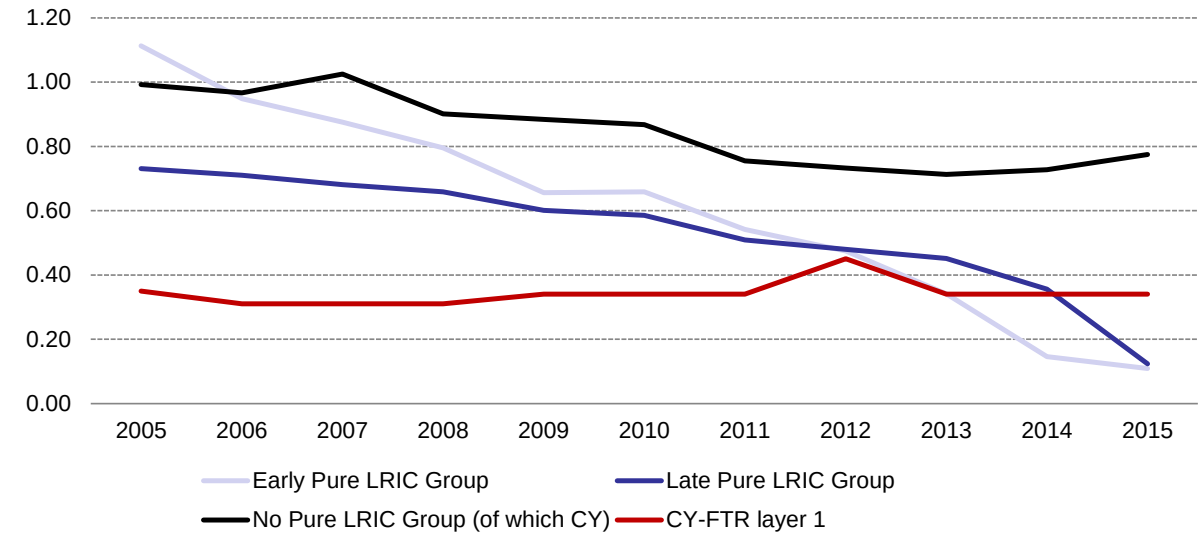
Figure 160 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 161). Since MTRs in Cyprus remained extremely stable, there is not much difference with the weighted average, although in 2015, the flat MTR in Cyprus is slightly below the No Pure LRIC Group's average.

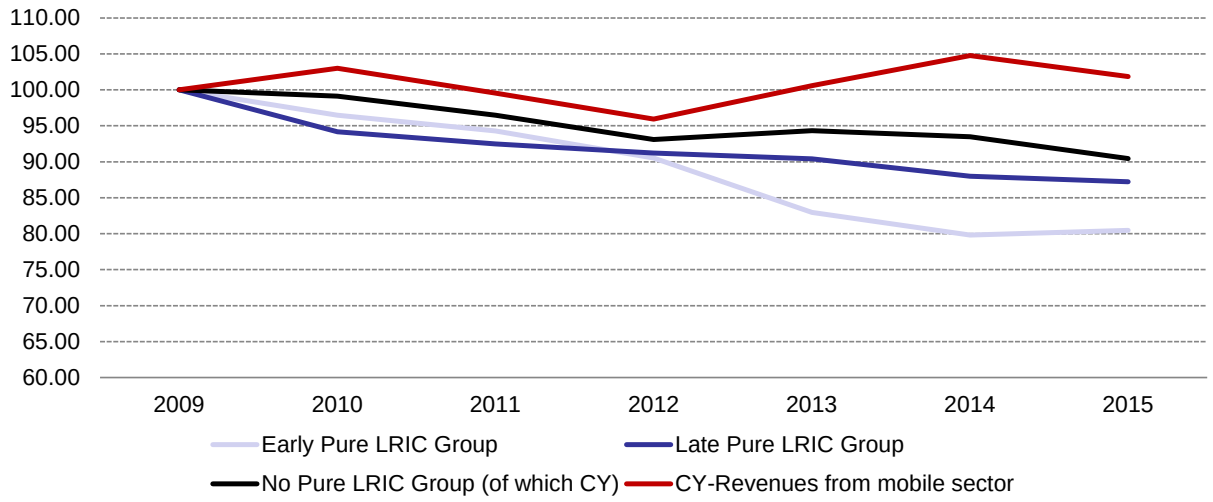
Figure 161 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 162 have been pretty stable since 2009 in Cyprus, whereas average revenues for all groups have been decreasing since 2009. Cyprus' revenues evolutions are closest to the No Pure LRIC Group's changes than the other groups.

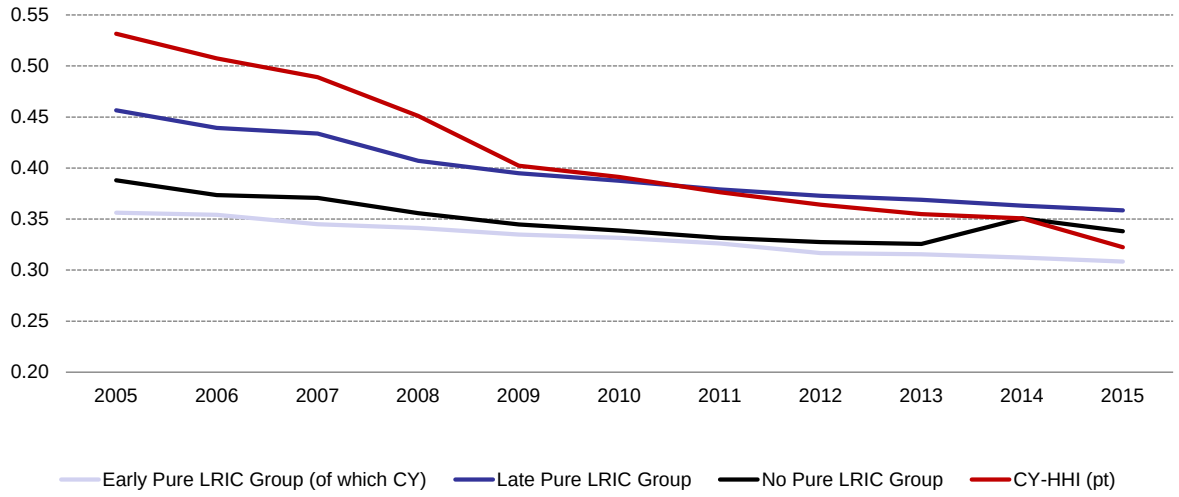
Figure 162 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

In 2015, three major mobile network operators (MNOs) are competing in the mobile market in Cyprus. The improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005. The HHI in Cyprus was rather high in 2005, and is now at a European standard, between the Early and No Pure LRIC Groups' averages.

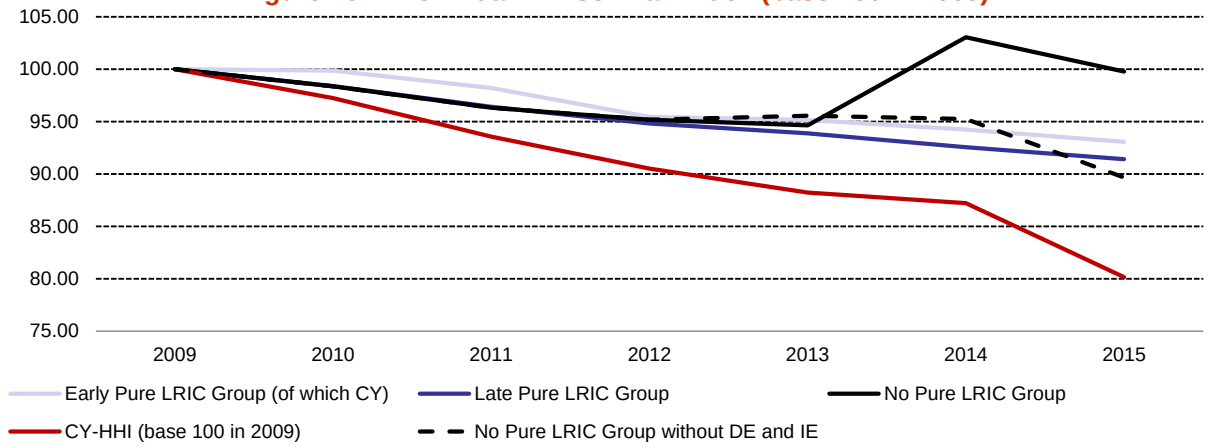
Figure 163 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the higher level of concentration in Cyprus since 2009 can be noticed in Figure 164: the HHI (as base 100 in 2009) has been continuously dropping, more than all other groups. This can be explained by the higher HHI in 2005 in Cyprus than most other MS.

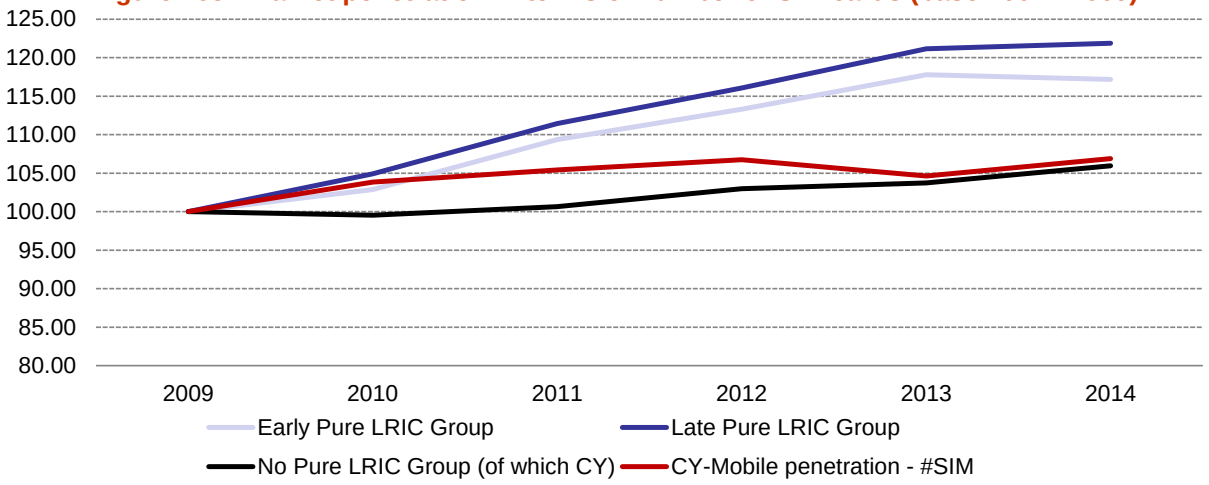
Figure 164 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The market penetration evolutions in terms of number of SIM in Cyprus has been pretty close to the No Pure LRIC Group since 2009, very slightly increasing whereas the two other groups' averages increased way faster, as can be observed in Figure 165:

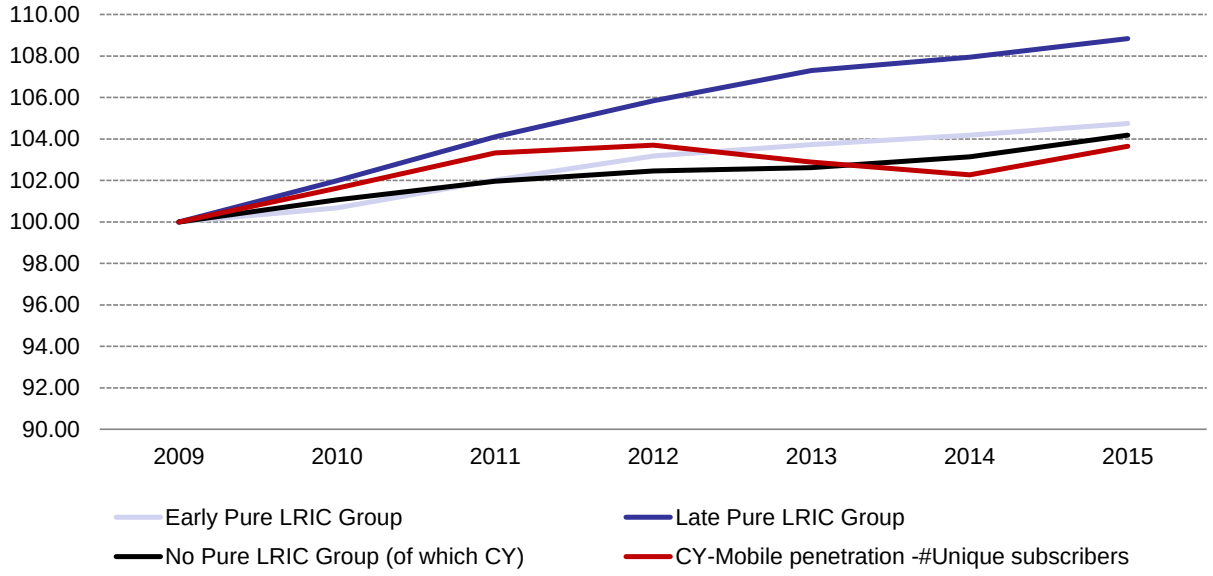
Figure 165 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 166 that the market penetration in terms of unique subscribers in Cyprus has been slightly increasing from 2009 to 2012, then it has remained quite constant between 2012 and 2015. The evolution of the market penetration in terms of unique subscribers have been pretty similar to the No Pure LRIC Group.

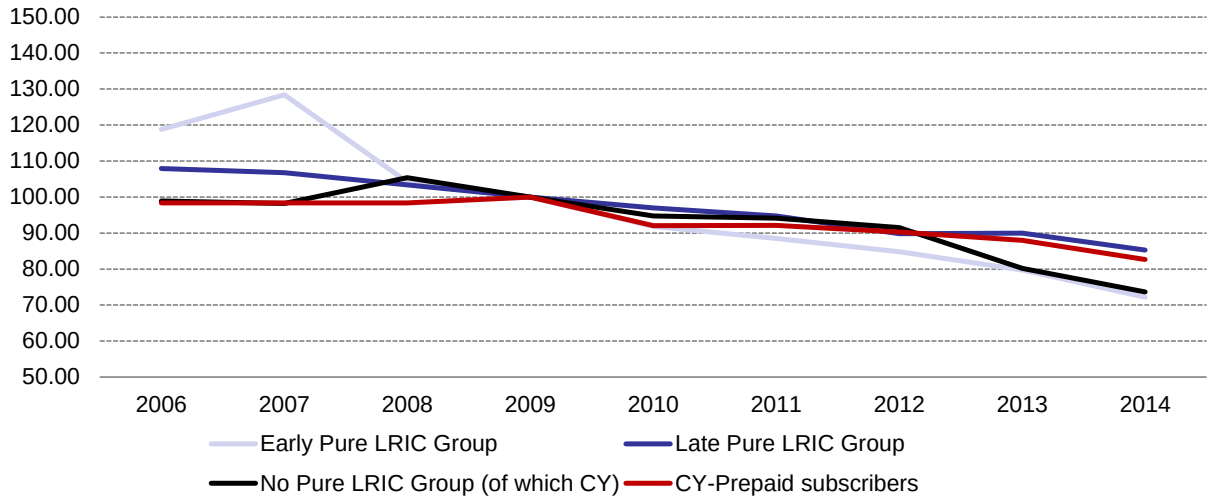
Figure 166 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 167 shows the evolution of the share of prepaid subscribers in Cyprus, compared to the three groups. It has been pretty stable since 2005, just slightly decreasing since 2009. The prepaid share evolution in Cyprus has been really close to the No Pure LRIC Group over this period.

Figure 167 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



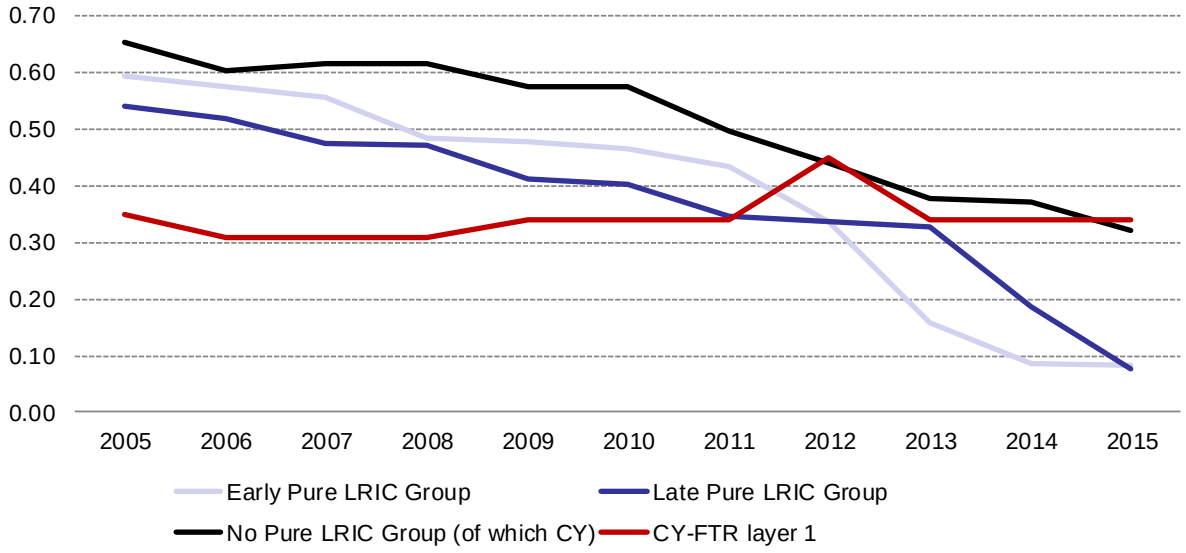
Source: TERA Consultants from GSMA, EC reports & Digital agenda

8.5.2 Fixed market

8.5.2.1 *Quantitative analysis*

FTRs in Cyprus have followed the same trend as MTRs. They were lower than all other countries in 2005, but remained on the same level until 2015, and are now higher than all weighted groups' averages, as observed in Figure 168.

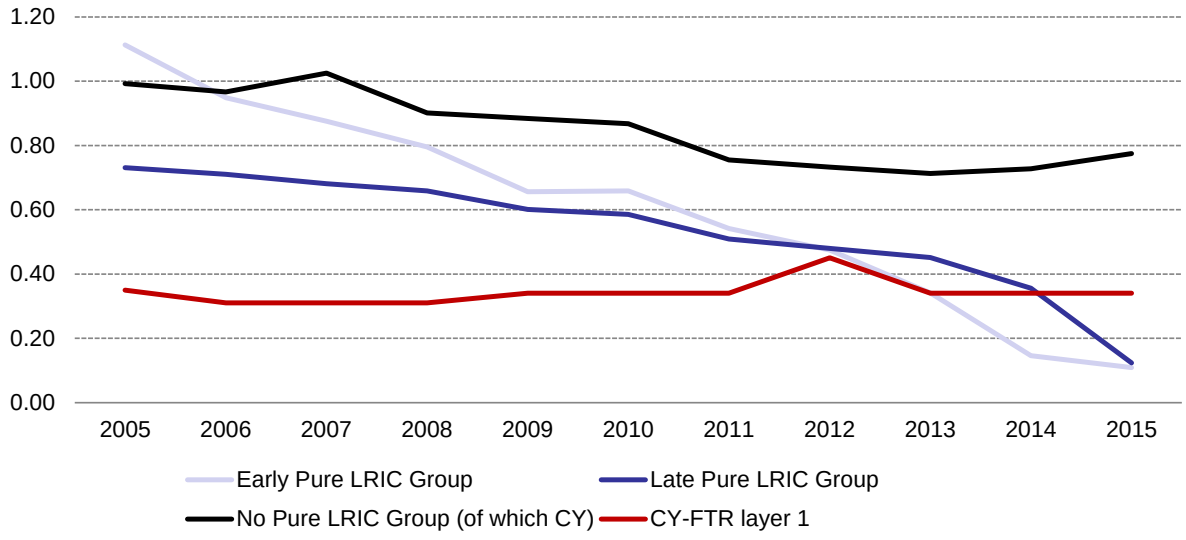
Figure 168 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 169 compares the Cypriot FTR to the flat averages of the three groups. It seems to be way closer to the other groups, than No Pure LRIC Group in this particular case. However, the latter is extremely high due to Finland's FTR which is already three times higher than the second highest in Europe.

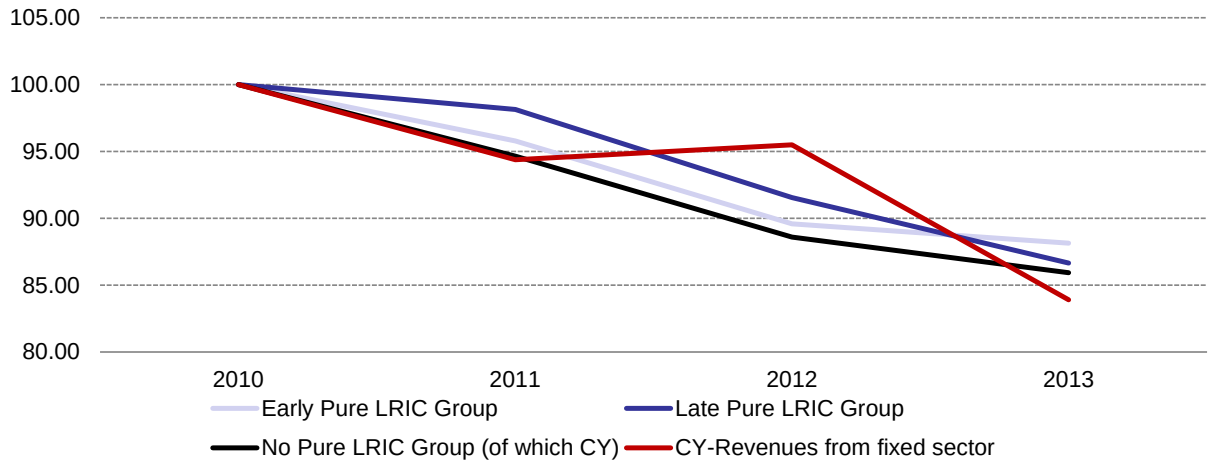
Figure 169 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 170 shows the evolution of revenues in the fixed sector for Cyprus compared to the three groups. Revenues in Cyprus have been roughly following the three groups' trends with an overall decline from 2010 to 2013 (-16%), closer to the No Pure LRIC Group than the two other groups.

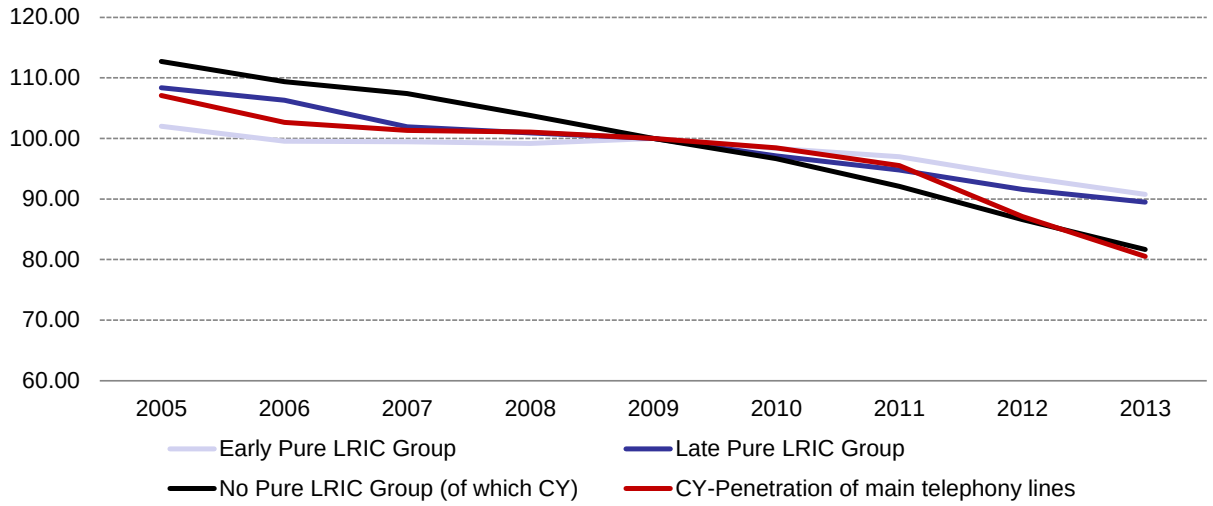
Figure 170 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The evolution of the number of main telephony lines in Cyprus that can be observed in Figure 171 has been pretty similar to the one of the Late Pure LRIC Group until 2011. It then decreased faster until 2013, being more similar to the No Pure LRIC Group

Figure 171 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.5.3 Summary

The tables below summarize, for each metric, the difference between Cyprus and the average metric for the No pure LRIC Group in order to highlight how Cyprus is positioned against its pair countries.

Figure 172 - Differences between Cyprus and its group

Metrics	Differences between the No Pure LRIC Group and Cyprus
Mobile revenues	Bigger increase for Cyprus than No Pure LRIC Group
Mobile investments	Not available
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards and unique

	subscribers than No Pure LRIC Group
Competition in mobile	Decrease of the HHI due to low level of competition in 2005

Figure 173 – Differences between the No Pure LRIC Group and Cyprus for the fixed market

Metrics	Differences between the No Pure LRIC Group and Cyprus
Fixed revenue	Very different evolution than the No Pure LRIC Group
Traffic	Not available
Main telephony lines	Close to The No Pure LRIC Group

Source: TERA Consultants

8.6 Czech Republic

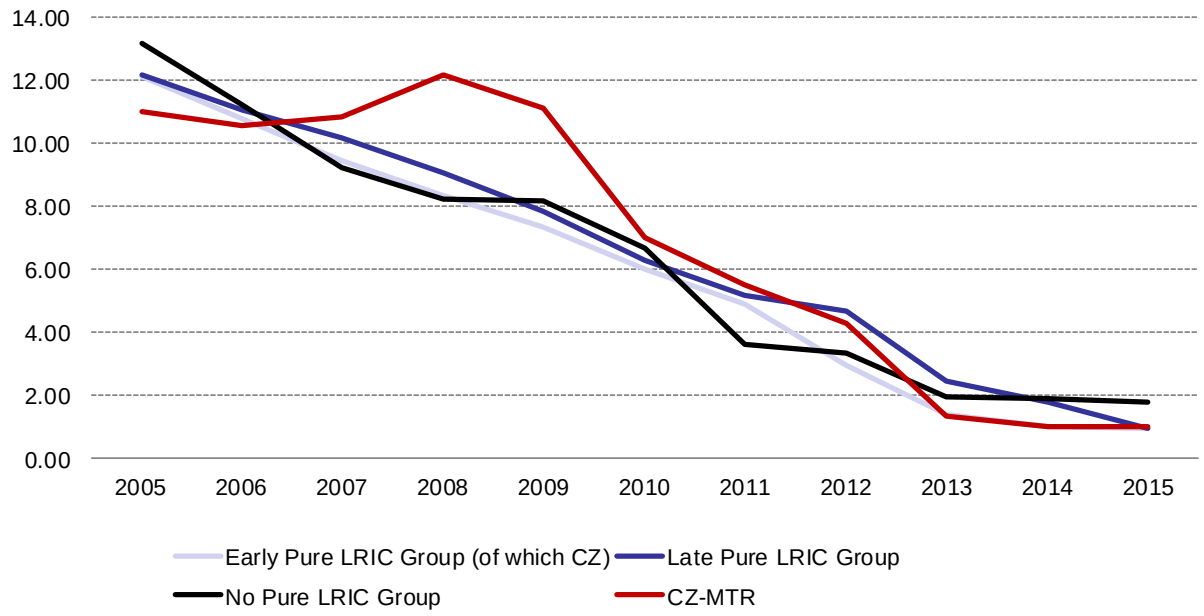
The Czech's telecom market includes a number of alternative operators in fixed market and four mobile operators. Its mobile penetration is one of the lowest in Europe (61% of unique subscribers). Czech's fixed and mobile markets incumbent is O2 Czech Republic formerly Český Telecom and Eurotel (1990). The four MNOs competing in the mobile market are: O2, Vodafone (entered 1999), T-Mobile (entered 1996) and Air telecom (entered 2007). The Czech regulator CTU adopted the pure LRIC approach for MTRs in early 2013 with a six months glide path, until 1 July 2013. The Pure LRIC approach for FTRs has been adopted in the second half of May 2014. The country has then been allocated to the Early Pure LRIC Group for the mobile sector analysis, and in the Late Pure LRIC Group for the fixed sector analysis.

8.6.1 Mobile market

8.6.1.1 *Quantitative analysis*

Figure 174 shows the Czech MTR compared to the three groups' weighted MTR averages. Since the implementation of Pure LRIC by Czech Republic in 2013, the MTR has been very close to its group weighted average, and below the two other groups.

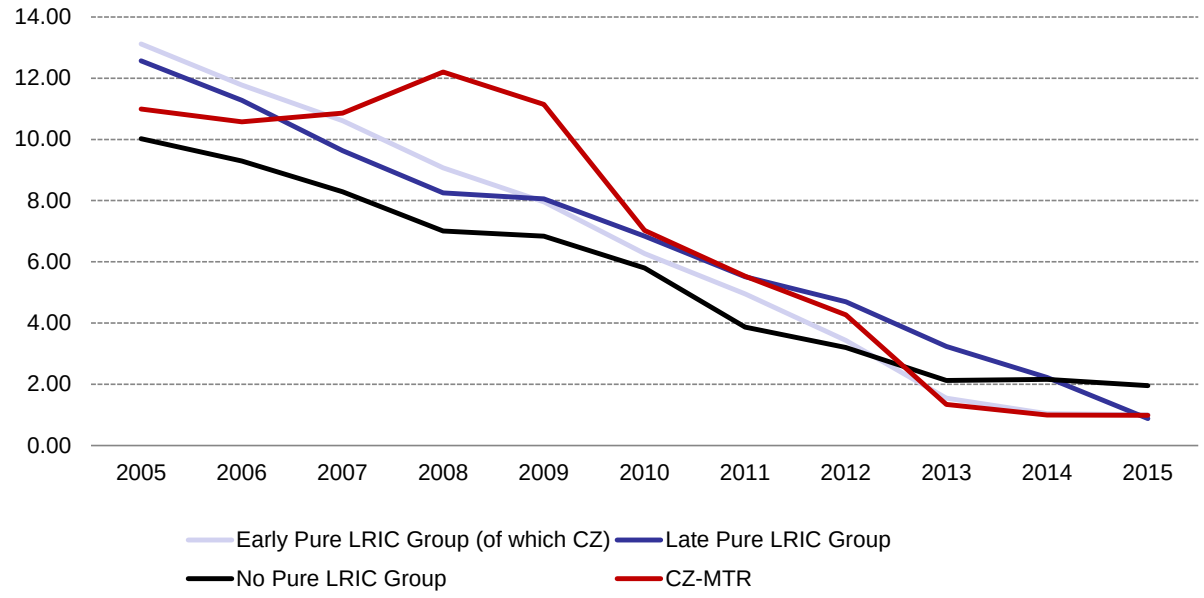
Figure 174 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 175), as opposed to the weighted average above. The trends are here very similar to the previous analysis.

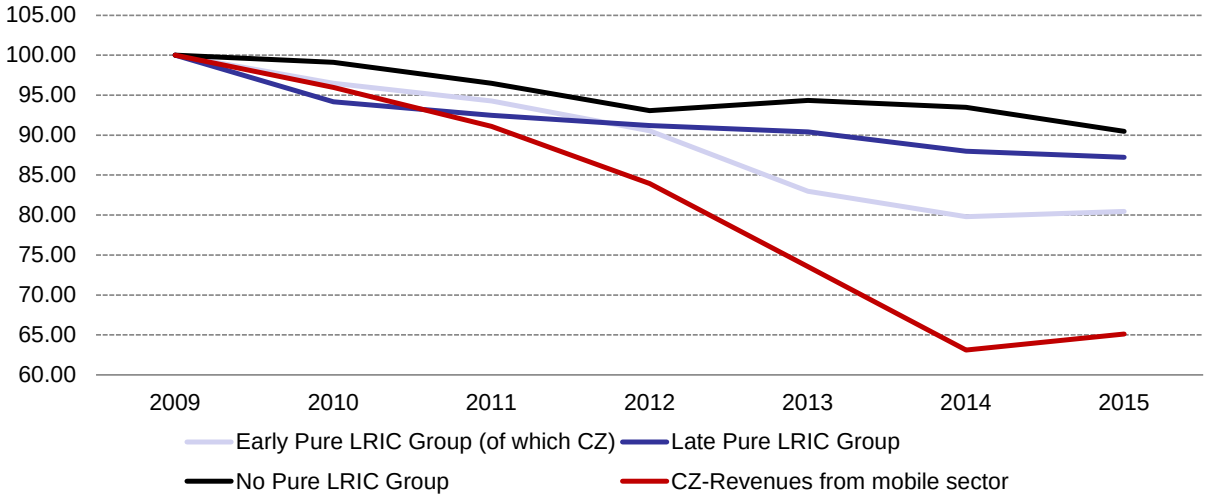
Figure 175 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 176 have been constantly dropping since 2009 in Czech Republic, only slightly increasing in 2015. Revenues in Czech Republic have decreased way faster than all other groups' averages since 2009.

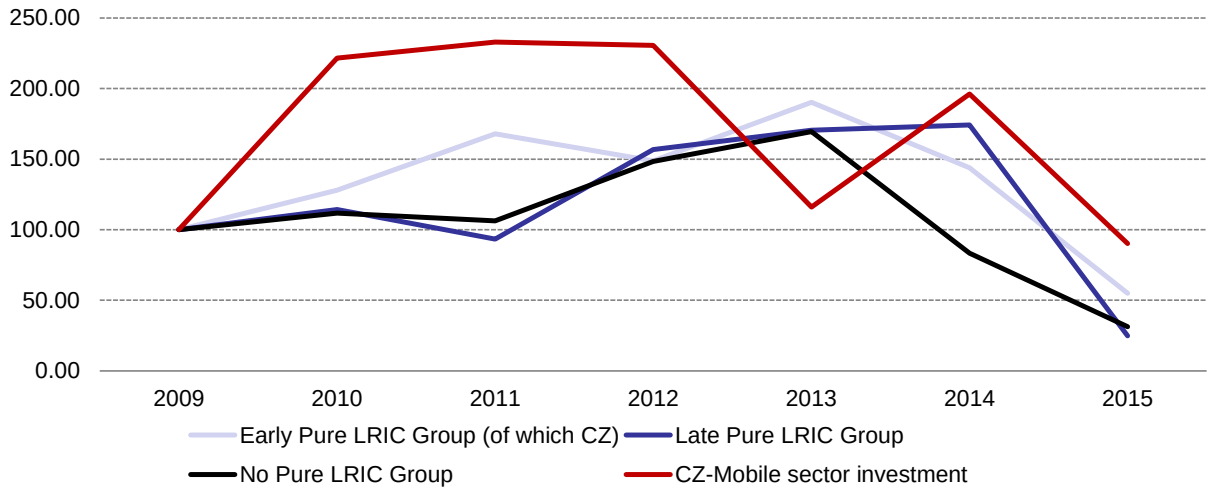
Figure 176 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments (see Figure 177) in the mobile sector have been pretty unstable since 2009 in Czech Republic. They doubled between 2009 and 2010, then remained constant for two years, fell back to their 2009 level, increased in 2014 and then eventually declined in 2015 like the three groups.

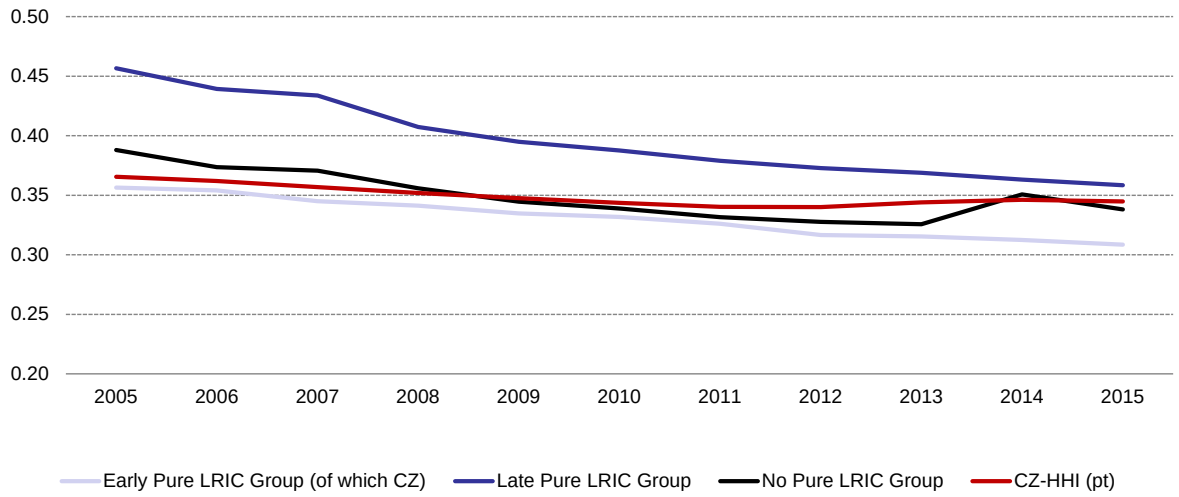
Figure 177 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Since thee four mobile operators are present in the market since 2007, the HHI has been pretty stable, actually closer to the No Pure LRIC Group average than to the other groups.

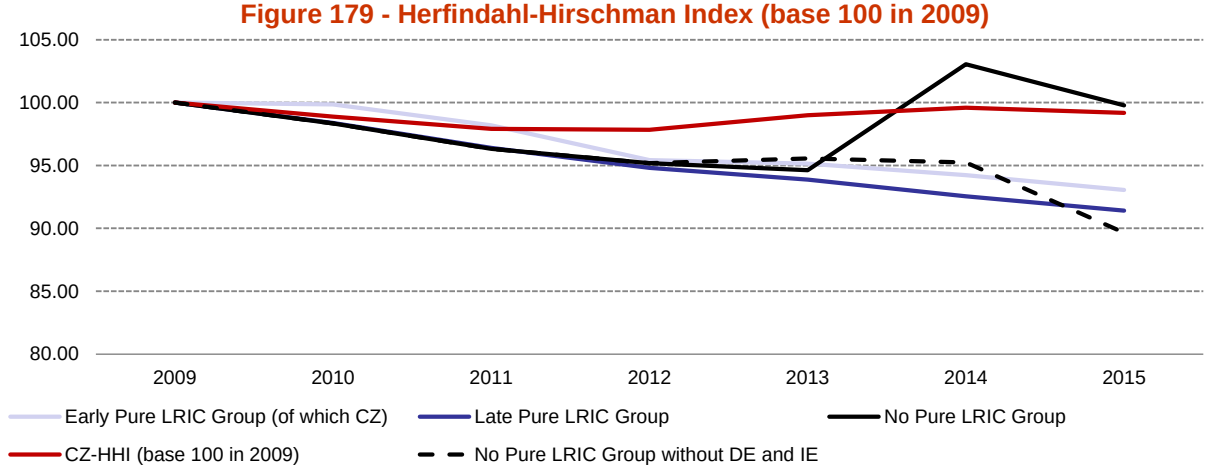
Figure 178 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the stabilization of the level of competition in Czech Republic since 2009 can be noticed in the figure below: the HHI (as base 100 in 2009) remained constant whereas Early and Late Pure LRIC Groups decreased.

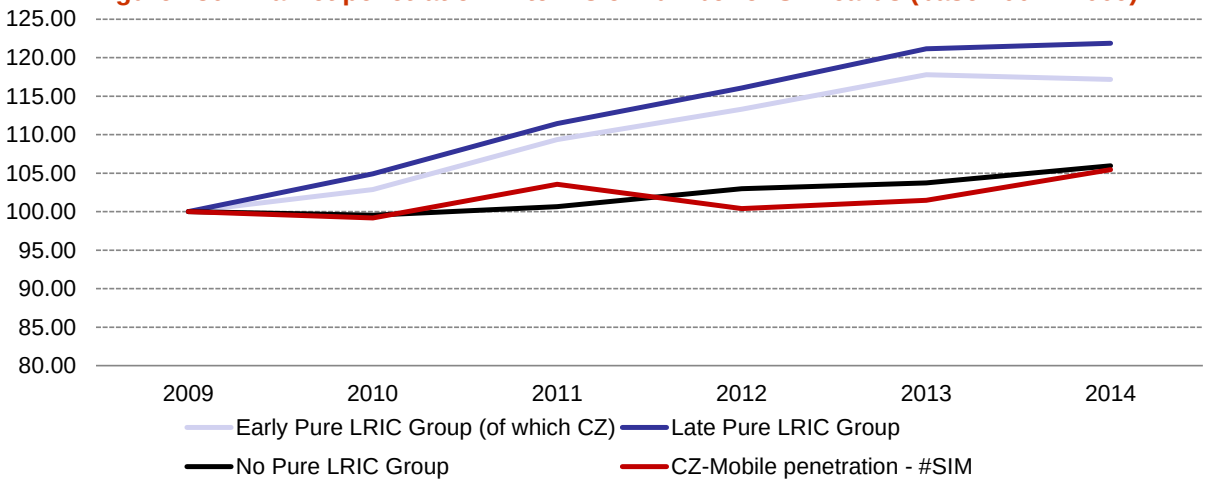
Figure 179 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Czech market penetration in terms of number of SIM has been constant since 2009, following the same trend as the No Pure LRIC Group, as observed in the figure below. In the meantime, the Early and Late Pure LRIC Groups followed roughly the same upward trend.

Figure 180 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 181 shows the evolution of the market penetration in terms of unique subscribers. Such as the number of SIM cards, it has been constant for Czech Republic since 2009, whereas it increased for all groups over this period.

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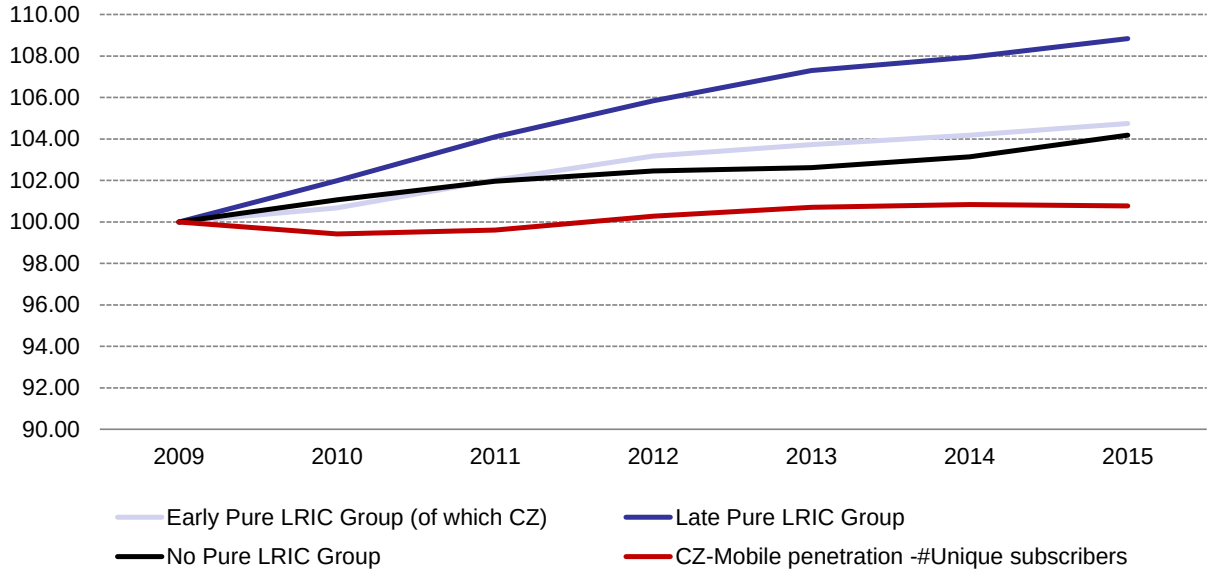
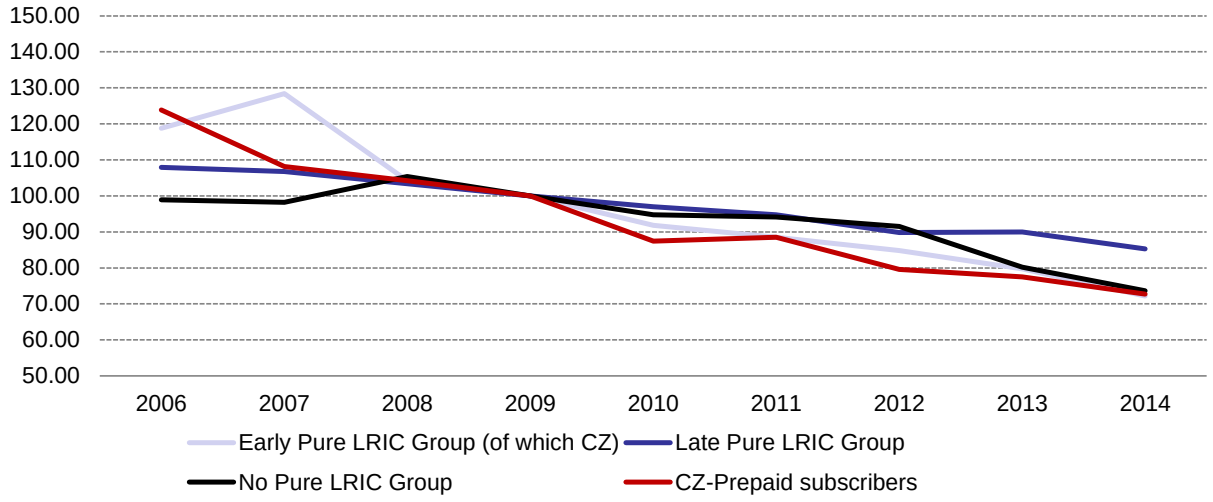
Figure 181 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 182 shows the evolution of the share of prepaid customers for Czech Republic and the three groups. It has been constantly decreasing since 2009, similarly to all groups.

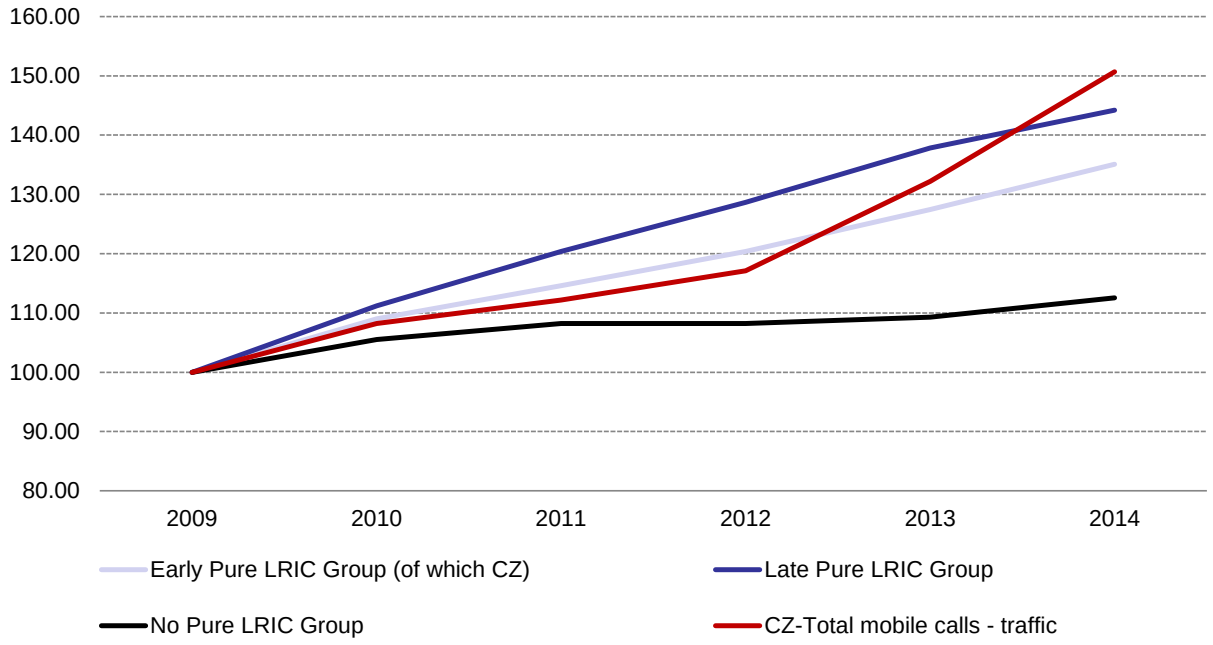
Figure 182 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 183 shows the evolutions of mobile traffic in Czech Republic. It has been continuously increasing since 2009, such as Late Pure LRIC Group, although the latter has increased faster until 2012 when the growth in Czech Republic intensified. In 2014, the mobile traffic in Czech Republic has increased slightly more than its group average.

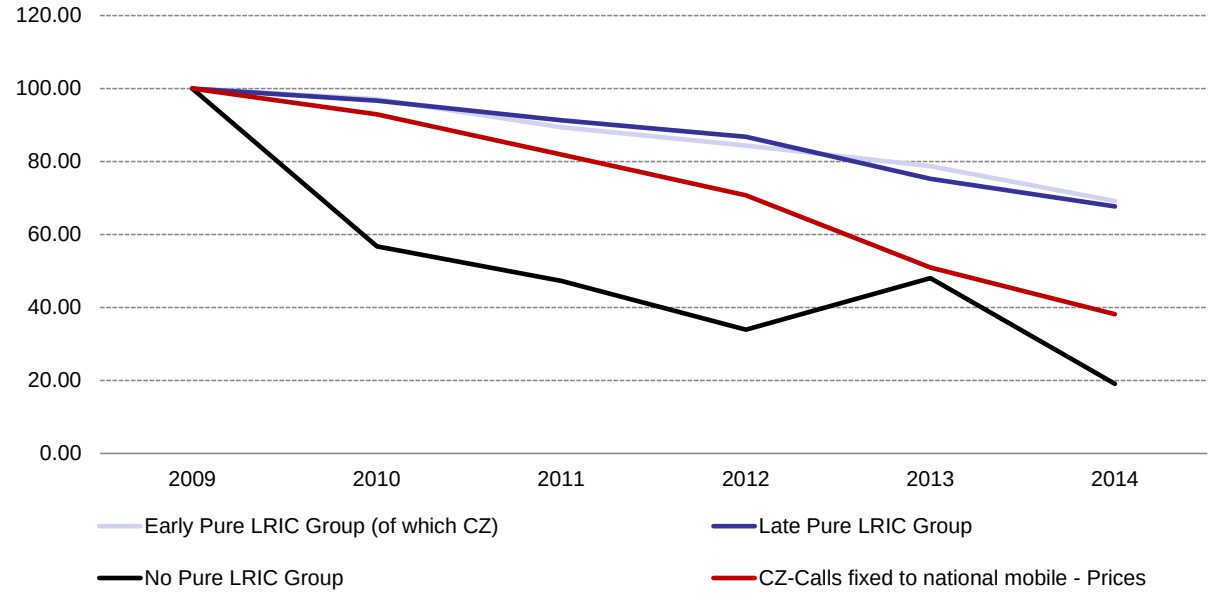
Figure 183 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Prices for fixed calls to national mobile, influenced by the evolution of MTRs, have shown a faster steady decline since 2009 than the Early Pure LRIC Group in Czech Republic, as shown in Figure 184.

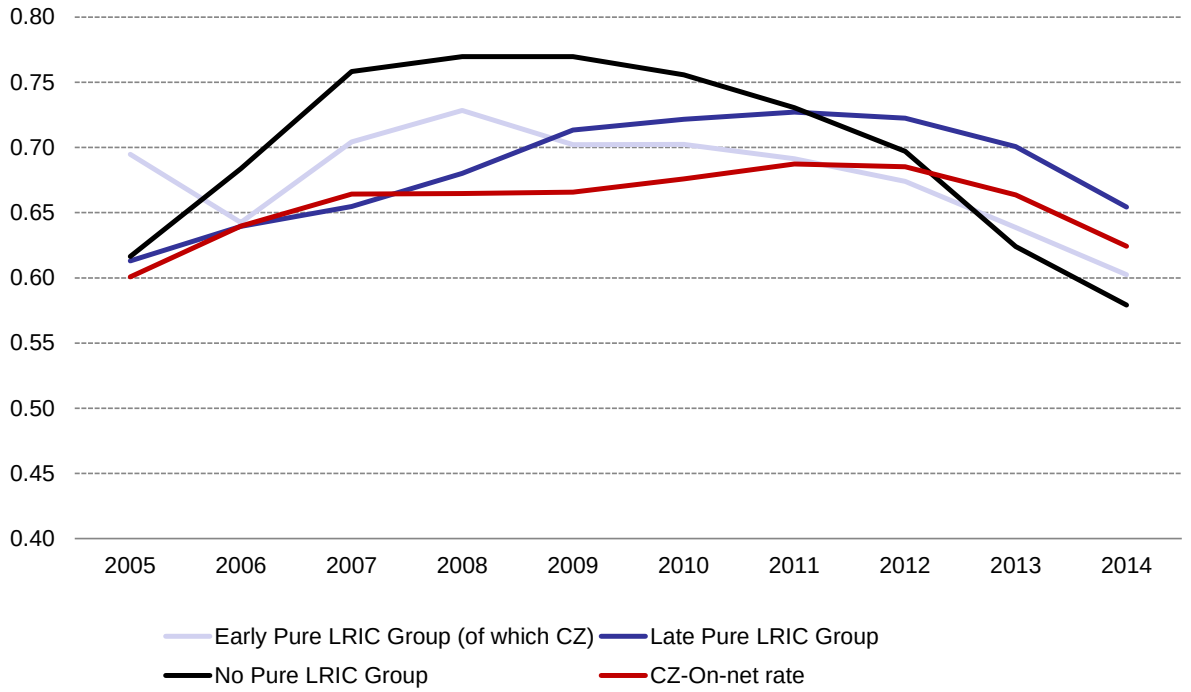
Figure 184 - Prices of fixed calls to national mobile (base 100 in 2009)



Source: CRC

Figure 185 shows the share of on-net mobile calls, which have been quite constant around 65% since 2006 in Czech Republic, although it started decreasing in 2012. The trend of on-net rate of mobile calls since 2012 has been comparable to both Early and Late Pure LRIC Group averages.

Figure 185 - On-net rate of mobile calls (%)



Source: CRC

8.6.1.2 *Evolution of retail mobile offers*

According the CTU, new retail mobile offers appeared in the spring of 2013 following a new offer from O2 which introduced flat tariffs, with still an on-net/off-net differentiation though. This was followed by the introduction of comparable offers by two other operators.

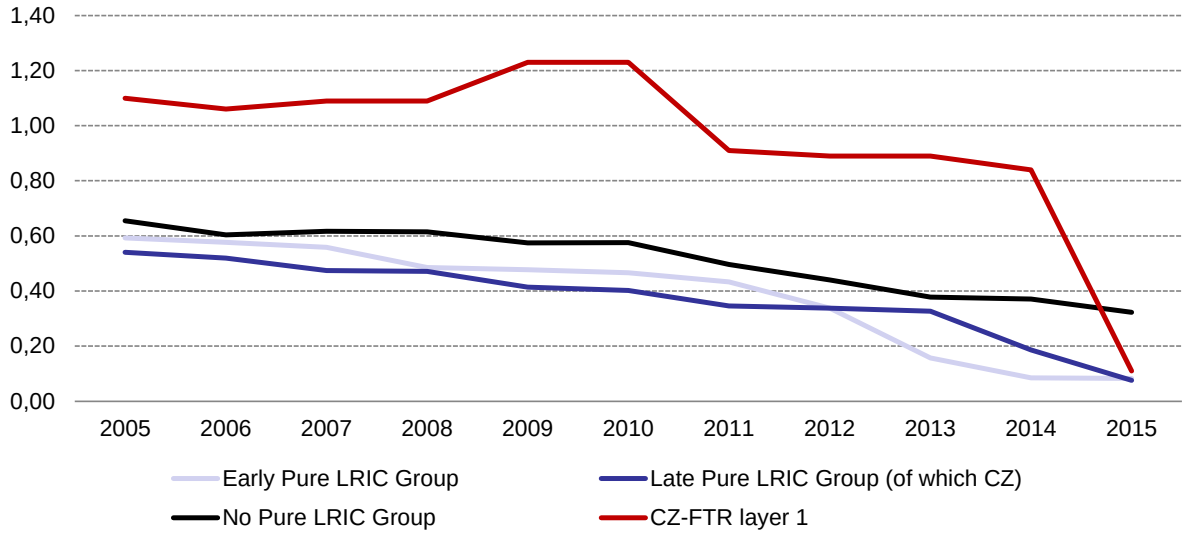
CTU however does not impute those changes to the reduction of MTR, but to the competition in Czech market, and the threat of possible regulation that may have urged operators to engage into tougher competition.

8.6.2 Fixed market

8.6.2.1 *Quantitative analysis*

The figure below compares the level of FTRs in Czech Republic to the weighted FTRs average of the three groups. It can be observed that the Czech FTR has been higher than all groups' averages until 2014, and then was set on the basis of the Pure LRIC approach and reached the level of the Early and Late Pure LRIC Groups.

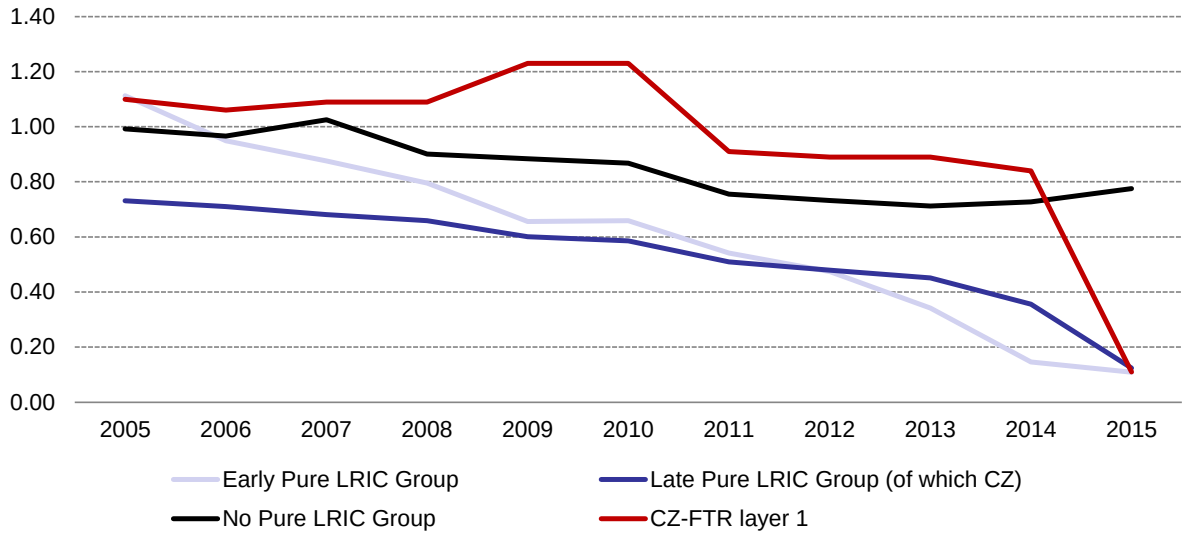
Figure 186 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

The figure below shows the flat average for the three groups as opposed to the previous figure. The main difference concerns the flat level of the three groups which is higher than weighted averages.

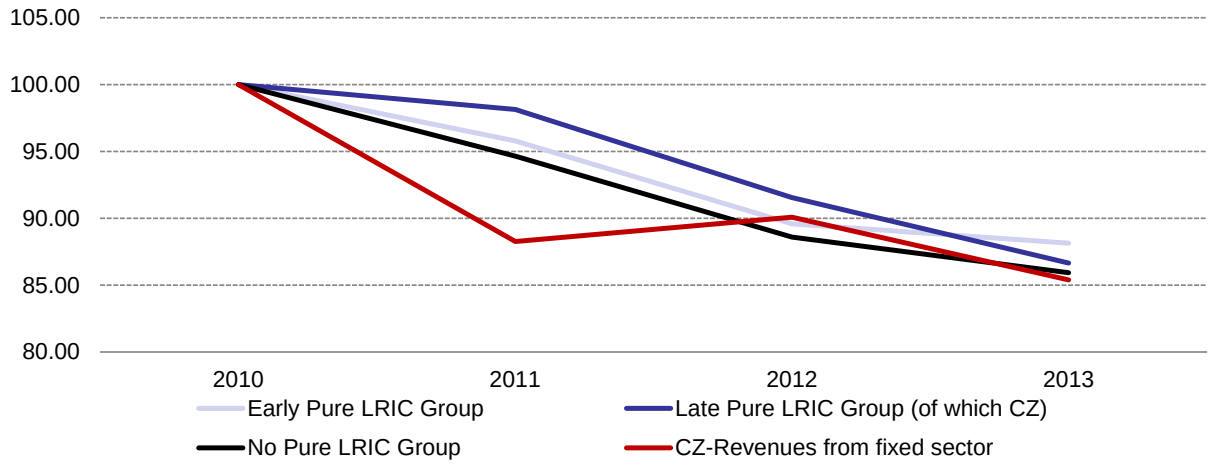
Figure 187 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 188 shows the fall of revenues from the fixed-line market since 2010 for both Czech Republic and countries of the Early Pure LRIC Group. In 2011, revenues in Czech Republic have decreased much more than its group average. In 2012 and 2013, the evolution of revenues in Czech Republic is much closer to the Late Pure LRIC Group.

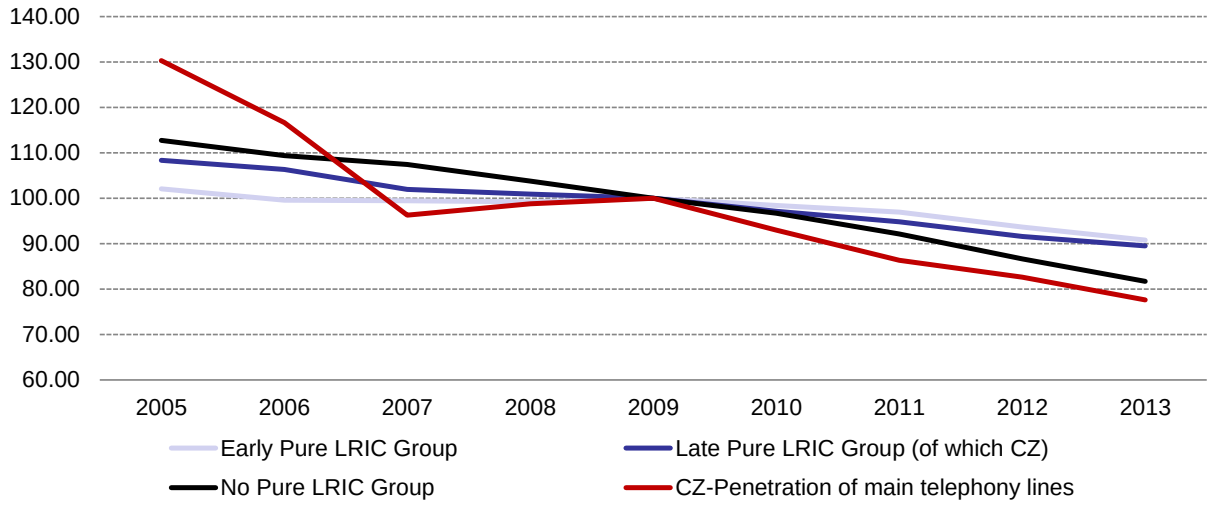
Figure 188 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Czech Republic has shown a constant and slow decrease since 2009, with a similar penetration to No Pure LRIC Group, also steadily decreasing as shown in the figure below. The Late Pure LRIC Group's penetration has been decreasing slower than Czech Republic since 2009.

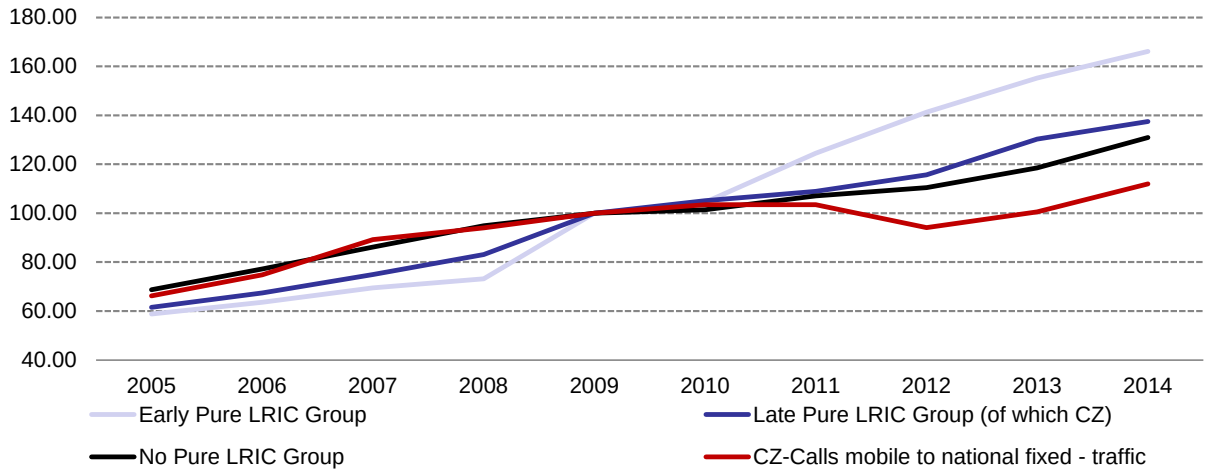
Figure 189 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile national calls to fixed in Czech Republic (which is supposed to be impacted by the level of FTRs), presented in the figure below, has been pretty stable or slightly declining between 2009 and 2012 and has been increasing since 2012. It followed roughly a comparable trend to the Early Pure LRIC Group, increasing a bit slower than its group.

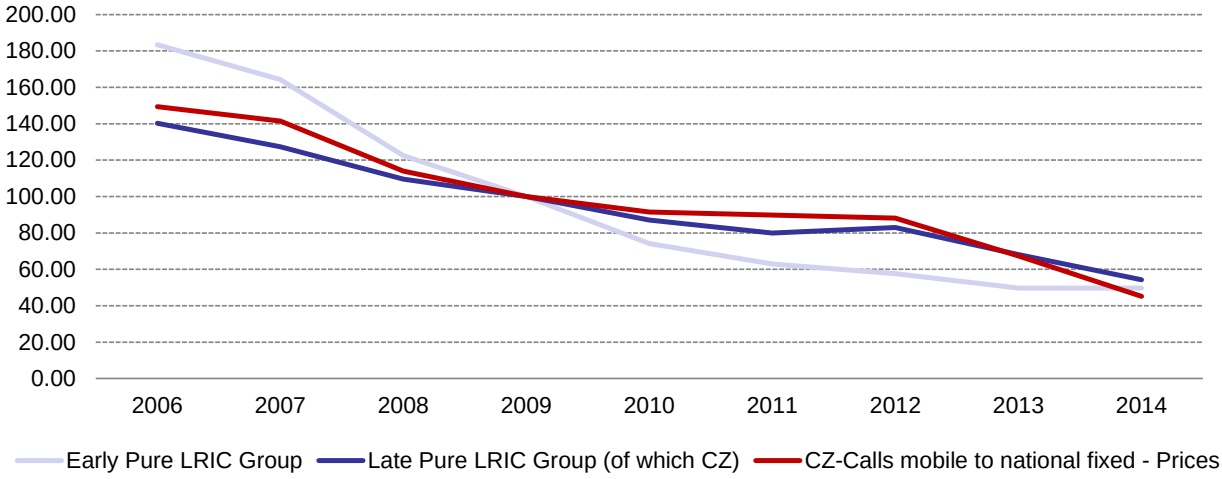
Figure 190 Traffic of mobile calls to national fixed (base 100 in 2009)[150]



Source: CTU

Figure 191 shows the evolution of retail prices for mobile calls to national fixed in Czech Republic. It can be observed that these prices have been following a very comparable trend to the Late Pure LRIC Group from 2006 to 2014 with a constant decrease until 2014.

Figure 191 Prices of mobile calls to national fixed (base 100 in 2009)



Source: CTU

8.6.2.2 *Evolution of retail fixed offers*

According to the CTU, no particular evolution in the fixed retail market was observed, especially after that FTR was set on Pure LRIC.

8.6.3 Summary

The table below summarizes, for each metric, the difference between Czech Republic and the average metric for the Early pure LRIC Group for mobile and the Late pure LRIC Group for fixed in order to highlight how Czech Republic is positioned against its pair countries.

[150] From number of minutes

Figure 192 - Differences between Czech Republic and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Czech Republic
Mobile revenues	Decreased way more than all other groups
Mobile investments	No particular trend followed
Mobile retail prices	Close to Early Pure LRIC Group trend
Mobile penetration	Closer to No Pure LRIC group in terms of SIM cards, lower increase than all groups in terms of unique subscribers
Competition in mobile	Closer to No Pure LRIC Group
On-net rate	Higher in absolute value and did not follow Early Pure LRIC Group trend
On-net rate	Closer in trend to the Late Pure LRIC Group

Figure 193 – Differences between the Late Pure LRIC Group and Czech Republic for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Czech Republic
Fixed revenue	Very different evolution than the Late Pure LRIC Group
Traffic	Much slower increase than the Late Pure LRIC Group
Main telephony lines	Faster decrease than the Late Pure LRIC Group

Source: TERA Consultants

8.7 Denmark

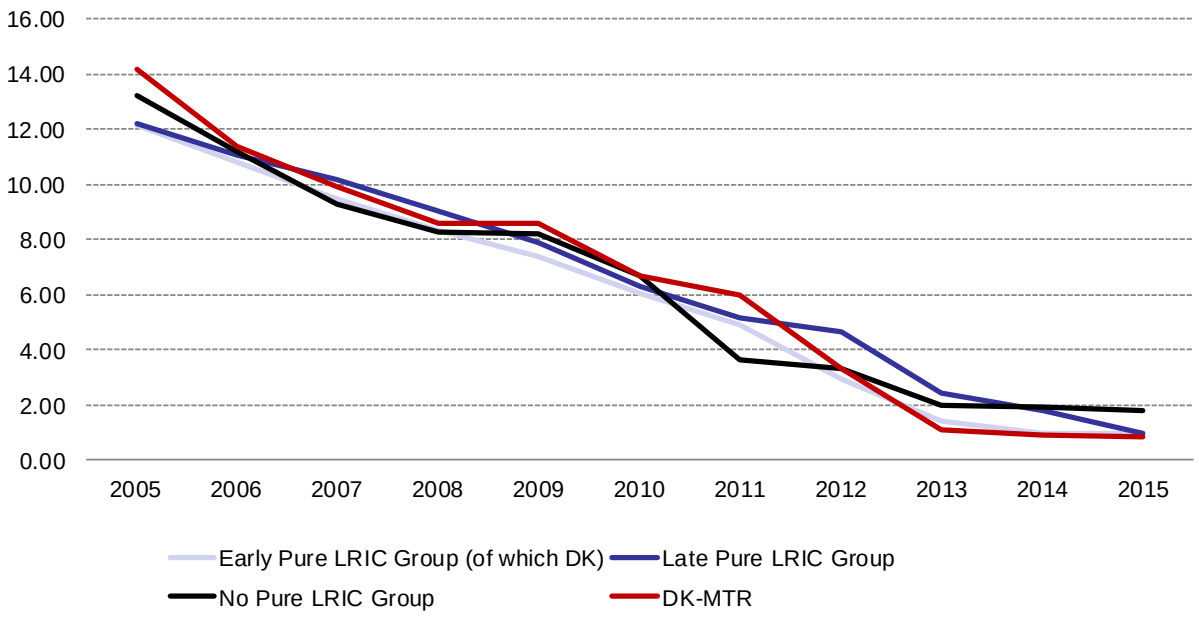
Mobile penetration in Denmark is among the highest in Europe, with four operators showing steady growth. TDC (launched 1990) is Denmark's incumbent and leader in both mobile and fixed sectors. It is challenged by Telenor Denmark (launched 1998), Telia (launched 1995) and 3 Denmark (launched 2003) in the mobile market. The Danish regulatory authority DBA has been following the pure LRIC recommendation for both MTRs and FTRs since 1 January 2013.

8.7.1 Mobile market

8.7.1.1 *Quantitative analysis*

MTRs in Denmark have been constantly declining since 2005 in a very comparable way to the Early Pure LRIC Group's weighted average MTR, as seen in the figure below. Although it was higher in 2005 than all groups, it is in 2015 at the same level as the Early Pure LRIC Group.

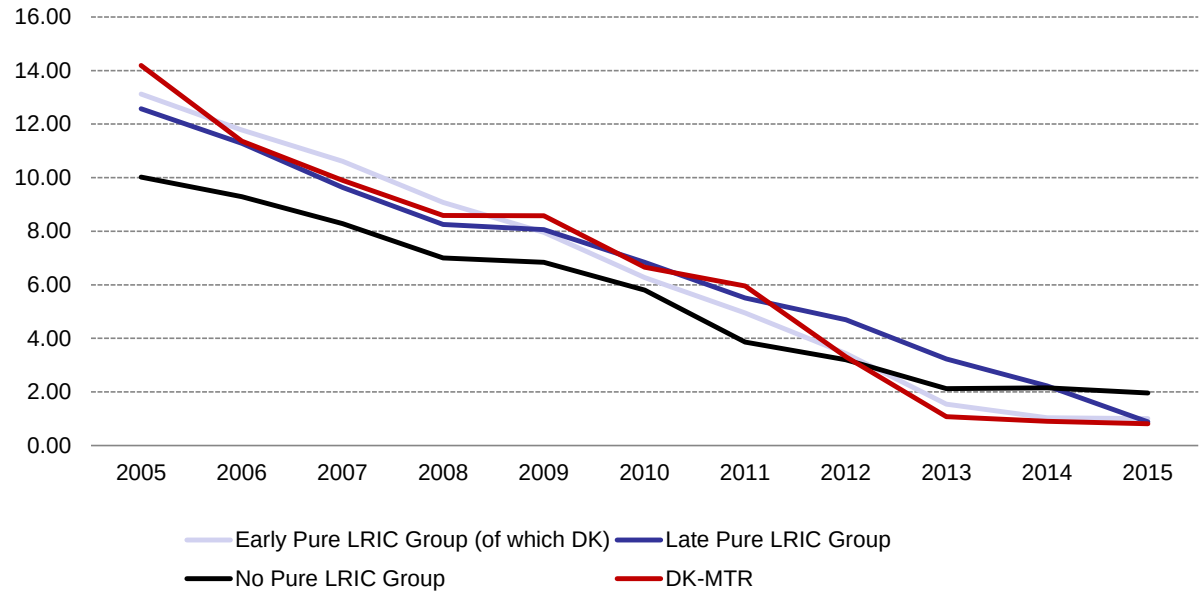
Figure 194 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA from BEREC & EC reports

A flat average MTR has also been calculated for each group (see figure below). The Danish MTR is in 2015 at the same level as the Early Pure LRIC Group flat average.

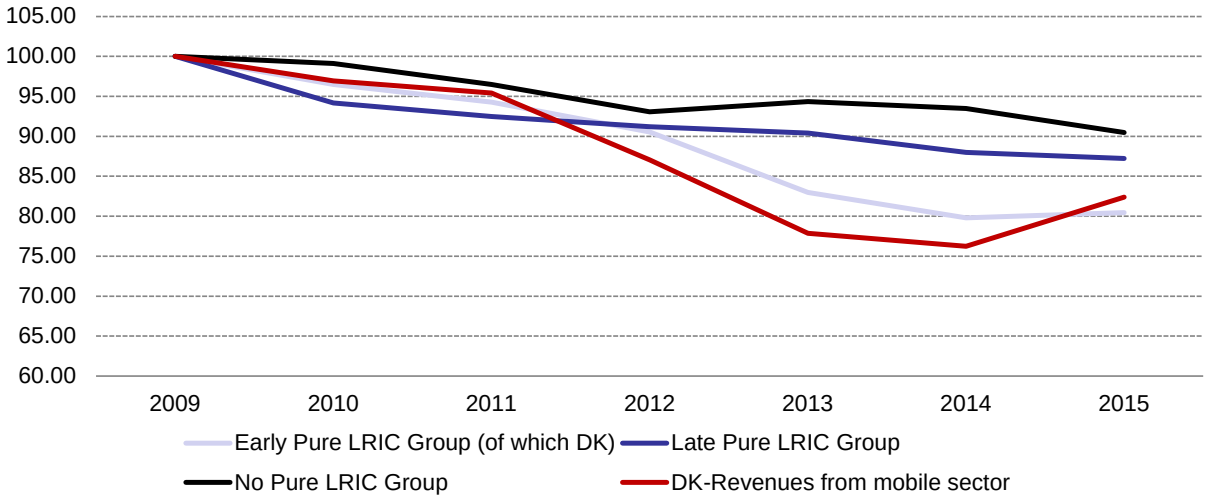
Figure 195 - Mobile termination rates / flat average (EURcts/min)



Source: TERA from BEREC & EC reports

Revenues from the Danish mobile sector presented in the figure below decreased between 2009 and 2014, and increased in 2015. The trend for Denmark is comparable to the Early Pure LRIC Group, with a slight difference in 2015 when Danish revenues are increasing whereas Early Pure LRIC Group's revenues remained constant.

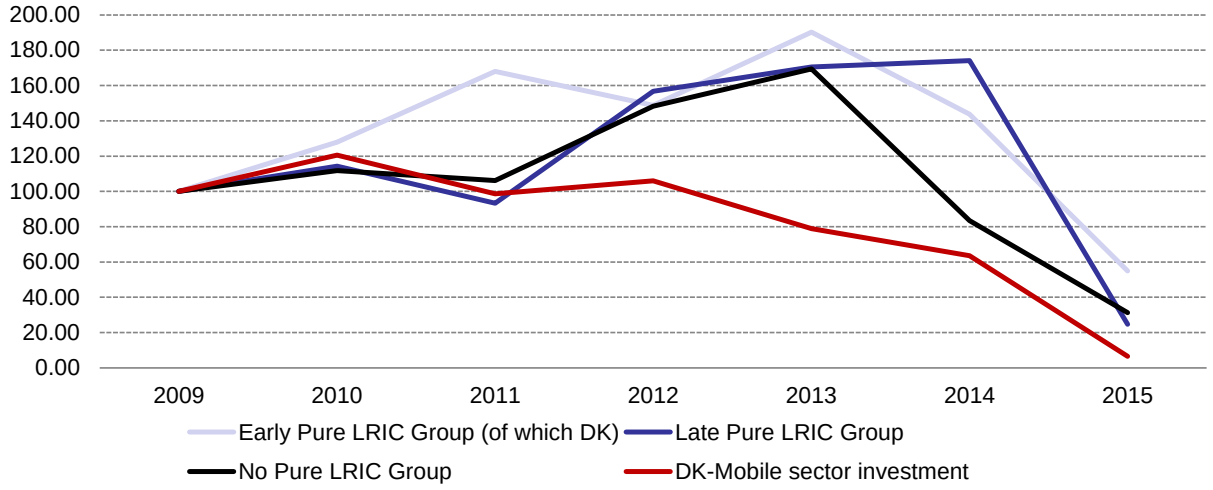
Figure 196 - Mobile revenues (base 100 in 2009)



Source TERA from: GSMA

Investments in the mobile sector in Denmark presented in Figure 197 remained relatively steady between 2009 and 2012 and started decreasing in 2013. Investments in Denmark then started decreasing before any other group. In 2015, annual mobile investments in Denmark have been divided by ten compared to 2009 level.

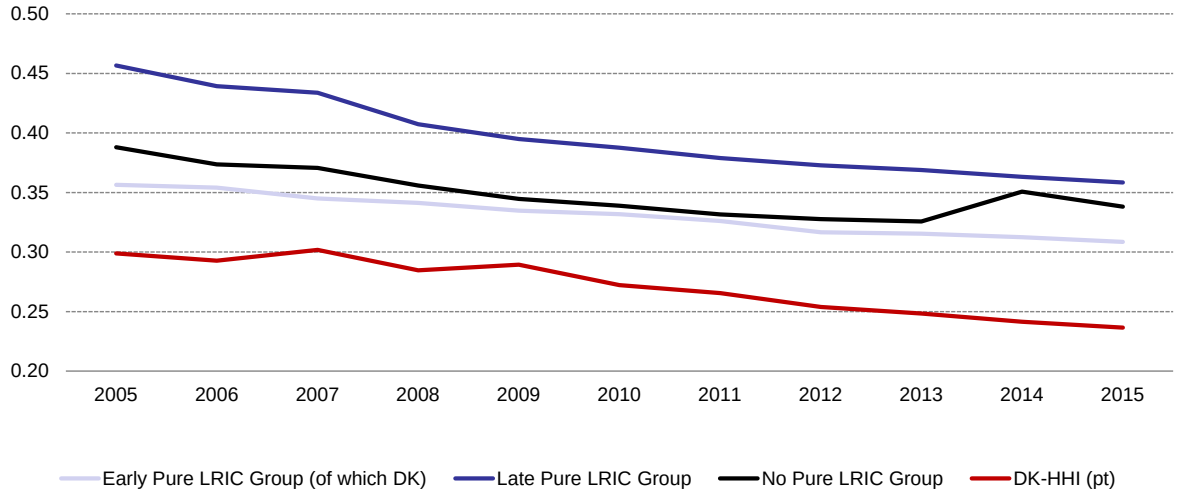
Figure 197 - Mobile investment (base 100 in 2009)



Source: TERA from GSMA, EC reports & Digital agenda

Four mobile network operators (MNOs) are competing in the Danish mobile market, all four offering nationwide coverage. The growing level of competition in Denmark over the past few years can be observed with the decrease of the HHI. The Danish HHI has been remaining constantly below all groups and is in 2015 the country with the highest level competition (as measured by the HHI) with a HHI of 0.24 (the same as Poland which is also in the Early Pure Group).

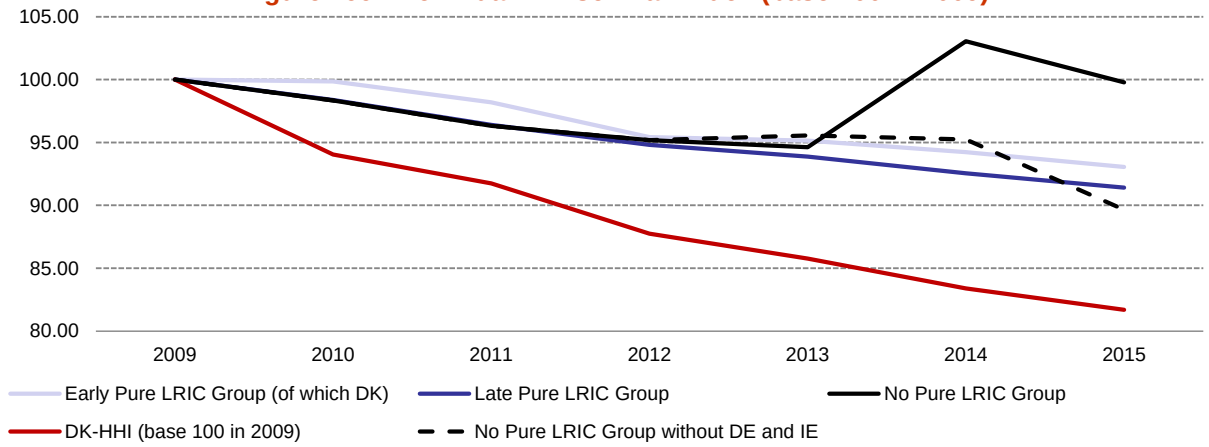
Figure 198 - Herfindahl-Hirschman Index (%)



Source: TERA from Eurostat & Digital agenda

More specifically, the increase in the level of competition in the Danish mobile market since 2009 can be observed in Figure 199: the HHI (as base 100 in 2009) has been continuously dropping and has been dropping faster than the HHI of the Early Pure LRIC Group and other groups of countries.

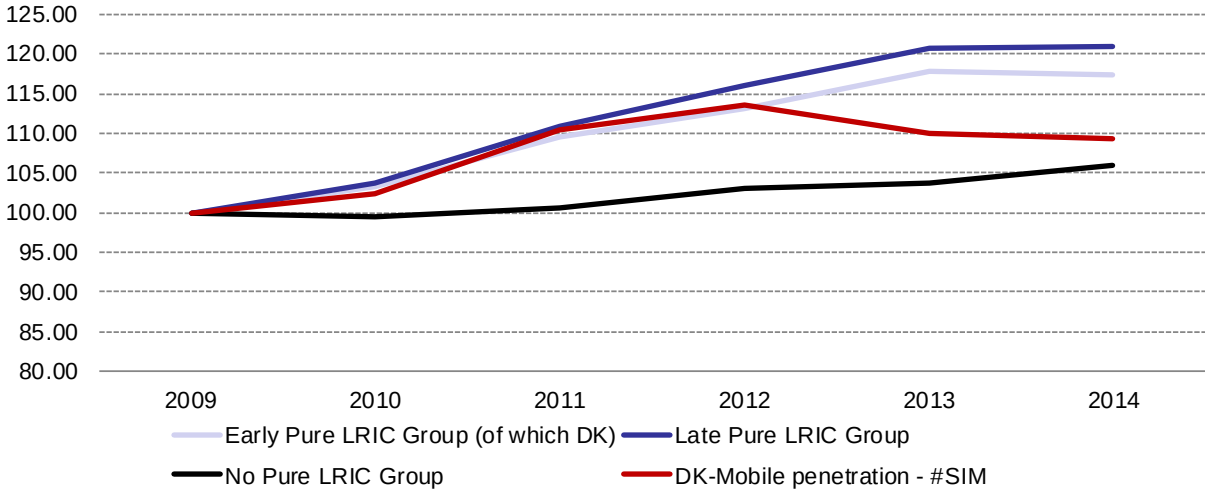
Figure 199 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA from Eurostat & Digital agenda

The Danish market penetration in terms of number of SIM has been increasing from 2009 to 2012 in a similar way as the Early Pure LRIC Group. Since 2012 however, penetration in Denmark has been declining, whereas it kept on increasing for all groups, as shown in Figure 200:

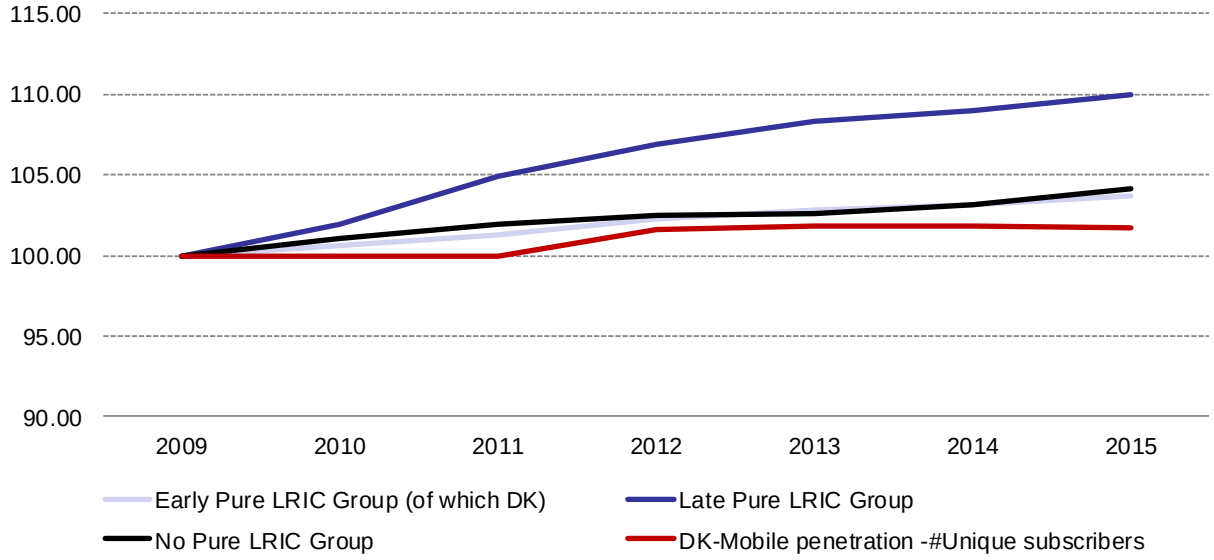
Figure 200 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA from EC reports & Digital agenda

The market penetration in terms of unique subscribers in Denmark observed with Figure 201 has been relatively steady since 2009, only slightly increasing since 2011. The evolution of the market penetration in Denmark is comparable to the Early Pure LRIC Group's trend.

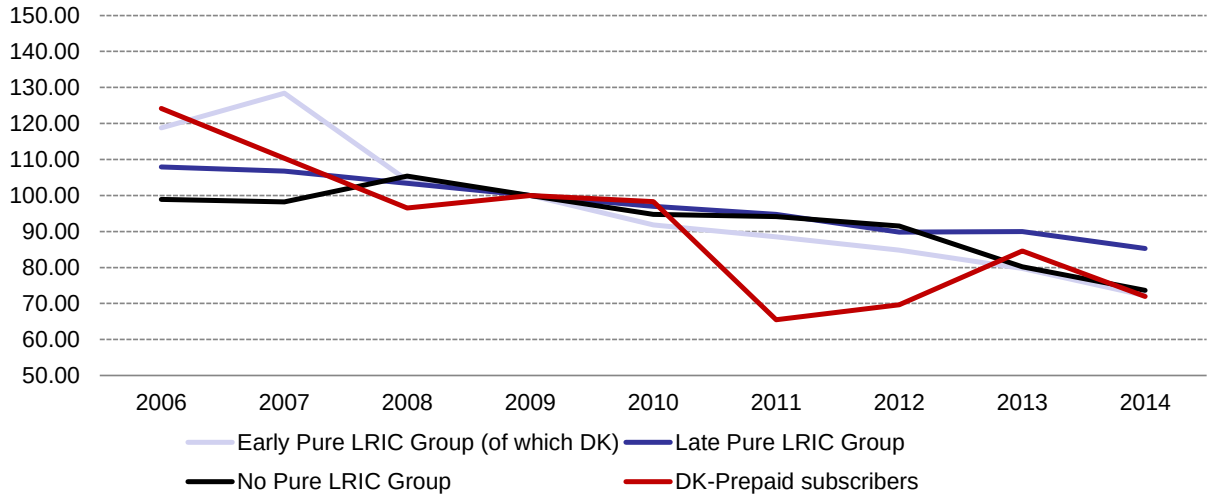
Figure 201 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA from GSMA

Figure 202 shows the evolution of the share of prepaid subscribers in Denmark. Since 2009, the prepaid share in Denmark has been decreasing more than all groups until 2011. In 2015, the share of prepaid subscribers in Denmark is one of the lowest in Europe after Finland[151].

Figure 202 - Share of prepaid subscribers in the mobile market (base 100 in 2009)

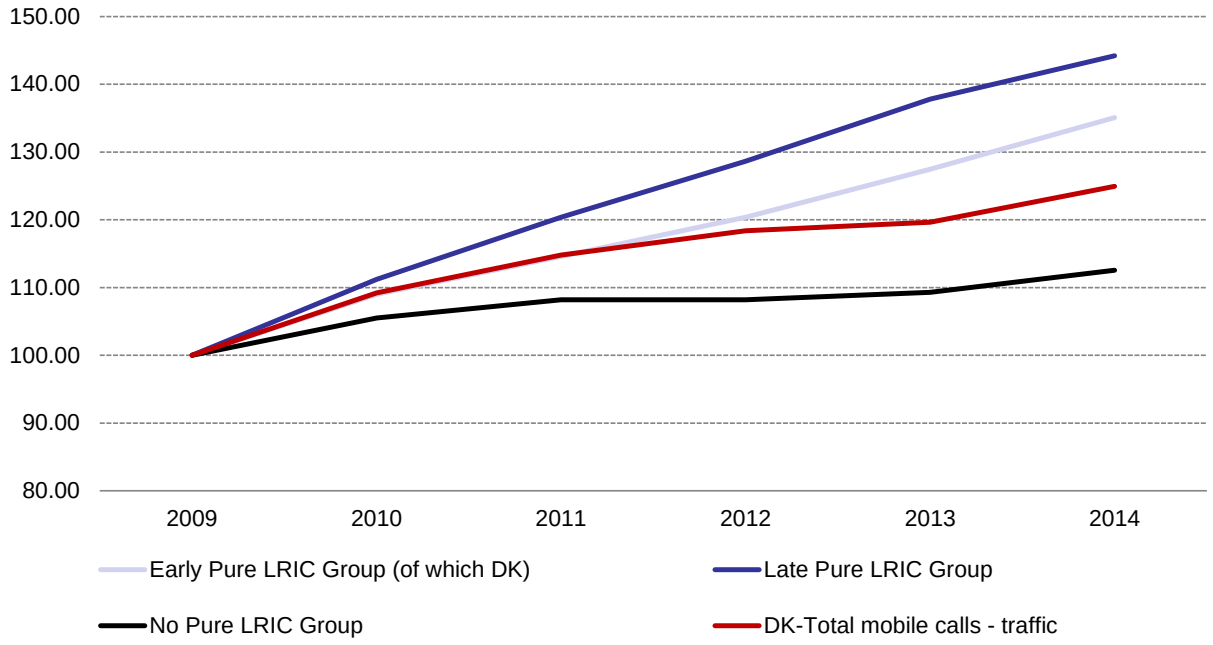


Source: TERA from EC reports & Digital agenda

Figure 203 shows the amount of minutes of mobile outgoing calls in Denmark. From 2009 to 2012, the traffic has been increasing and has been following the Early Pure LRIC Group's trend, and then after 2012 kept on increasing but at a slower pace than the Early Pure LRIC Group.

[151] Source: EC reports & Digital agenda

Figure 203 - Total minutes of mobile traffic (base 100 in 2009)



Source: TERA from NRAs Replies to questionnaire

8.7.1.2 *Evolution of retail mobile offers*

According the DBA, the first mobile flat rate offers appeared in 2010 with an MVNO being the first mover. DBA noticed that flat rate bundled offers are now dominant in the Danish market.

In 2014, H3G started offering unlimited roaming minutes as part of its premium subscription, at first only in the countries where H3G have mobile network, and then expanded to other countries.

The competition has now been transferred to roaming and international calls, with operators offering an add-on service to call to international.

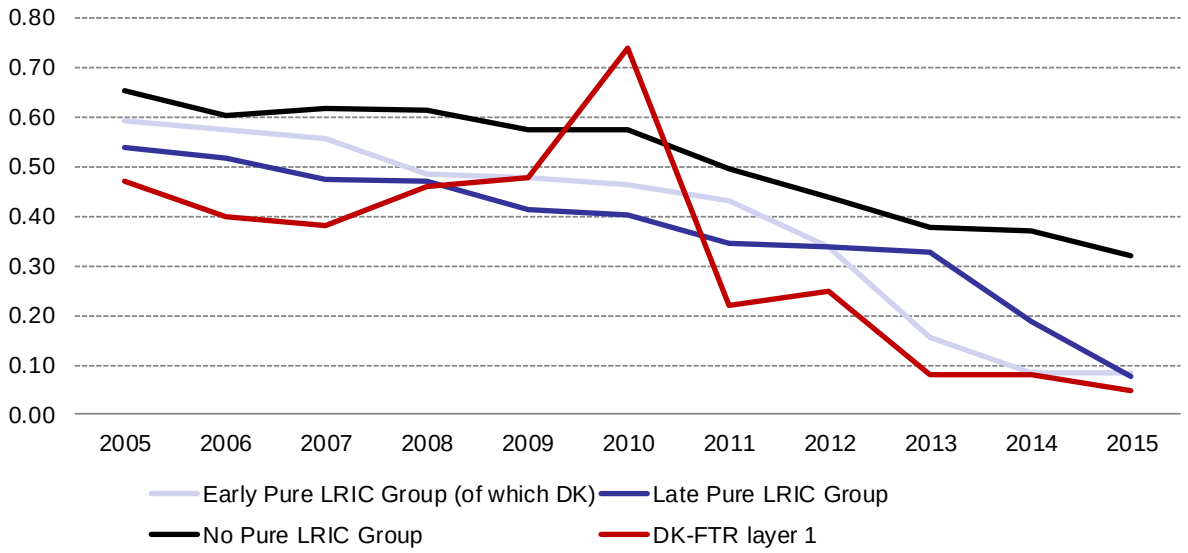
DBA did not state whether these evolutions were triggered by the lower MTR, although, according to DBA, it certainly helped in that direction.

8.7.2 Fixed market

8.7.2.1 *Quantitative analysis*

In 2010, FTRs in Denmark were relatively high compared to the three groups weighted averages. It then shrunk from 2010 to 2013 to reach a value set on the basis of the Pure LRIC approach, and has remained steady ever since, as it is shown in Figure 204. In 2015, Danish FTRs are on the same level as the Early Pure LRIC Group's weighted average FTR.

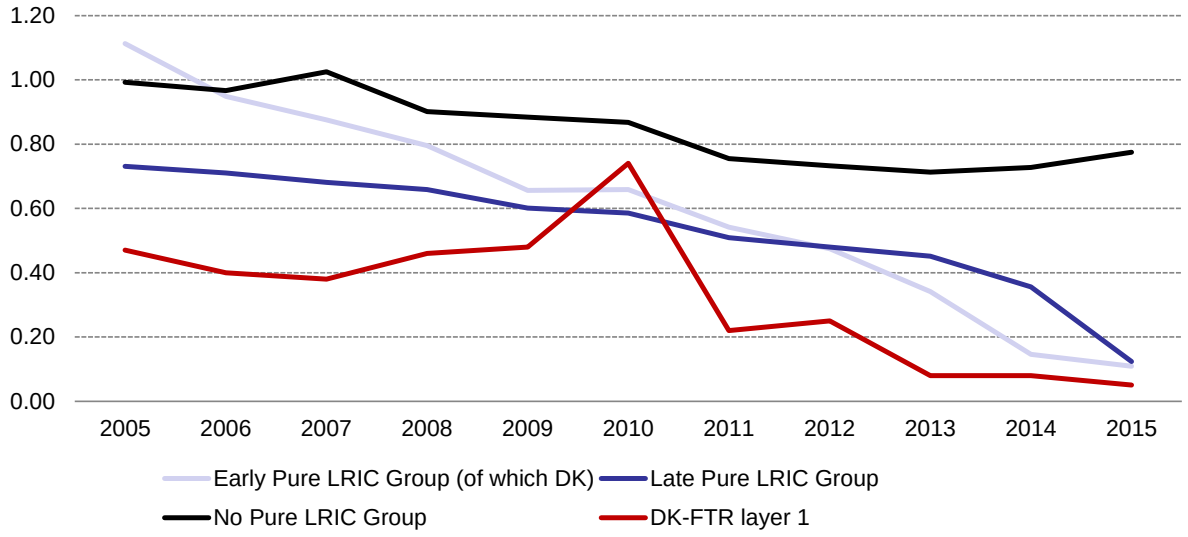
Figure 204 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA from BEREC & EC reports

Figure 205 shows the flat average for the three groups as opposed to the previous figure. When considering flat averages, it can be observed that FTR in Denmark has always been lower than most MS from 2011.

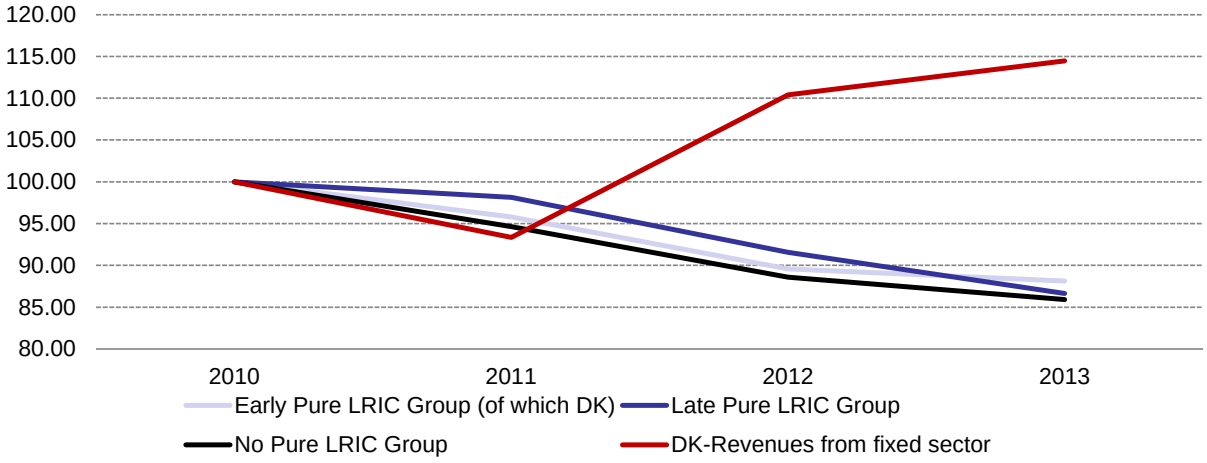
Figure 205 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA from BEREC & EC reports

Figure 206 shows the decline of revenues from fixed-line market between 2010 and 2011 in Denmark. It then increased from 2011 to 2013, whereas all groups kept on falling. Since 2009, revenues from fixed-line sector have been following no comparable group's trend.

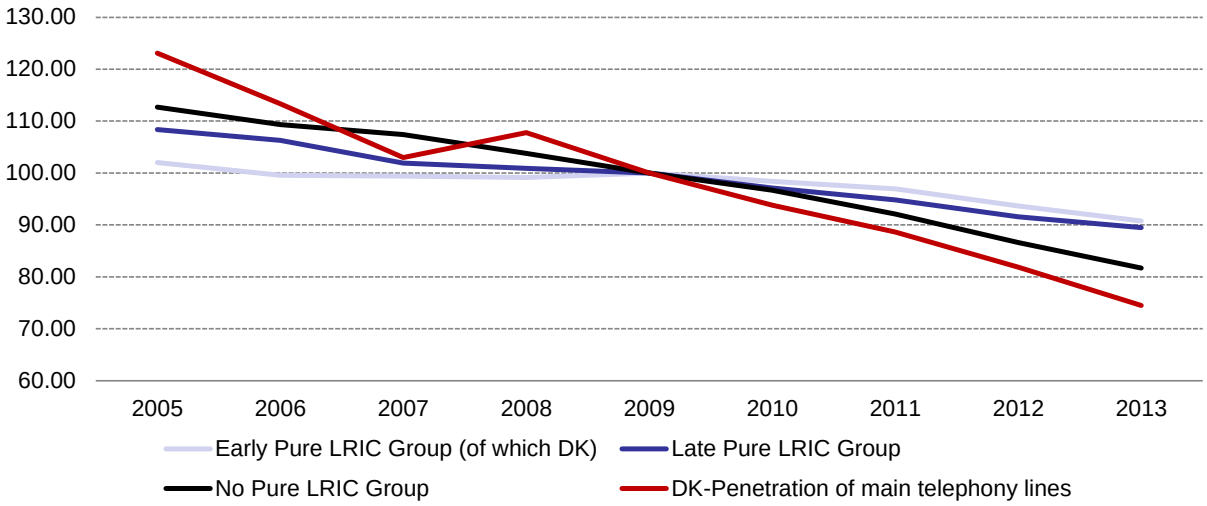
Figure 206 – Evolution of fixed market revenues (base 100 in 2009)



Source: TERA from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Denmark has shown a constant and slow decrease since 2005 (except in 2011), although it has been falling faster than all groups as shown in Figure 207.

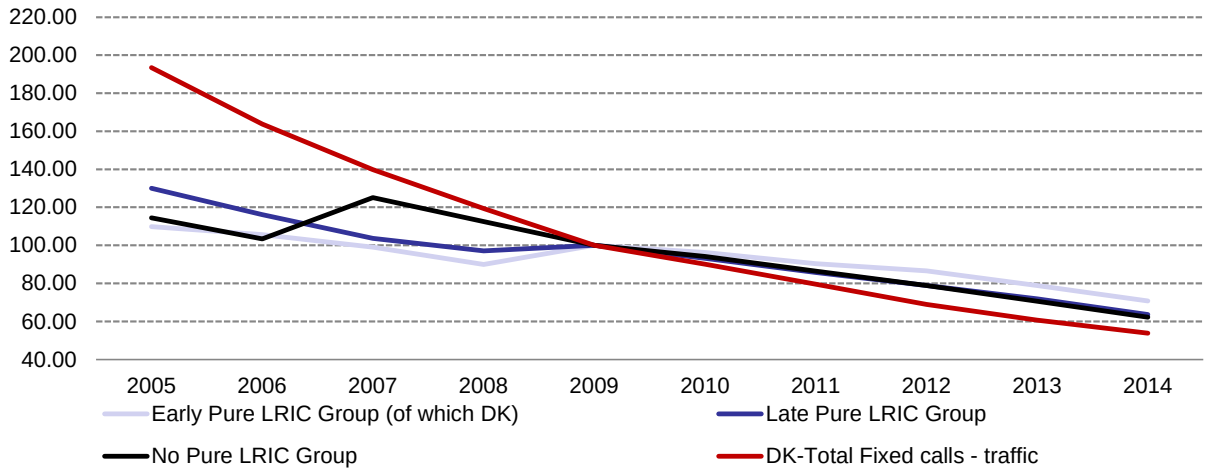
Figure 207 - Market penetration of main telephony lines (base 100 in 2009)



Source: TERA from Eurostat

The amount of minutes of fixed national calls in Denmark, presented in Figure 208, has been falling since 2005, especially between 2005 and 2009. Since 2009, it has still been decreasing more than all groups, confirming the observation from DBA that "*fixed market is shrinking*".

Figure 208 - Total minutes of fixed calls (base 100 in 2009)[152]



Source: TERA from DBA

8.7.2.2 *Evolution of retail fixed offers*

According to DBA, fixed market is shrinking and limited new offers are being introduced.

Flat rate offers have been introduced, and sometimes only applies to fixed-to-fixed calls. On-net/off-net differentiation still exists in the fixed retail market.

8.7.3 Summary

The table below summarizes, for each metric, the difference between Danish and the average metric for the Early Pure LRIC Group for mobile and for fixed in order to highlight how Denmark is positioned against its pair countries.

Figure 209 – Differences between the Early Pure LRIC Group and Denmark for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Denmark
Mobile revenues	Followed Early Pure LRIC Group's trend
Mobile investments	Faster decrease than other groups
Mobile retail prices	Not available
Mobile traffic	Followed Early Pure LRIC Group's trend
Mobile penetration	Close to Early Pure LRIC Group
Competition in mobile	Much faster decrease than all groups

Source: TERA Consultants

[152] From number of minutes

Figure 210 – Differences between the Early Pure LRIC Group and Denmark for the fixed market

Metrics	Differences between the Early Pure LRIC Group and Denmark
Fixed revenue	Very different evolution than the Early Pure LRIC Group
Traffic	Slightly faster decrease than all groups
Main telephony lines	Much faster decrease than all groups

Source: TERA Consultants

8.8 Estonia

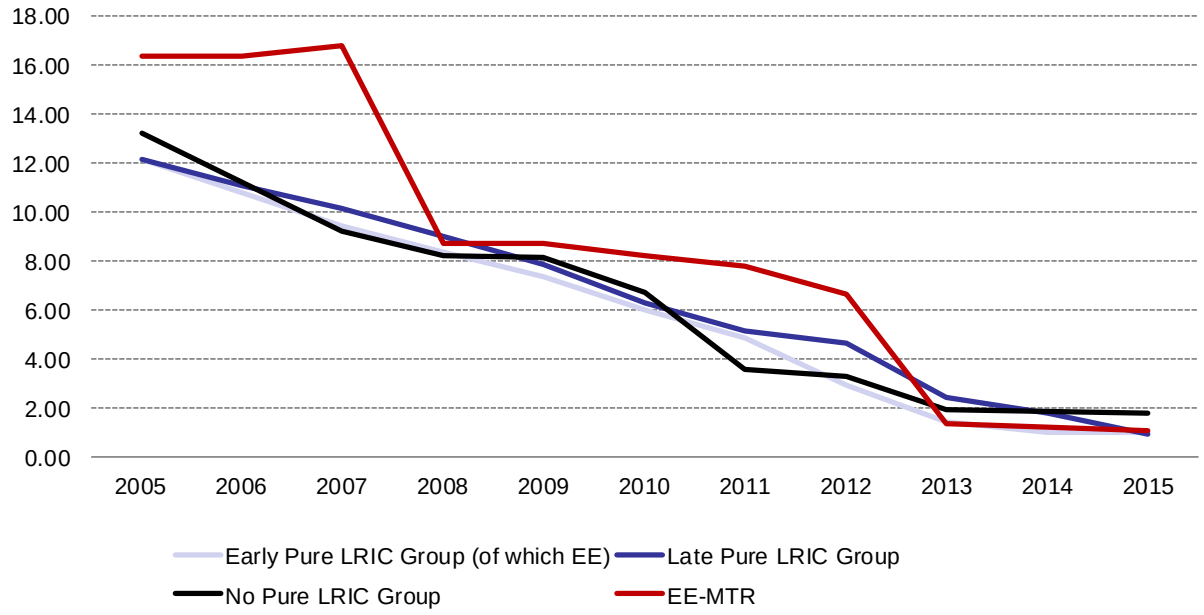
The Estonian telecom market is dominated by its incumbent Eesti Telekom (1993). This dominance was challenged last years though, with the rise of Elisa (1882) and Tele2 (1993), especially in the mobile sector. Eesti Telekom was acquired by TeliaSonera in 2009. Since the Estonian regulator TJA has set MTRs by benchmarking countries using Pure LRIC since 2013, Estonia has then been attributed to the "Early Pure LRIC group" for the mobile sector analysis. On the other hand, the Estonian regulator adopted Pure BU LRIC in January 2016 for FTRs and has then been allocated to the Late Pure LRIC.

8.8.1 Mobile market

8.8.1.1 *Quantitative analysis*

MTRs in Estonia were among the highest in Europe in 2005. shows that Estonian MTRs were more than 2€cents above all groups, and shrunk in 2008, then have been remaining higher than all groups for four years, and fell a second time in 2013 to reach a MTR set on Pure LRIC (benchmark). It is now, and since 2013, at the same level as the Early Pure LRIC Group.

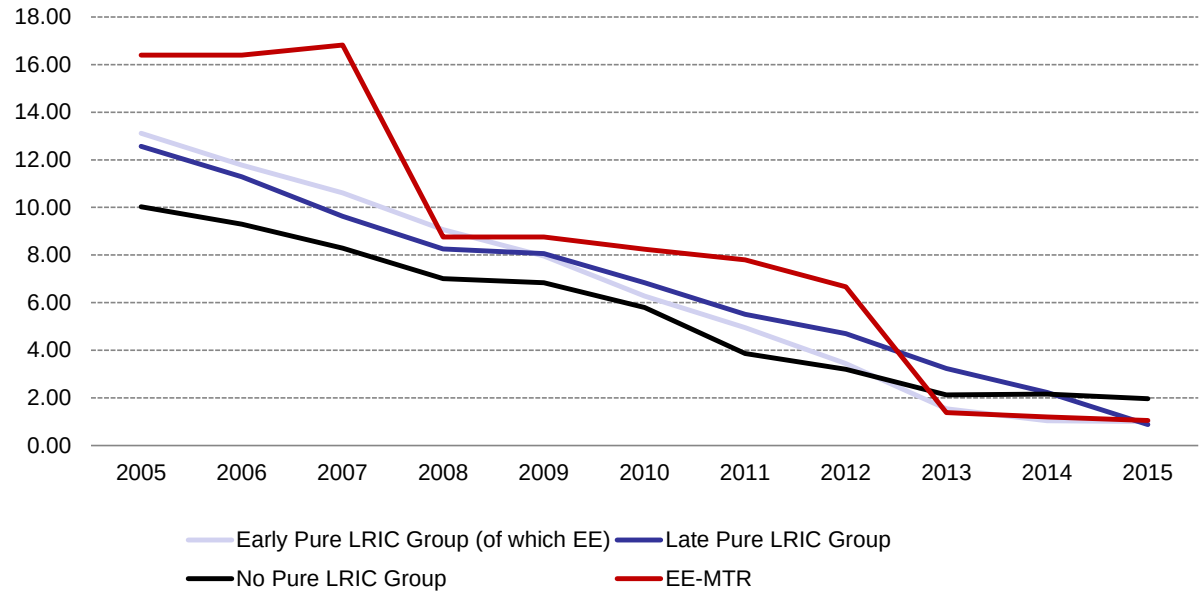
Figure 211 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see figure below). The trend is very comparable to the previous figure.

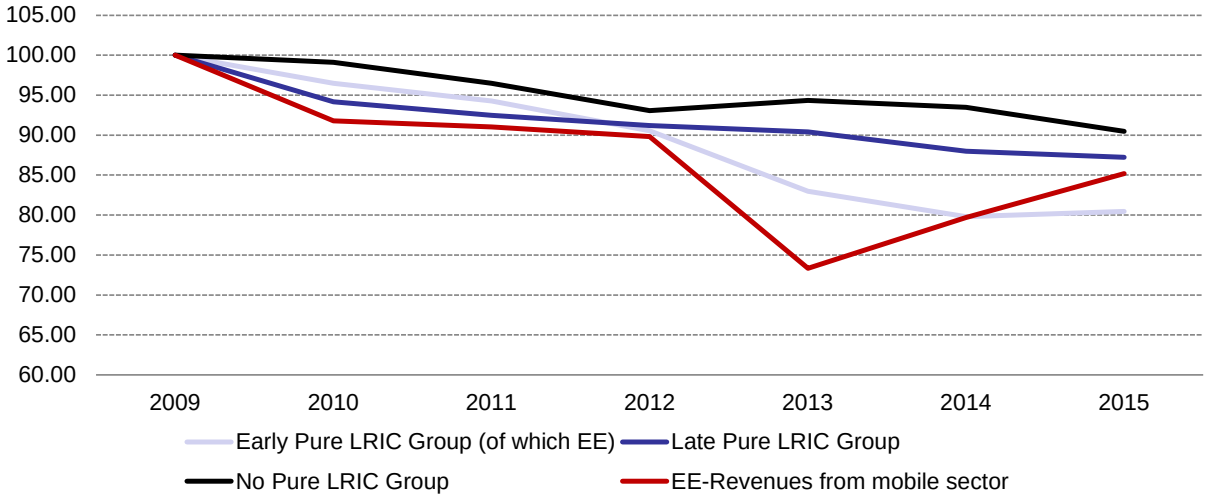
Figure 212 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in have been constantly decreasing from 2009 to 2013, especially between 2012 and 2013. It then increased from 2013 to 2015 whereas all groups declined or remained steady, so that Estonia has not followed its group trend.

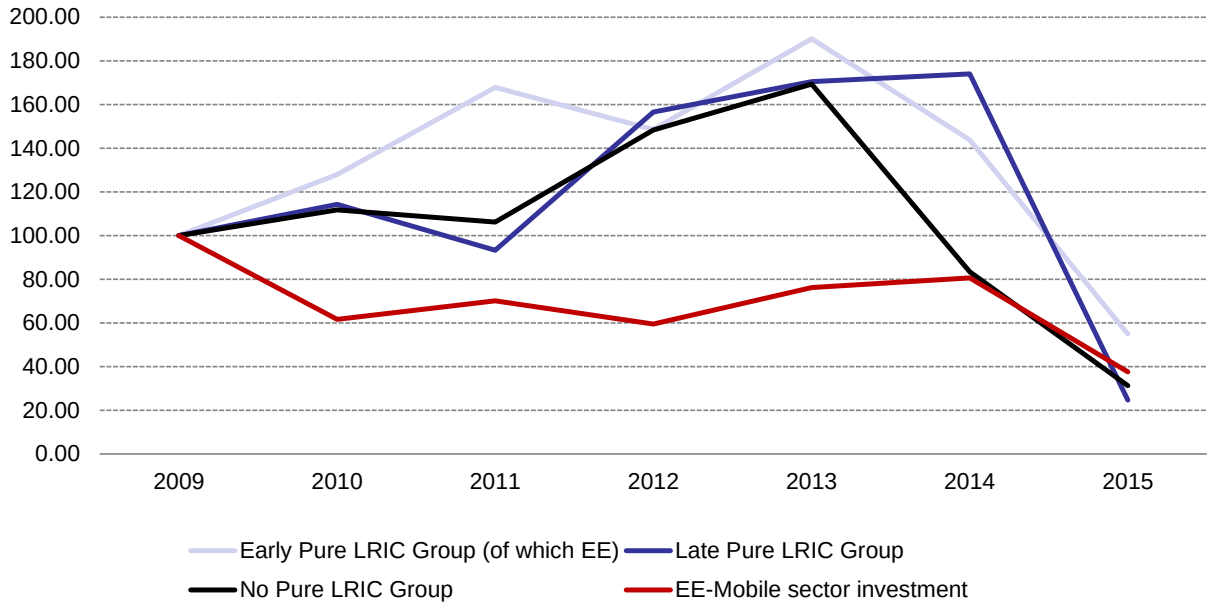
Figure 213 - Mobile revenues (base 100 in 2009)



Source : GSMA

shows the evolution of Estonian investments in the mobile sector compared to the three groups' averages. It can be observed that investments have been falling in 2010, and then remained steady until 2014, and fell a second time in 2015. Since 2009, mobile investments in Estonia have been divided by more than two.

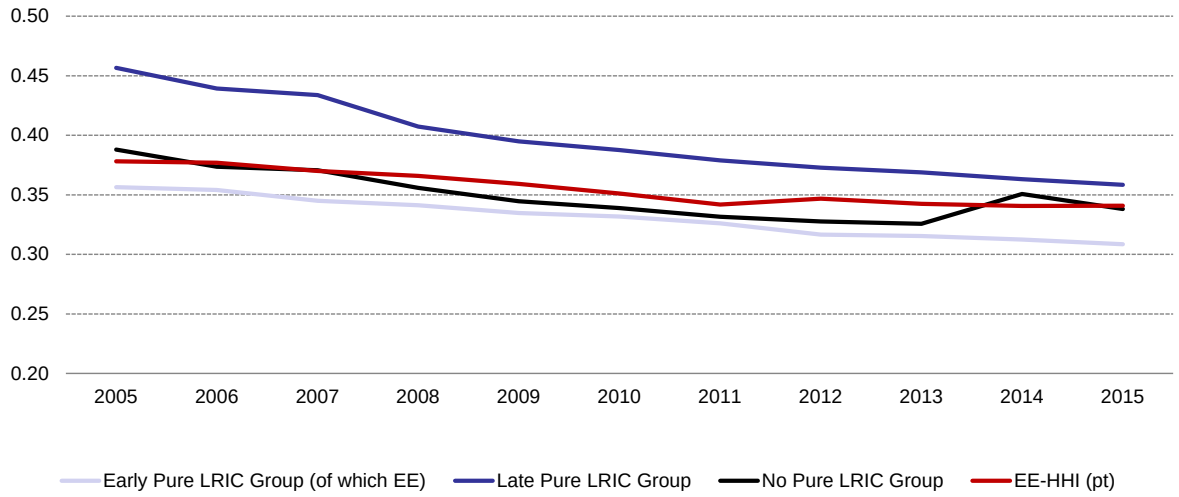
Figure 214 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the Estonian mobile market, all three offering nationwide coverage. The slight improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005. Since 2005, Estonian HHI has been closer to No Pure LRIC Group than the other groups.

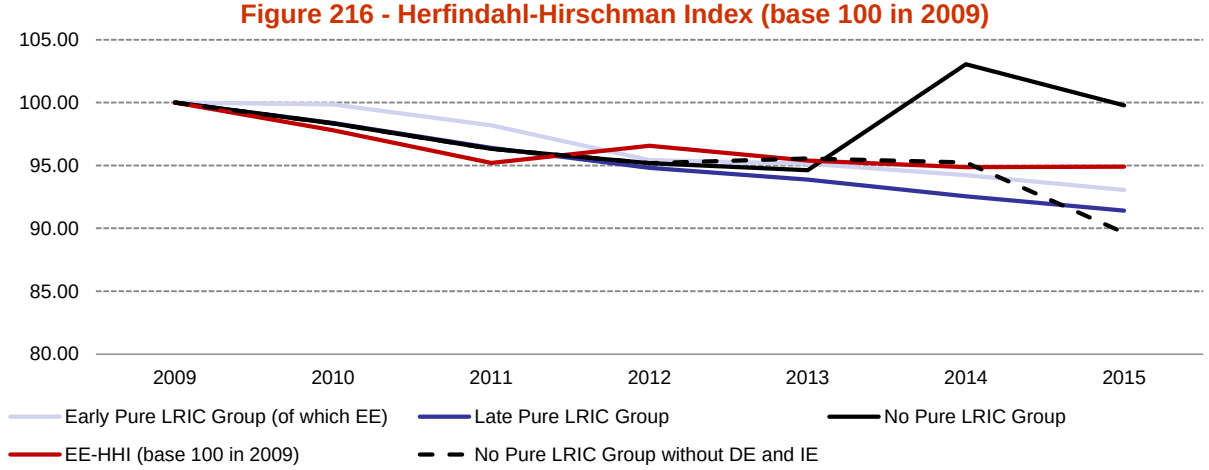
Figure 215 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Estonia since 2009 can be noticed in : the HHI (as base 100 in 2009) has been continuously declining following the trend of Early Pure LRIC Group.

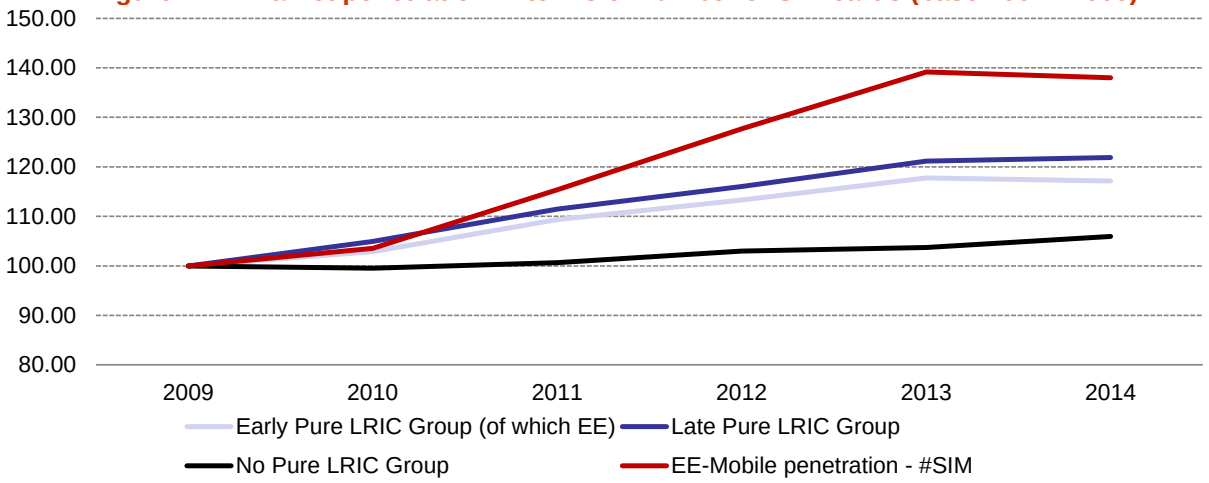
Figure 216 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The trend of the Estonian market penetration in terms of number of SIM was consistent with the average of the Early Pure LRIC group from 2009 to 2010. It has strongly increased from 2010 to 2013 before stabilizing. It is in 2014 above the level of all groups as shown in Figure 217:

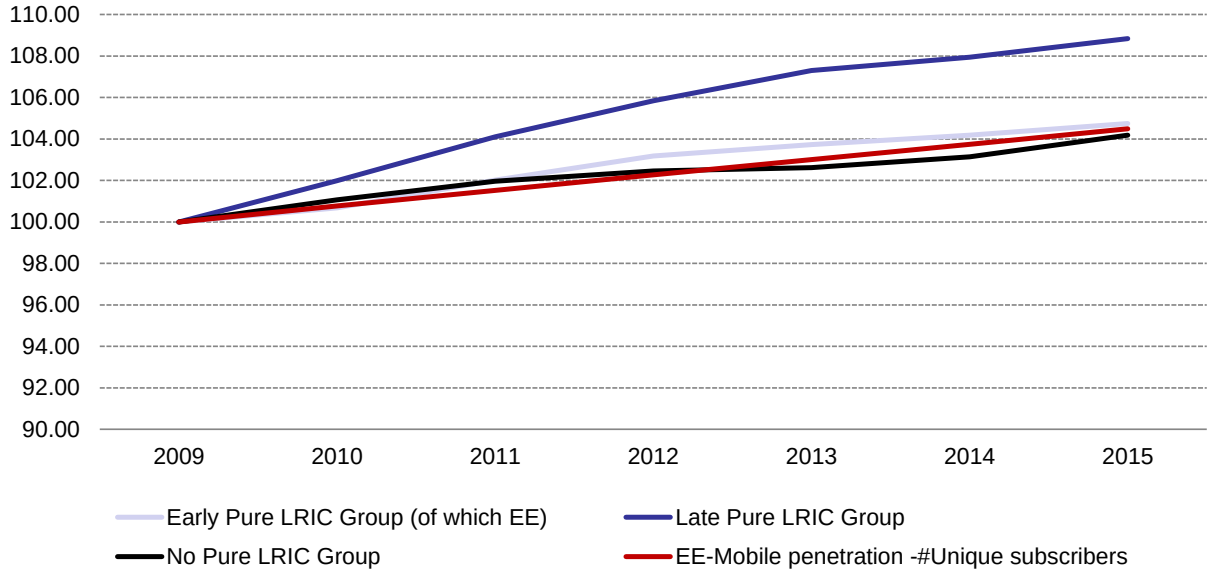
Figure 217 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 218 that the market penetration in terms of unique subscribers however, has ben increasing slower, following Ealy and No Pure LRIC Groups' trends.

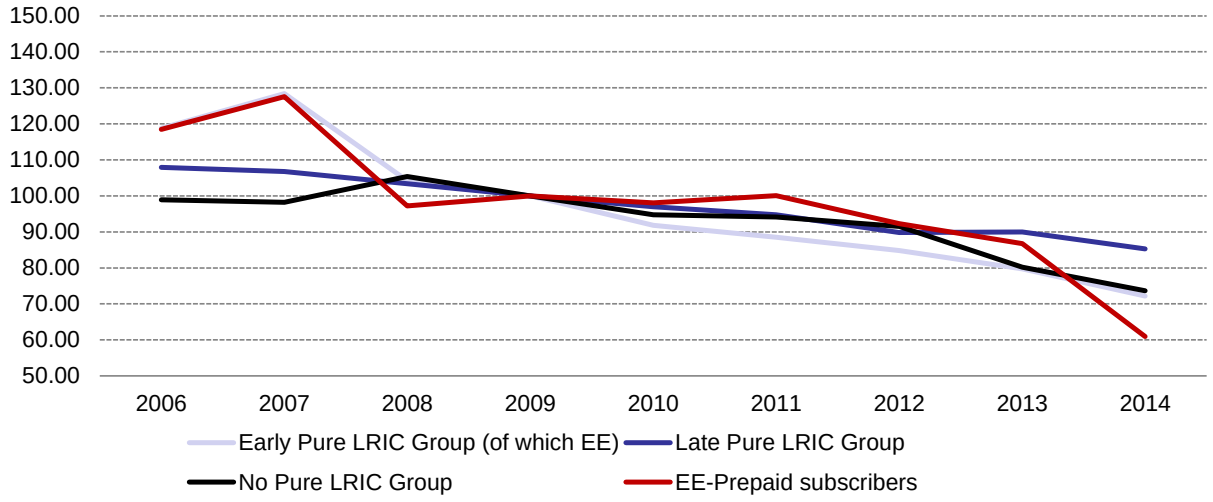
Figure 218 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 219 shows the evolution of the share of prepaid subscribers in Estonia since 2005. It can be observed that it has been decreasing since 2011 more than the three groups. It is at 20% in 2015, below most of the countries in Europe.

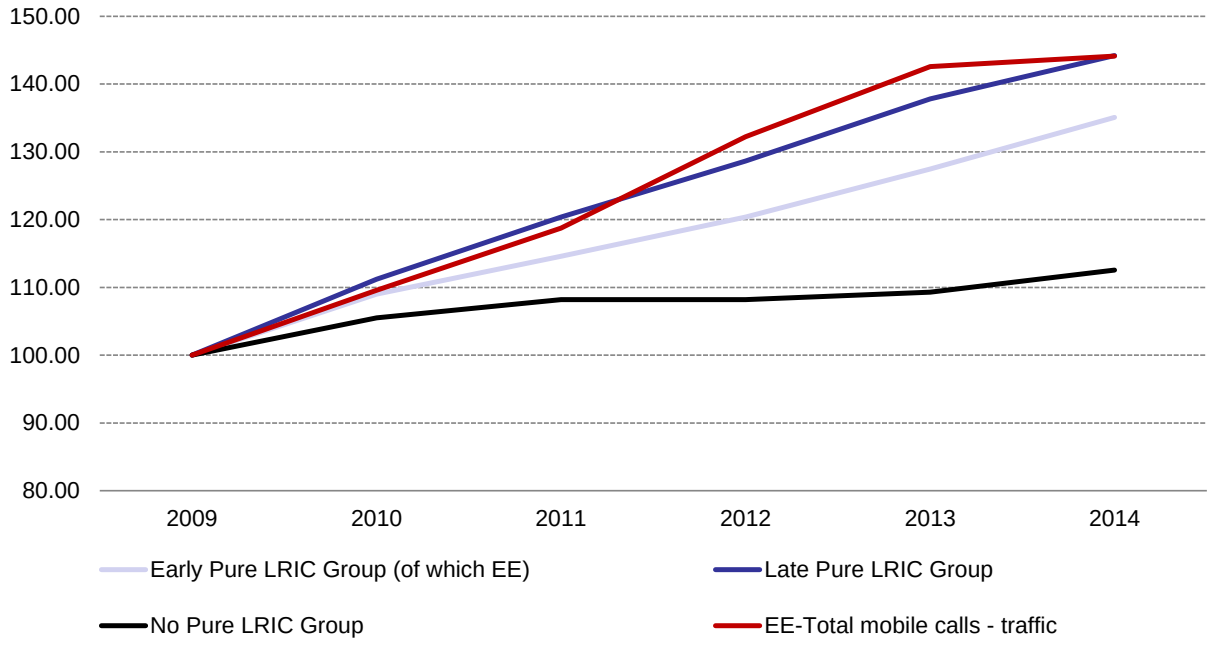
Figure 219 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 220 shows the evolution of the total amount of minutes of mobile calls in Estonia. It can be noticed that it has been increasing from 2009 to 2013, and seemed to bottom-out in 2014. That upward trend is very comparable to the evolution of the Late Pure LRIC Group rather than the Early Pure LRIC Group.

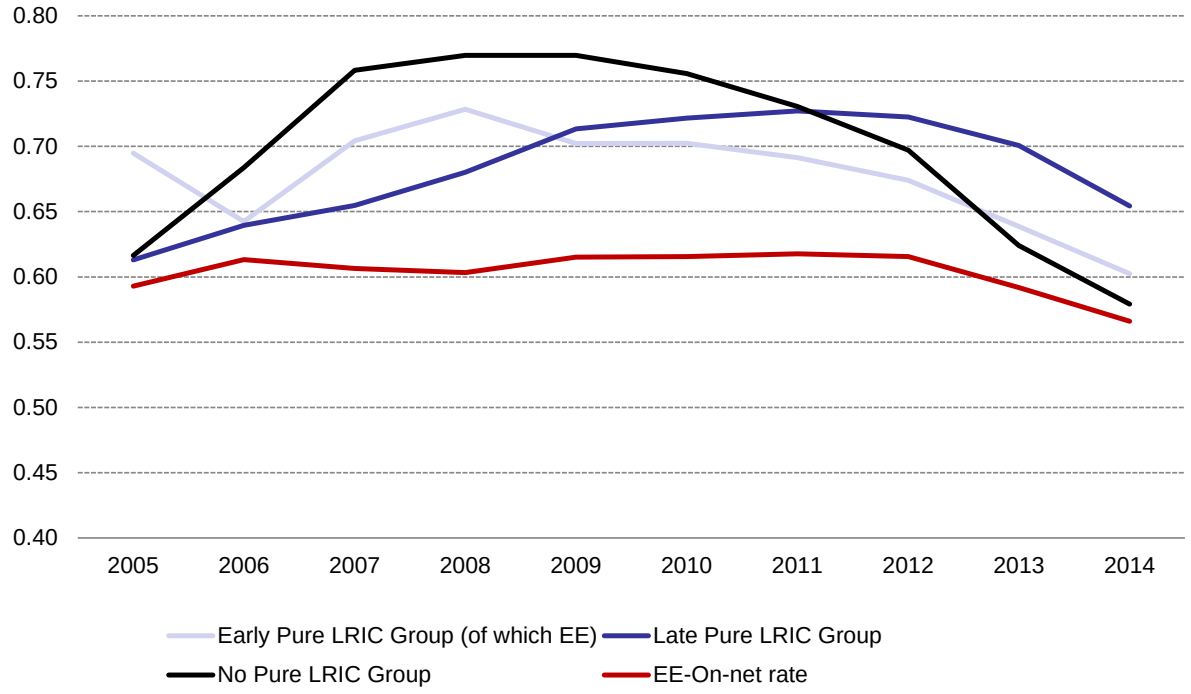
Figure 220 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 221 shows the share of on-net mobile calls, which has been remaining steady from 2006 to 2012, and then slightly decreased from 2012 to 2014. Estonian level is significantly below all group levels over the period.

Figure 221 - On-net rate of mobile calls (%)



Source: TJA

8.8.1.2 *Evolution of retail mobile offers*

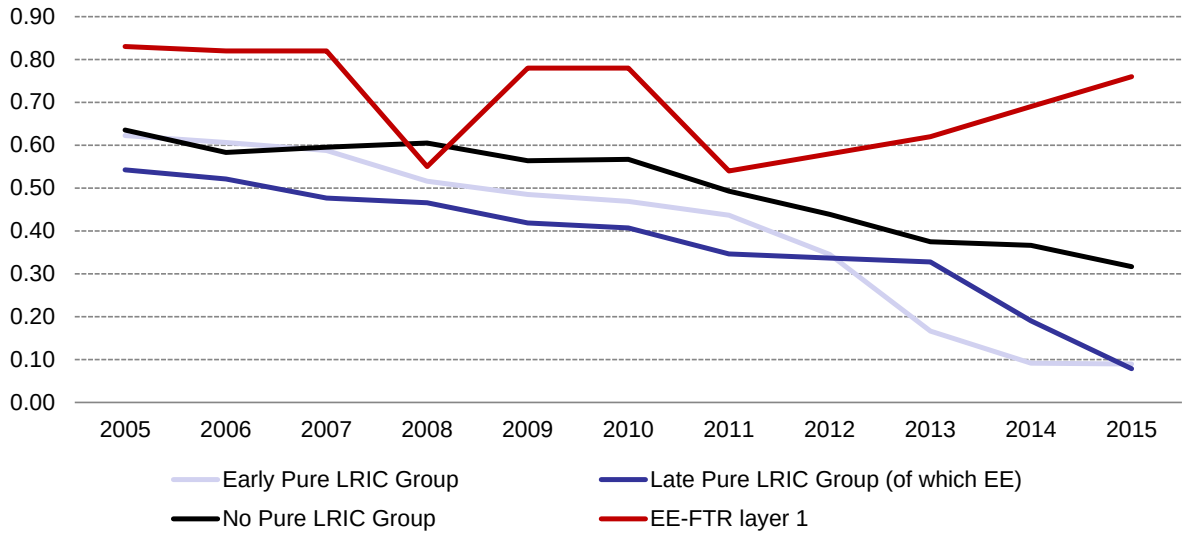
TJA did not observe any particular changes in the retail mobile offers. It has observed a steady decrease of retail prices which is inter alia influenced by the lower MTR.

8.8.2 Fixed market

8.8.2.1 *Quantitative analysis*

FTRs in Estonia have been above all groups' weighted average FTRs since 2005 (with an exception in 2008). Since 2011, FTRs in Estonia have been continuously increasing whereas it has been falling for the three groups. Therefore, FTR in Estonia is above all groups' weighted average in 2015 as it is presented in the figure below.

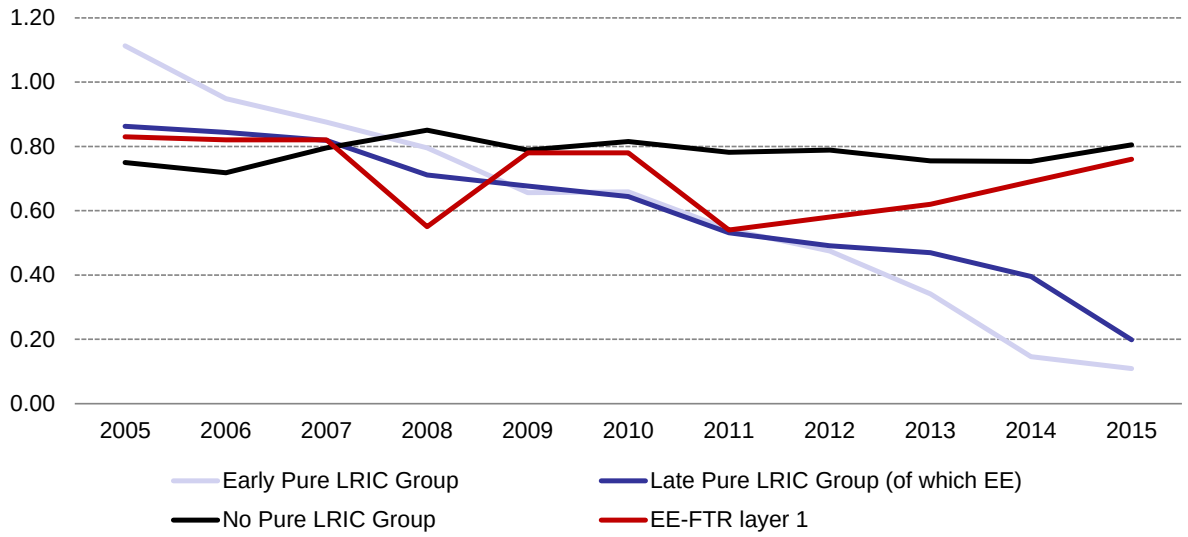
Figure 222 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 223 shows the flat average for the three groups as opposed to the previous figure. Considering flat averages, it can be observed that FTR in Estonia has been in the medium range of European MS from 2005 to 2011. Since 2011 however, its constant growth has set it among the highest in Europe, at the same level as the No Pure LRIC Group in 2015.

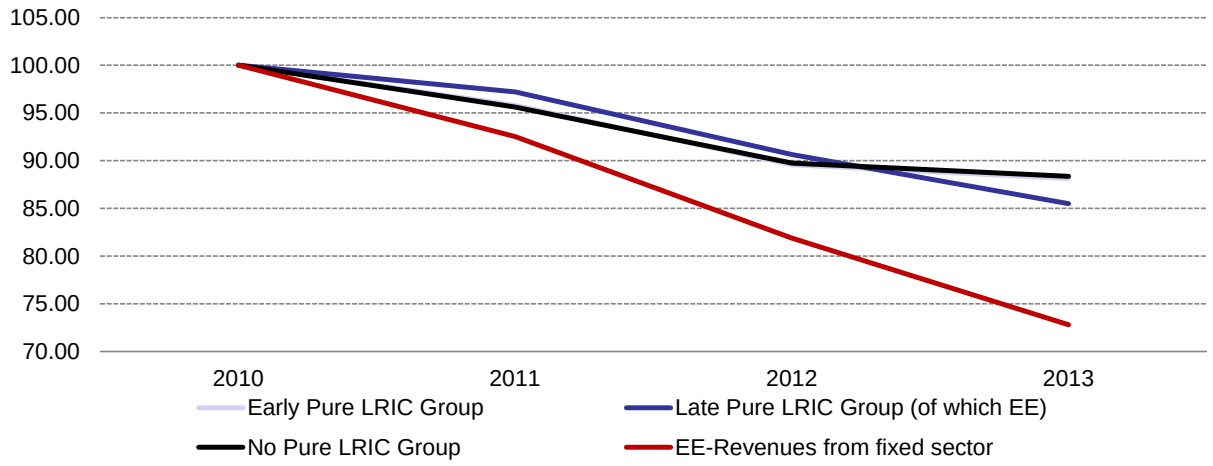
Figure 223 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 224 shows the fall of revenues from fixed-line market since 2010 for Estonia and the three groups. Since 2010, revenues from fixed-line market have been decreasing much more than all groups.

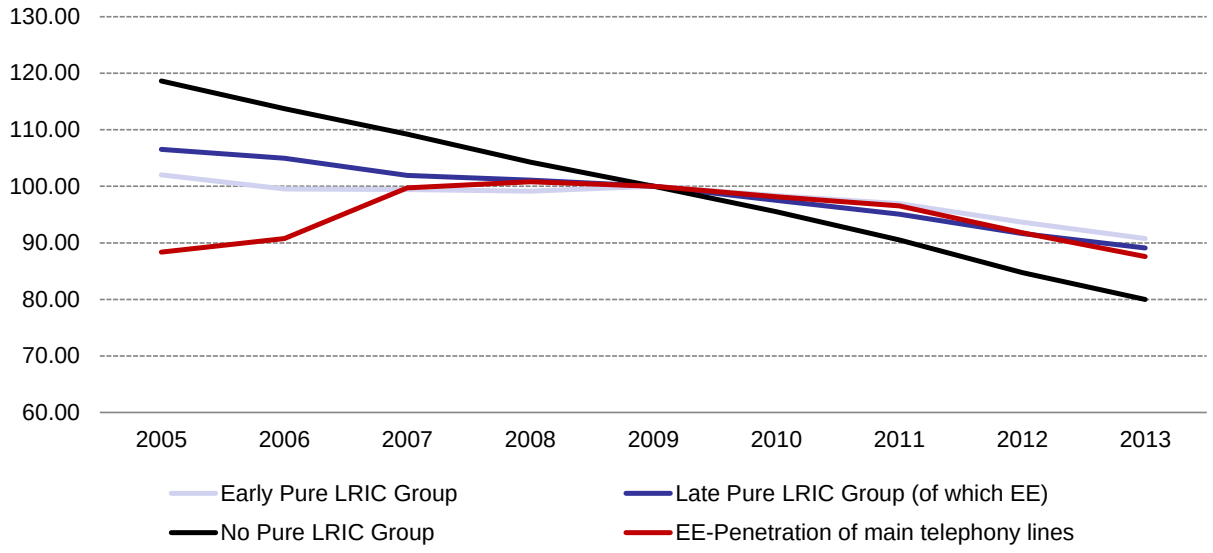
Figure 224 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Estonia has been growing from 2005 to 2008, and then started falling following the European trend, and especially Early and Late Pure LRIC Groups' trends, as can be observed in Figure 225. In 2013, the market penetration was relatively low (33%) compared to the other MS.

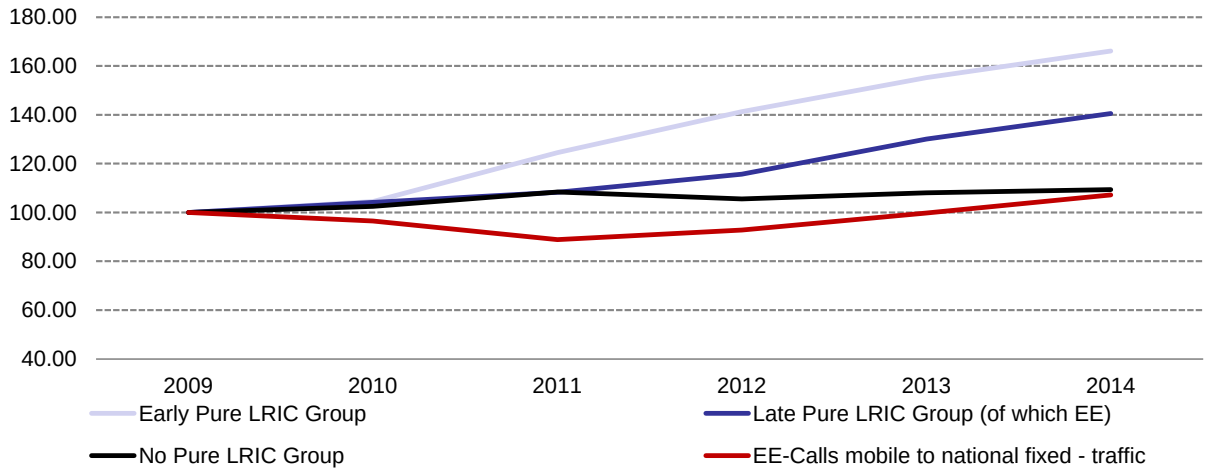
Figure 225 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Estonia, presented in Figure 226, has shown a steady decline between 2009 and 2011 and has been slightly increasing ever since.

Figure 226 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: TJA

8.8.2.2 *Evolution of retail fixed offers*

Concerning the fixed retail offers, TJA did not observe any particular change in retail prices, but noticed that on-net/off-net differentiation still exists.

8.8.3 Summary

The table below summarizes, for each metric, the difference between Estonia and the average metric for the Early pure LRIC Group for mobile and the No pure LRIC Group for fixed in order to highlight how Estonia is positioned against its pair countries.

Figure 227 - Differences between Estonia and its group

Metrics	Differences between the Early Pure LRIC Group and Estonia
Mobile revenues	Decreased way more than all groups
Mobile investments	No particular trend followed
Mobile retail prices	Not available
Mobile penetration	Increased more than all groups in terms of SIM cards, close to Early Pure LRIC Group in terms of unique subscribers
Competition in mobile	Level closer to No Pure LRIC Group, but followed the evolutions of Early Pure LRIC Group

Figure 228 – Differences between the Late Pure LRIC Group and Estonia for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Estonia
Fixed revenue	Much faster decrease than all groups
Traffic	Slower increase than the Late Pure LRIC Group
Main telephony lines	Similar to the Late Pure LRIC Group

Source: TERA Consultants

8.9 Germany

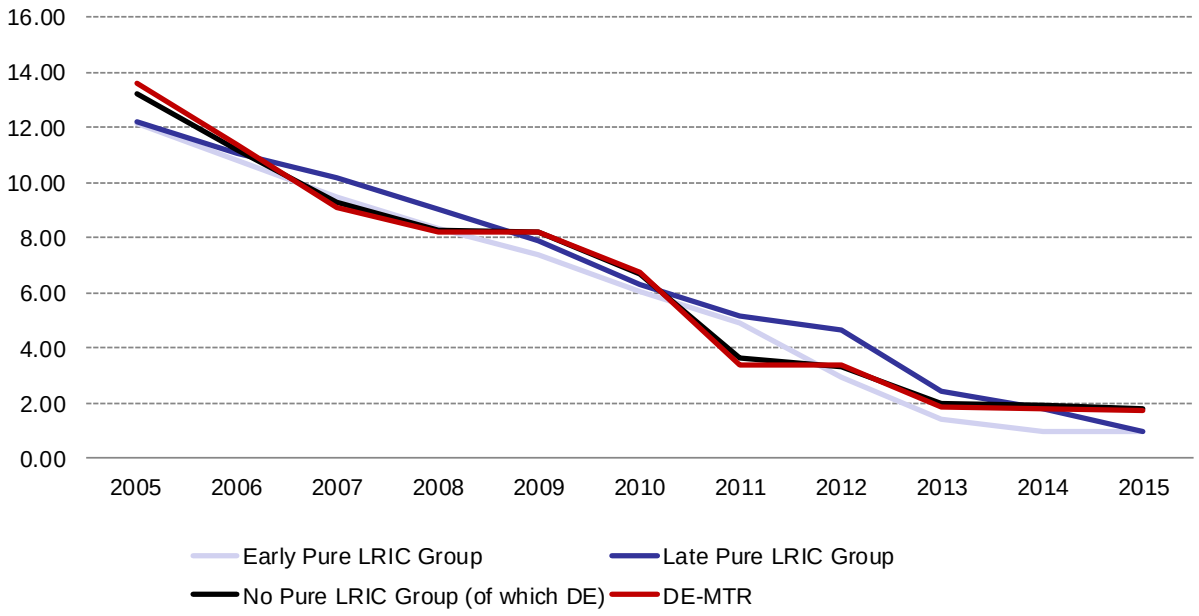
Germany's telecom market is the largest in Europe with fixed-line market led by the incumbent Deutsche Telekom, the biggest telecom company in Europe. In 2014, the acquisition of E-Plus (launched 1992) by O2 (launched 1995) in 2014 made O2 the leader in the mobile sector in Germany. The other operators are T-Mobile (1992), DT's mobile brand, and Vodafone (1990). Germany's regulator is BNetzA, which adopted BU LRAIC+ for both MTRs and FTRs by the end of 2012 for FTRs and on 1 January 2013 for MTRs.

8.9.1 Mobile market

8.9.1.1 *Quantitative analysis*

Mobile termination rates (MTRs) in Germany were among the highest in Europe in 2005 and decreased following the No Pure LRIC Group's trend from 2005 to 2015. Indeed, as observed with Figure 229, MTRs in Germany were slightly above Early and Late Pure LRIC Groups' weighted averages in 2009, and are almost twice their value in 2015.

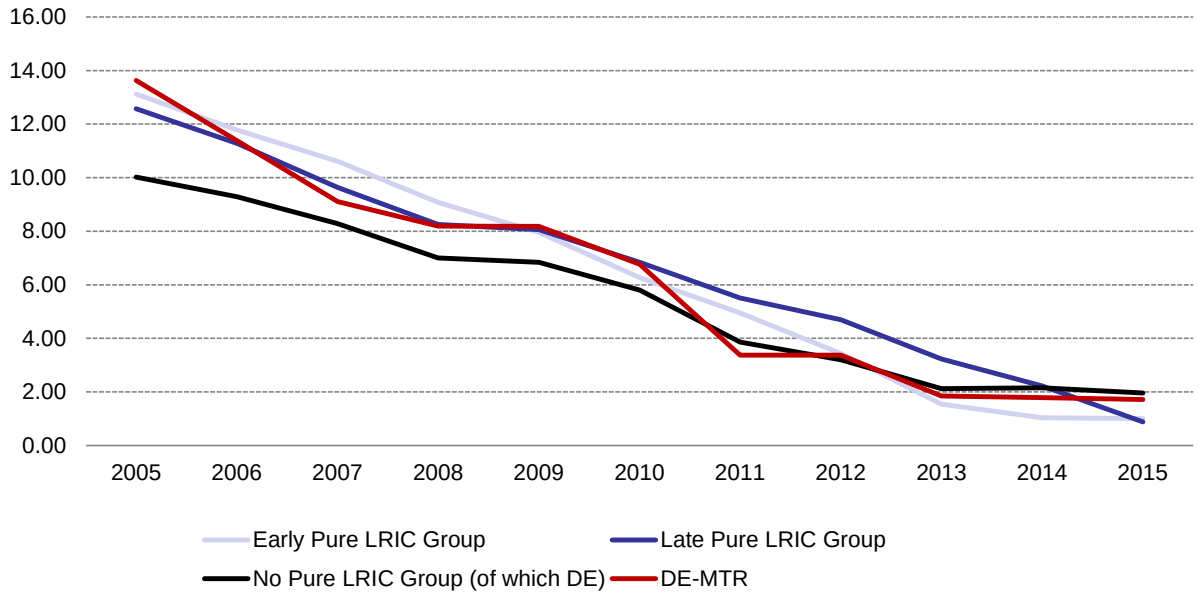
Figure 229 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 230). The trend is approximately the same as the weighted average trend: the MTR in Germany was way higher than its group average in 2005 and decreased faster to catch up in 2011. However since 2011, MTR in Germany decreased slower than Late and Early Pure LRIC Groups and German MTR is now circa twice average "Early Pure LRIC" and "Late Pure LRIC" MTRs.

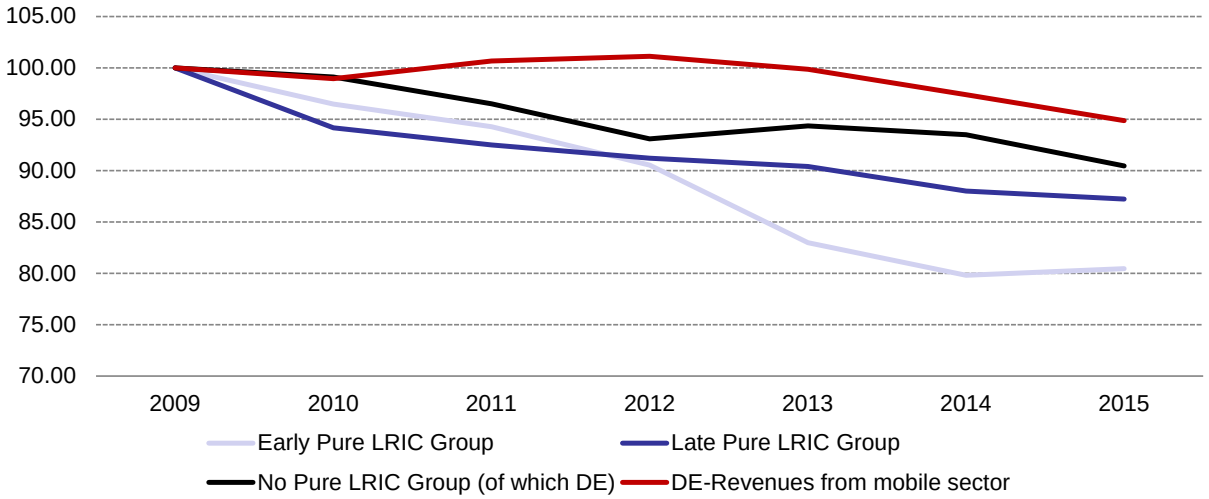
Figure 230 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 231 have been pretty steady from 2009 to 2013, and then started decreasing. No Pure LRIC Group's average revenues have been decreasing faster since 2010, but slower than the two other groups. German revenues from mobile sector are then closer to No Pure LRIC group's trend than the other groups.

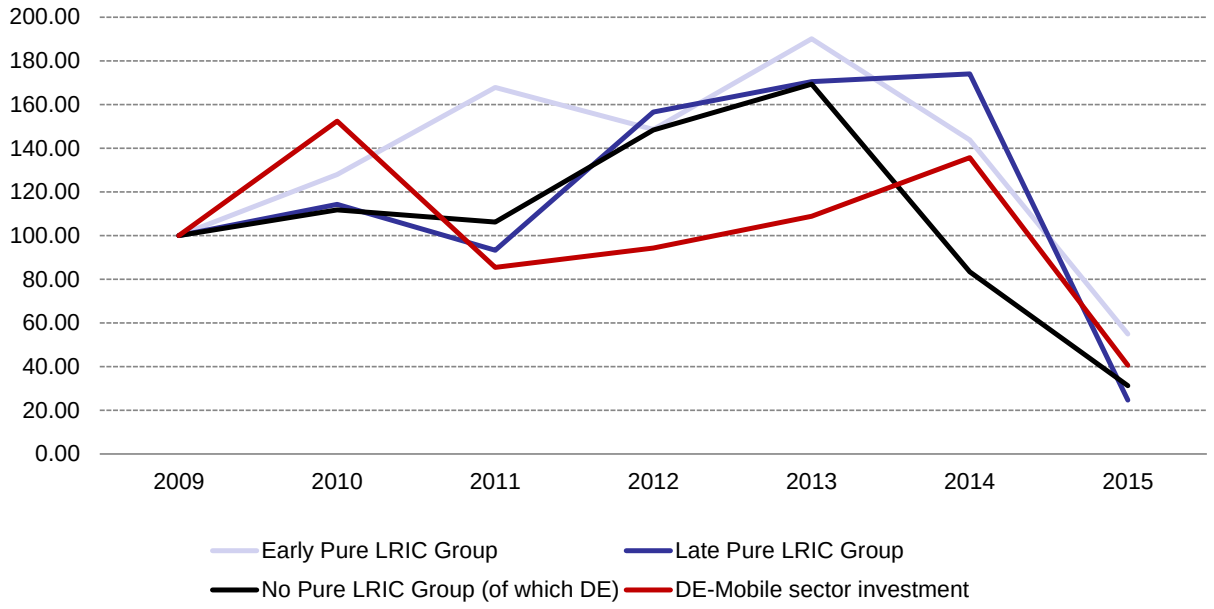
Figure 231 - Mobile revenues (base 100 in 2009)



Source : GSMA

Investments in the mobile sector in Germany presented in Figure 232 have been relatively unstable since 2009, increasing in 2010, then decreasing in 2011, slowly increasing until 2014 and eventually decreasing in 2015. German investments followed no particular trend, but started decreasing in 2014 such as Late Pure LRIC Group, whereas the two other groups had declining investments since 2013.

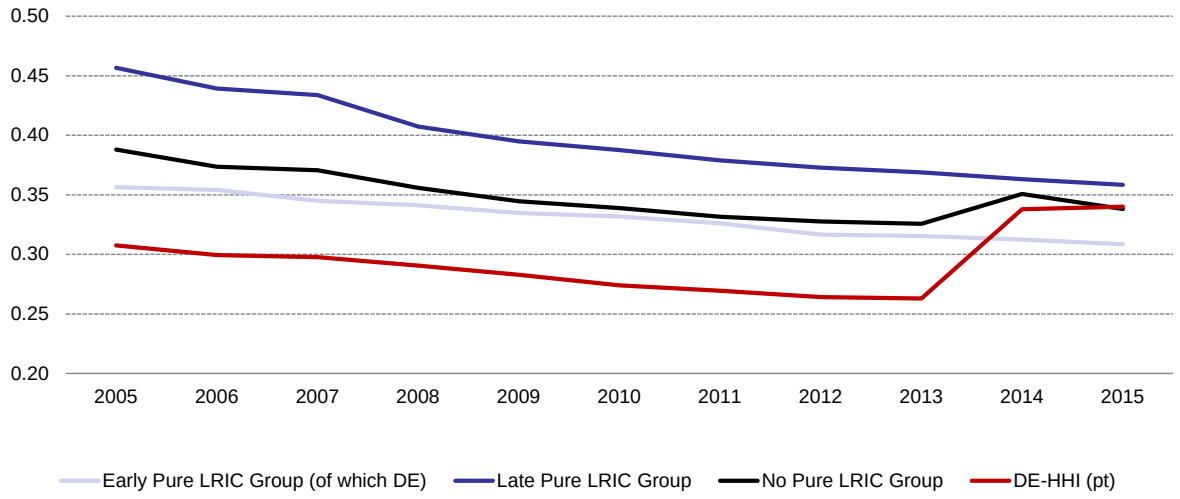
Figure 232 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the German mobile market, all three offering nationwide coverage. Between 2005 and 2013, German market was served by four operators, and its HHI was then between 0.30 and 0.27. The sudden increase of HHI in 2014 has been caused by the merger between E-Plus and O2, and led to a comparable HHI for Germany than its group average in 2014 and 2015.

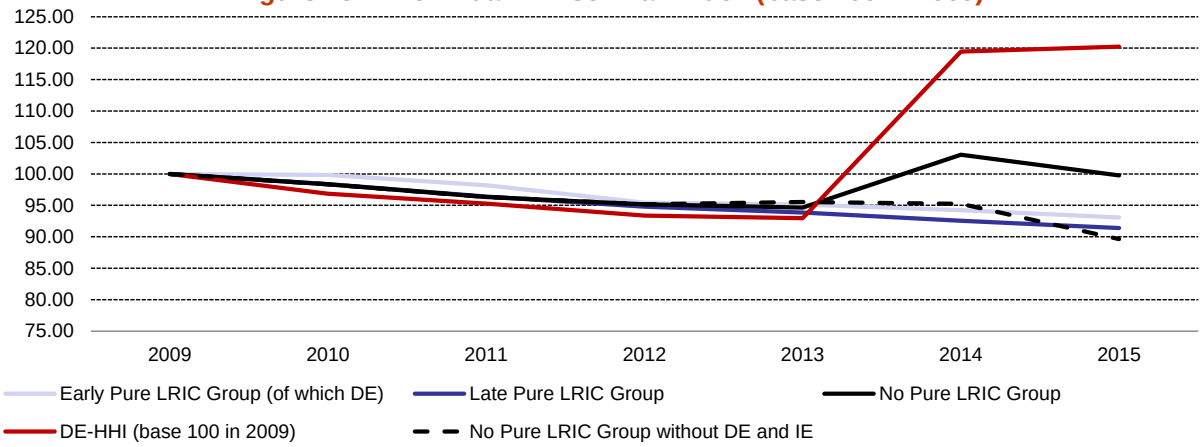
Figure 233 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the lower level of concentration in Germany since 2013 can be noticed in : the HHI (as base 100 in 2009) has been suddenly increasing in 2014, influencing its group average evolution.

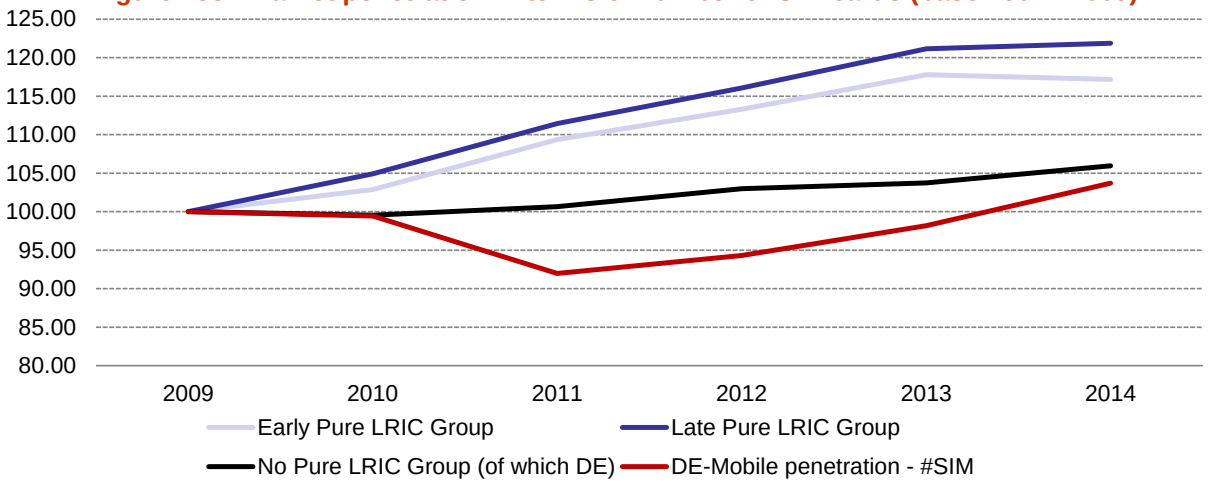
Figure 234 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

German market penetration in terms of number of SIM cards was steady from 2009 to 2010, then suddenly decreased in 2011 and slowly increased after 2011 as shown in the figure below.

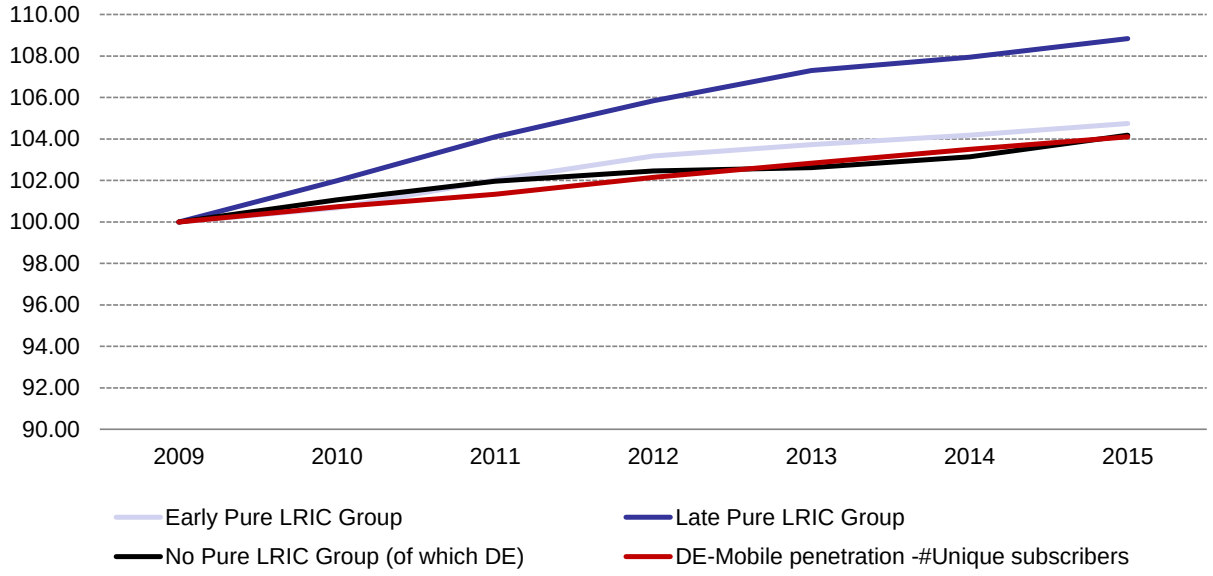
Figure 235 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Since 2009, market penetration in terms of unique subscribers in Germany has been slowly increasing, following the trend of both Early and No Pure LRIC Groups, way slower than Late Pure LRIC Group, as observed with the figure below.

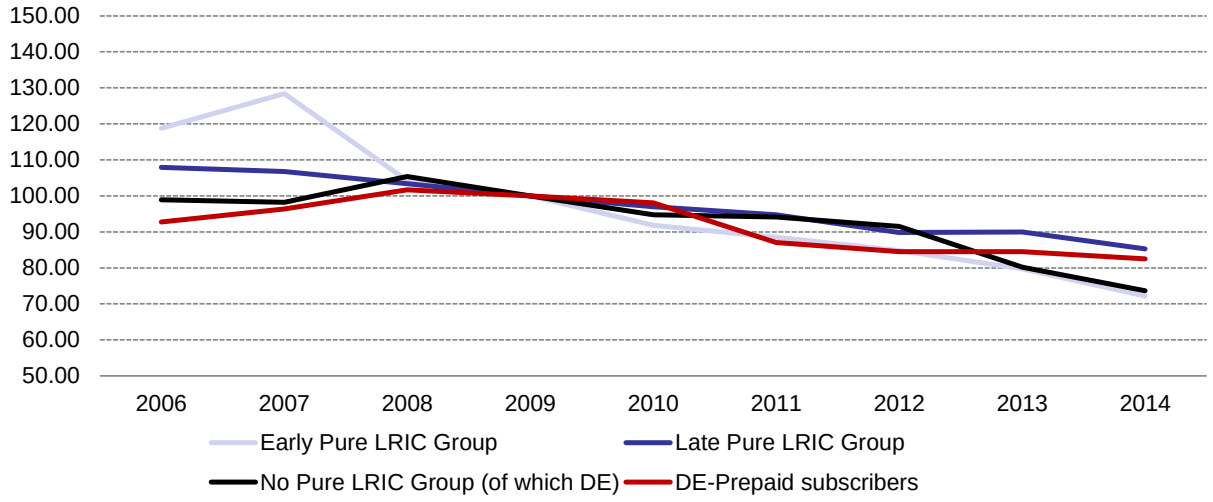
Figure 236 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 237 shows the evolution of the share of prepaid customers in Germany and in average in the three groups. It has been constantly decreasing since 2008, such as all groups. Its evolution however, has been closer to Late and Early Pure LRIC groups since 2011.

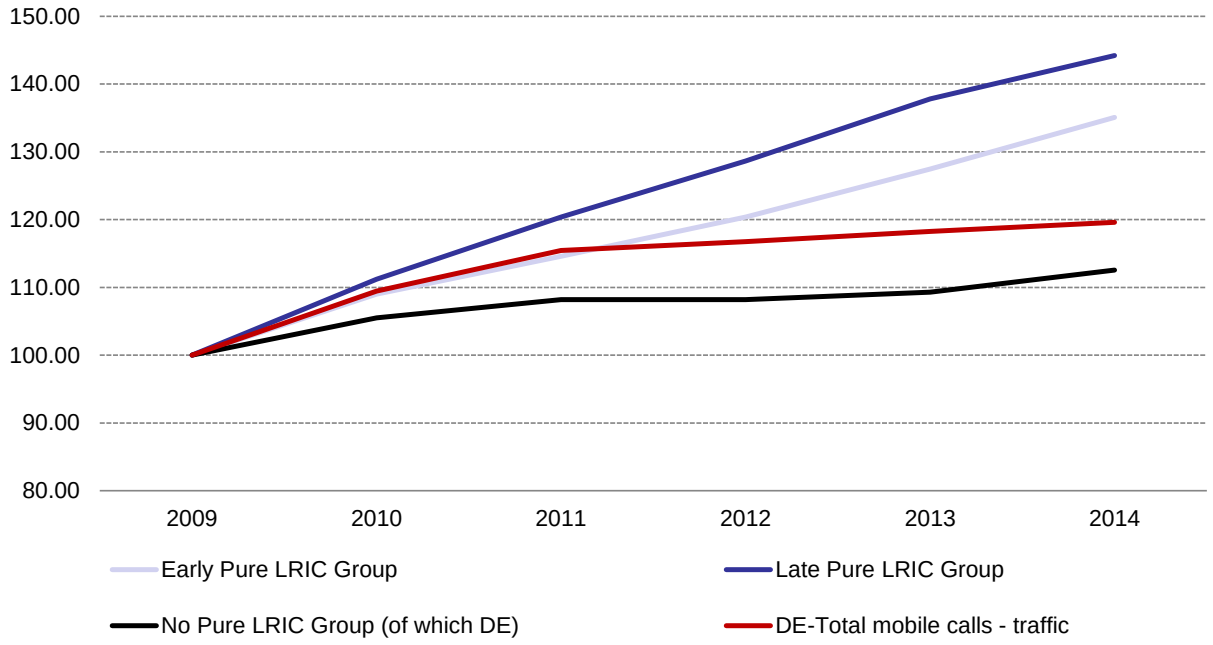
Figure 237 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 238 shows the evolution of the total amount of minutes of mobile calls in Germany. Since 2009, the mobile traffic has been increasing in Germany following a very comparable trend to the No Pure LRIC Group, although it has been increasing slightly faster from 2009 to 2011.

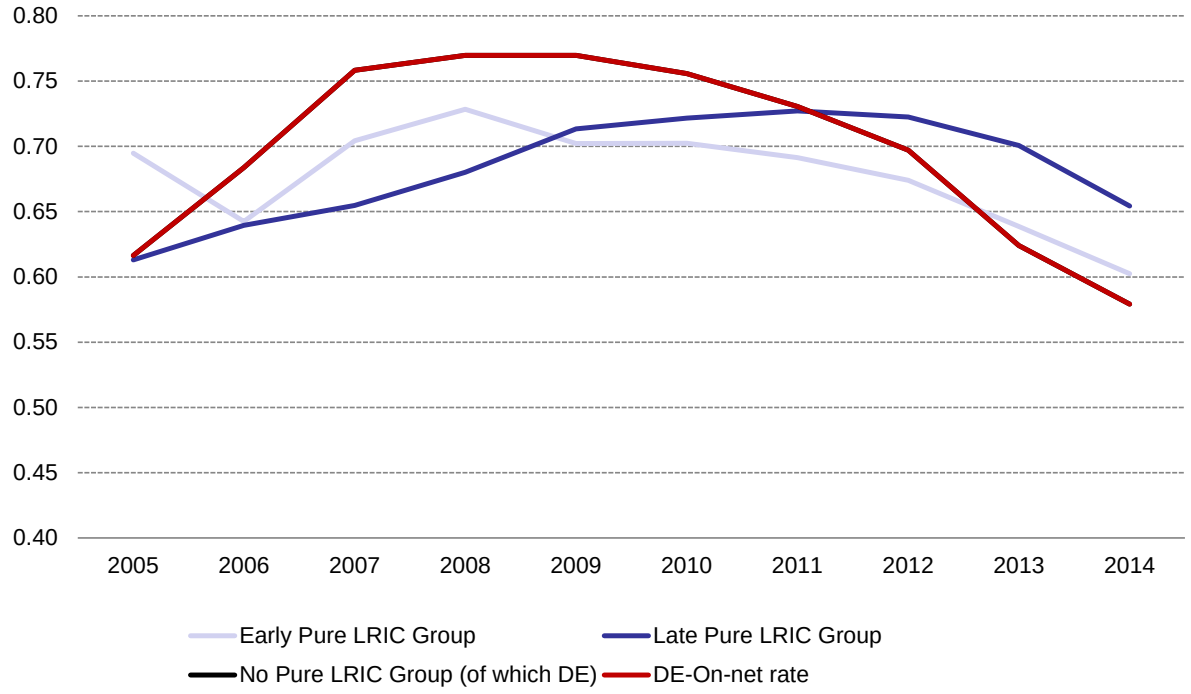
Figure 238 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 239 shows the share of on-net mobile calls in Germany, which has been strongly increasing between 2005 and 2007, and then declined faster and faster until 2014. This highlights the observation of BNetZa about on-net/off-net differentials which tend to disappear.

Figure 239 - On-net rate of mobile calls (%)



Source: BNetZa

8.9.1.2 *Evolution of retail mobile offers*

According the BNetZa, a number of trends in the mobile retail sector can be observed since 2009. BNetZa noticed that bundled offers became more and more popular. It has also been observed that flat rate offers included a growing number of minutes over the time.

The market was also influenced by the predominance of data which started to take a pivotal role in consumers' choices.

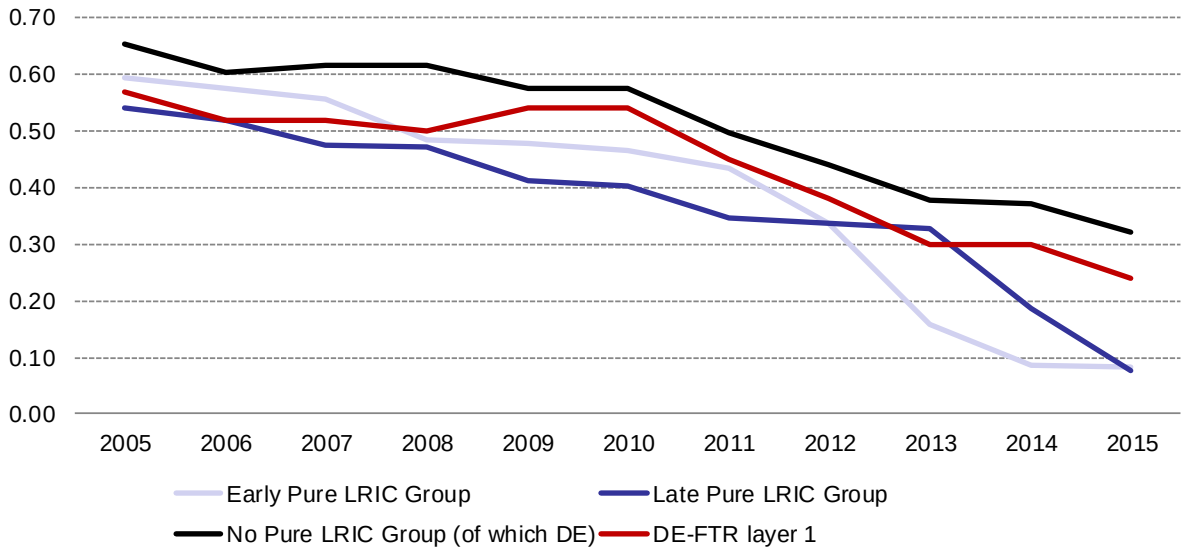
Eventually, although BNetZa noticed that on-net/off-net differentiation tended to disappear, it still exists in some cases.

8.9.2 Fixed market

8.9.2.1 *Quantitative analysis*

The level of German FTRs has been higher in average to all weighted groups' averages since 2014. In 2015 in particular, German FTR was two times higher than Early and Late Pure LRIC Groups, as presented in the figure below.

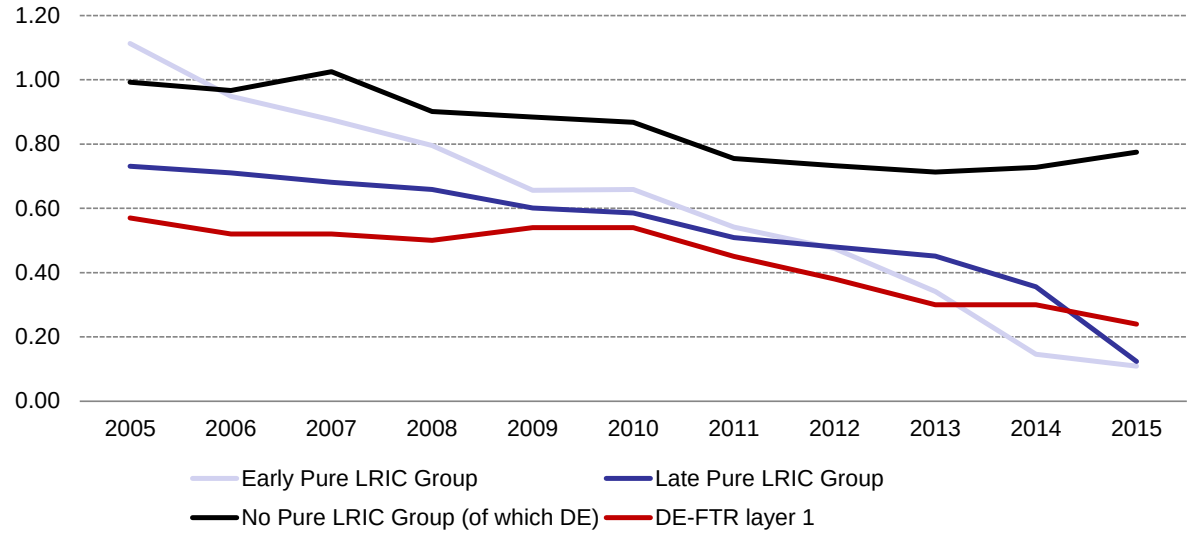
Figure 240 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 241 shows the flat average FTR for the three groups as opposed to the previous figure. In that case, German FTR is closer to Early and Late Pure LRIC Groups, even though it is higher in 2015.

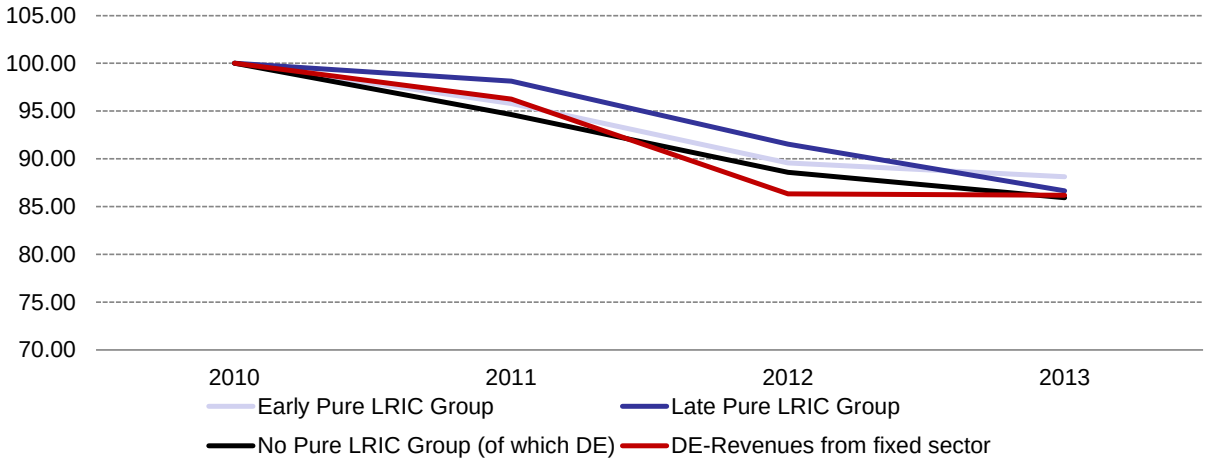
Figure 241 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 242 shows the steady decline of revenues from fixed-line market since 2009 for Germany and countries of the No Pure LRIC Group which have both followed a very comparable trend from 2010 to 2013.

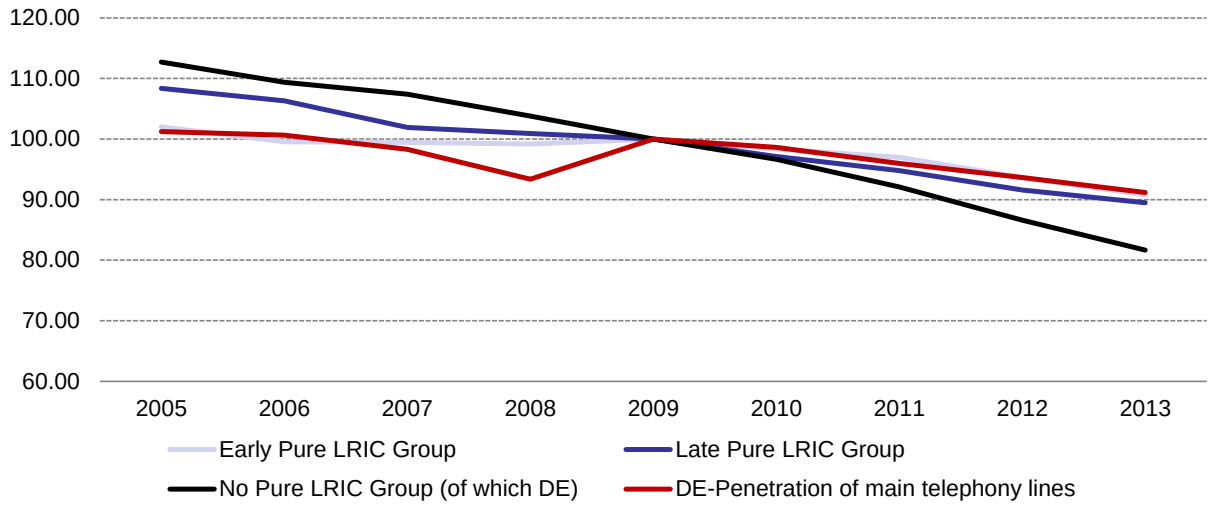
Figure 242 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Germany has shown a constant and slow decrease since 2005 (except in 2009), with a similar evolution to the penetration rate to Early and Late Pure LRIC Groups - rather than No Pure LRIC Group - also steadily decreasing as shown in Figure 243. The No Pure LRIC Group average penetration has been decreasing faster than the German penetration from 2009 to 2013.

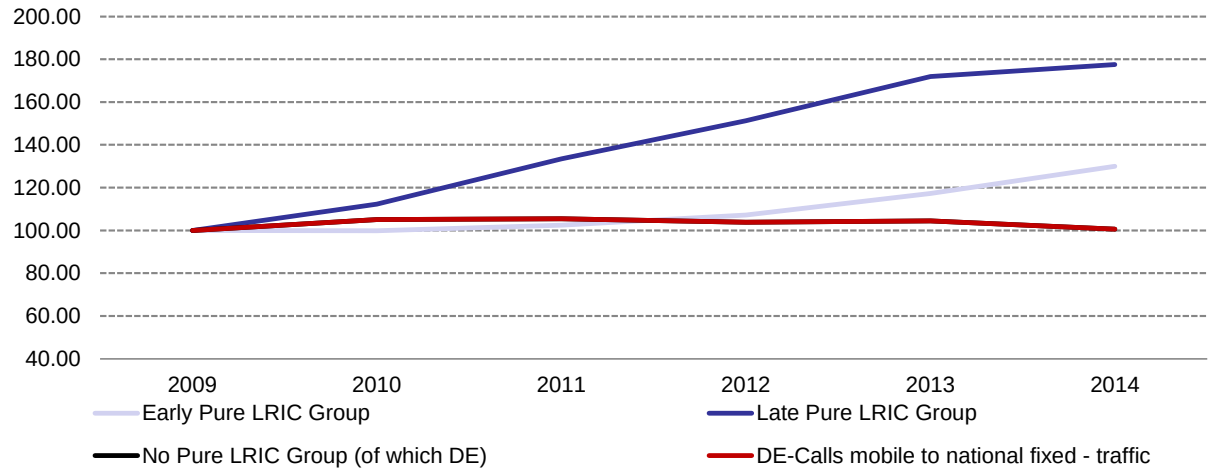
Figure 243 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of fixed national calls to mobile in Germany, presented in Figure 244, has been steady between 2009 and 2014, whereas it has been increasing for the Early and Late Pure LRIC Groups.

Figure 244 - Traffic of mobile calls to national fixed (base 100 in 2009)[153]



Source: BNetZa

8.9.2.2 *Evolution of retail fixed offers*

According to the BNetZa, retail fixed offers have been following a comparable trend to the mobile sector, with a lot of bundling offers including mostly broadband, television and telephony.

8.9.3 Summary

The tables below summarize, for each metric, the difference between Germany and the average metric for the No pure LRIC Group in order to highlight how Germany is positioned against its pair countries.

[153] From number of minutes

Figure 245 - Differences between Germany and its group for mobile markets

Metrics	Differences between the No Pure LRIC Group and Germany
Mobile revenues	Slower decrease than all groups, closer to No Pure LRIC Group than the two other groups
Mobile investments	Trend closer to Late Pure LRIC Group
Mobile retail prices	Not available
Mobile penetration	Trend closer to Late and Early Pure LRIC Groups in terms of SIM cards. Faster Increase than all groups in terms of unique subscribers
Competition in mobile	Close to No Pure LRIC level
On-net rate	Only country of its group where the information is available

Source: TERA Consultants

Figure 246 – Differences between the No Pure LRIC Group and Germany for the fixed market

Metrics	Differences between the No Pure LRIC Group and Germnay
Fixed revenue	Very close evolution to the No Pure LRIC Group
Traffic	Germany is the only country of this group available for this metric
Main telephony lines	Slower decrease than the No Pure LRIC Group

Source: TERA Consultants

8.10 Greece

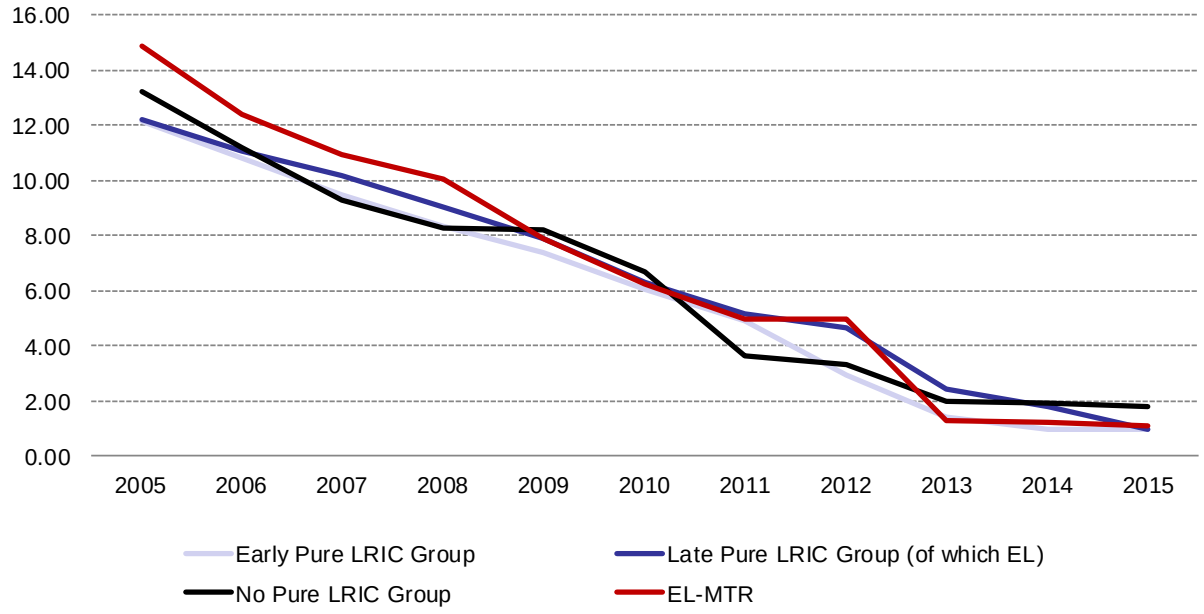
The incumbent OTE owned by Deutsche Telekom remains leading in both the fixed and mobile markets. Its two competitors in the mobile market are Vodafone (launched 1992) and Wind Hellas (launched 1992). The regulator EETT decided to implement the pure LRIC approach for the calculation of MTRs from 2015, and FTRs from 2017. Greece is therefore allocated to the “Late Pure LRIC group”.

8.10.1 Mobile market

8.10.1.1 *Quantitative analysis*

MTRs in Greece have been continuously dropping since 2005, following the European trend. Although Greece implemented Pure LRIC in 2015, its MTR has been comparable to the Early Pure LRIC Group’s average since 2013. In 2015, its level is the same as the Late Pure LRIC Group as observed in the figure below.

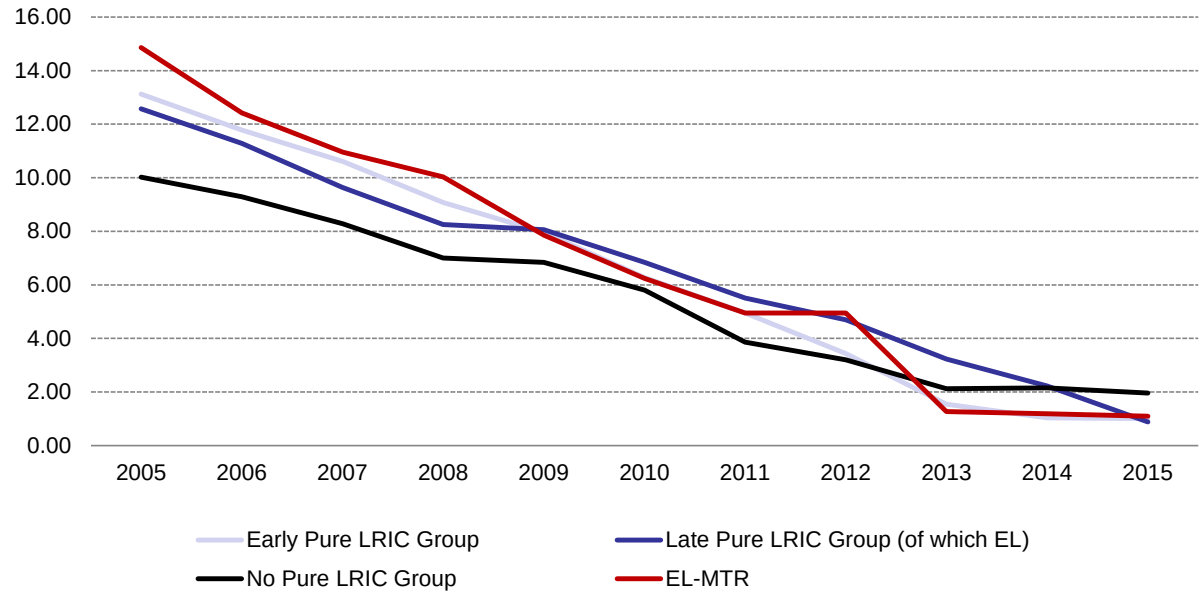
Figure 247 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 248). The trend is approximately the same as the weighted average trend: MTRs in Greece were in the European average until 2013 when it fell and were set at the same level as the Early Pure LRIC Group.

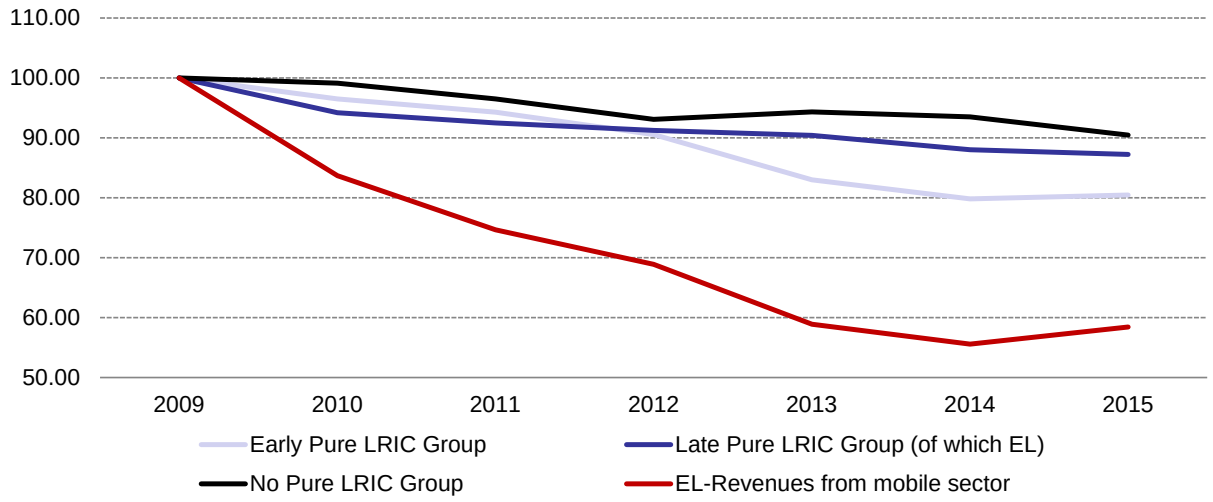
Figure 248 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in the figure below have shrunk between 2009 and 2014 (-45%), and slightly increased in 2015. However, since 2009, revenues in Greece have decreased far more than all groups. The economic downturn must have played a significant role in this evolution.

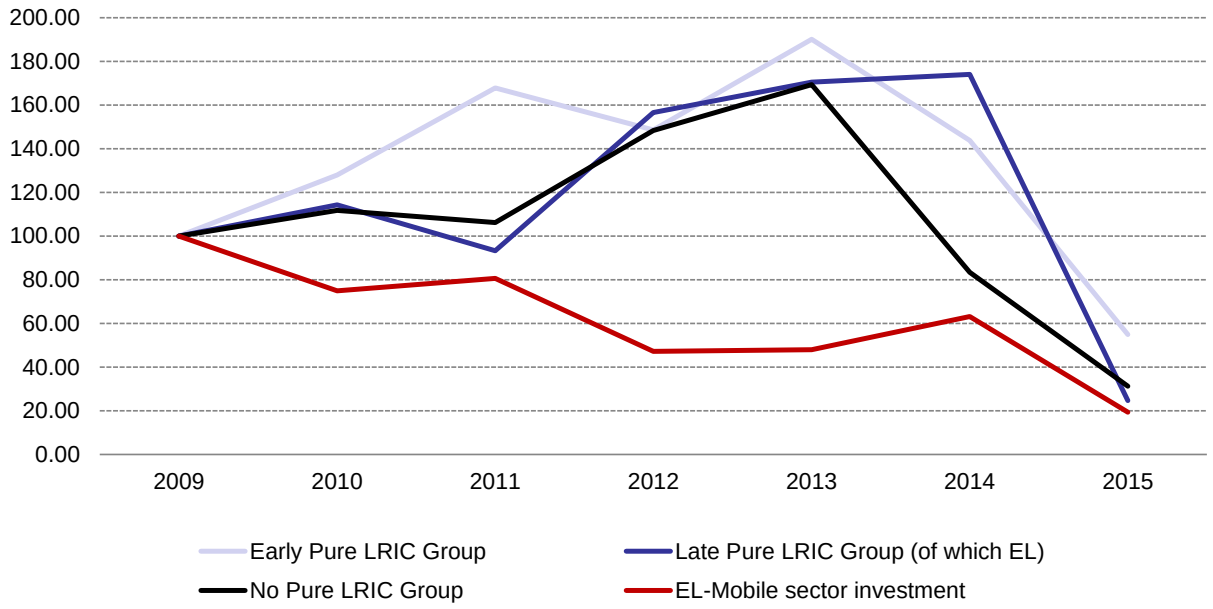
Figure 249 - Mobile revenues (base 100 in 2009)



Source: GSMA

Investments in the mobile sector in Greece are analysed in Figure 250. They have been continuously dropping since 2009, especially in 2012 and 2015, although between 2012 and 2014, investments have remained steady. Since 2012, the evolution of investments in Greece has been comparable to the Late Pure LRIC Group: steady from 2012 to 2014, then decreasing in 2015 (stronger decrease for the Late Pure LRIC Group however).

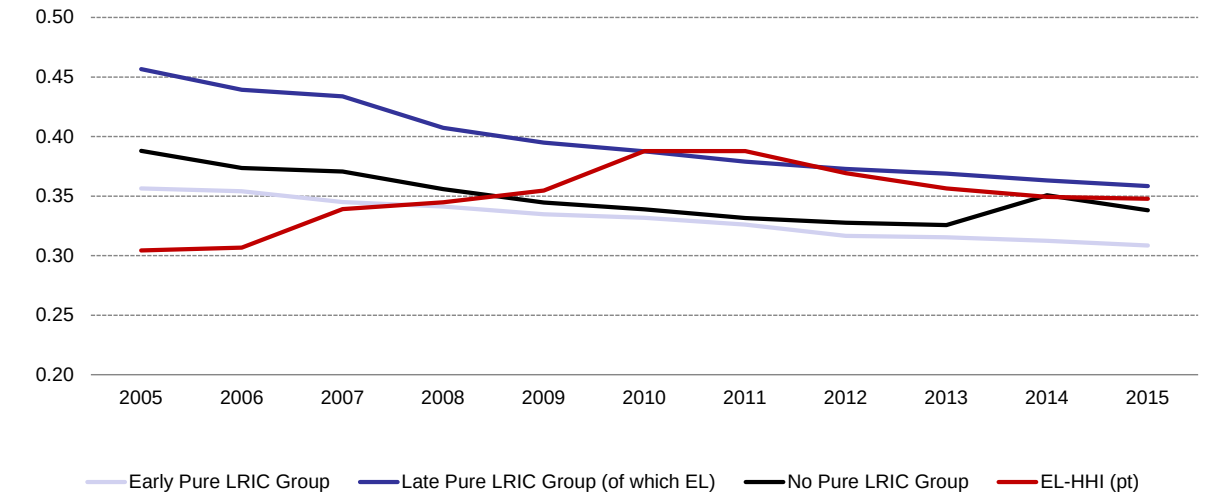
Figure 250 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the Greek mobile market. Between 2005 and 2009, the HHI measuring the degree of concentration of a given market has been continuously increasing following the merger between Q Telecom and WIND as well as the growing market share of the dominant operator Cosmote. Since 2010 however, the trend has been reversed and competition in Greece has been improving. It is in 2015 comparable to the Late and No Pure LRIC Groups, as observed with Figure 251. However, it is still higher than 2009 figure.

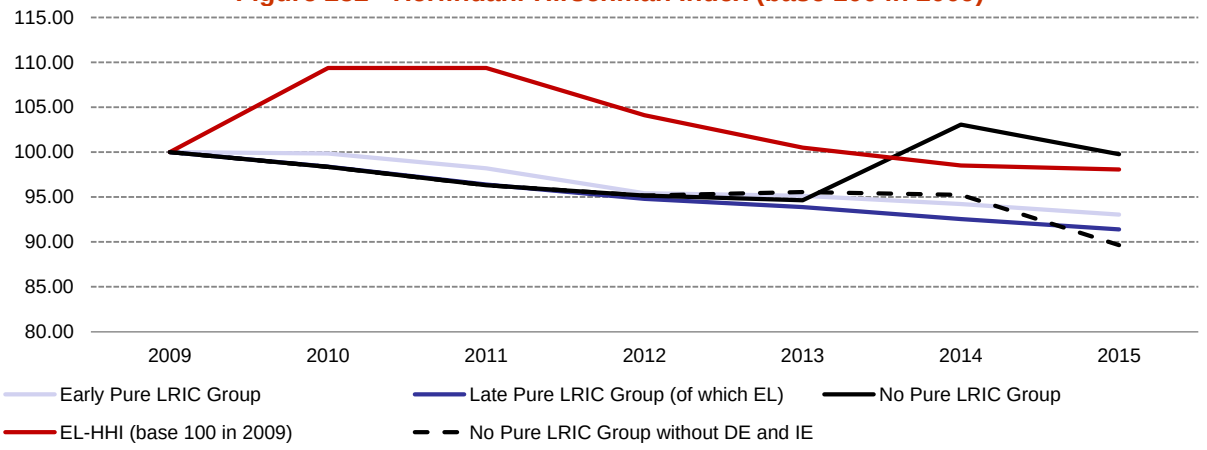
Figure 251 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Greece since 2009 can be noticed in the figure below: the HHI (as base 100 in 2009) has been continuously dropping since 2010 although it seems to bottom-out since 2014.

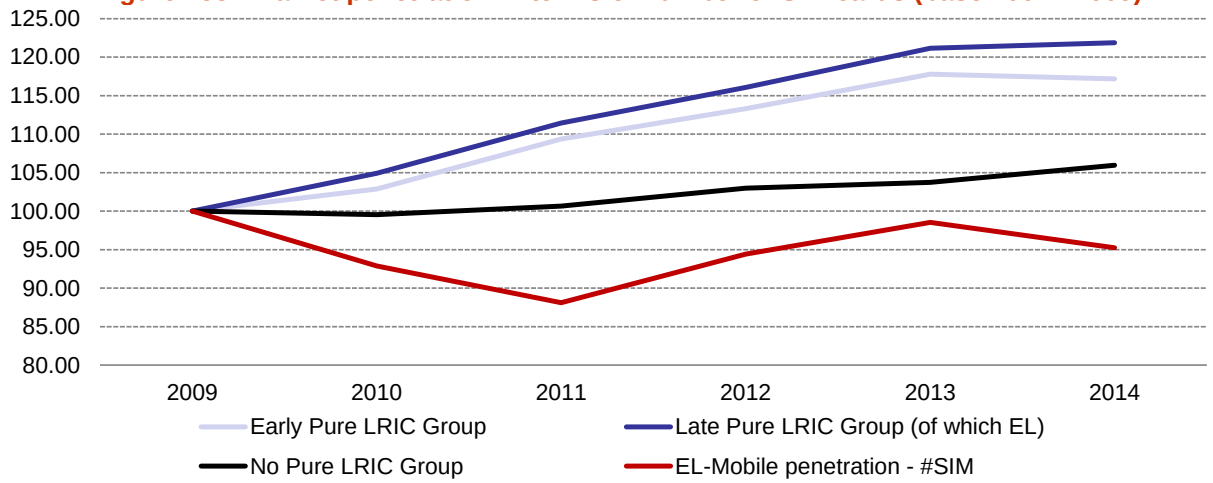
Figure 252 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Greek market penetration in terms of number of SIM has been decreasing from 2009 to 2011 whereas it has increased for all groups over the same period. It has then been growing from 2011 to 2013, and slightly decreased in 2014. Since market penetration has been increasing from 2009 to 2014 for all groups, as observed with Figure 253, it can be said that Greece does not follow the trend of any country.

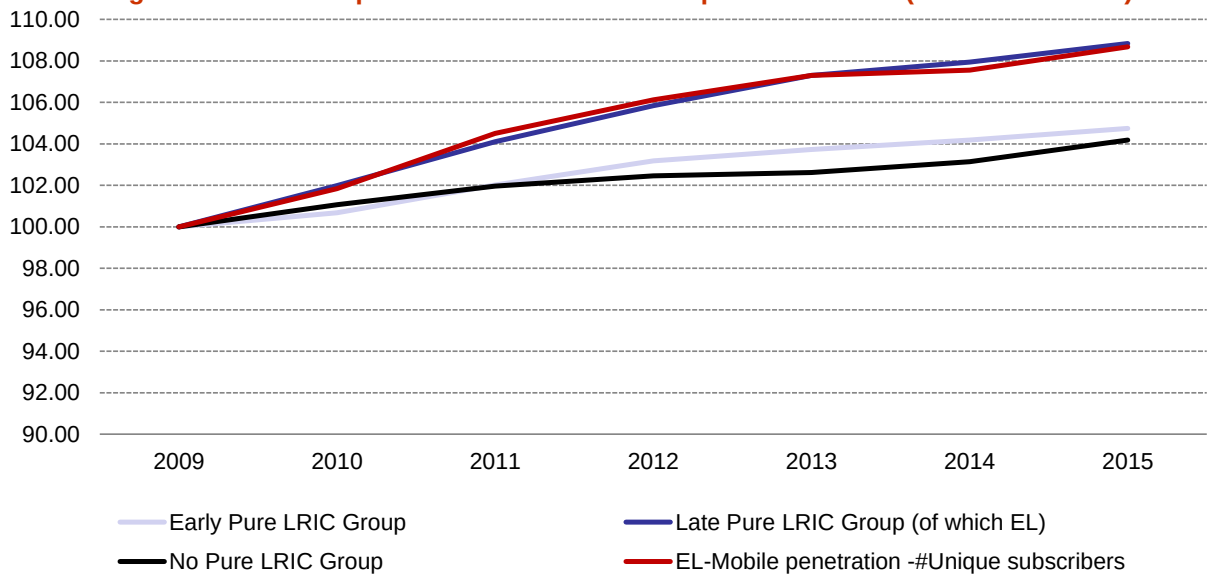
Figure 253 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Concerning the market penetration in terms of unique subscribers, it can be observed in the figure below that it has been continuously growing since 2009, in a very comparable way to the Late Pure LRIC Group.

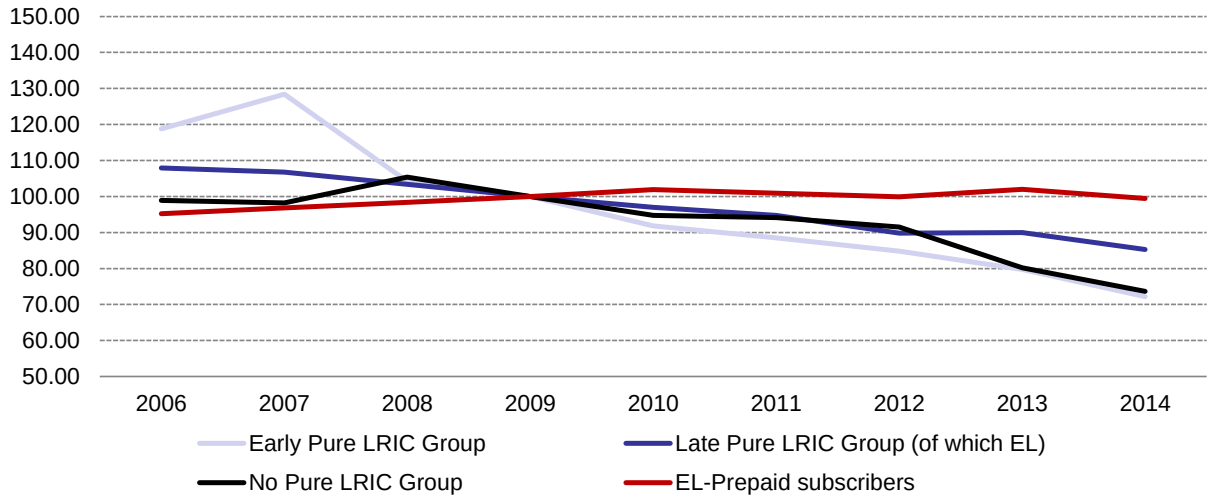
Figure 254 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 255 shows the share of prepaid subscribers in Greece compared to the three groups' averages. The share of prepaid customers in Greece has been extremely steady from 2005 to 2014 whereas it has been decreasing for all groups.

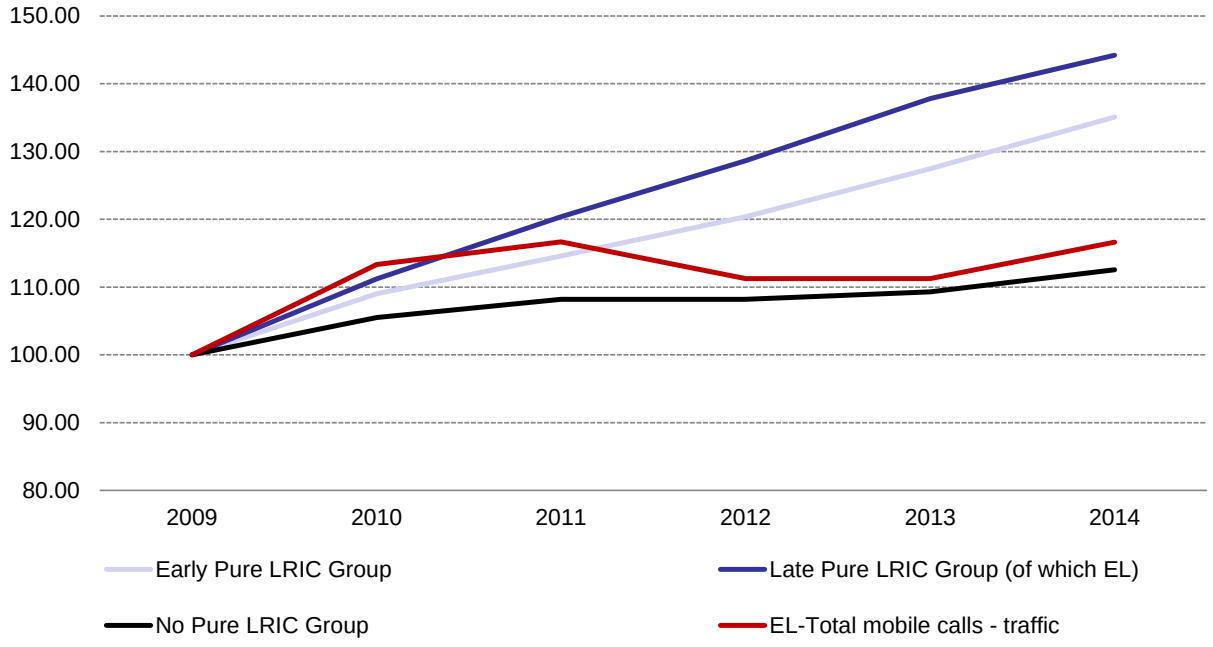
Figure 255 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The total amount of minutes of mobile calls in Greece observed in Figure 256 has been increasing from 2009 to 2011 following the Late Pure LRIC Group trend over this period. It then started decreasing, whereas all groups kept on increasing. It only started increasing again in 2014, and the global evolution of the amount of minutes of mobile calls in Greece has been closer between 2009 and 2014 to the No Pure LRIC Group.

Figure 256 - All mobile calls - traffic (base 100 in 2009)

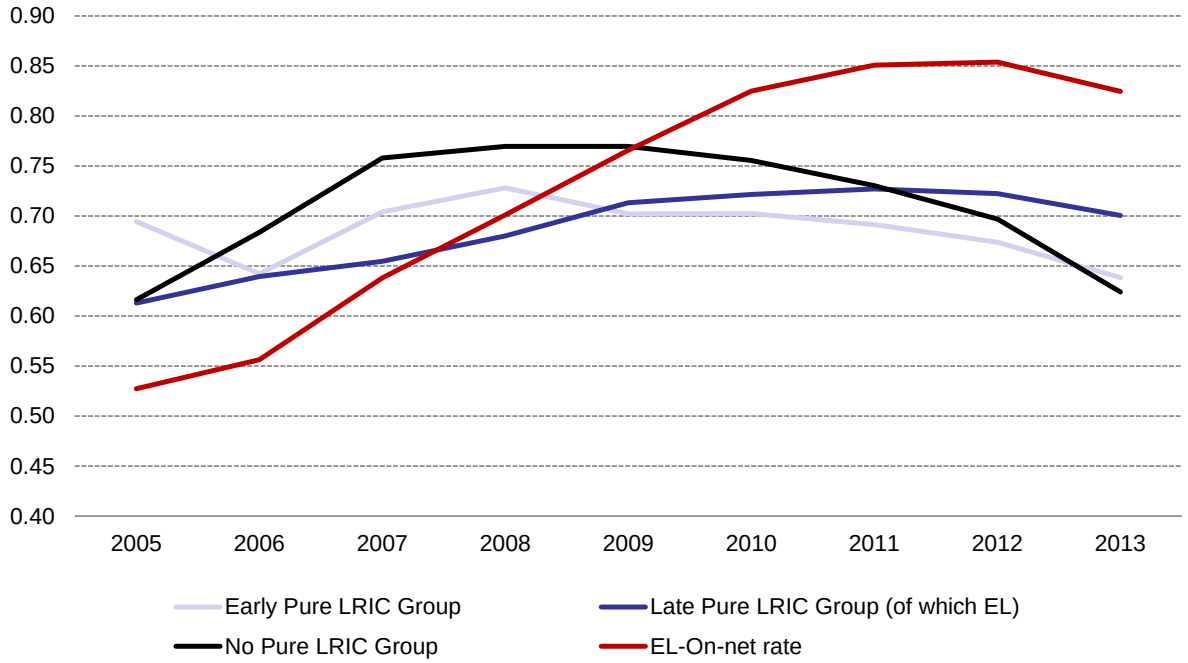


NRAs Replies to questionnaire

Figure 257 shows the share of on-net mobile calls in Greece, compared to the three groups. It can be observed that it has been strongly increasing from 2005 to 2011, more than the three groups. It then stabilized, and started decreasing in 2013, following the decline of minutes of

on-net mobile calls observed in previous figures, and reflecting EETT's observation about the slow decrease of on-net/off-net differentials.

Figure 257 - On-net rate of mobile calls (%)



Source: EETT

8.10.1.2 *Evolution of retail mobile offers*

According to EETT, small changes in the retail mobile offers occurred over the past few years.

EETT noticed that flat rate offers have been declining for 2-3 years. Furthermore, the on-net/off-net differentiation still exists, only slowly decreasing.

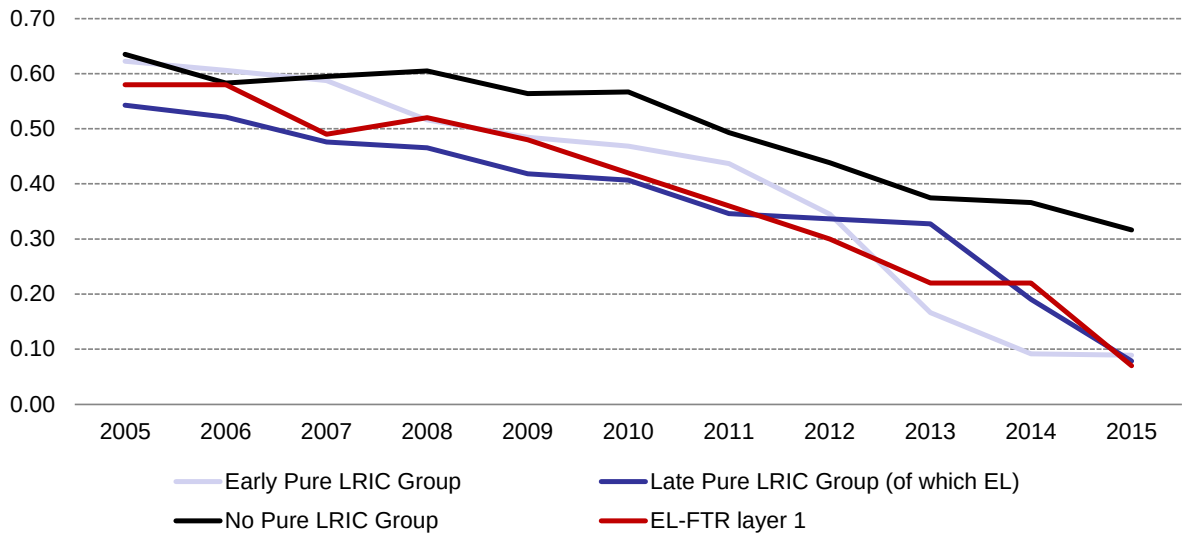
EETT stated that the lower MTR had an influence on lowering the differentiation, and the decrease of flat rate offers.

8.10.2 Fixed market

8.10.2.1 *Quantitative analysis*

Figure 258 shows the level of FTRs in Greece since 2005, compared to the weighted average FTR for the three groups. It can be observed that FTRs in Greece have remained in the low range of European figures from 2005 to 2015, and followed the Late Pure LRIC Group's declining trend in 2014 and 2015.

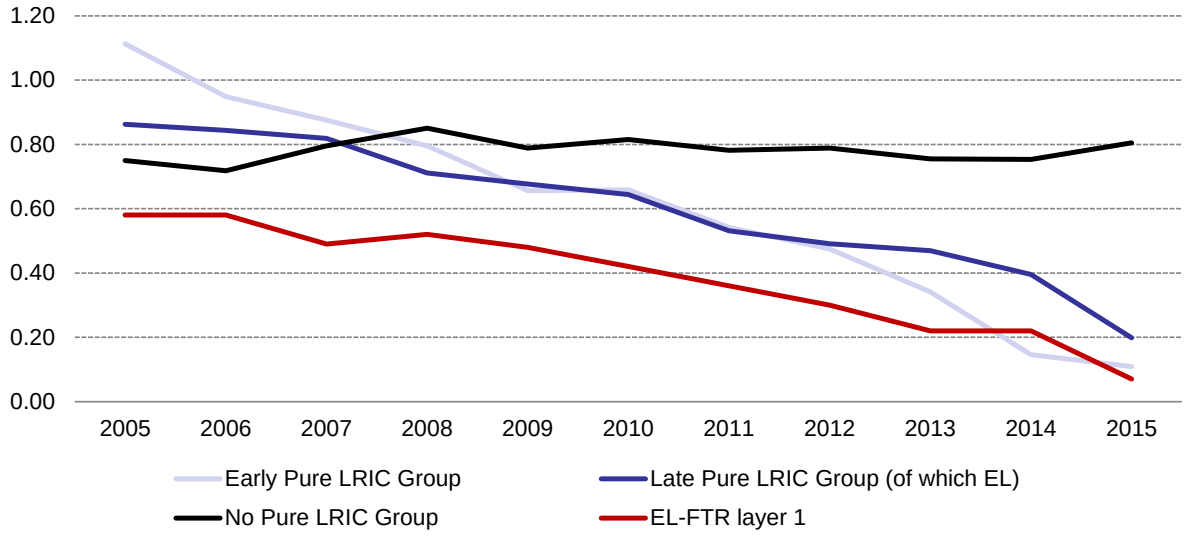
Figure 258 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 259 shows the flat average for the three groups as opposed to the previous figure. When comparing Greek FTRs to flat averages for the three groups, it can be observed that FTRs in Greece were among the lowest in Europe until 2014, and are now at the same level as the Early pure LRIC Group, slightly below the Late Pure LRIC Group.

Figure 259 - Fixed termination rates flat average - layer 1 (EURcts/min)

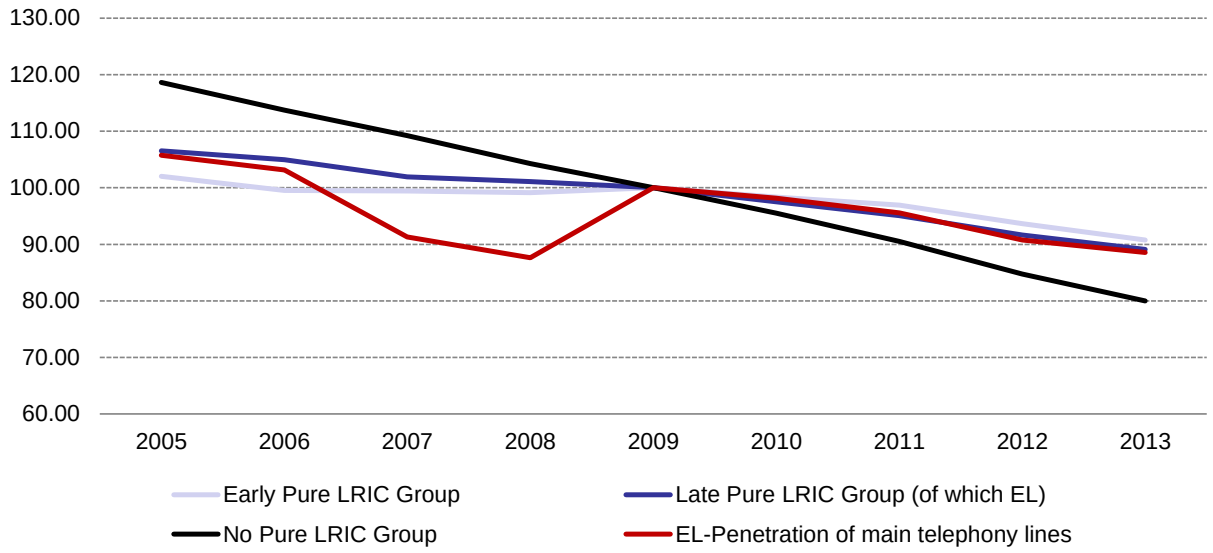


Source: TERA Consultants from BEREC & EC reports

The number of main telephony lines in Greece has shown a constant and slow decrease since 2009 with a similar evolution of the market penetration to the Early and Late Pure LRIC

Groups, also steadily decreasing as shown in the figure below. It can also be noticed that from 2005 to 2008, the market penetration of main telephony line had been shrinking.

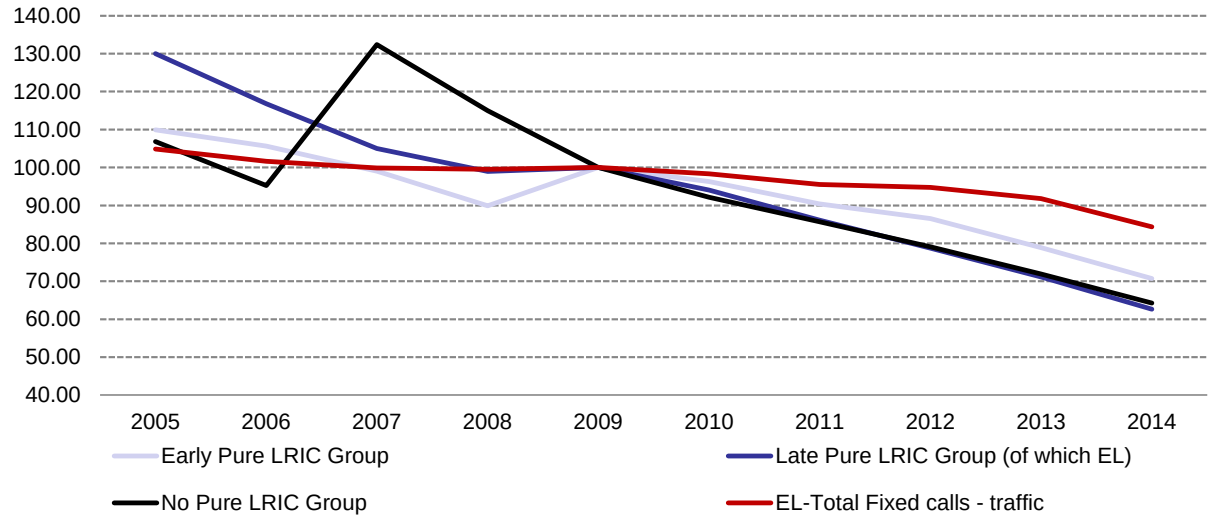
Figure 260 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of fixed national calls to mobile in Greece, presented in the figure below, has shown a steady decline between 2009 and 2014 such as the Early Pure LRIC Group, although the latter declined a bit faster.

Figure 261 Total minutes of fixed calls (base 100 in 2009)[154]



Source: EETT

8.10.2.2 *Evolution of retail fixed offers*

According to EETT, the evolution of the retail fixed offers has been similar to the one of the mobile sector, with an increase of minutes of calls included in bundles from fixed to mobile off-net.

[154] From number of minutes

International calls in Greece do not depend on the destination and are included in flat rate offers despite the difference in termination rates between all countries.

EETT noticed that the general reduction of termination rates may have facilitated the increase of fixed calls to mobile off-net.

8.10.3 Summary

The tables below summarize, for each metric, the difference between Greece and the average metric for the Late pure LRIC Group in order to highlight how Greece is positioned against its pair countries.

Figure 262 - Differences between Greece and its group for the mobile market

Metrics	Differences between the Late Pure LRIC Group and Greece
Mobile revenues	Way larger decrease than all groups
Mobile investments	Constant decrease, especially since 2014 like Late Pure LRIC group
Mobile retail prices	Not available
Mobile penetration	Decrease in terms of SIM cards unlike all groups, and followed Late Pure LRIC Group's trend in terms of unique subscribers
Competition in mobile	Decrease since 2005, is now on the level of Late Pure LRIC Group
On-net rate	In constant increase whereas its group has been decreasing

Source: TERA Consultants

Figure 263 – Differences between the Late Pure LRIC Group and Greece for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Greece
Fixed revenue	Not available
Traffic	Slower decrease than the Late Pure LRIC Group
Main telephony lines	Similar to the Late Pure LRIC Group

Source: TERA Consultants

8.11 Finland

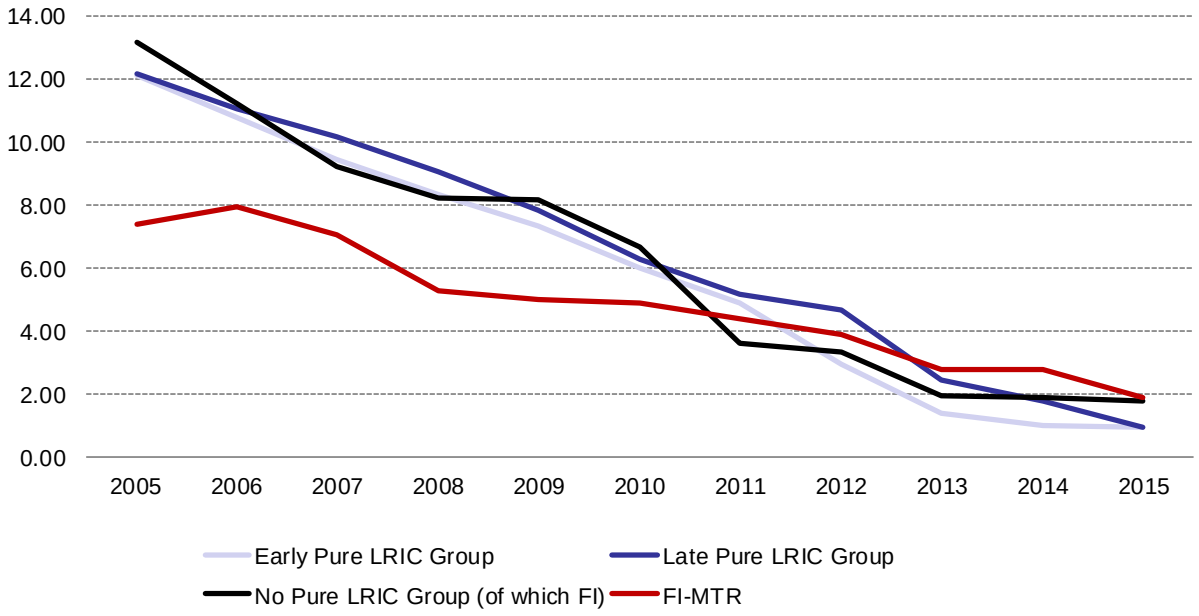
Finland's largest operator is TeliaSonera, born from the 2003 merger of Sonera, and Telia, respectively Finnish and Swedish incumbents. The Finnish mobile market is characterized by a strong level of competition with two notable operators apart from TeliaSonera: Elisa (1882) which launched GSM services in 1991 and DNA (2000). The Regulatory Authority FICORA currently does not plan to implement the pure LRIC approach for termination rates calculation and is then allocated to the "No Pure LRIC group".

8.11.1 Mobile market

8.11.1.1 *Quantitative analysis*

Figure 264 shows the level of MTRs in Finland, compared to the three groups' weighted average MTRs. It can be observed that Finnish MTRs were below all groups from 2005 to 2011, but decreased slower than all other groups, and almost double Early and Late Pure LRIC Groups' averages in 2015, and remain at the same level as the ones of the No Pure LRIC Group. However, MTRs in Finland have significantly decreased in December 2015 and are now set at 1.25 EURcents/min.

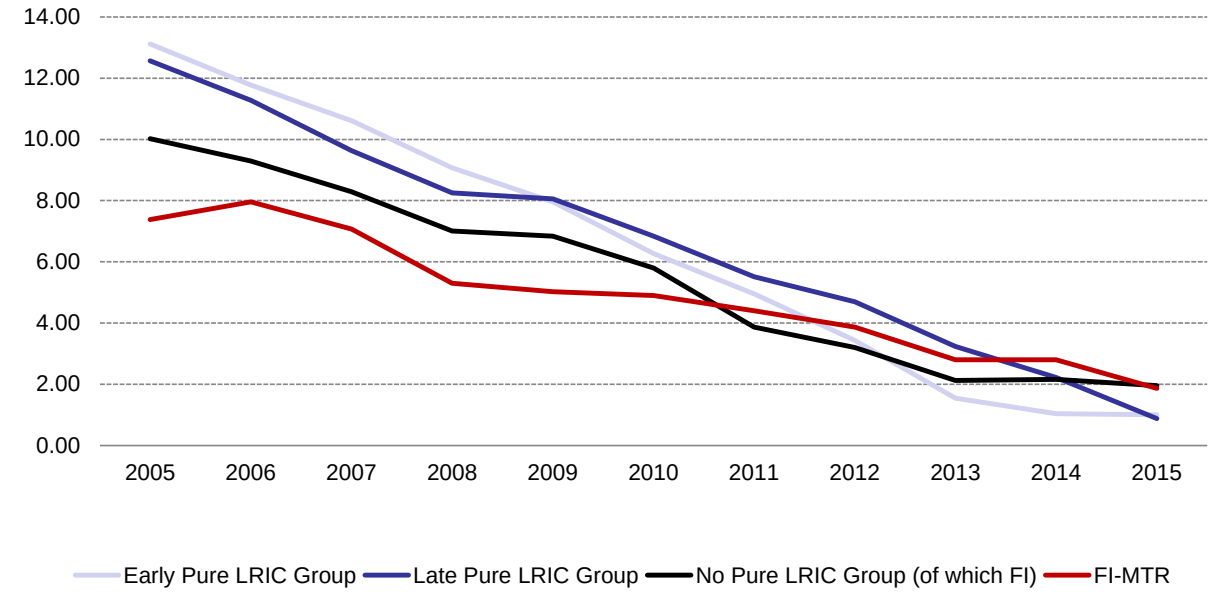
Figure 264 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group as observed in the figure below. The trend is very comparable to the previous figure, with a slower decline of MTR in Finland than all groups, and a higher level in 2015.

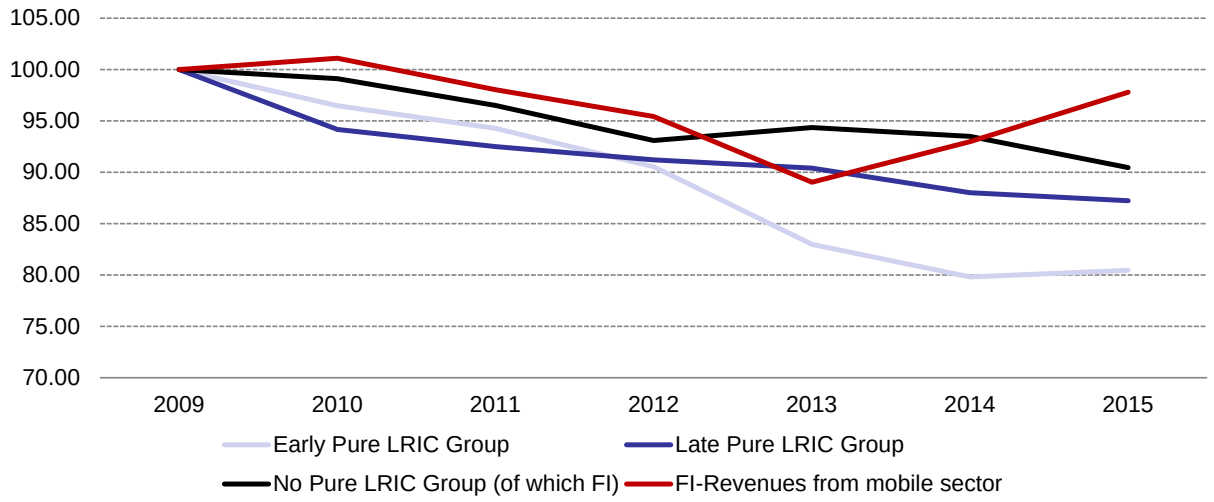
Figure 265 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in the figure below have been decreasing from 2009 to 2013, following the European trend. Then, revenues increased from 2013 to 2015.

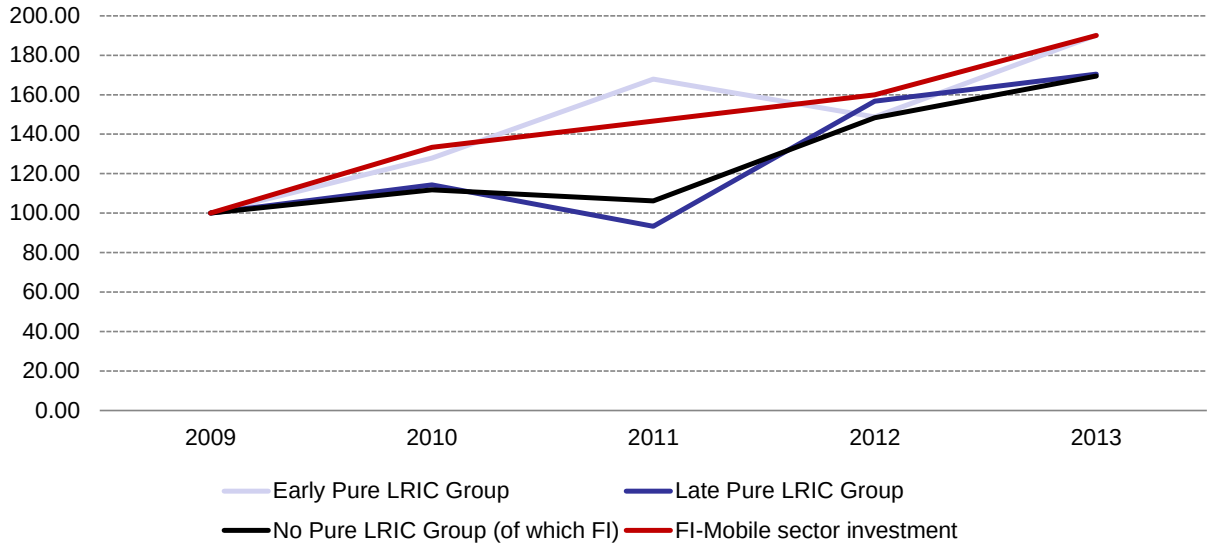
Figure 266 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

The evolution of investments in the mobile sector in Finland is analysed in the figure below. They have been continuously increasing since 2009, and have been relatively comparable to the Early Pure LRIC Group since 2009

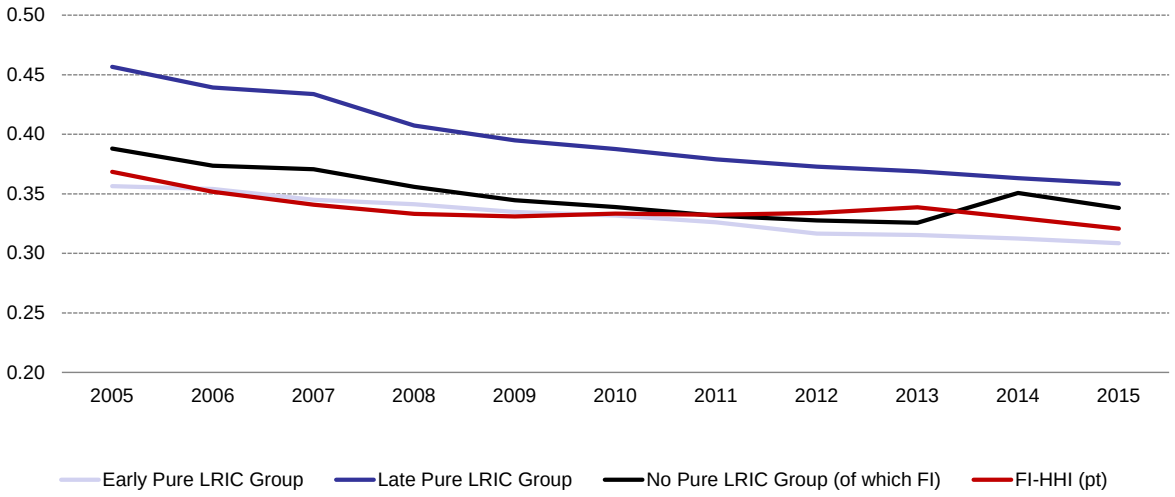
Figure 267 - Mobile investments (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators (MNOs) are competing in the Finnish mobile market. The improvement in the level competition in the mobile market since 2005 can be noticed with the overall decrease of the Herfindahl-Hirschman Index since 2005 in Finland. From 2005 to 2010, it has been remaining closer to the Early Pure LRIC Group, which then declined faster. In 2015, the HHI in Finland is above the Early Pure LRIC Group but lower than its group average.

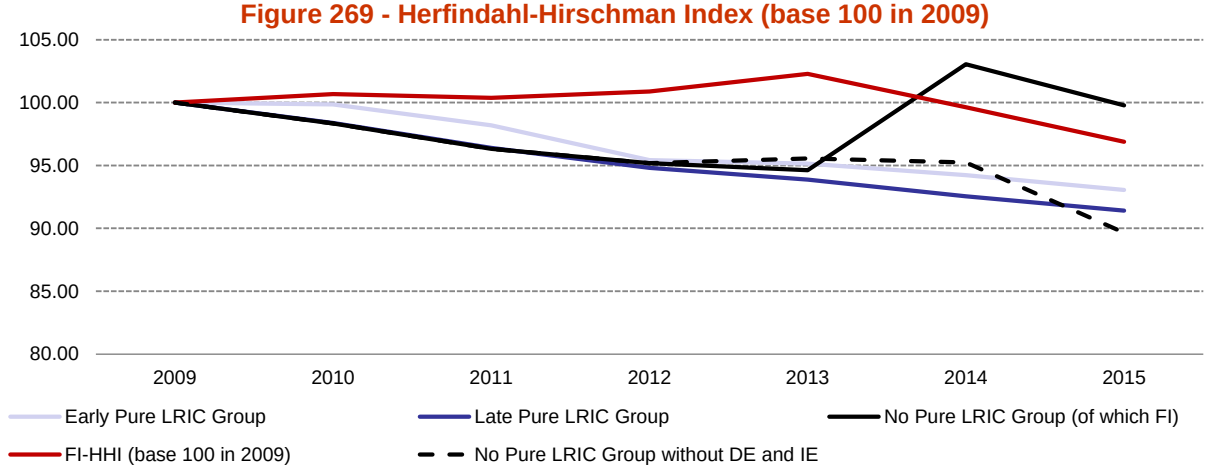
Figure 268 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

Figure 269 shows the evolution of the HHI (as base 100 in 2009) in Finland and in the three groups of countries. It can be observed that it has been pretty constant from 2009 to 2013, and then started decreasing.

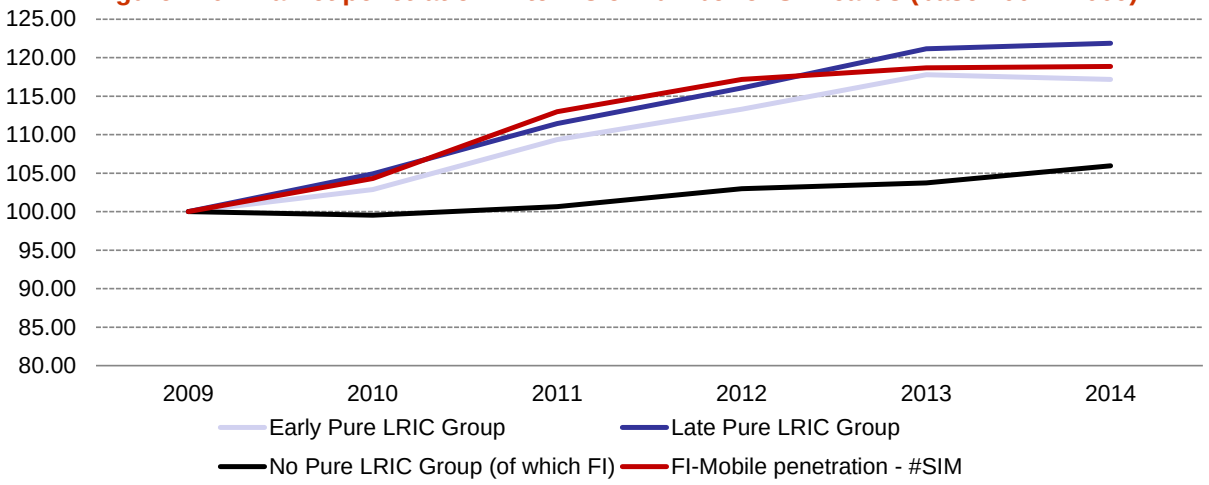
Figure 269 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Finland's market penetration in terms of number of SIM observed in the figure below has been continuously increasing since 2009, with a similar trend to the Early and Late Pure LRIC Groups, and way more than its group average.

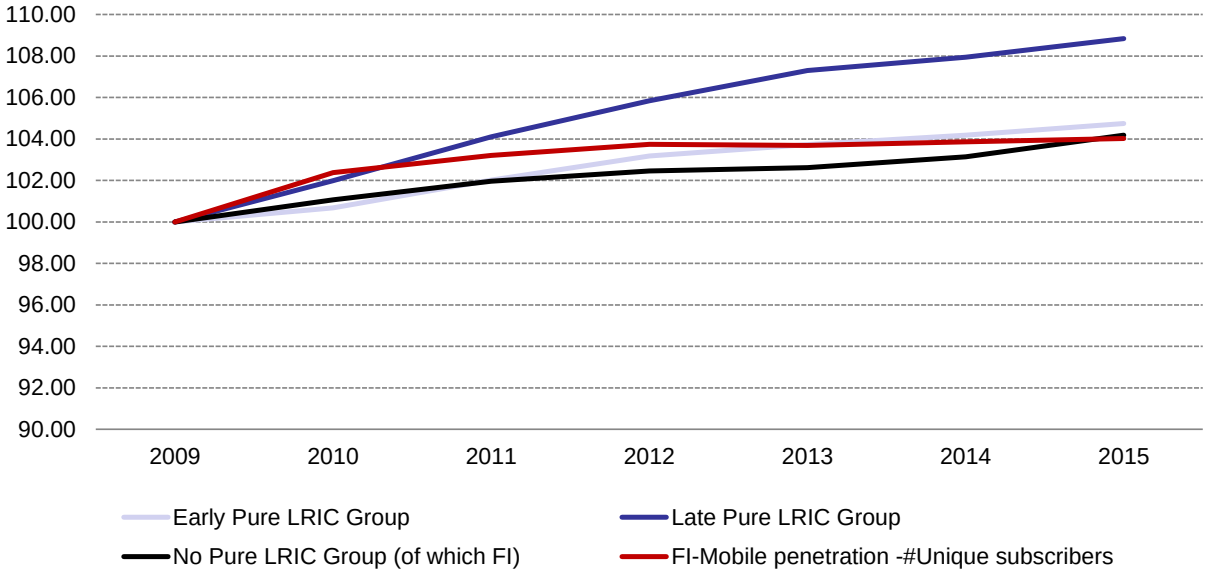
Figure 270 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Also analysed in terms of unique subscribers, the market penetration in Finland has been increasing as well, following a comparable trend to the No Pure LRIC Group from 2009 to 2015, as observed in the figure below.

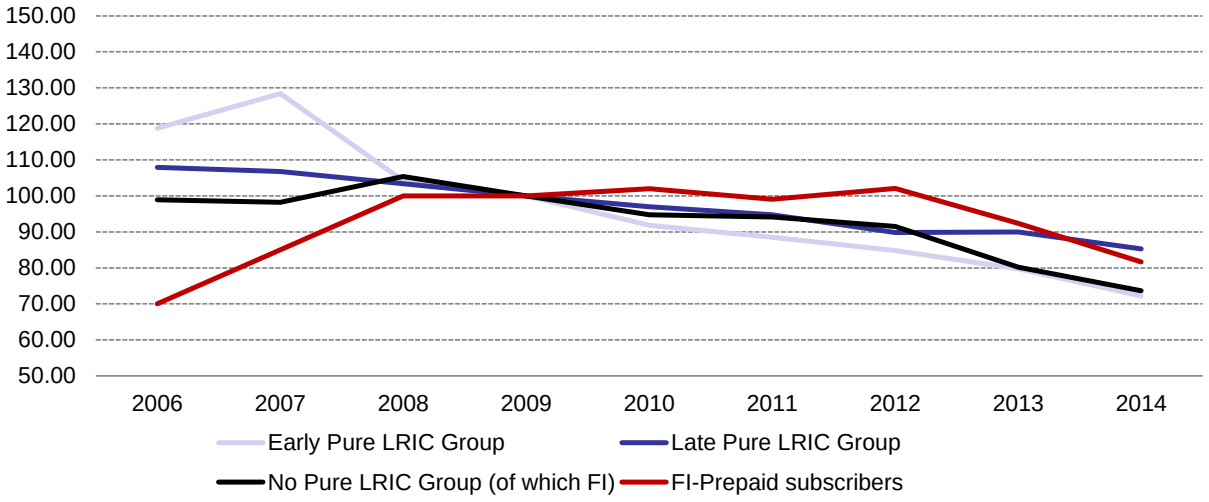
Figure 271 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 272 shows the share of prepaid subscribers in Finland, compared to the three groups. It can be observed that it has been remaining steady from 2008 to 2012, and then started decreasing. In comparison, all groups have been decreasing since 2009.

Figure 272 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

8.11.1.2 *Evolution of retail mobile offers*

According to FICORA, the past few years have seen the generalization of flat rate offers including on-net and off-net calls, SMS and data, but usually not calls to other countries.

Usage-based pricing offers are also common in Finland, and are commercially successful.

FICORA also noticed that on-net/off-net differentiation hardly existed, and on-net and off-net calls usually have similar prices. However, calls to international have different prices based on the country of destination.

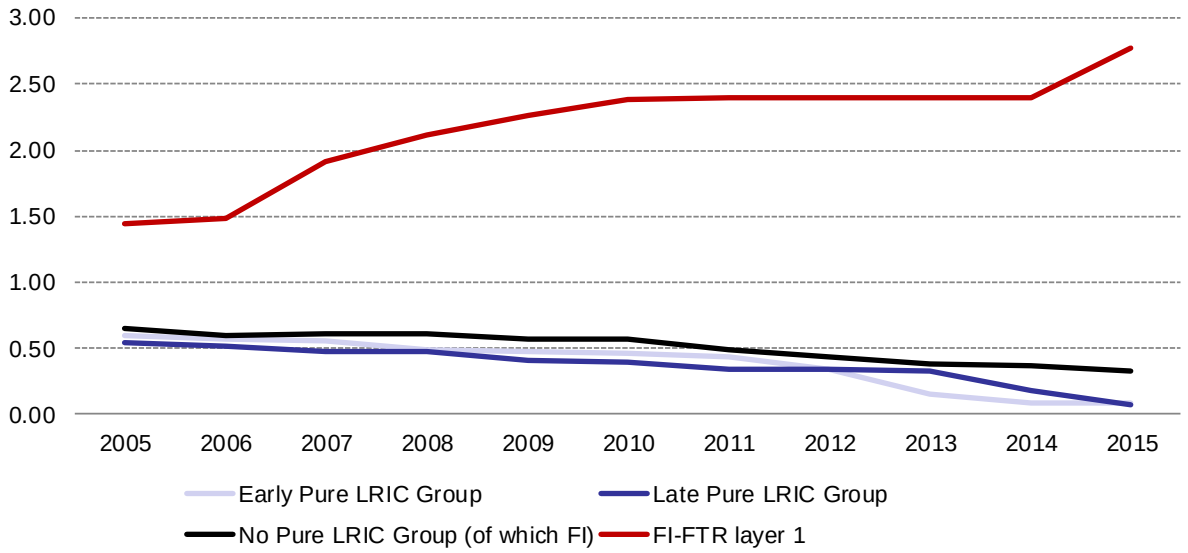
FICORA considers that "*symmetrical MTRs have promoted the development of flat rate offers and unified pricing of on-net and off-net calls.*"

8.11.2 Fixed market

8.11.2.1 *Quantitative analysis*

The level of FTR in Finland observed in Figure 273 has been constantly way above all other countries from 2005 to 2015. In 2015 especially, Finnish FTRs were more than three times higher than the second highest, and more than nine times higher than the European average (2.8€cent).

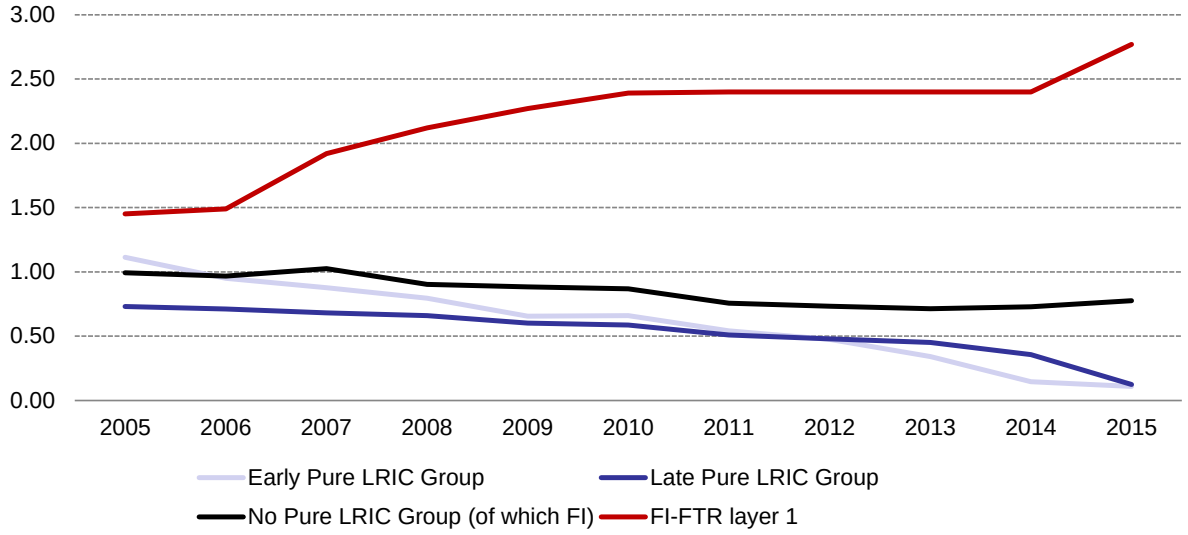
Figure 273 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 274 shows the flat average for the three groups as opposed to the previous figure. The same trend can be observed, FTR in Finland being way above all other countries.

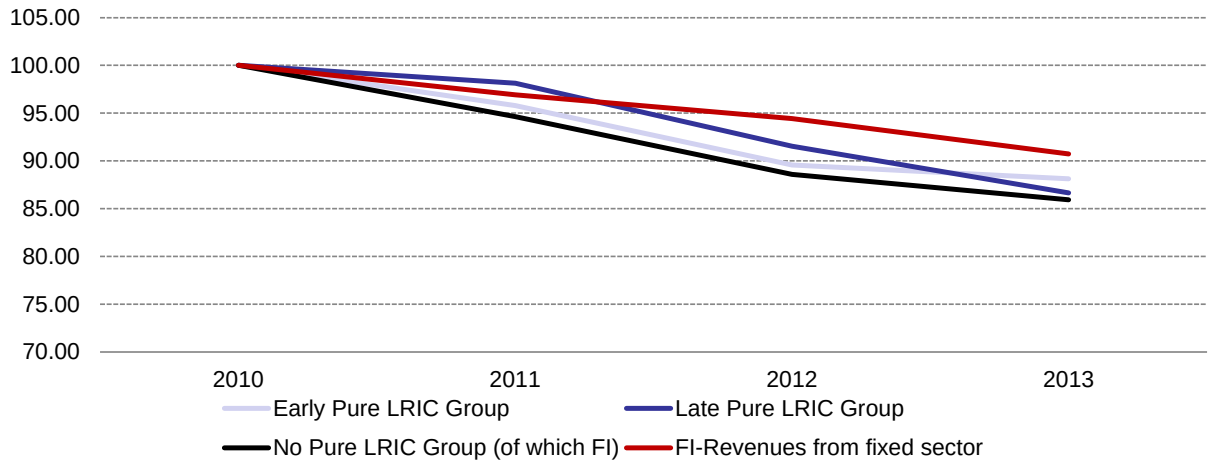
Figure 274 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 275 shows the slow and constant decline of revenues from fixed-line market since 2009 for Finland. Comparing Finland and No Pure LRIC Group, it can be observed that revenues in the No Pure LRIC Group have decreased faster than in Finland. By the end of 2013, the evolution of revenues from fixed-line market in Finland has been closer to the Early Pure LRIC Group.

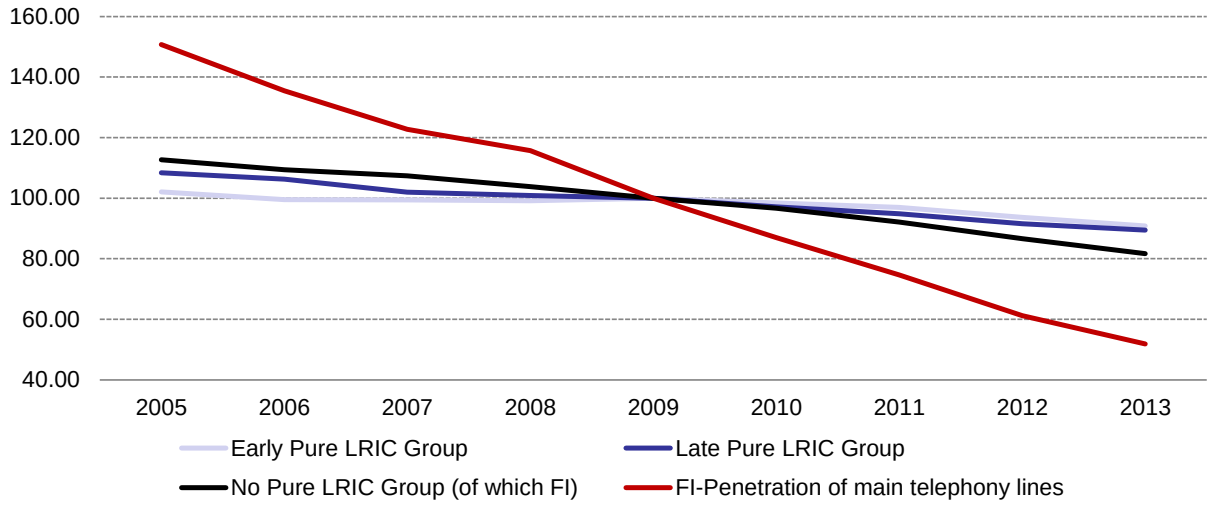
Figure 275 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Finland has shown a constant and fast decrease since 2005 whereas all groups have been decreasing way slower. In 2015, the market penetration of main telephony lines in Finland is one of the lowest in Europe (14%) as observed with the figure below.

Figure 276 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.11.2.2 *Evolution of retail fixed offers*

According to FICORA, the retail fixed market has become marginal in Finland, and operators are no longer interested in developing new offers.

FICORA also observed that there was no development of converging offers between fixed and mobile markets.

8.11.3 Summary

The tables below summarize, for each metric, the difference between Finland and the average metric for the No Pure LRIC Group in order to highlight how Finland is positioned against its pair countries.

Figure 277 - Differences between Finland and its group

Metrics	Differences between the No Pure LRIC Group and Finland
Mobile revenues	Increased since 2013 contrary to all groups
Mobile investments	Followed Early Pure LRIC trend between 2009 and 2013
Mobile retail prices	Not available
Mobile penetration	Same trend as Early and Late Pure LRIC groups in terms of SIM cards, same trend as No Pure LRIC Group in terms of unique subscribers
Competition in mobile	Followed a similar trend to No Pure LRIC Group

Source: TERA Consultants

Figure 278 – Differences between the No Pure LRIC Group and Finland for the fixed market

Metrics	Differences between the No Pure LRIC Group and Finland
Fixed revenue	Slower decrease than the No Pure LRIC Group
Traffic	Not available
Main telephony lines	Much faster decrease than all groups

Source: TERA Consultants

8.12 France

The telecom market in France is the third largest in Europe. The mobile sector in particular is supported by 77 million subscriptions with four operators. Both fixed and mobile sectors are dominated by the incumbent Orange (formerly France Telecom), one of the world's major player. The large amount of MVNOs and the emergence of Free Mobile in 2012 put great pressure on prices among MNOs SFR (launched 1987), Orange's main competitor sold to Atlice by Vivendi in 2014, and Bouygues Telecom (launched 1994). France is allocated to the "Early Pure LRIC group" since ARCEP, the French regulator, took the decision in 2011 to implement pure LRIC from 2013.

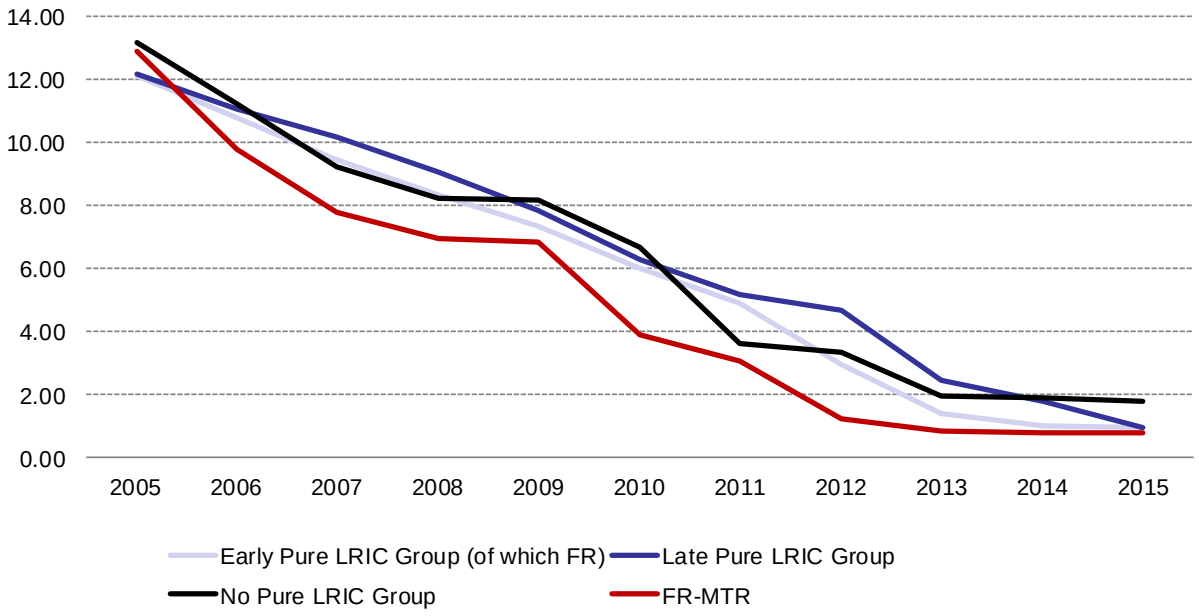
NB: the evolution of retail offers, as described by the NRA, is described for both fixed and mobile markets in section 8.12.3.

8.12.1 Mobile market

8.12.1.1 *Quantitative analysis*

Figure 279 shows the constant decrease of MTRs in France since 2005. From 2005 to 2012 they have been declining faster than all groups, then bottomed-out after the implementation of the Pure LRIC approach. It is in 2015 on the same level as the Early Pure LRIC Group.

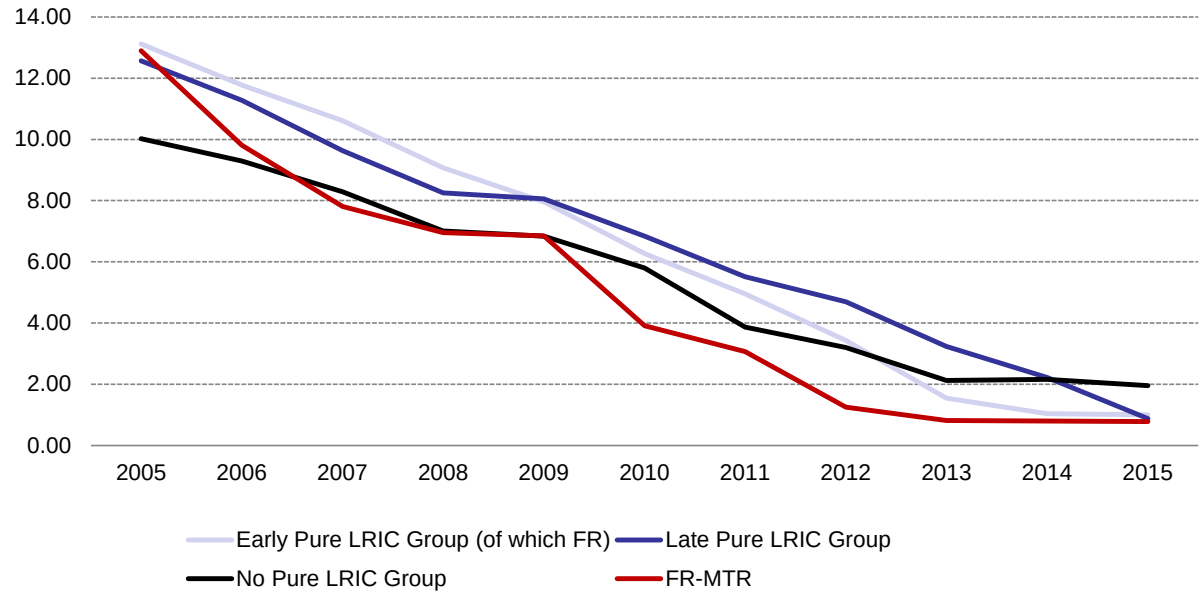
Figure 279 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 280). The trend is very comparable to the previous figure with the faster decline of French MTR compared to the three groups until 2012.

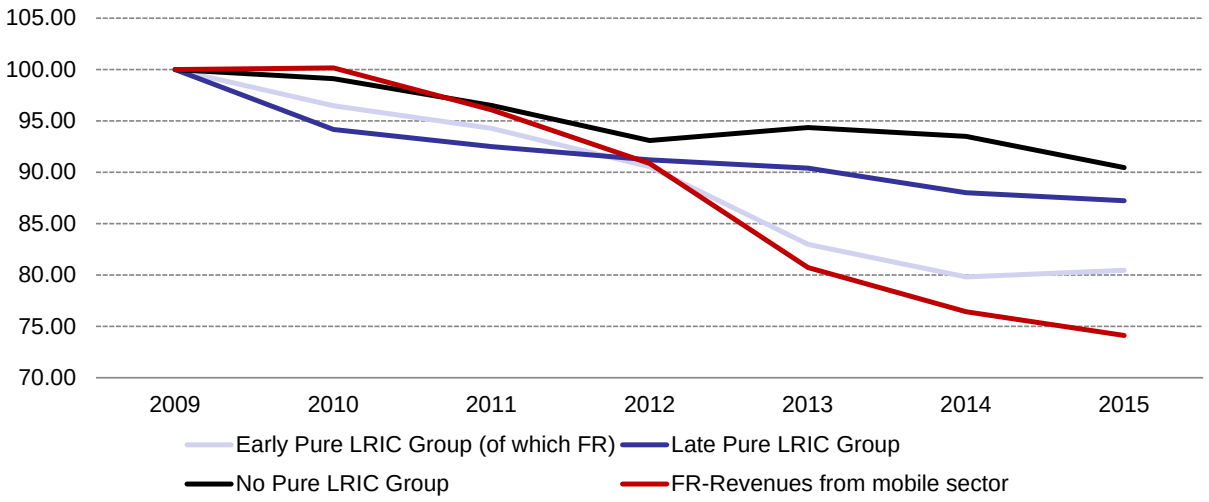
Figure 280 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

French revenues from the mobile sector, displayed in the figure below have been steadily declining since 2010, following a similar trend to the Early Pure LRIC Group.

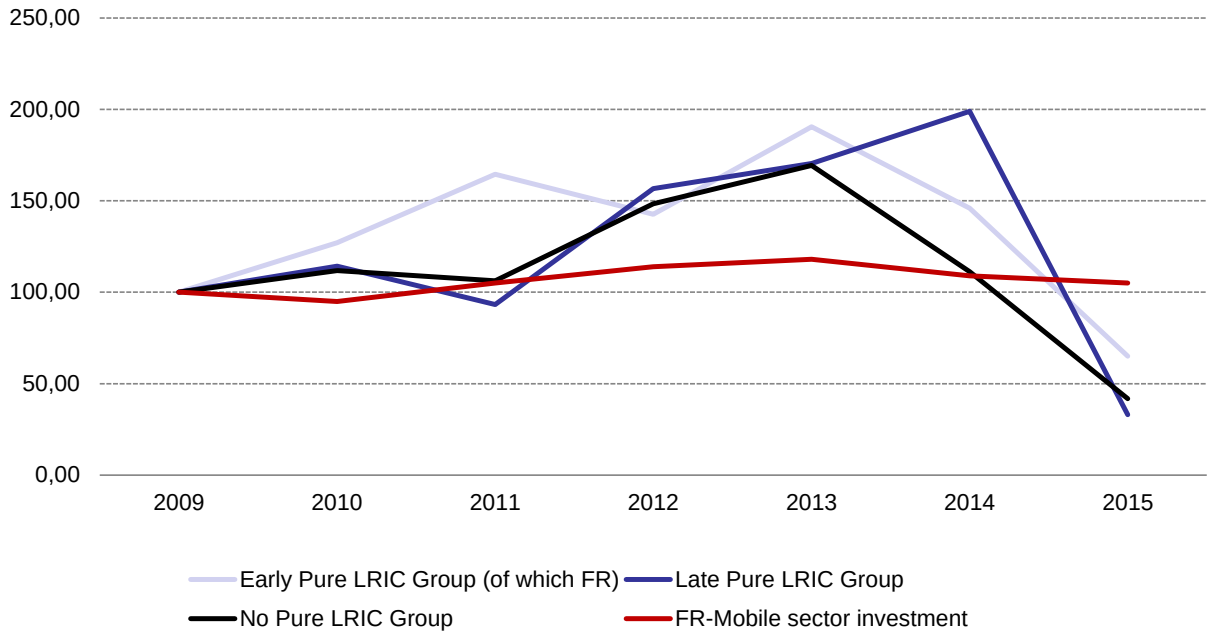
Figure 281 - Mobile revenues (base 100 in 2009)



Source : GSMA

Investments in the mobile sector in France have been growing from 2009 to 2013, and then started decreasing a year earlier than Early and No Pure LRIC Groups. However, investments have not decreased as much as in the other groups and remained higher than in most countries of the EU..

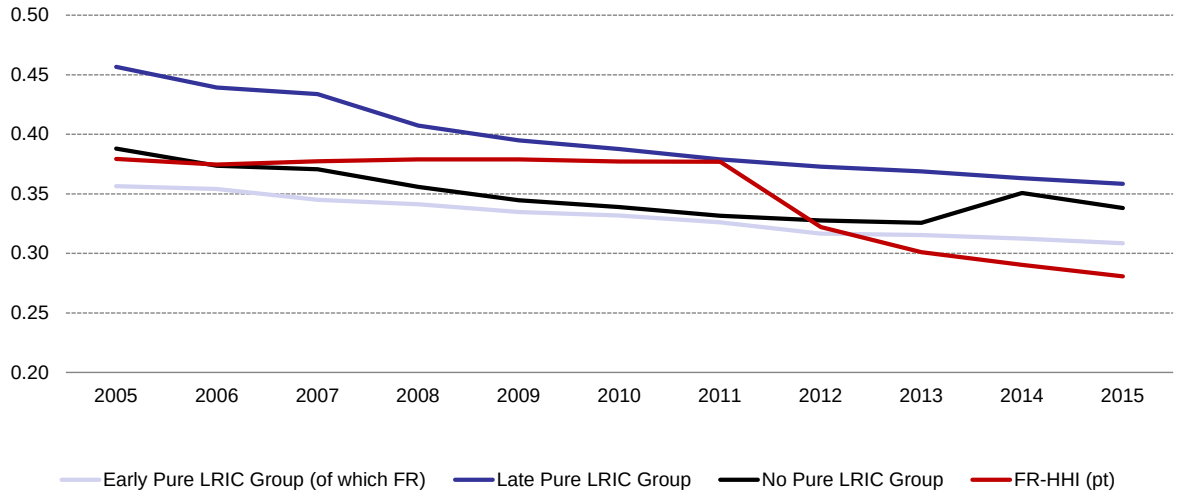
Figure 282 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators (MNOs) are competing in the French mobile market. The decrease of the level of concentration in the mobile market can be noticed in particular since 2012 and the entry of Free Mobile in the market (see figure below). Before 2011, the HHI in France had been remaining steady, above Early and No Pure LRIC Groups' averages. It then started decreasing and is now below all groups.

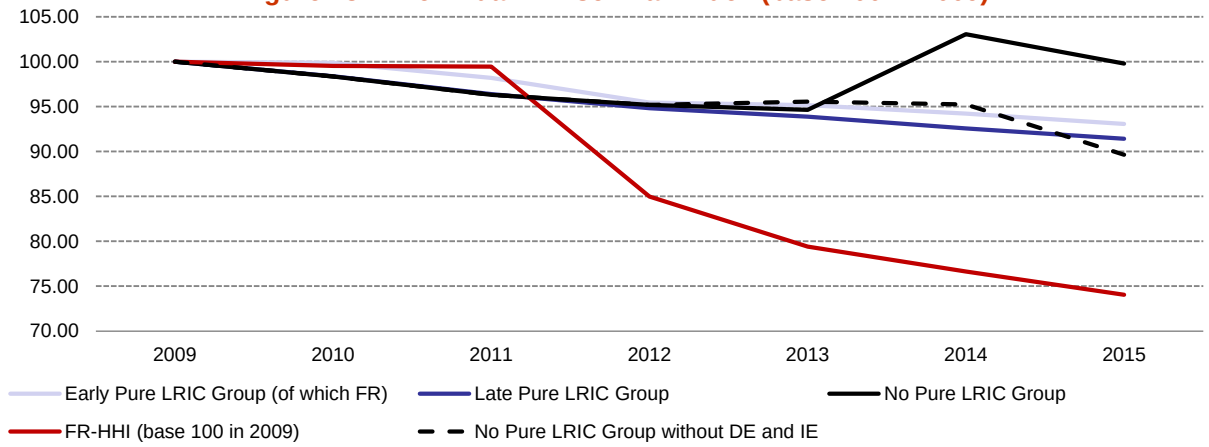
Figure 283 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in France since 2011 can be noticed in the figure below: the HHI (as base 100 in 2009) has been continuously dropping, more than any other group.

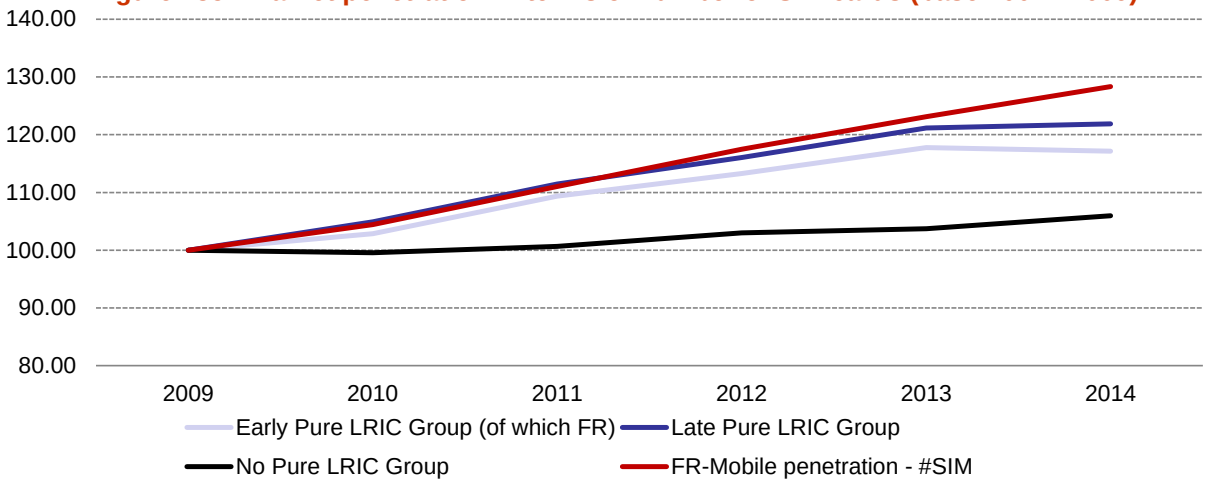
Figure 284 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The French market penetration in terms of number of SIM has been increasing since 2009, and kept on growing in 2014 whereas the one of the Early and Late Pure LRIC Groups ended their upward trend and remained steady, as observed with Figure 285.

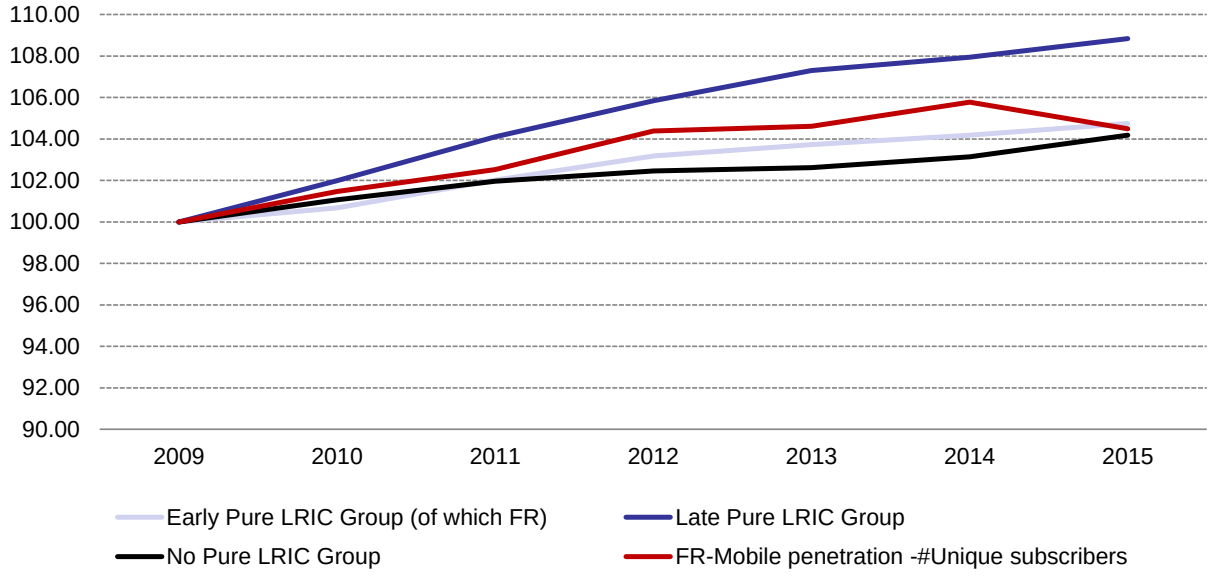
Figure 285 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The market penetration in terms of unique subscribers in France analyzed in Figure 286 has also been growing from 2009 to 2014. In 2015 however, it slightly decreased, and was in 2015, at the same level of evolution since 2009 as the Early and No Pure LRIC Groups.

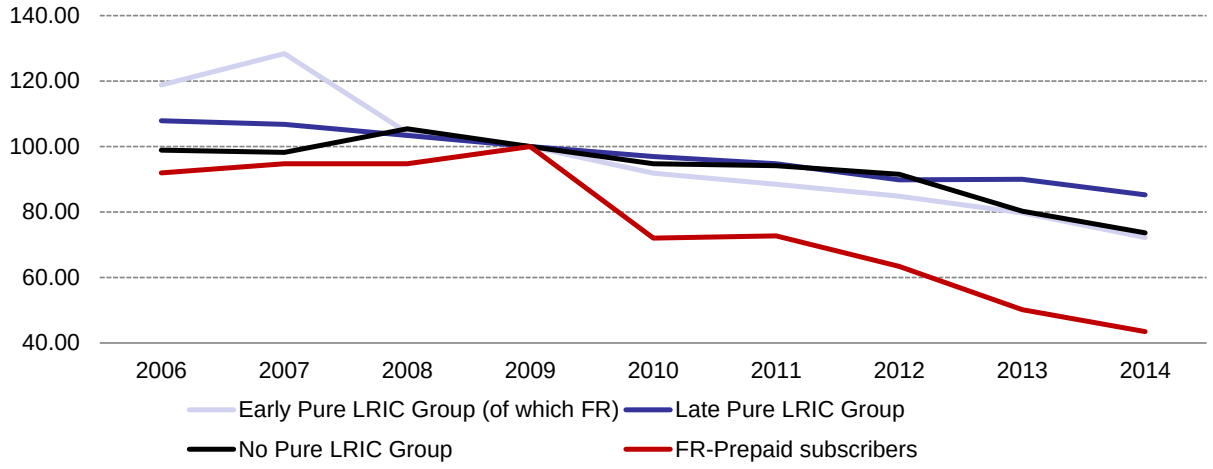
Figure 286 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

The share of prepaid subscribers in France displayed in Figure 287 has been continuously falling since 2009, especially in 2010. Already starting from a relatively low level compared to European countries, the share of prepaid subscribers in France was in 2014 one of the lowest in Europe.

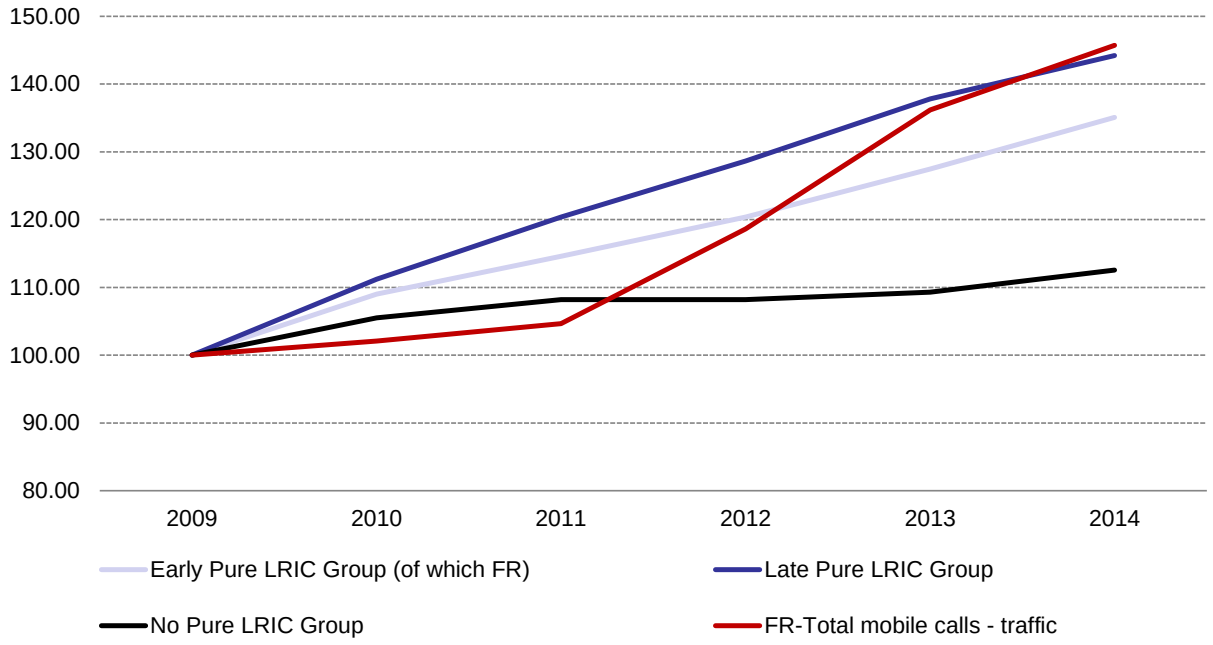
Figure 287 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The total amount of minutes of mobile calls was pretty steady in France before 2012, only slightly increasing. After the entry of Free Mobile on the market in 2012, the mobile traffic has exploded (+30% between 2011 and 2013). The global evolution of the mobile traffic in France has been closer to the Late Pure LRIC Group over the 2009-2014 period.

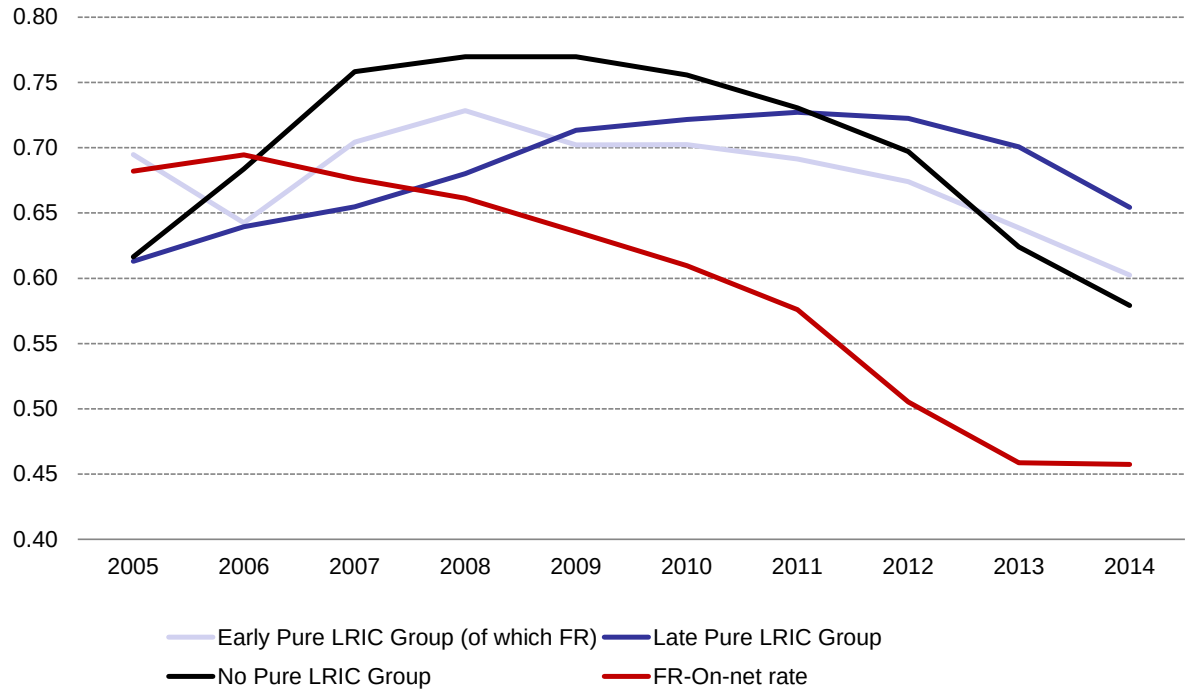
Figure 288 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 289 shows the share of on-net mobile calls in France, compared to the three groups. According to ARCEP, the implementation of Pure LRIC, decided in 2007 and gradually set with a glide path from 2011 to 2013, was targeted against the growing number of retail offers including on-net/off-net differentials. It can then be observed that the share of on-net mobile calls has been continuously falling from 2006 to 2013 in France.

Figure 289 - On-net rate of mobile calls (%)



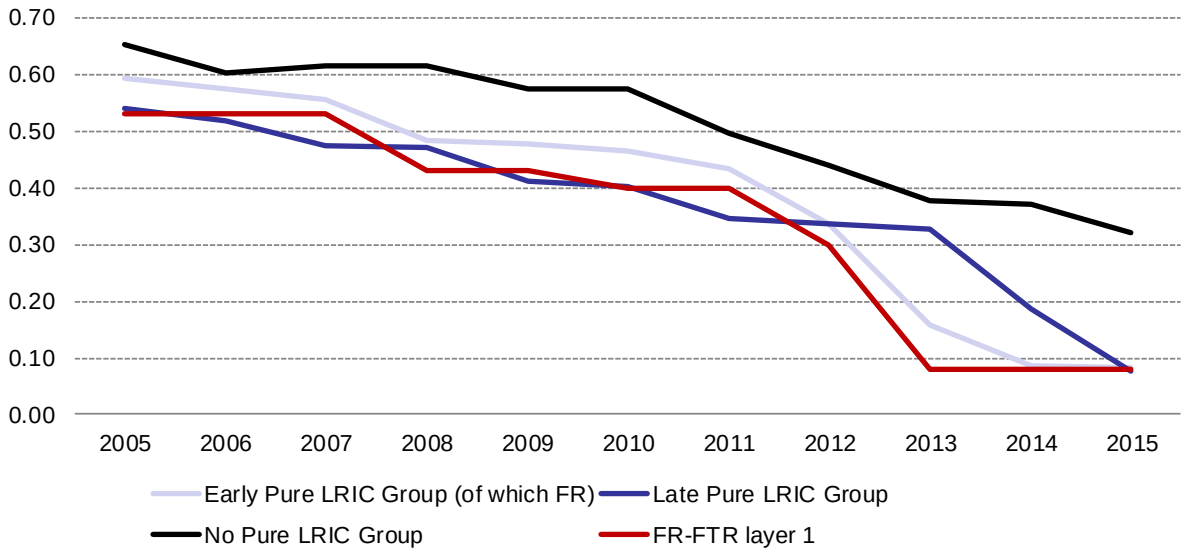
Source: ARCEP

8.12.2 Fixed market

8.12.2.1 *Quantitative analysis*

The level of FTRs in France observed in Figure 290 has been decreasing from 2005 to 2013, following a comparable trend to the Early Pure LRIC Group's weighted average FTR. It has especially shrunk in 2013 after it was set at the Pure LRIC level. In 2015, FTRs in France are at the same level as the Early Pure LRIC Group

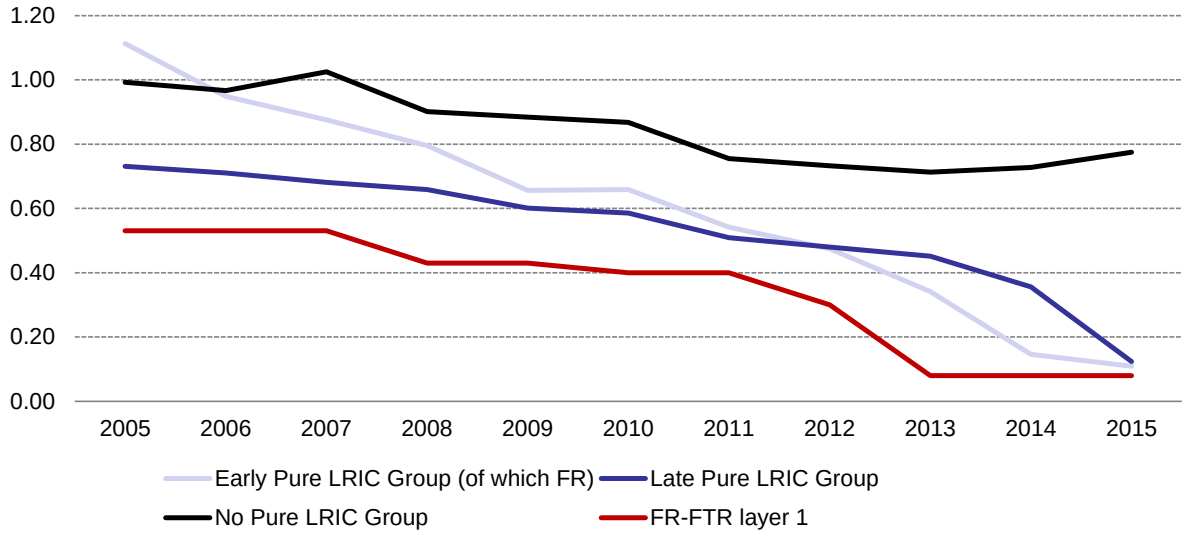
Figure 290 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 291 shows the flat average for the three groups as opposed to the previous figure. Considering the flat averages, it can be observed that French FTRs have been since 2005 among the lowest in Europe.

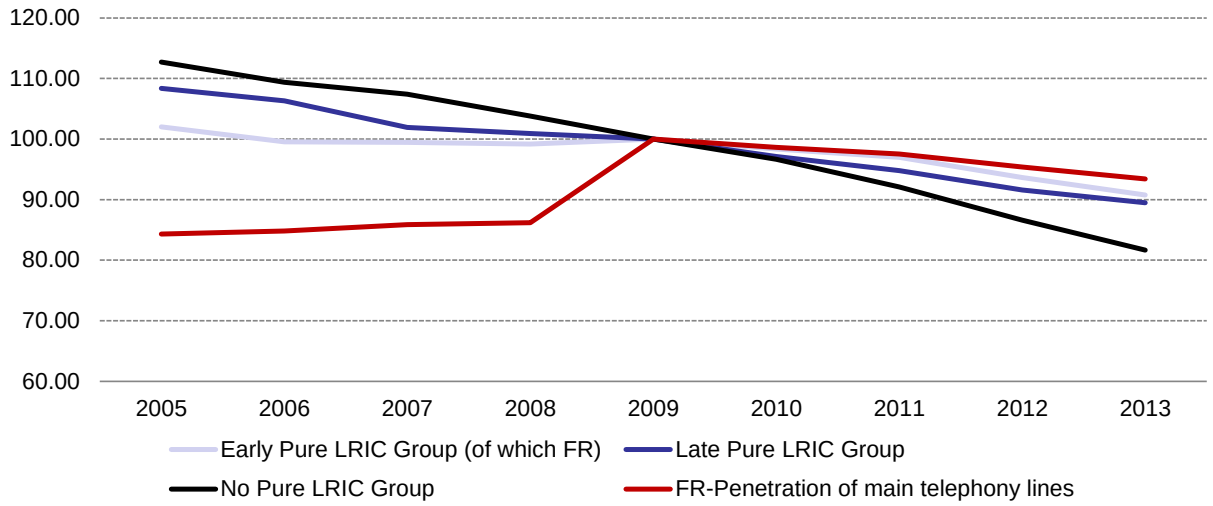
Figure 291 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

The number of main telephony lines in France has been increasing from 2005 to 2009, and then started decreasing slightly slower than all groups from 2009 to 2015, as presented in the figure below.

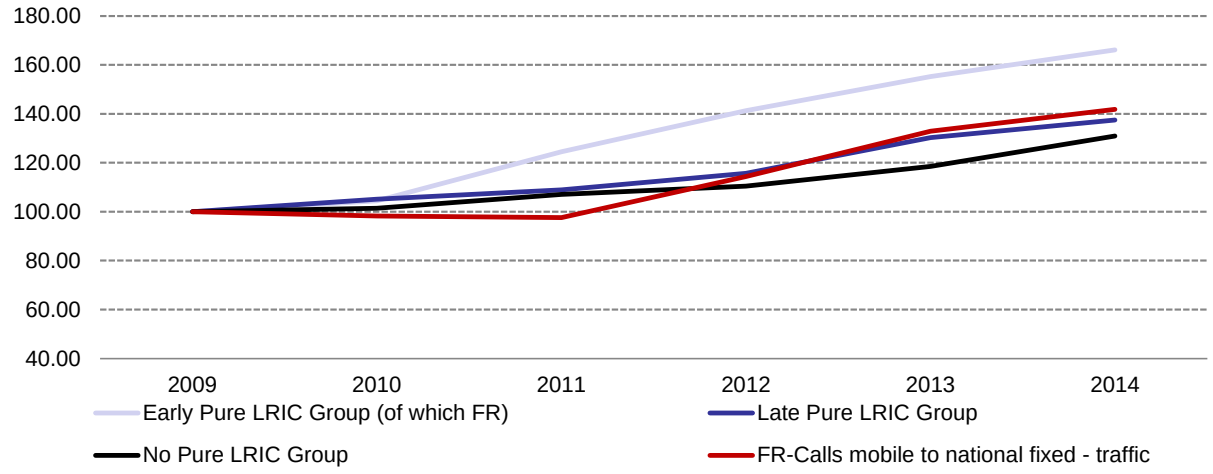
Figure 292 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in France, presented in the figure below, has been remaining steady between 2009 and 2011, and then started increasing, probably following the entry of Free Mobile in 2012. The traffic of mobile calls to national fixed in France has been following a comparable trend to the Early Pure LRIC Group.

Figure 293 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: ARCEP

8.12.3 General evolution of retail offers

ARCEP considers that high TR may create a floor to retail pricing and make it difficult for operators to offer flat rate offers due to uncertainty regarding future wholesale settlements. For ARCEP reducing TR on the other hand could enhance the decrease of per-minute costs, and therefore provide a more level playing field for fixed and small operators to develop innovative offers, such as bundles involving various combinations of fixed and mobile services.

ARCEP summarized that TR set on Pure LRIC could:

- Enhance competition,
- Facilitate the development of innovative pricing structures (flat rate offers),
- Facilitate the development of innovative services (bundles),

- Lead to more effective investments and balanced regulatory environment,
- And increase consumer's choice due to the previous factors.

ARCEP indeed noticed that symmetrical decreases in TR in France for all operators led to the decline of payments made by fixed operators for fixed-to-mobile calls, and by small mobile operators which are usually net senders of call traffic. This allowed increasing price competition which ensured a continuous downward trend for overall prices.

Following the implementation of symmetric MTR, and the glide path to apply Pure LRIC, the fixed operator Free decided to include all mobile networks in its fixed triple play offer flat-rate calling plan. Within a year, all major operators followed leading to an explosion of fixed-to-mobile calls, in particular with voice over broadband.

Although MTRs had been reduced multiple times in France before 2011, it was only in 2011 when TR reached a sufficiently low level for one operator to include fixed-to-mobile calls in its bundles that these evolutions occurred. According to ARCEP, this highlights the existence of threshold effects in Termination Rates regulation.

Concerning mobile on-net/off-net differentiation, ARCEP announced in 2007 the implementation of the Pure LRIC approach, targeted against the important development of on-net offers which were considered to increase the "club effect" to the advantage of biggest mobile operators. The differentiation then progressively disappeared after Free Mobile launched in January 2012 a flat rate calling plan for €20/month. All operators followed the lead and subsequently launched similar offers. This led to a significant increase in voice traffic originating from mobile networks. ARCEP noticed that in 2015, all mobile operators are offering flat rate calling plans with unlimited voice, of which the cheapest costs 10€/month.

Furthermore, ARCEP noticed that nearly all flat rate calling plans offered calls to international fixed destinations since FTRs are much lower than MTRs

ARCEP stated that the fundamental feature of Pure LRIC MTRs was the development of competition, enabling operators to be first-movers which triggers in-chain reactions where most retail offers have to evolve.

8.12.4 Summary

The tables below summarize, for each metric, the difference between France and the average metric for the Early pure LRIC Group in order to highlight how France is positioned against its pair countries.

Figure 294 - Differences between France and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and France
Mobile revenues	Same trend as Early Pure LRIC Group
Mobile investments	Decrease since 2012, earlier than all groups
Mobile retail prices	Not available
Mobile penetration	Increased like Early Pure LRIC Group in terms of SIM cards, no particular trend followed in terms of unique subscribers

Competition in mobile	Trend depending on the entry of a new operator in 2012
On-net rate	Way lower than its group

Figure 295 – Differences between the Early Pure LRIC Group and France for the fixed market

Metrics	Differences between the Early Pure LRIC Group and France
Fixed revenue	Not available
Traffic	Very close to the Early Pure LRIC Group since 2011
Main telephony lines	Very close to the Early Pure LRIC Group

Source: TERA Consultants

8.13 Hungary

The Hungary's telecom market is dominated by its incumbent Magyar Telekom founded in 1989 from the split of Magyar Posta in three enterprises. The economic crisis has affected telecom revenues, exacerbated by the government's recent telecom taxes. The attempt to impose a tax on internet data traffic was abandoned in November 2014 following civil demonstrations against it[155]. The mobile market counts three operators alongside MT, Telenor (1994) and Vodafone (1999). Since Hungary decided to apply the pure LRIC approach for MTR calculation from 2015, it is allocated in the "Late Pure LRIC group". Pure LRIC is also used for FTRs from 2014 with a 7 months glide path.

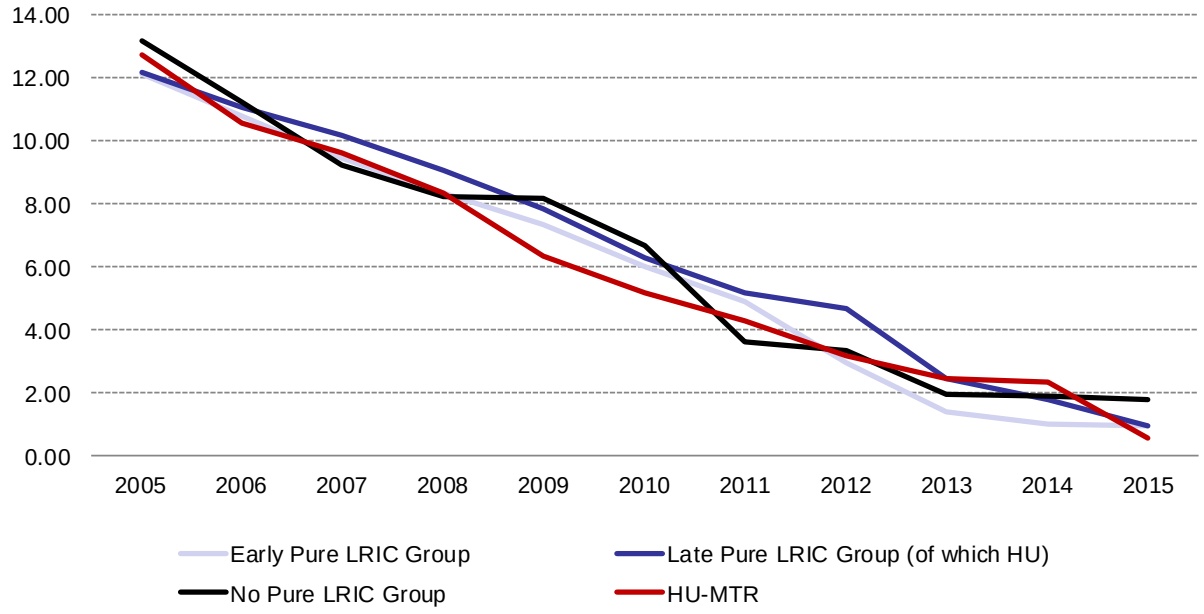
8.13.1 Mobile market

8.13.1.1 *Quantitative analysis*

MTRs in Hungary have been relatively consistent with the European trend, constantly declining since 2005. The implementation of the Pure LRIC approach can be observed with the sudden decrease in 2015 as presented in the figure below.

[155] http://uk.reuters.com/article/uk-hungary-protests-idUKKBN0IF0X320141026

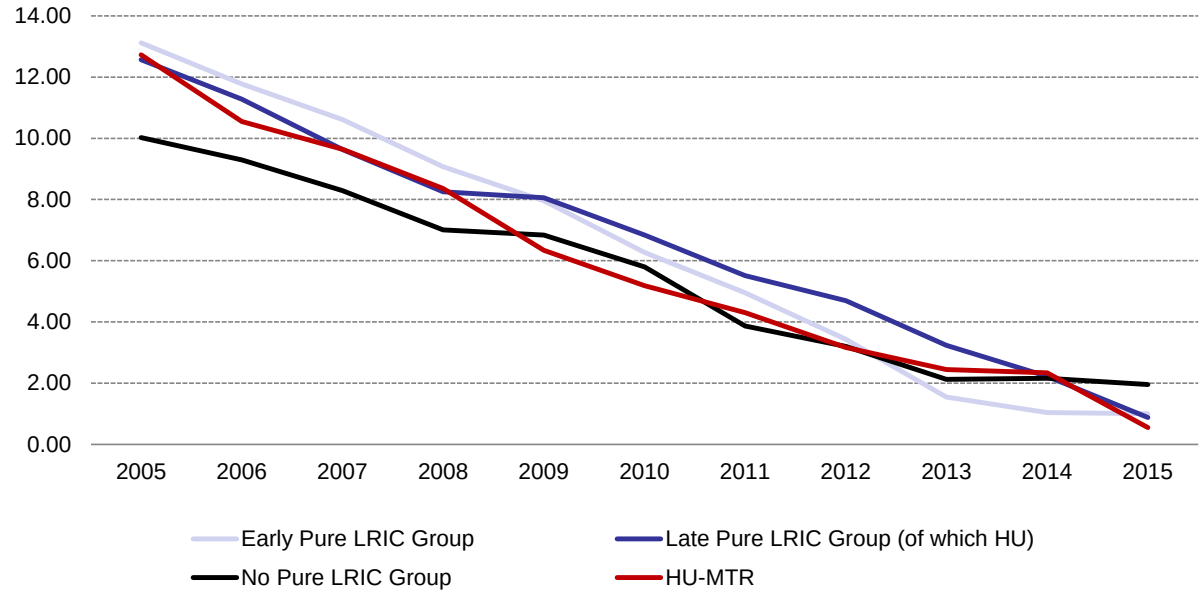
Figure 296 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see figure below). The trend is approximately the same as the weighted average trend: with Hungarian MTR remaining in the average average compared to other countries in Europe.

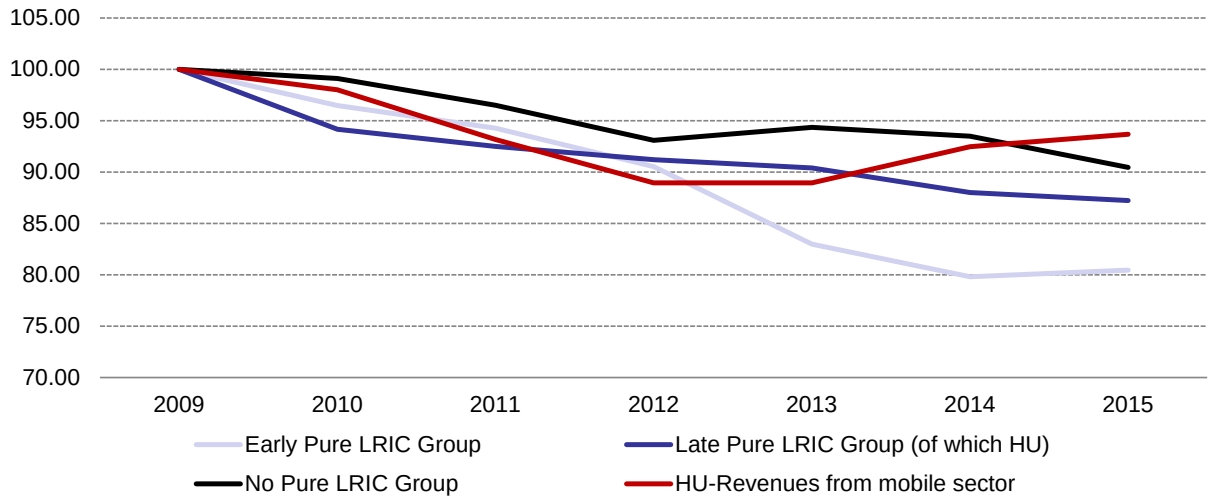
Figure 297 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in the figure below have been decreasing from 2009 to 2012, and then started growing from 2013.

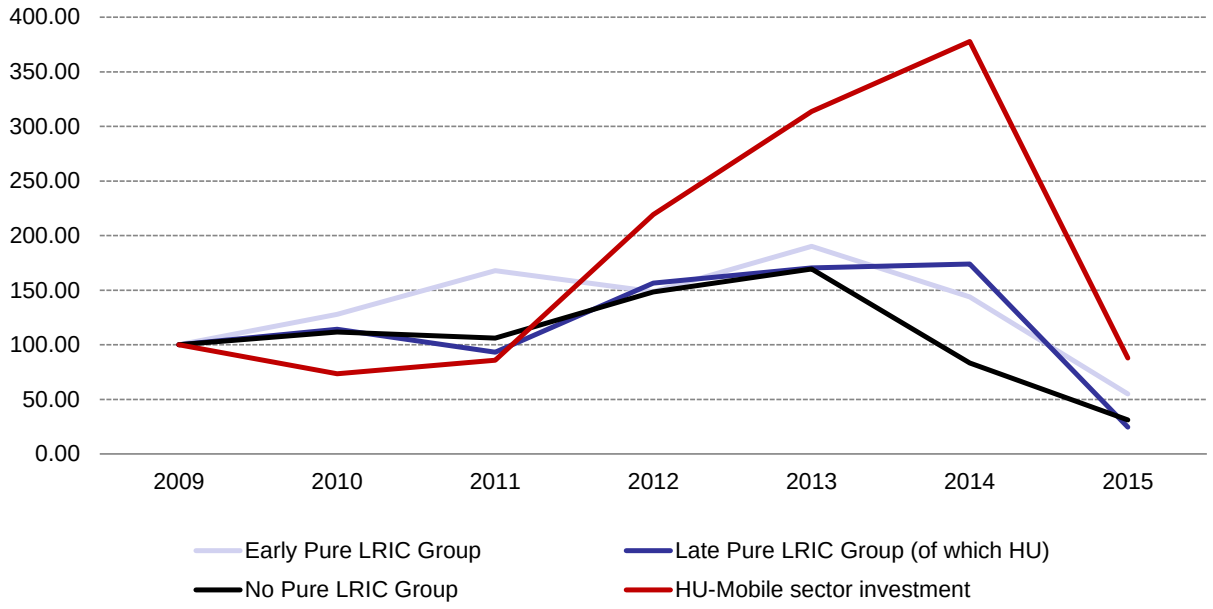
Figure 298 - Mobile revenues (base 100 in 2009)



Source: GSMA

Mobile investments in Hungary shown in the figure below have been strongly increasing from 2011 to 2014, then heavily shrunk in 2015.

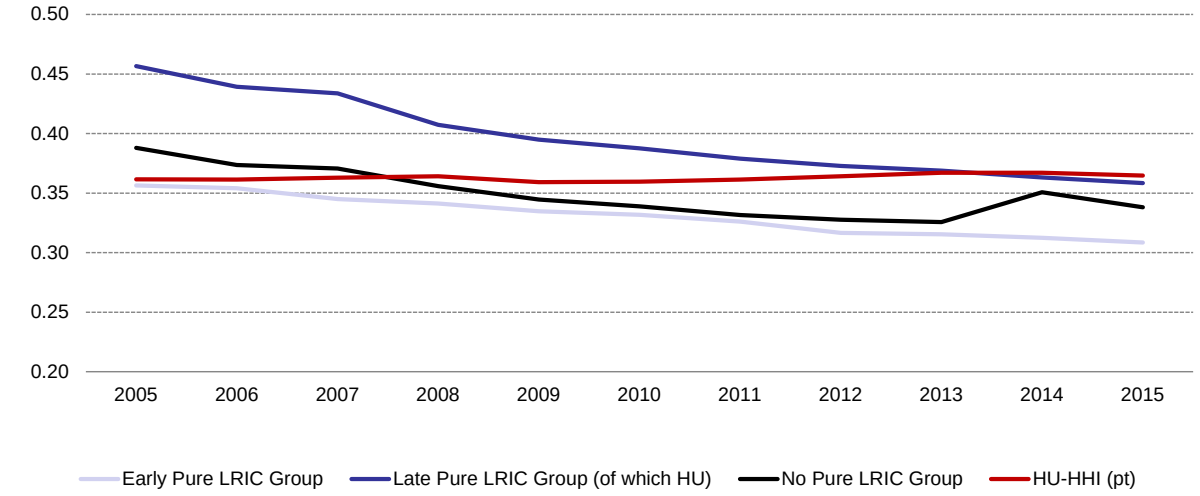
Figure 299 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Hungarian mobile market. The HHI calculated for Hungary has been remaining constant between 2005 and 2015, whereas it has been decreasing for all groups. Therefore, in 2005 Hungary had a lower level of concentration than most countries, and is in 2015 above all groups.

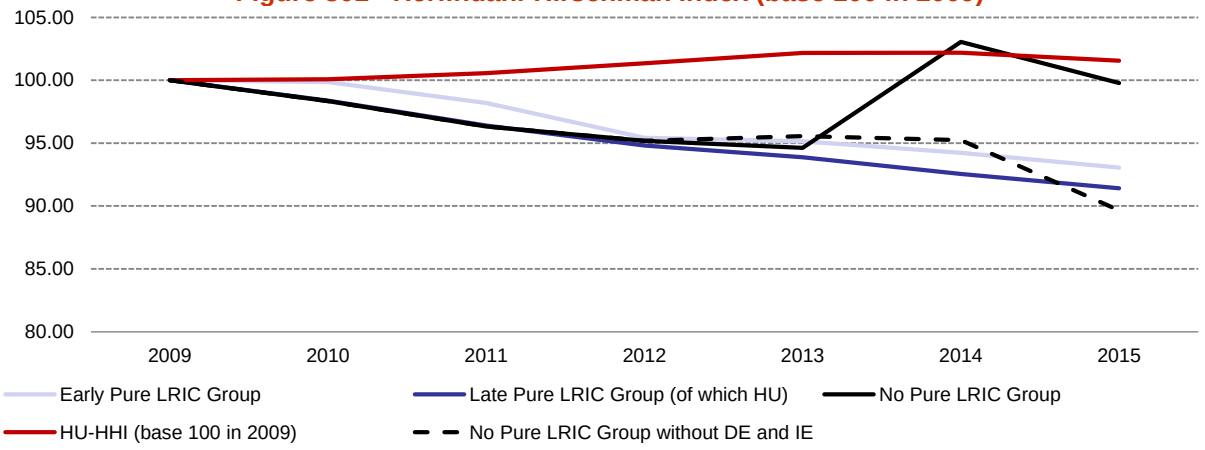
Figure 300 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

In particular Figure 301 shows the evolution of the concentration in the mobile market in Hungary. It has actually been slightly increasing since 2009, not following its group's downward trend.

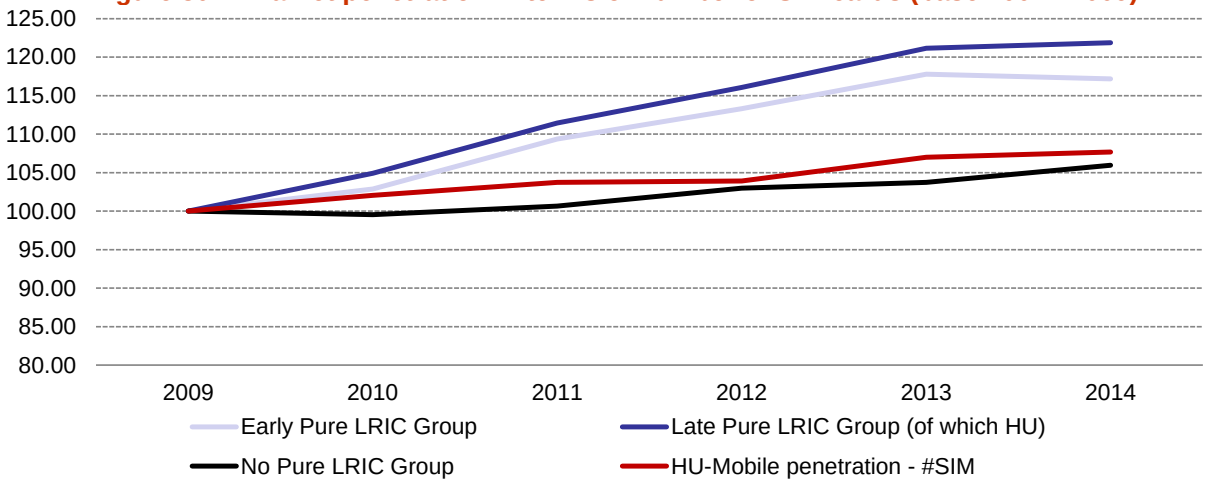
Figure 301 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Hungarian market penetration in terms of SIM cards presented in the figure below has been slowly increasing since 2009, and has been closer over this period to the No Pure LRIC Group than Late Pure LRIC Group.

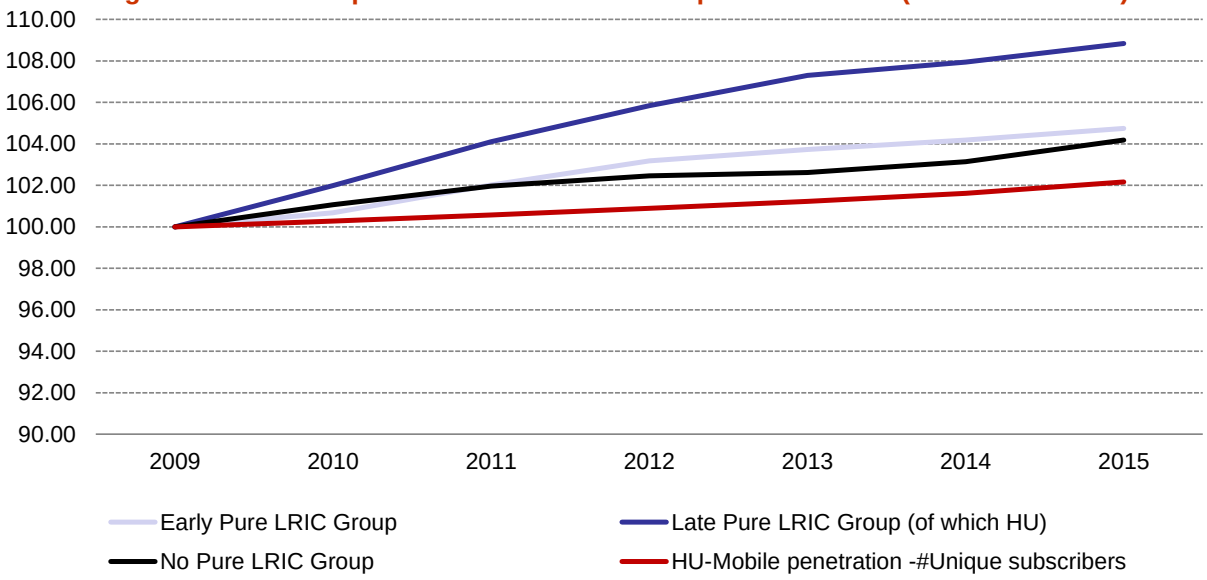
Figure 302 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 303 shows the market penetration in terms of unique subscribers in Hungary and for the three groups. Similarly to the previous figure, it has been slowly increasing since 2009 and its evolution has been closer to the Early and No Pure LRIC Groups than its own group.

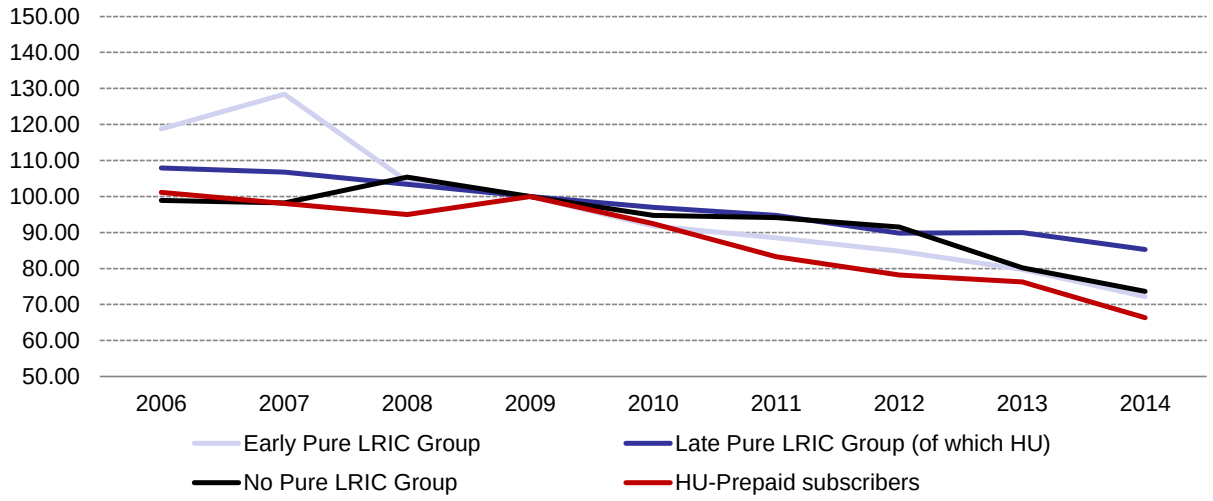
Figure 303 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 304 shows the share of prepaid subscribers in Hungary compared to the three groups. It can be observed that it has been constantly decreasing since 2009, slightly faster than all groups, and especially more than Late Pure LRIC Group.

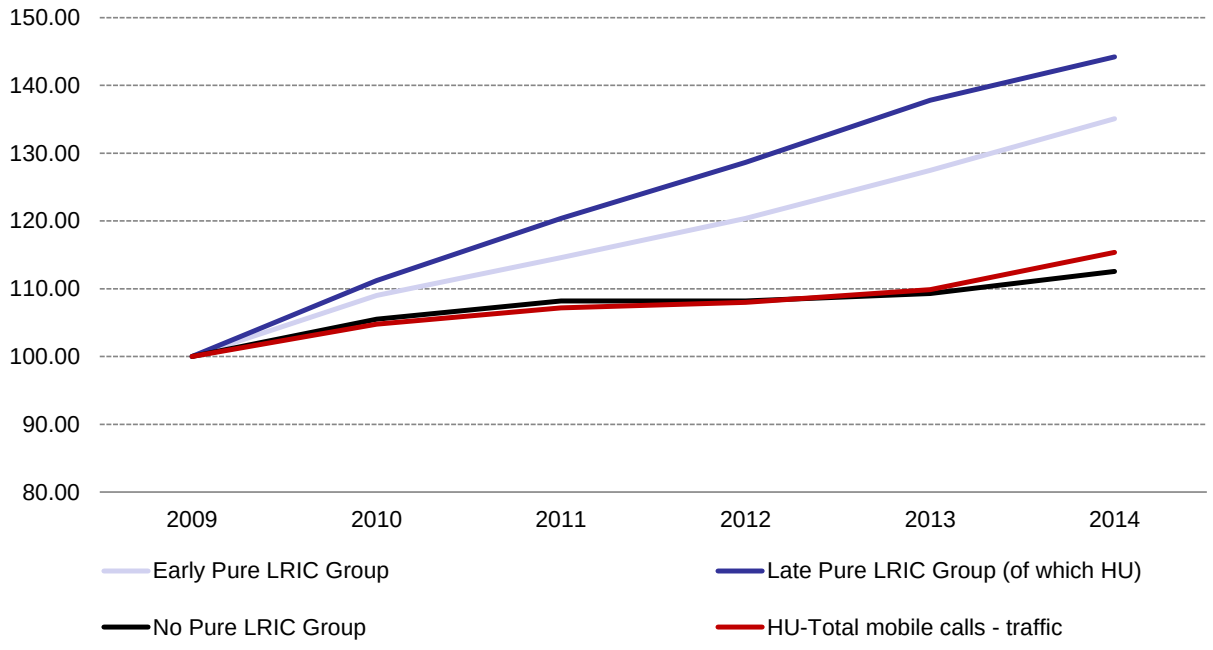
Figure 304 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 305 shows the evolution of the amount of minutes of mobile calls in Hungary. It has been steadily increasing since 2009, following a very similar trend to the No Pure LRIC Group rather than the Late Pure LRIC Group.

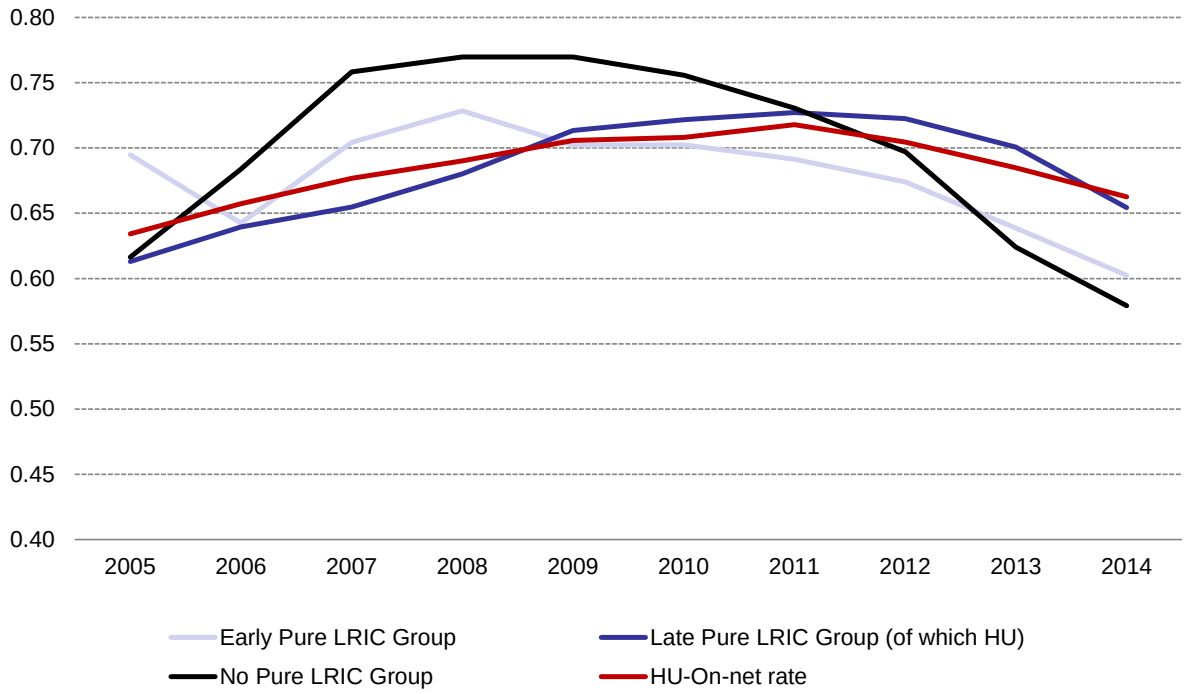
Figure 305 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 306 shows the share of on-net mobile calls. It can be noticed that it has been increasing from 2005 to 2011, and then started decreasing. It can also be observed that Hungary has been following roughly the same trend as the Late Pure LRIC Group.

Figure 306 - On-net rate of mobile calls (%)



Source: NMHH

8.13.1.2 *Evolution of retail mobile offers*

According to NMHH, multiple trends could be observed in the past few years in Hungary for all 3 MNOs:

- On-net/off-net and peak/off-peak differentiation has almost ceased,
- Partially or totally unlimited calls have been wide spread, and appeared by the end of 2012,
- Price of mobile handsets is mostly included in monthly fee, the amount of monthly fees depending on the type of handset.

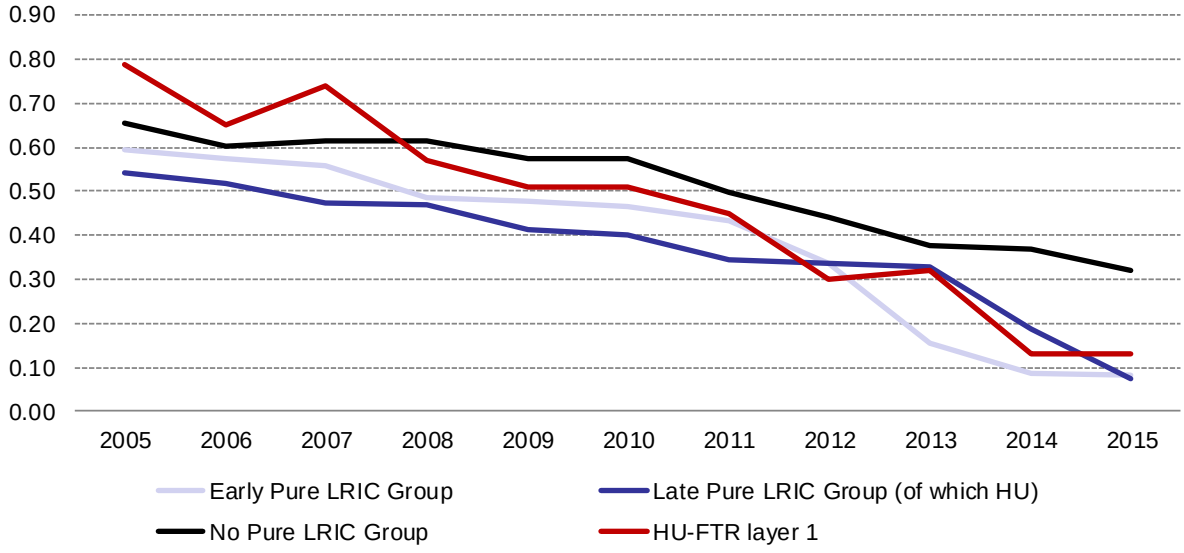
NMHH stated that lower MTR must have contributed to the appearance and spreading of such offers.

8.13.2 Fixed market

8.13.2.1 *Quantitative analysis*

Figure 307 compares the level of FTRs in Hungary with the weighted average of the three groups. It can be observed that Hungarian FTRs were above all groups' weighted averages in 2005, and decreased faster until it reached a Pure LRIC level in 2014, where they are slightly above the Late Pure LRIC Group.

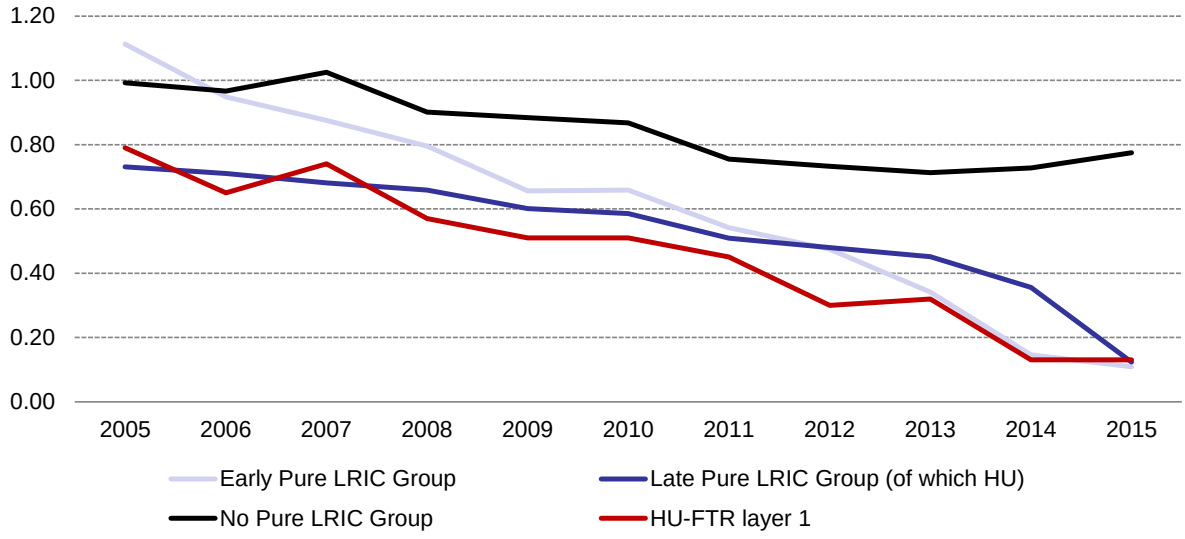
Figure 307 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 308 compares this time the level of FTRs in Hungary with the flat averages of the three groups. It can be noticed that when considering flat averages, FTRs in Hungary were actually relatively low compared to other European countries, and are in 2015 at the same level as the Late Pure LRIC Group.

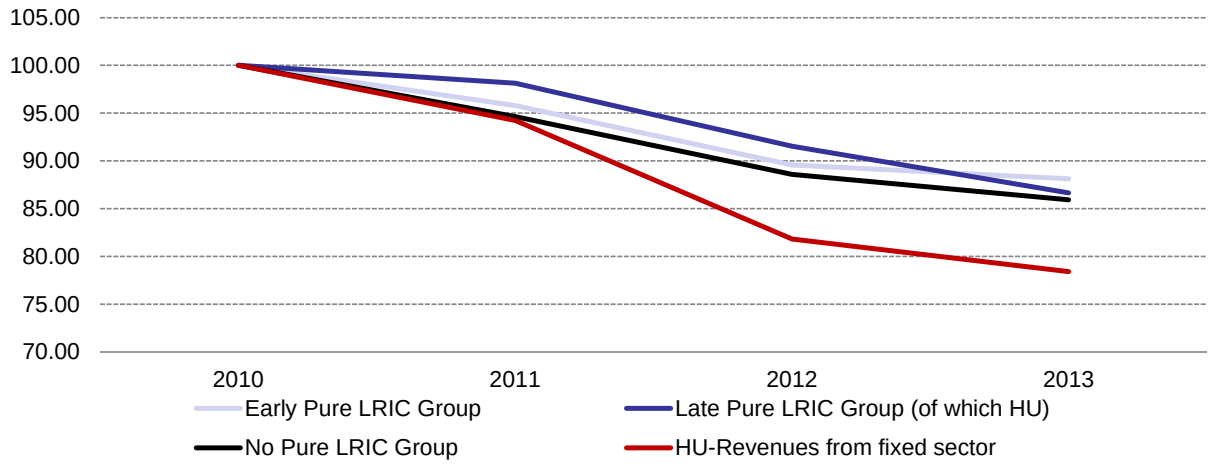
Figure 308 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 309 shows the fall of revenues from fixed-line market since 2009 for Hungary. Revenues have especially shrunk in 2012, and have been decreasing more than all groups since 2009.

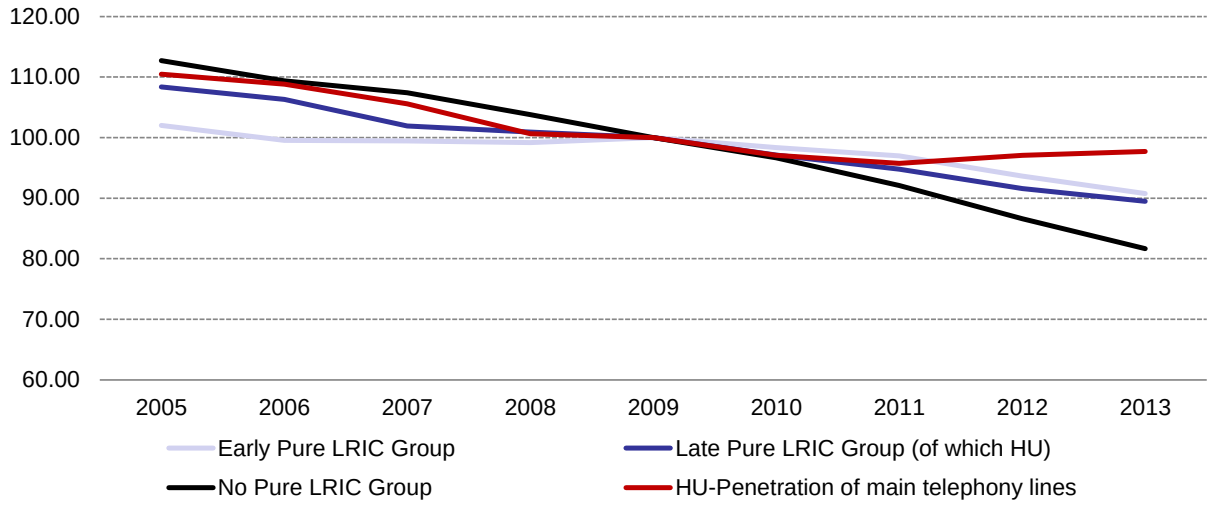
Figure 309 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Hungary has shown a constant and slow decrease from 2005 to 2011, with a similar evolution to the one of the Late Pure LRIC Group over this period, also steadily decreasing as shown in Figure 310. Since 2011 however, the market penetration in Hungary has been increasing whereas it kept on declining for all groups.

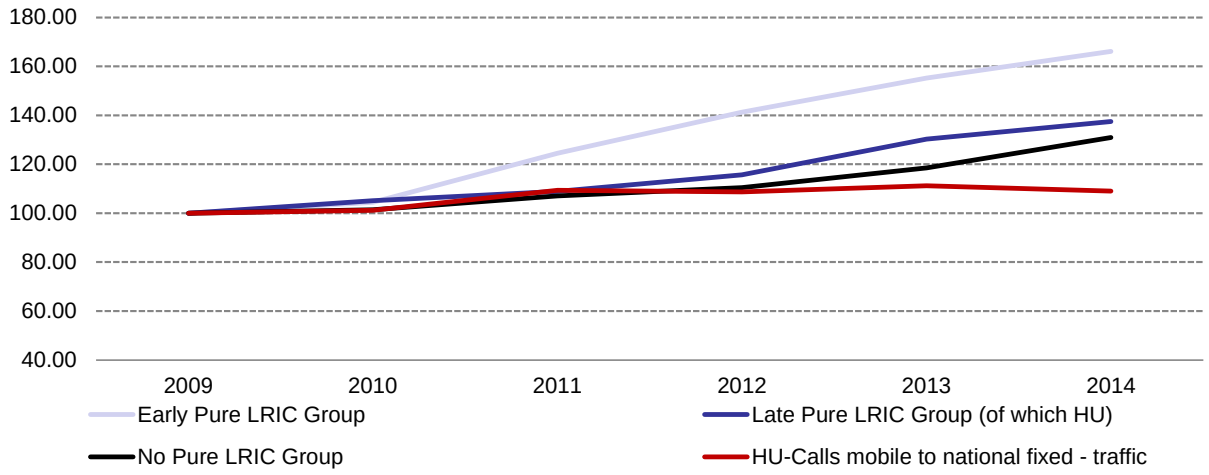
Figure 310 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Hungary, presented in Figure 311, has shown a slight increase since 2009, following a comparable trend to the No Pure LRIC Group.

Figure 311 Traffic of mobile calls to national fixed (base 100 in 2009)[156]



Source: NMHH

8.13.2.2 *Evolution of retail fixed offers*

According to NMHH, several evolutions occurred in the fixed retail market, and not for all operators:

- Differentiation between on-net/off-net and peak/off-peak tariffs have been ceased in some offers,
- Partially or totally unlimited calls have appeared since 2014 but are not yet widespread,
- Family packages have appeared, as described in mobile section including:
  - Decreasing call price per minute,
  - Increasing included minutes/SMS/data,
  - Increasing unlimited calls,
  - More and more additional or comfort services.

NMHH stated that lower termination rates must have contributed to the appearance and spreading of such offers.

8.13.3 Summary

The tables below summarize, for each metric, the difference between Hungary and the average metric for the Late pure LRIC Group in order to highlight how Hungary is positioned against its pair countries.

Figure 312 - Differences between Hungary and its group for the mobile market

Metrics	Differences between the Late Pure LRIC Group and Hungary
Mobile revenues	Decreased like all groups, not following a particular trend
Mobile investments	Increased more than all groups until 2013, then decreased more than all groups

[156] From number of minutes

Mobile retail prices	Not available
Mobile penetration	Closer to No Pure LRIC Group than Late Pure LRIC Group in terms of SIM cards and unique subscribers
Competition in mobile	Stable since 2005, no particular trend
On-net rate	Very close to its group

Source: TERA Consultants

Figure 313 – Differences between the Late Pure LRIC Group and Hungary for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Hungary
Fixed revenue	Decreased much slower than all groups
Traffic	Increased much slower than the Late Pure LRIC Group
Main telephony lines	Different trend followed than all groups

Source: TERA Consultants

8.14 Ireland

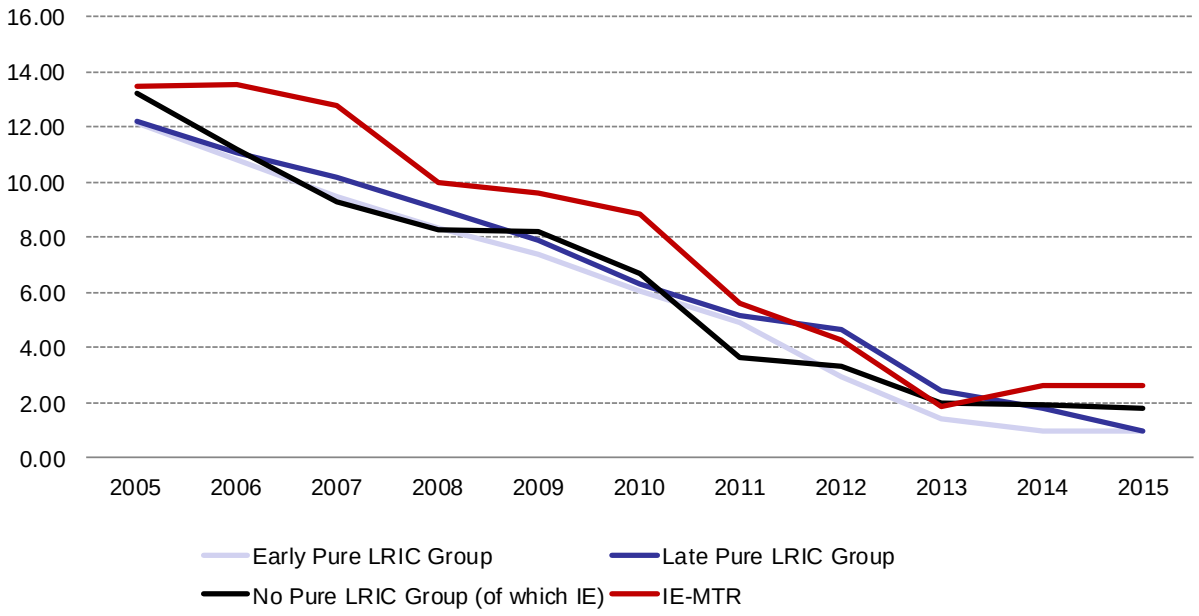
Eircom is the Irish incumbent founded in 1999 when former state owned company was privatized. The mobile market has undergone a lot of changes recently with the acquisition of O2 by Three Ireland in 2014, securing a 37% market share behind Vodafone, leading the sector with a 42% market share. Other mobile operators include Eircom's mobile brand Meteor (launched 1998), e-mobile which is a leading provider of business mobile services and a small number of MVNOs. ComReg, Ireland's Regulatory Authority took the decision to implement pure LRIC approach for MTR calculation in April 2016, after the report was written. The country was therefore ranked in the "No Pure LRIC group" for the mobile market. However, for the fixed market, Ireland is allocated to the "Late Pure LRIC group".

8.14.1 Mobile market

8.14.1.1 *Quantitative analysis*

Figure 314 compares the level of MTRs in Ireland and the weighted averages of the three groups. It can be observed that Irish MTRs have been above all groups from 2005 to 2011, then from 2014 to 2015. In 2015, they are more than two times higher than Early and Late Pure LRIC Groups, and 0.8€cent/min higher than its group average.

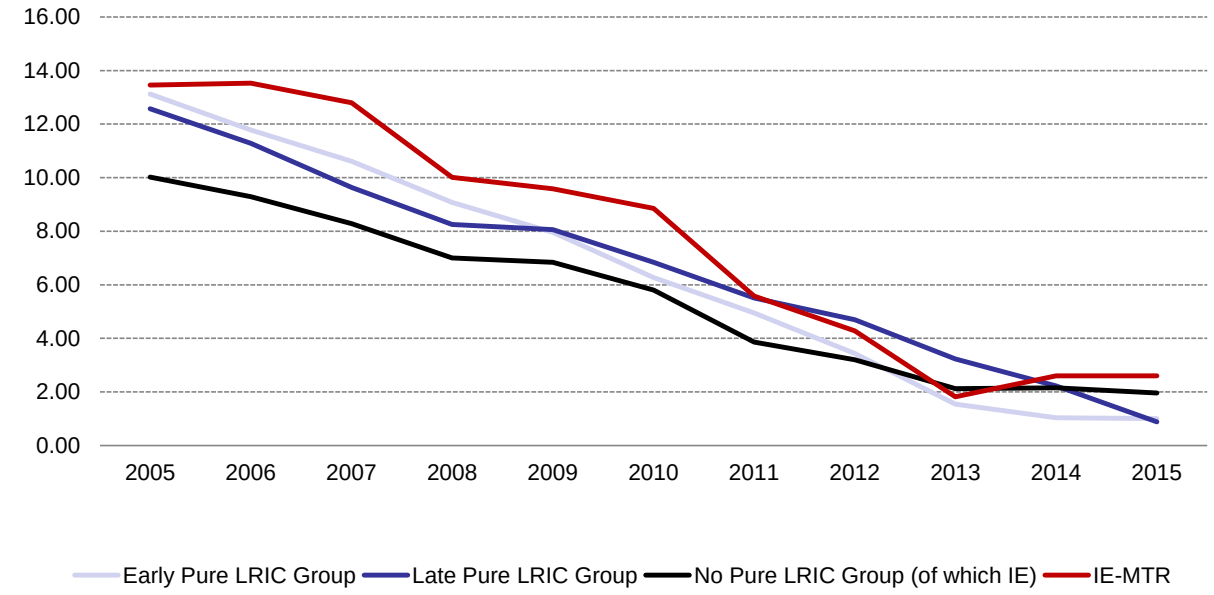
Figure 314 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 315). The trend is approximately the same as the weighted average trend: MTRs in Ireland remaining above all groups from 2005 to 2011, and then from 2014 to 2015.

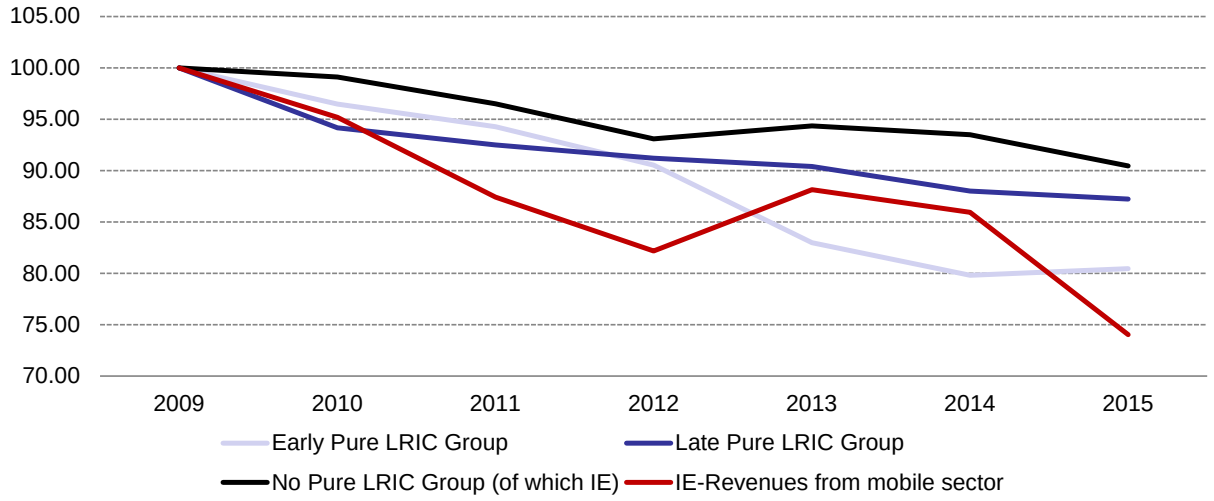
Figure 315 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from mobile sector presented in Figure 316 in Ireland have been decreasing more than all groups between 2009 and 2012 (especially with the strong economic downturn). It then slightly increased in 2013 and fell again in 2014 and 2015. It has been decreasing over this period more than its group average.

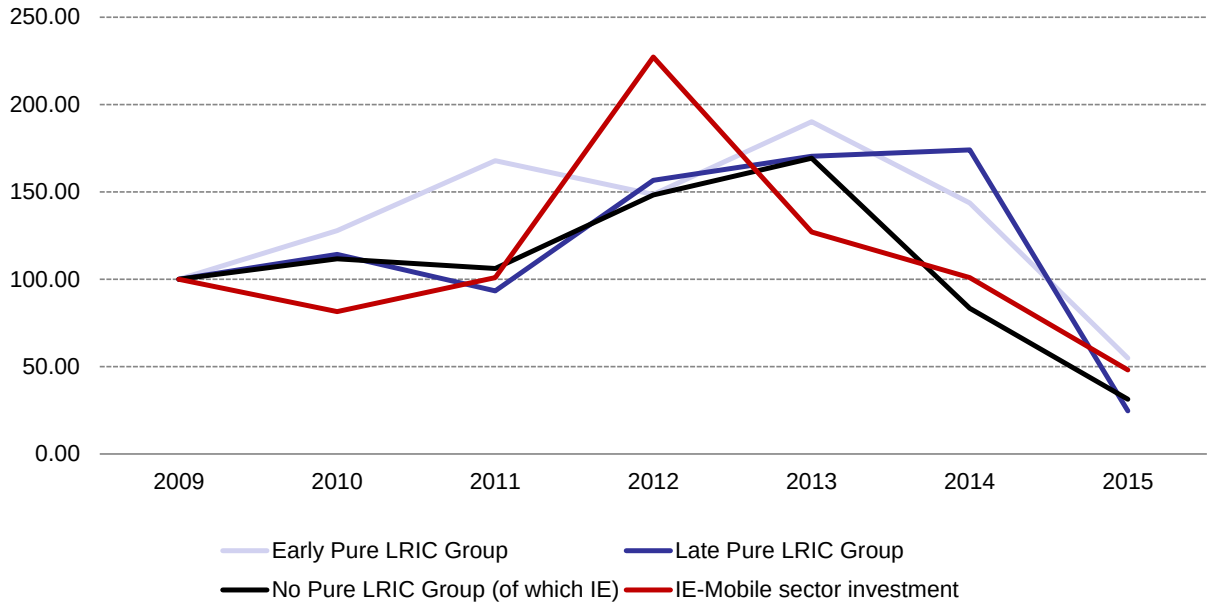
Figure 316 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 317 presents the evolution of investments in the mobile sector in Ireland. They have been rising from 2010 to 2012, and then decreased as fast as they grew from 2012 to 2015. The evolution of investments in Ireland roughly followed the European trend, but has not been comparable to any group's trend since it started decreasing a year earlier than the three groups.

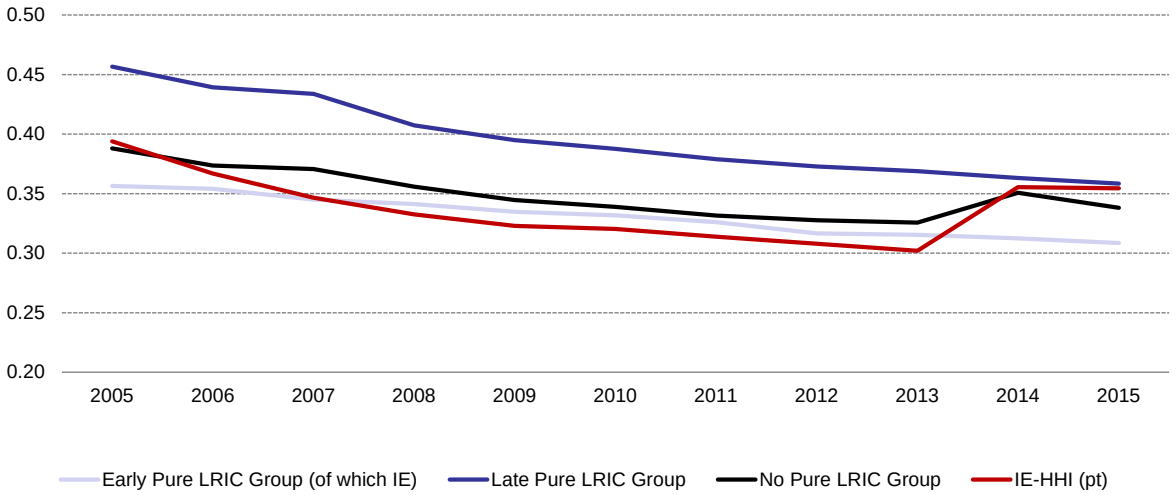
Figure 317 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Irish mobile market. Between 2005 and 2013, the Irish HHI measuring the concentration of the market has been decreasing when it was served by four operators. With the merger between Three and O2 in 2014, the HHI has significantly raised and is in 2015 at the same level as the HHI of the Late Pure LRIC Group.

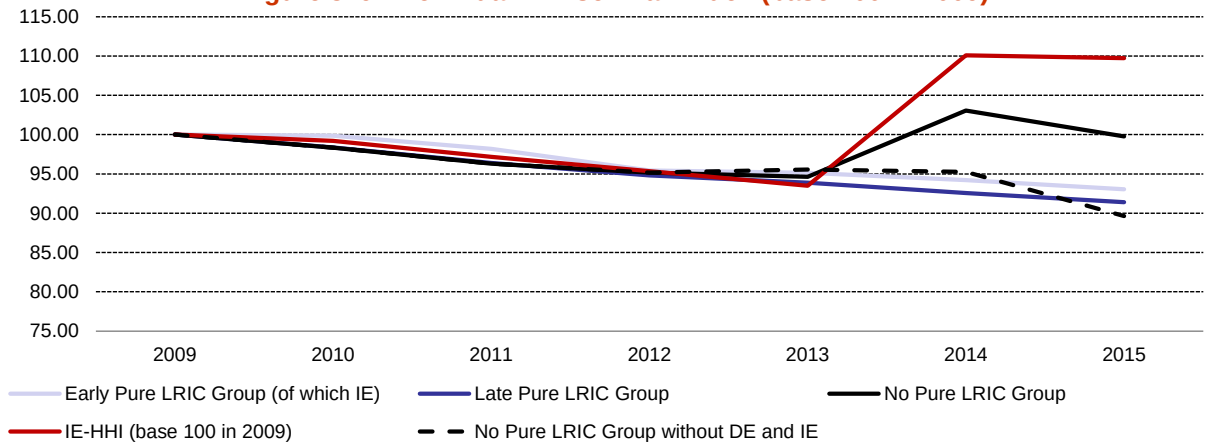
Figure 318 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the evolution of the concentration in mobile market in Ireland can be observed with Figure 319 presenting the HHI as base 100 in 2009. It can be noticed that it has been strongly increasing for the No Pure LRIC Group in 2014, subsequently to the mergers in Ireland and Germany, which both belong to the No Pure LRIC Group.

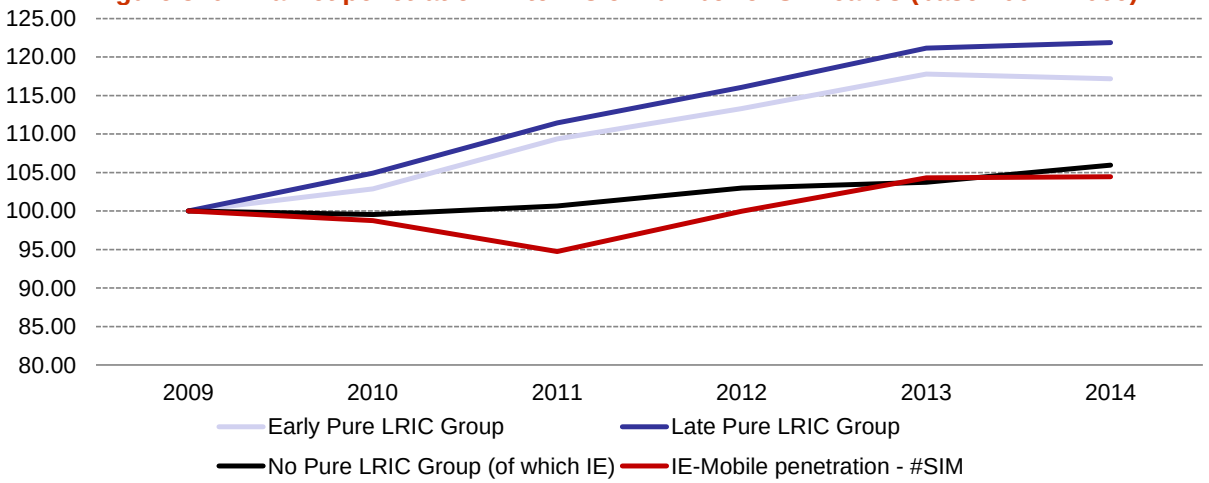
Figure 319 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Irish market penetration in terms of number of SIM has been decreasing between 2009 to 2011, and then slightly increased between 2011 and 2014, whereas the No Pure LRIC Group's market penetration has been constantly growing between 2009 and 2014. However, the development of the market penetration in terms of SIM cards has been comparable for Ireland and its group over this period.

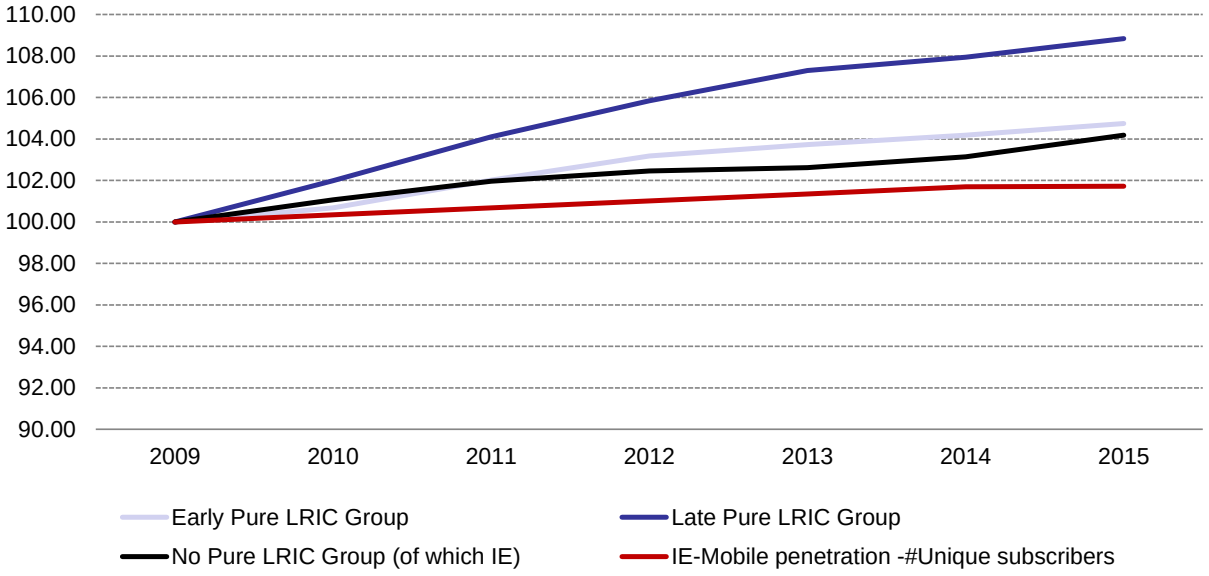
Figure 320 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

With respect to the market penetration in terms of unique subscribers, it can be observed with Figure 321 that it has been slowly increasing from 2009 to 2015 for both Ireland and the No Pure LRIC Group.

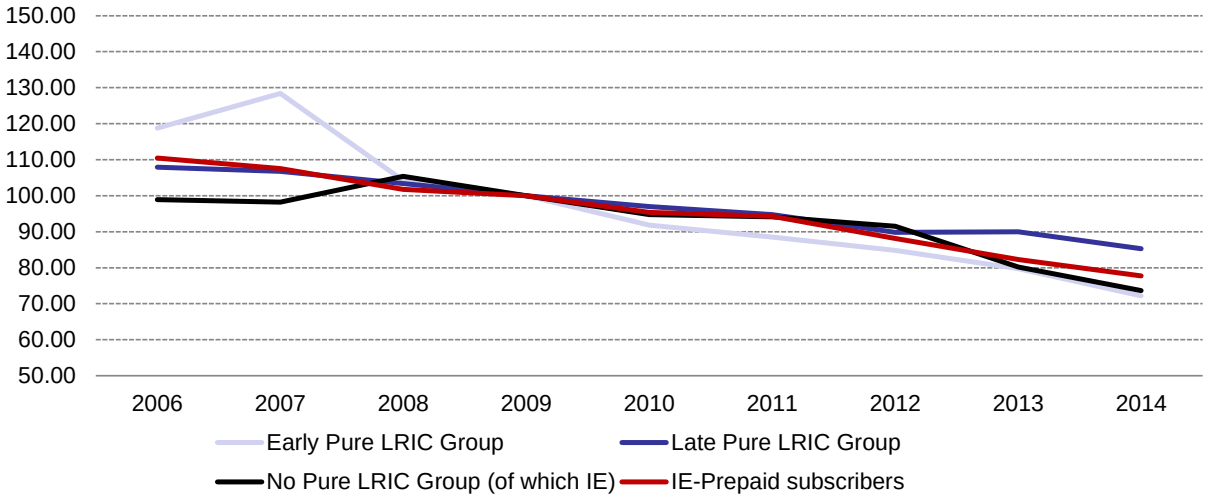
Figure 321 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 322 shows the share of prepaid subscribers in Ireland, which has been constantly declining from 2007 to 2014, such as all groups.

Figure 322 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

8.14.1.2 *Evolution of retail mobile offers*

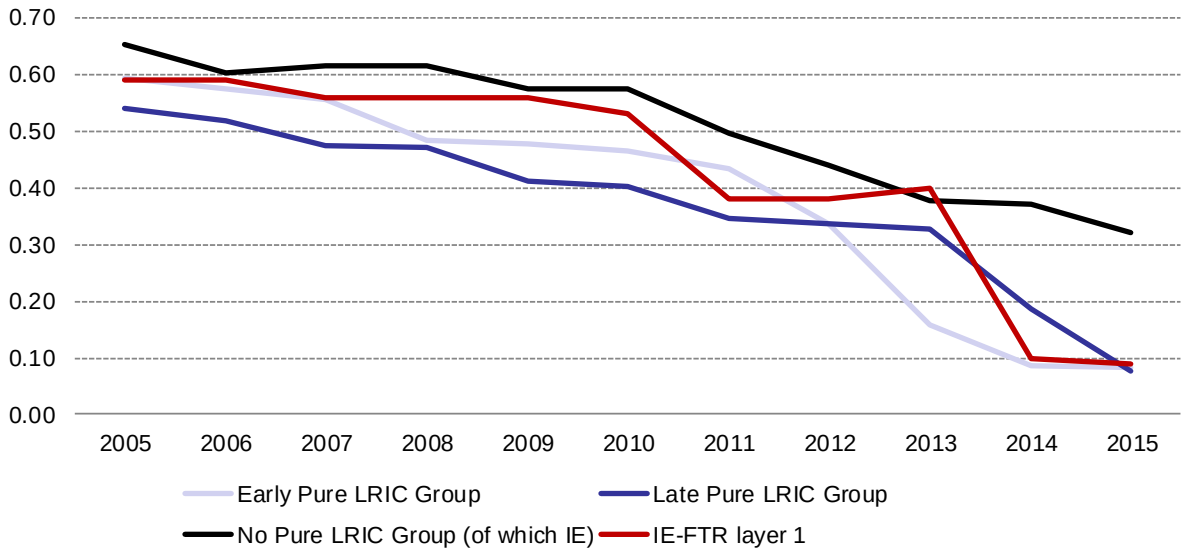
ComReg did not answer the questionnaire sent by the EC.

8.14.2 Fixed market

8.14.2.1 *Quantitative analysis*

Figure 323 compares the Irish FTRs with the weighted average of the three groups. It can be observed that they has been close to the EU average from 2005 to 2012 compared to weighted averages, then shrunk in 2014 to reach a Pure LRIC level, and they are in 2015 comparable to the average FTRs of the Early and Late Pure LRIC Groups.

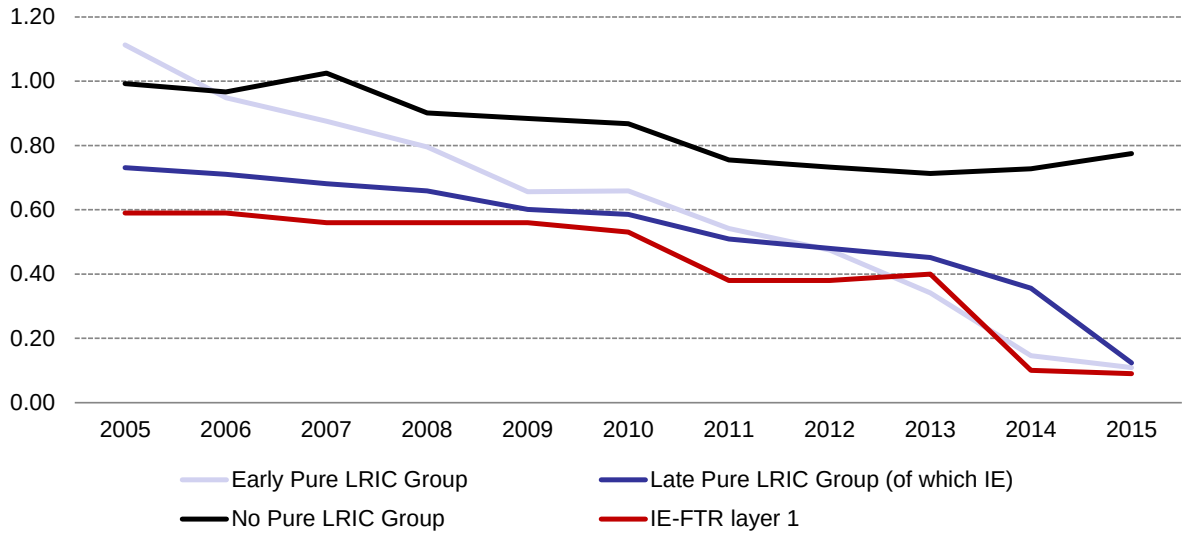
Figure 323 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 324 shows the flat average for the three groups as opposed to the previous figure. Compared to the three groups' flat averages, it can be observed that FTRs in Ireland have been relatively low.

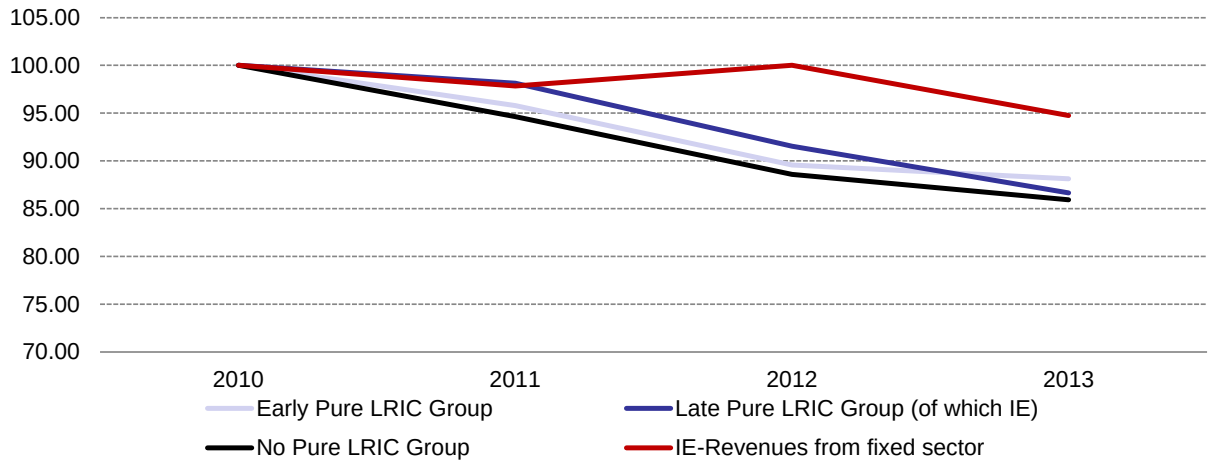
Figure 324 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 325 shows the evolution of revenues of the fixed sector in Ireland. It can be observed that they have been decreasing from 2009 to 2013 overall, with a slight increase in 2012. Their evolution has been comparable to Late Pure LRIC Group's trend between 2009 and 2011, and then did not follow the trend of any group.

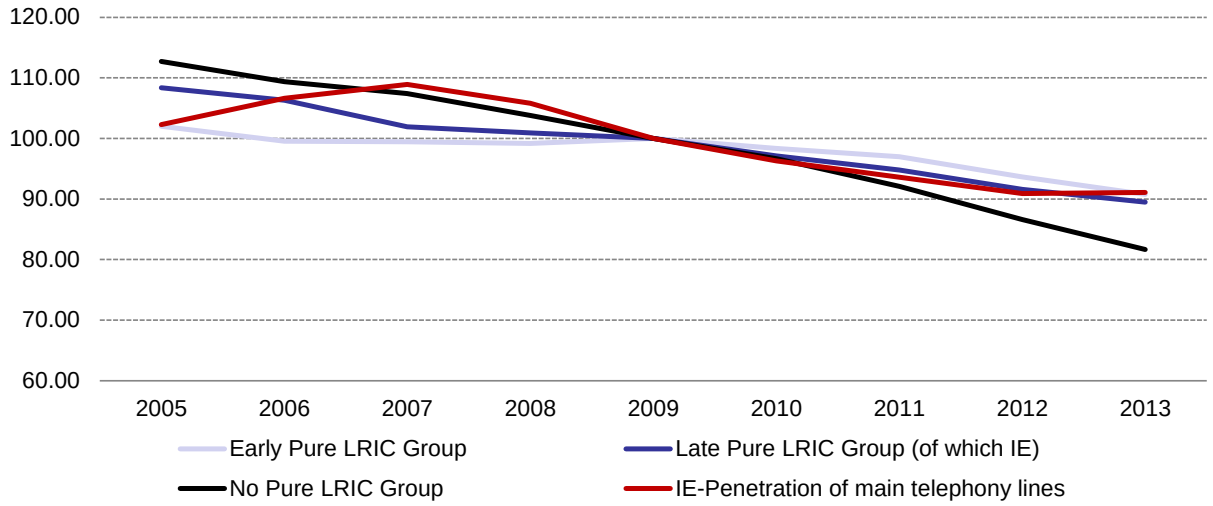
Figure 325 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Ireland has shown a constant and slow decrease since 2007, with a similar evolution of penetration to the Early and Late Pure LRIC Groups, also steadily decreasing as shown in the figure below.

Figure 326 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.14.2.2 *Evolution of retail fixed offers*

ComReg did not answer the questionnaire sent by the EC.

8.14.3 Summary

The tables below summarize, for each metric, the difference between Ireland and the average metric for the No pure LRIC Group for the mobile market and for the Late Pure LRIC Group for the fixed market in order to highlight how Ireland is positioned against its pair countries.

Figure 327 - Differences between Ireland and its group for the mobile market

Metrics	Differences between the No Pure LRIC Group and Ireland
Mobile revenues	Decreased not following any group's trend
Mobile investments	Decreased like all groups since 2013

Mobile retail prices	Not available
Mobile penetration	Followed roughly the same trend as No Pure LRIC Group in terms of SIM cards and unique subscribers
Competition in mobile	Followed the trend of No Pure LRIC Group

Source: TERA Consultants

Figure 328 – Differences between the No Pure LRIC Group and Ireland for the fixed market

Metrics	Differences between the No Pure LRIC Group and Ireland
Fixed revenue	Decreased much slower than all groups
Traffic	Not available
Main telephony lines	Very close to the Late Pure LRIC Group

Source: TERA Consultants

8.15 Italy

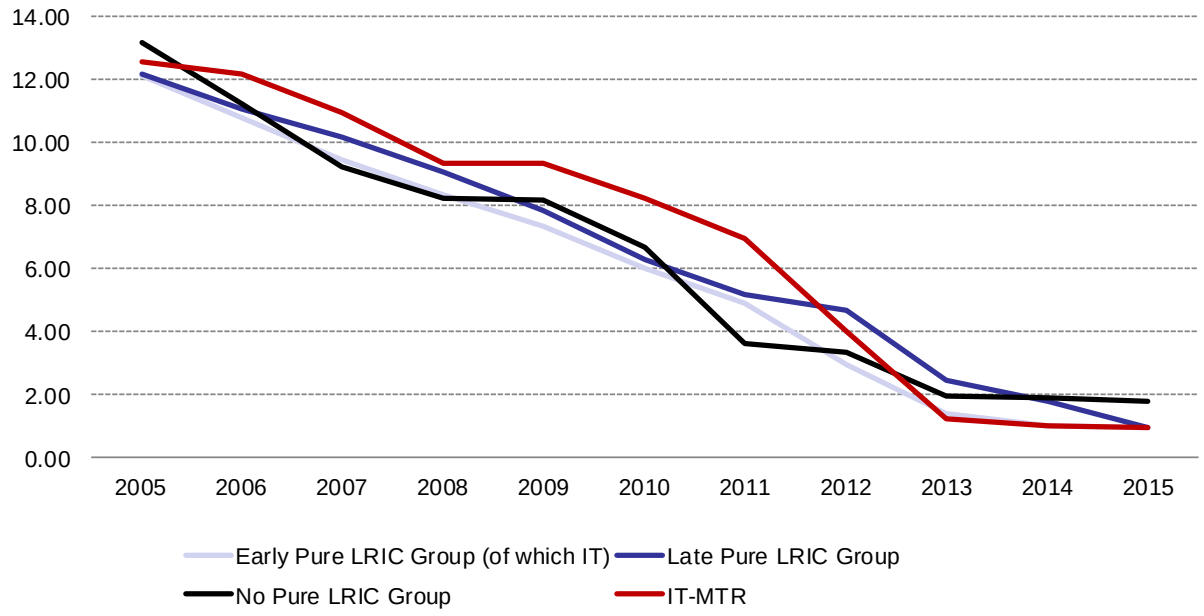
Italy's large telecom market benefits from one of the highest mobile penetration rates in Europe (in terms of number of SIM). The fixed-line sector on the other hand continues to dwindle as consumers adopt mobile-only solutions and VoIP. The Italian incumbent is Telecom Italia founded in 1994 from the merger of several state-owned companies. Its mobile brand TIM (1995) is challenged by Vodafone (1995), Wind (1997) and Three (2003). Since the Italian regulator AGCOM decided to implement the pure LRIC approach for MTR, the country is allocated to the "Early Pure LRIC group" for this study. However, since Pure LRIC has been implemented later for FTR, the country has been allocated to the Late Pure LRIC Group for the fixed sector analysis.

8.15.1 Mobile market

8.15.1.1 *Quantitative analysis*

Figure 329 compares the level of MTRs in Italy with the three groups' weighted averages. It can be observed that it has been constantly decreasing from 2005 to 2013, remaining slightly above all groups over this period. Since 2013 however, Italian MTRs have been set on a Pure LRIC basis and have been comparable to the ones of the Early Pure LRIC Group's average.

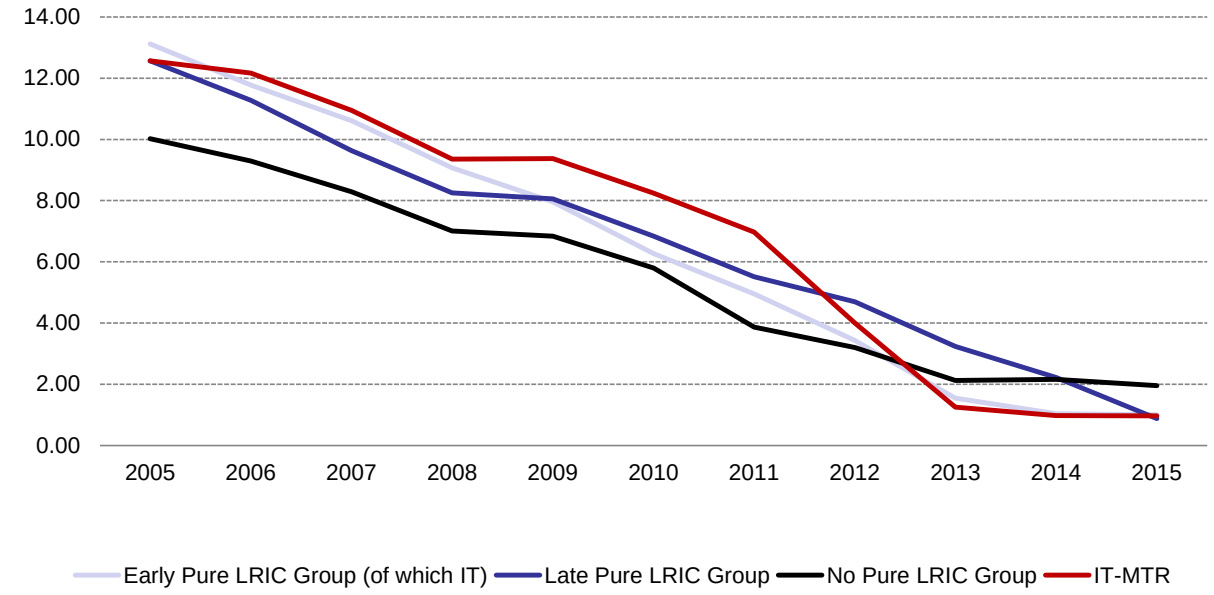
Figure 329 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 330). The trend is approximately the same as the weighted average trend with Italian MTRs remaining slightly above all groups until 2013 when they were set on a Pure LRIC basis.

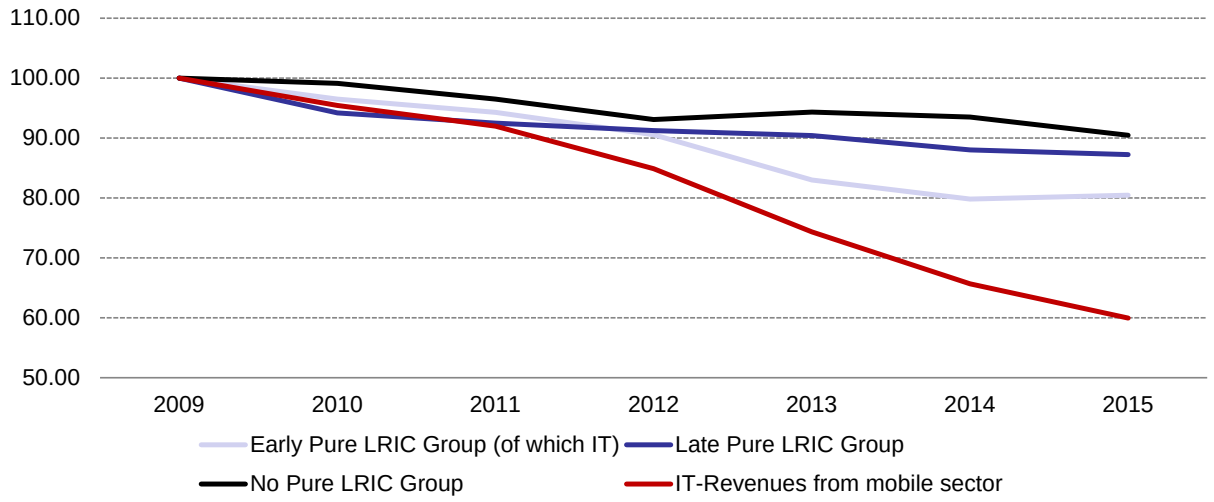
Figure 330 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector in Italy presented in Figure 331 have been constantly dropping between 2009 and 2015, more than all groups especially since 2011.

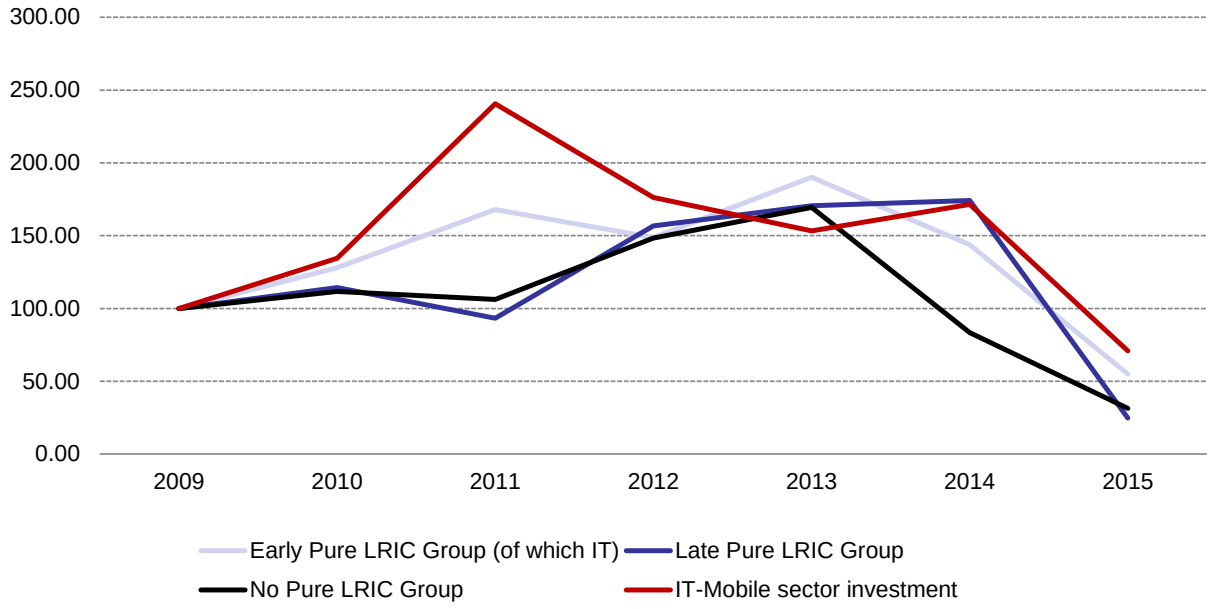
Figure 331 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in the Italian mobile sector shown in Figure 332 have been increasing from 2009 to 2011, and then have been falling from 2011 to 2015 with a slight upsurge in 2014. Therefore, their evolution has been comparable to the Late Pure LRIC Group over the past two years.

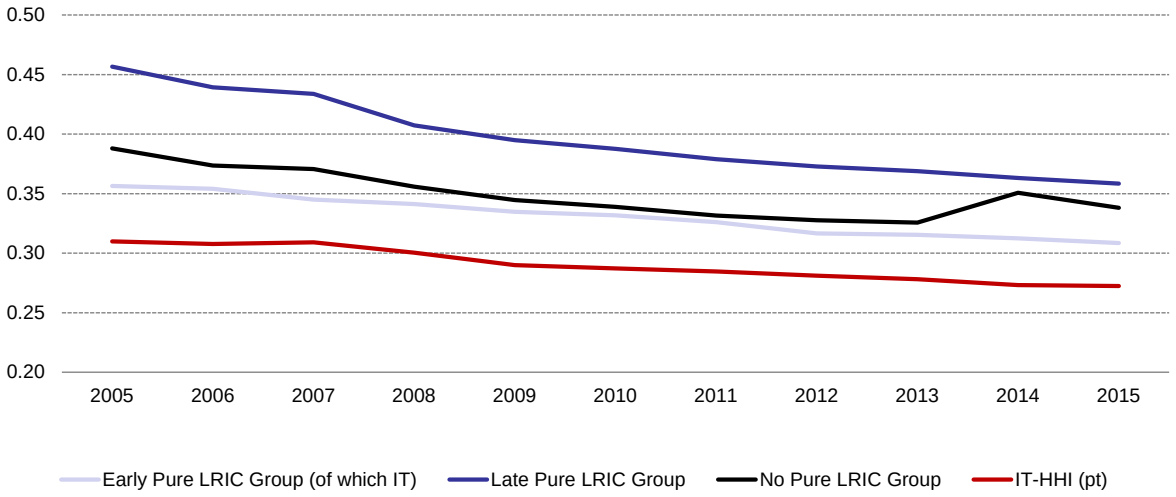
Figure 332 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Italian mobile market. The low level of concentration in Italy can be observed with its HHI, presented in Figure 333, which is one of the lowest in Europe reflecting relatively similar market shares between 3 out of the 4 operators.

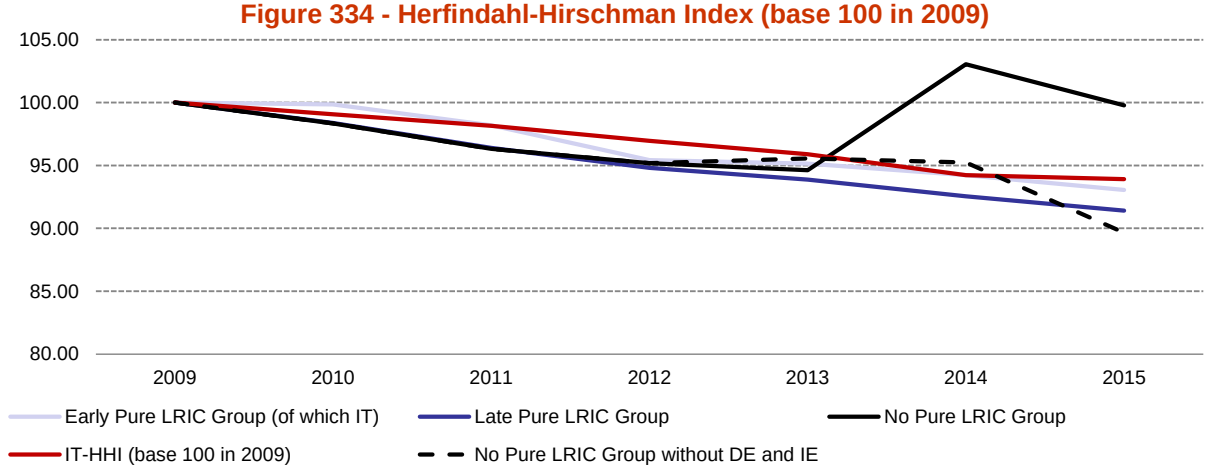
Figure 333 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the evolution of the concentration in the Italian mobile market can be observed with Figure 334 showing HHI as base 100 in 2009. It can be noticed that it has been very close to the Early Pure LRIC Group between 2009 and 2015.

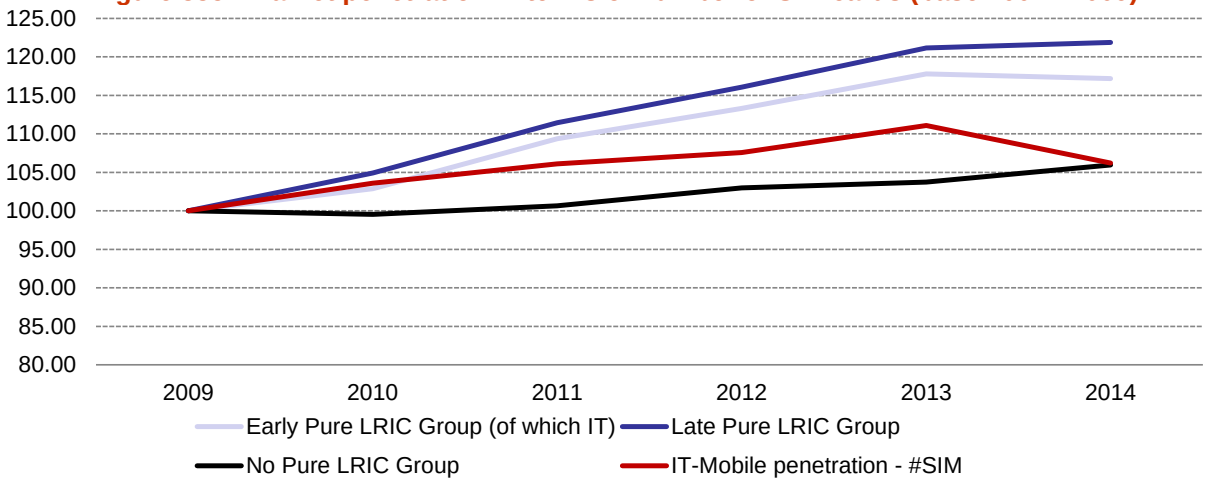
Figure 334 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Italian market penetration in terms of number of SIM has been constantly increasing from 2009 to 2013, and then fell in 2014. It has been following no particular group's trend over this period, but eventually had the same evolution compared to the one of the No Pure LRIC Group between 2009 and 2014.

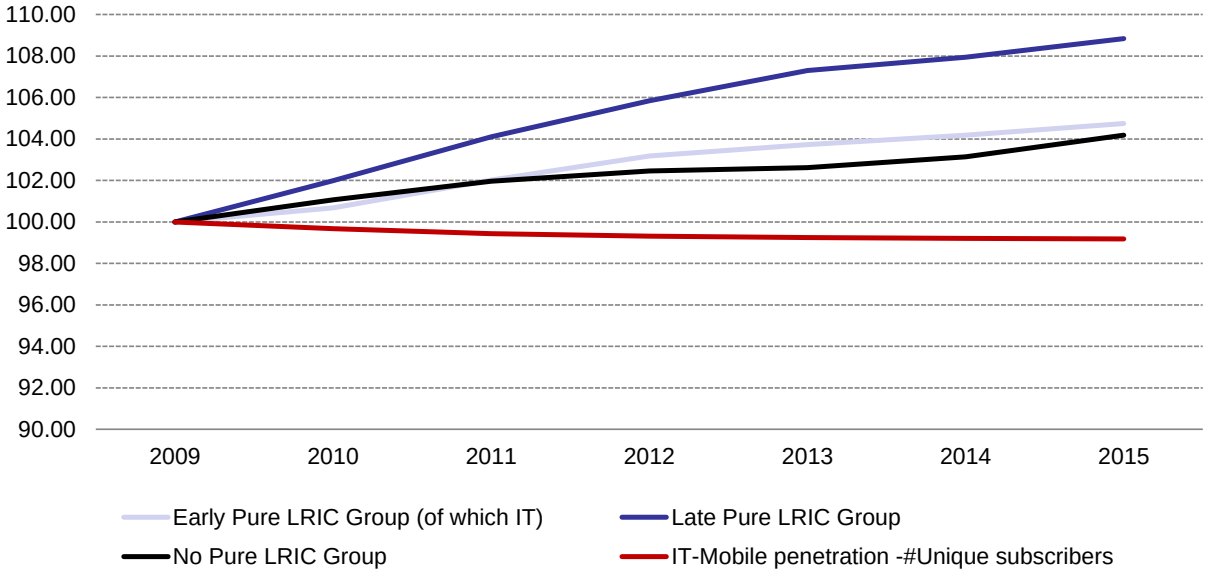
Figure 335 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Regarding the market penetration in terms of unique subscribers, it can be observed with Figure 336 that it has been very slowly decreasing from 2009 to 2015 whereas it has been increasing for all groups. It has however worth reminding that Italy has one of the highest penetration rate in Europe.

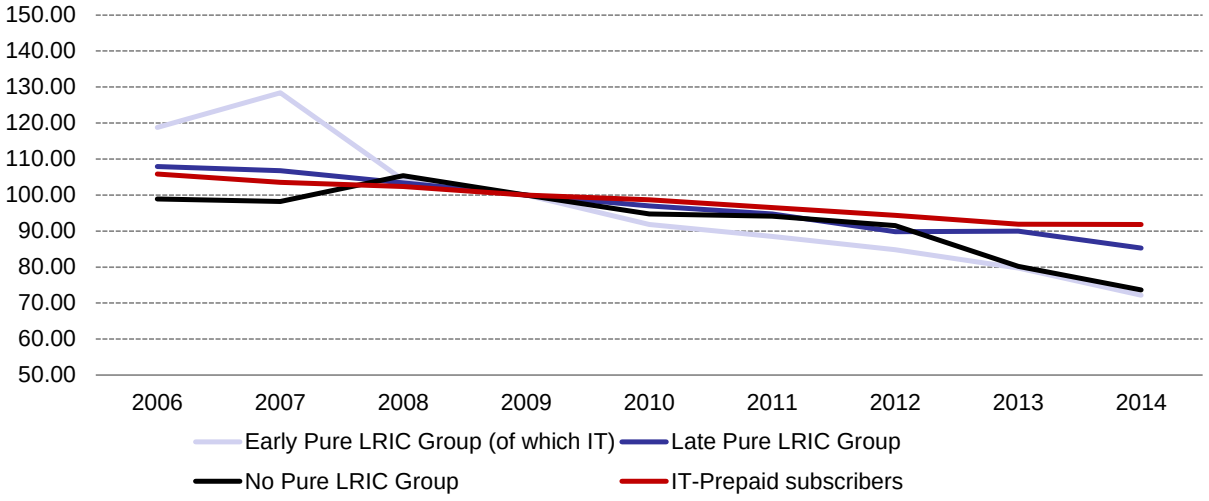
Figure 336 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 337 shows the share of prepaid subscribers in Italy compared to the three groups. The share of prepaid customers is one of the highest in Europe (91% in 2005), and has been decreasing slower than all groups. It is therefore in 2014 still way higher than most European countries, especially from those of the Early Pure LRIC Group.

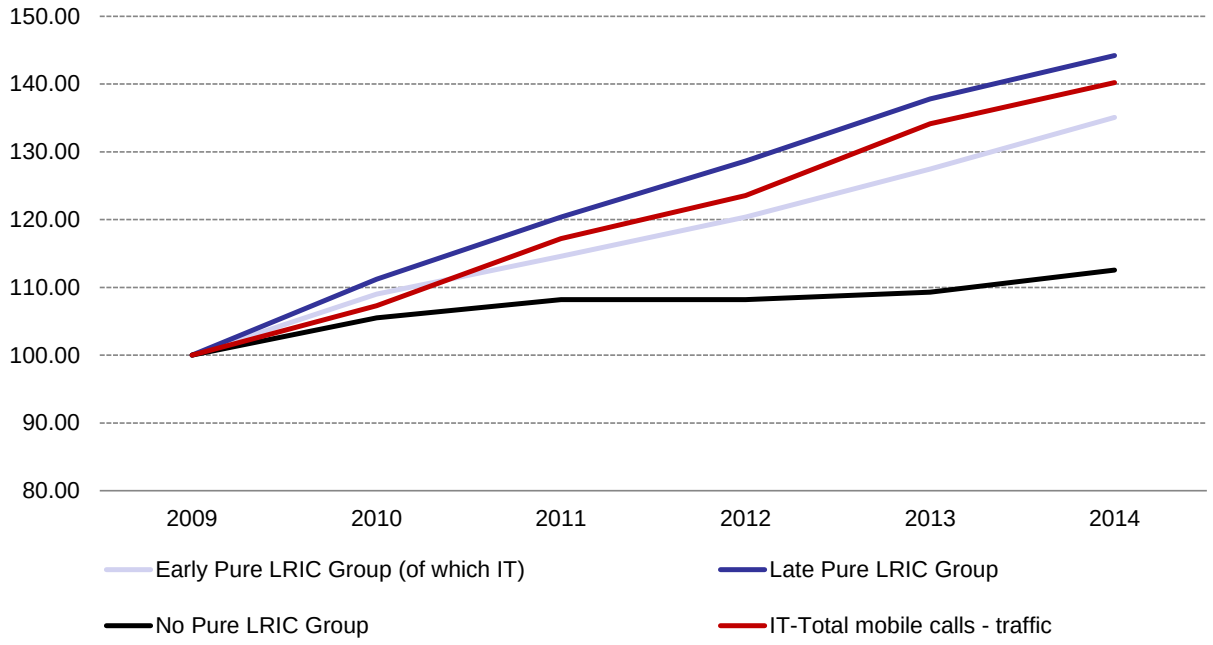
Figure 337 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 338 shows the evolution of the total amount of minutes of mobile calls in Italy. It can be observed that it has been growing since 2009, following a similar trend to the Early and Late Pure LRIC Groups.

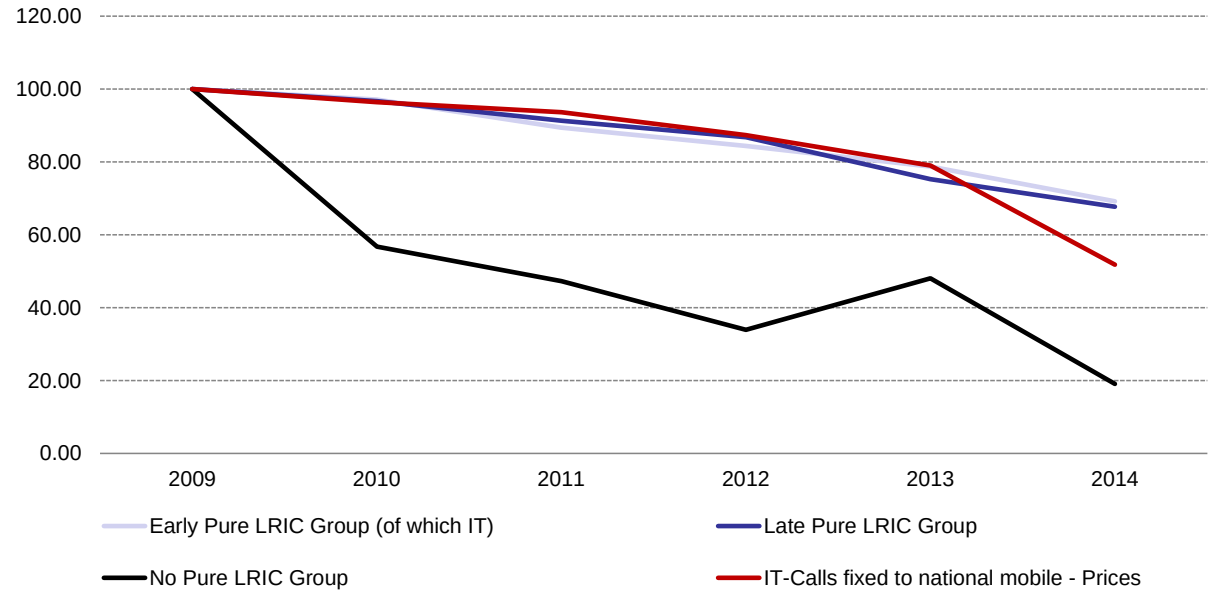
Figure 338 - Total minutes of mobile traffic (base 100 in 2009)



NRAs Replies to questionnaire

Prices for on-net mobile calls have shown a strong decline since 2009, being divided by more than two, and following a similar evolution to the Early Pure LRIC group.

Figure 339 - Prices of fixed calls to national mobile (base 100 in 2009)



Source: AGCOM

8.15.1.2 *Evolution of retail mobile offers*

According to AGCOM, most of the current offers in Italy are bundles offering minutes of voice call to an upper limit within a certain monthly fee. The limits are different regarding the type of service, focused on voice calls, SMS or data such as:

- 500/1000 minutes,
- 500/1000 SMS,
- 1/2/3 Gigabytes of data.

AGCOM noticed that data is now the most relevant service.

Some offers also include calls to international, especially to European countries.

AGCOM stated that these evolutions were enabled by the symmetry among MTR and their reduction after the adoption of Pure LRIC:

- The price of fixed-to-mobile calls has decreased by 45% between 2011 and 2014,
- The price of off-net mobile calls has decreased by 63% over the same period.

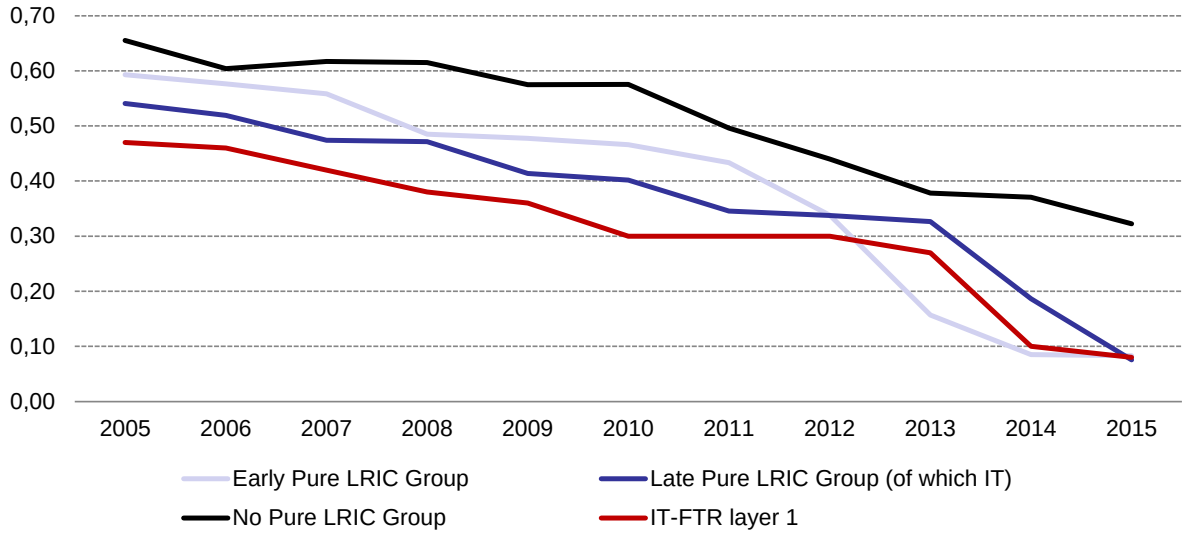
AGCOM highlighted that the difference between on-net and off-net prices was mainly reduced since MTR are set on a Pure LRIC basis, although they imposed symmetry among MTR since 2011. In particular, the volume of off-net mobile calls almost doubled between 2011 and 2014 (+94%).

8.15.2 Fixed market

8.15.2.1 *Quantitative analysis*

The level of FTRs in Italy compared to the three groups' weighted averages in Figure 340 shows that they have been lower than all groups from 2005 to 2012, they then started decreasing a year later than the ones of the Early Pure LRIC Group, and were set on a Pure LRIC basis in 2015 although they were already at the same level of the Early Pure LRIC Group in 2014.

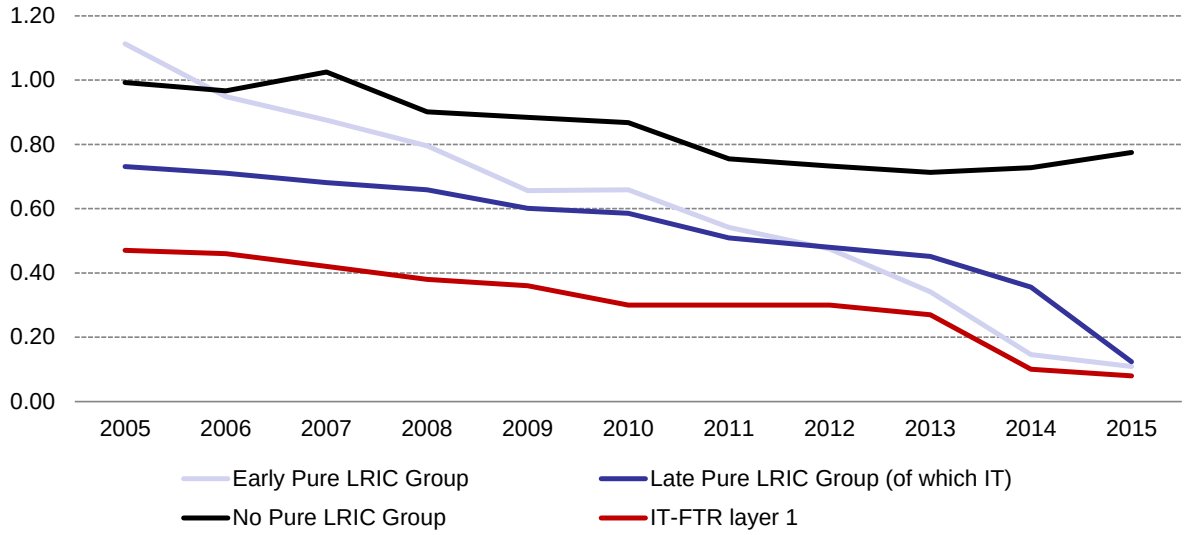
Figure 340 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 341 shows the flat average for the three groups as opposed to the previous figure. It can be observed that Italian FTRs have been following a more similar trend to the Early Pure LRIC Group's flat average from 2013 to 2015.

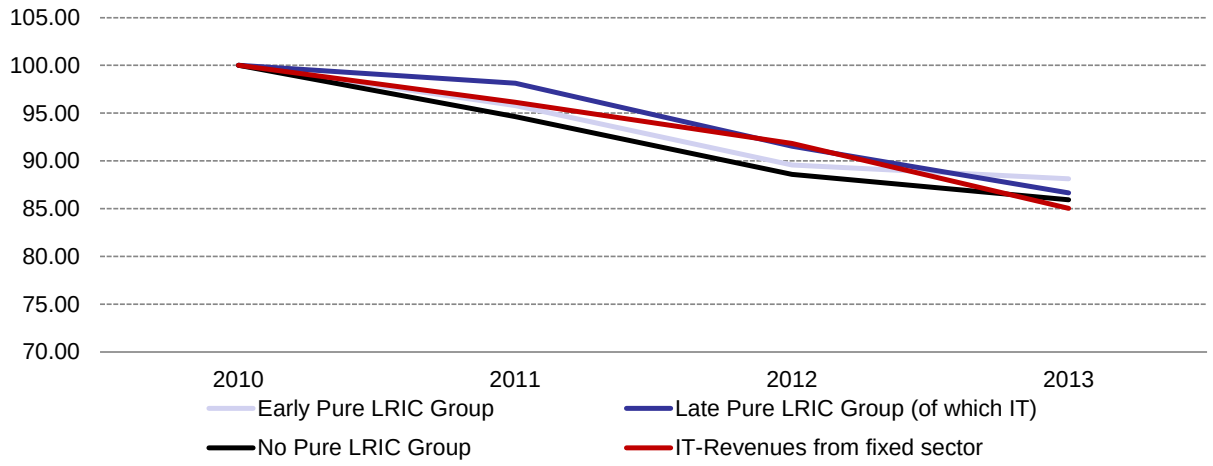
Figure 341 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 342 shows the steady decline of revenues from the fixed sector in Italy. The trend followed since 2010 by Italian revenues from fixed sector is relatively comparable to the Late Pure LRIC Group of which Italy belongs.

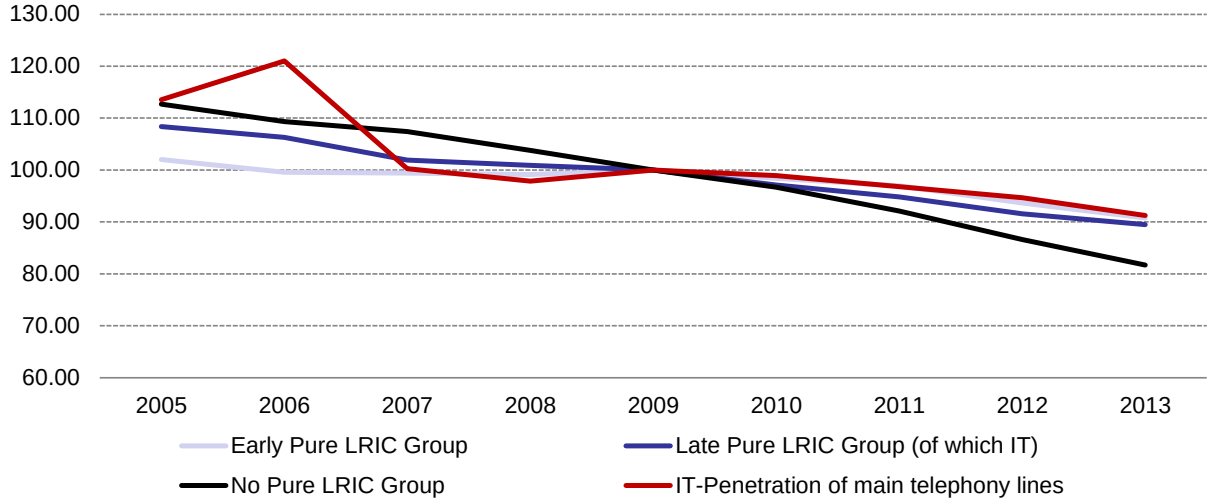
Figure 342 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Italy presented in Figure 343 dropped in 2007 and has then been constantly decreasing from 2009 to 2013, following the trend of Early and Late Pure LRIC Groups over this period.

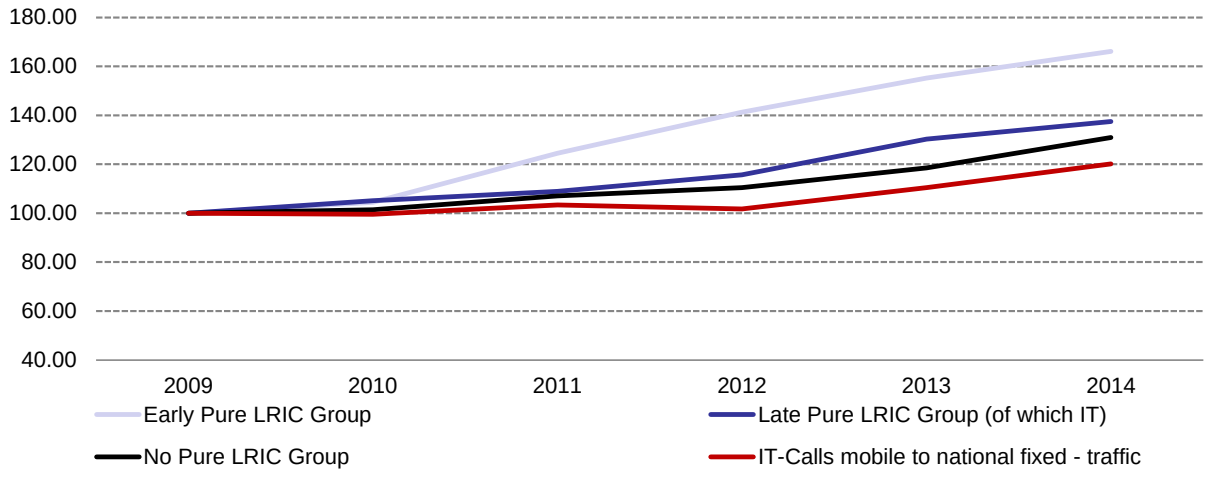
Figure 343 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Italy, presented in the figure below, has been fairly steady from 2009 to 2012, and then started increasing in 2012 until 2014. It can be noticed that the mobile to fixed traffic in Italy has been roughly following the Late Pure LRIC Group's evolution since 2009.

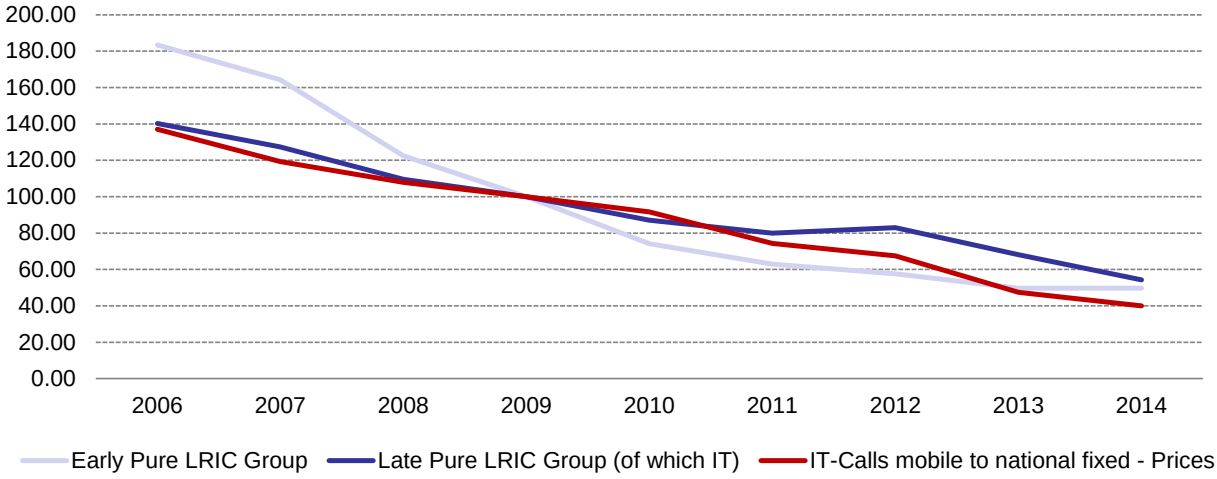
Figure 344 Traffic of mobile calls to national fixed (base 100 in 2009)



Source: AGCOM

Figure 345 shows the evolution of retail prices for mobile calls to national fixed. It can be noticed that their evolution has been very similar to the Late Pure LRIC Group since 2006, being divided by three over this period.

Figure 345 Prices of mobile calls to national fixed (base 100 in 2009)



Source: AGCOM

8.15.2.2 *Evolution of retail fixed offers*

According to the AGCOM, the most common retail fixed offers are bundles including unlimited minutes of voice call and data, and sometimes unlimited voice calls to mobile, within a certain monthly fee. The offers are also likely to include voice calls to international (especially European countries). Although there is still a differentiation depending on the destination of the call, AGCOM has noticed the general reduction of prices for international calls.

AGCOM stated that these evolutions, and the reduction of prices for international calls in particular, were allowed by the reduction of FTR.

8.15.3 Summary

The tables below summarize, for each metric, the difference between Italy and the average metric of the Early pure LRIC Group for the mobile market and the Late Pure LRIC Group for the fixed market in order to highlight how Italy is positioned against its pair countries.

Figure 346 - Differences between Italy and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Italy
Mobile revenues	Decreased more than all groups
Mobile investments	Followed the trend of Late Pure LRIC Group since 2013
Mobile retail prices	Followed the same declining trend as the Early Pure LRIC Group
Mobile penetration	Decreased more in terms of unique subscribers than all groups. Followed no particular trend in terms of SIM cards
Competition in mobile	Higher level of competition than all groups. Followed the evolution of Early Pure LRIC group

Source: TERA Consultants

Figure 347 – Differences between the Late Pure LRIC Group and Italy for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Italy
Fixed revenue	Very close to the Late Pure LRIC Group
Traffic	Slower increase than the Late Pure LRIC Group
Main telephony lines	Very close to the Late Pure LRIC Group

Source: TERA Consultants

8.16 Lithuania

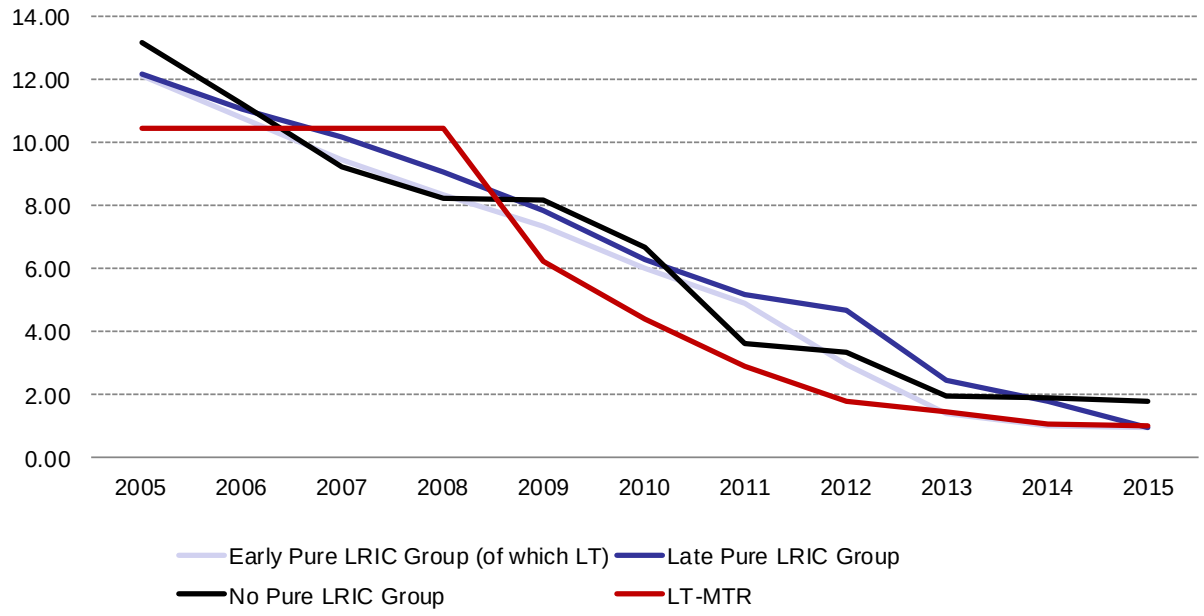
Lithuania's telecommunications market is served by multiple operators in both fixed and mobile markets. While its incumbent TEO LT (launched 1992) managed to keep 90% of telephony lines[157] in the fixed market, the mobile sector is more competitive with three players having close market shares: Tele2 (launched 2005), Omnitel (launched 1991) which belongs to TeliaSonera and Bite (launched 2005). The Lithuanian regulator RRT has been benchmarking countries using the Pure LRIC approach since 2013 to determine the level of MTRs in Lithuania and has then been allocated to the Early Pure LRIC Group. The level of FTRs on the other hand is set on a BU LRAIC+ approach, the country has then been allocated to the No Pure LRIC Group for the fixed sector analysis.

8.16.1 Mobile market

8.16.1.1 *Quantitative analysis*

Figure 348 compares the level of MTR in Lithuania with the three groups' weighted averages. It remained at the same level from 2005 to 2008 and then decreased faster than all groups. Since it has been set at the Pure LRIC level in 2013 (by benchmark), MTRs in Lithuania have become comparable to the Early Pure LRIC Group since 2013.

Figure 348 - Mobile termination rates / weighted average (EURcts/min)

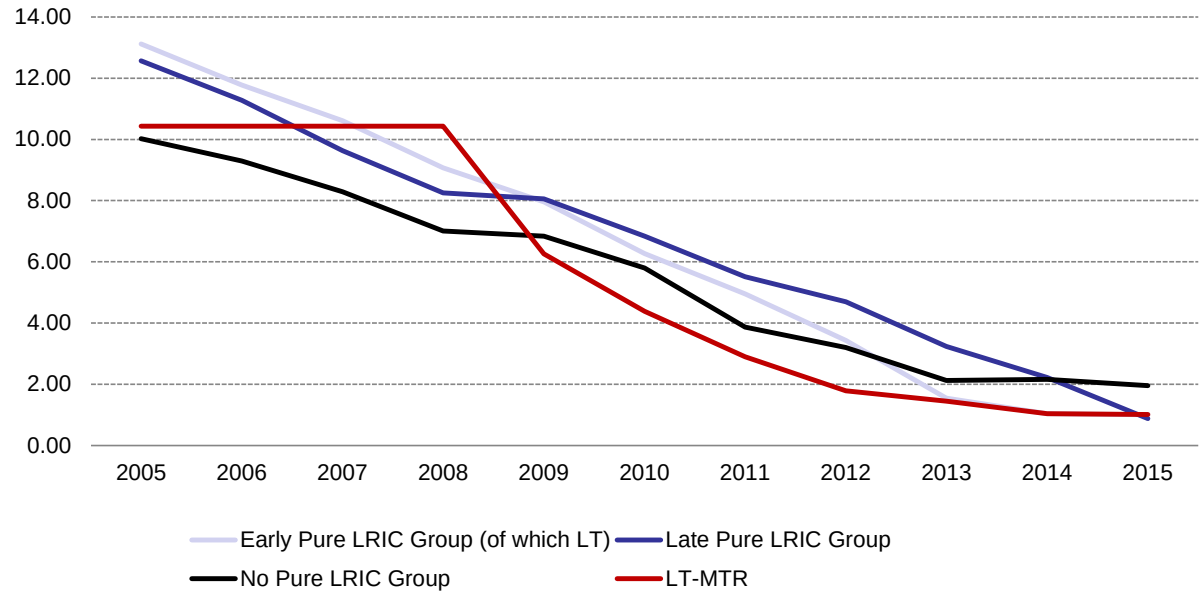


Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 349). There is hardly any difference with the previous figure.

[157] Buddecom report on Lithuanian mobile market

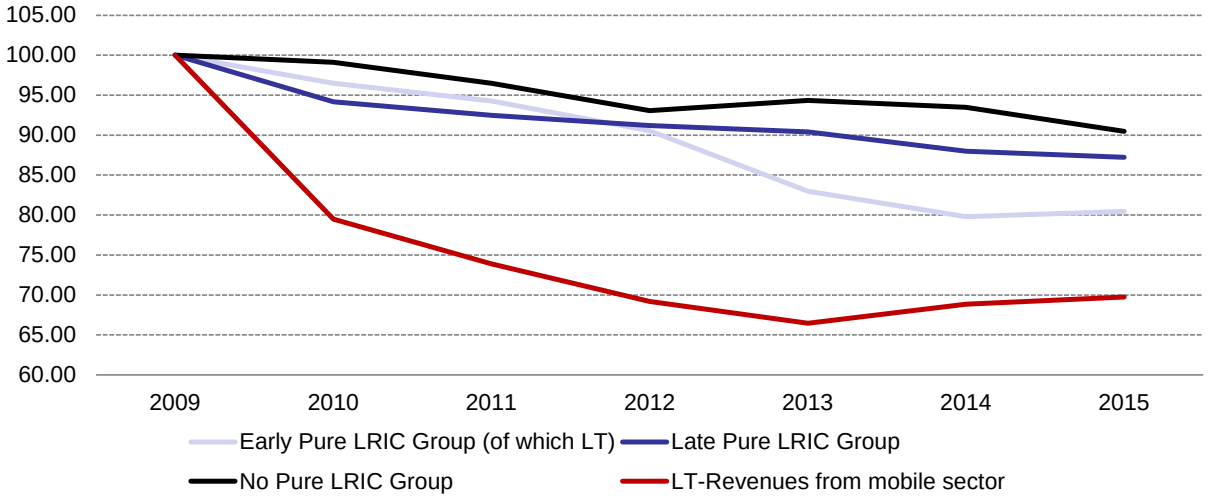
Figure 349 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector in Lithuania presented in Figure 350 have been dropping between 2009 and 2013 more than all groups, and remained pretty steady ever since. Lithuanian revenues have not been following the trend of any country since 2009.

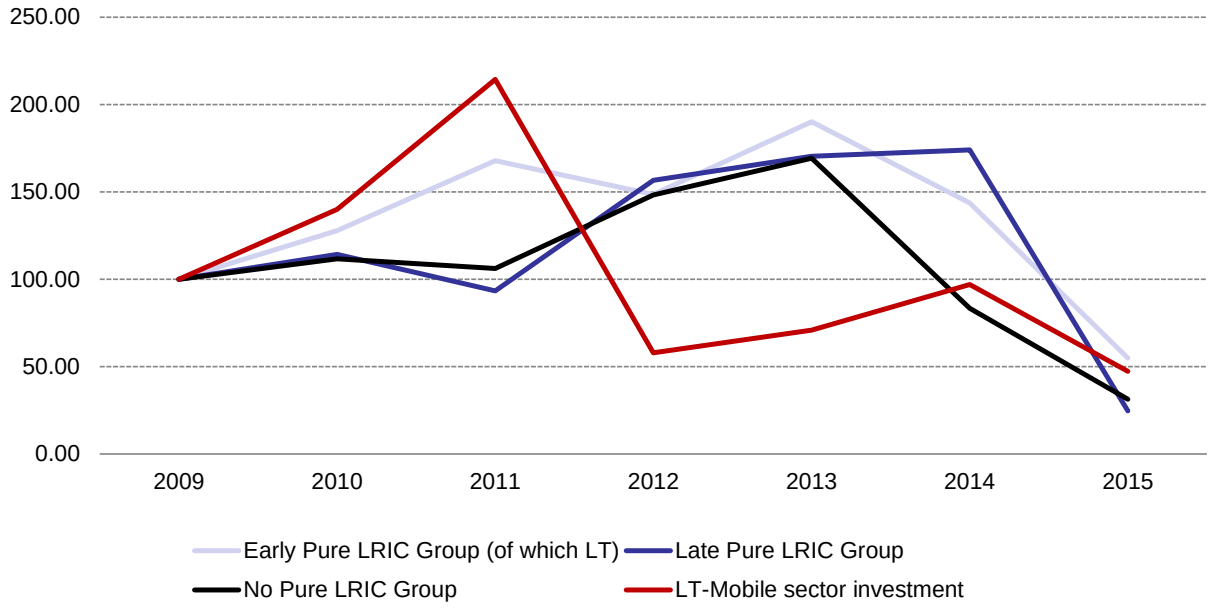
Figure 350 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in the Lithuanian mobile sector presented in Figure 351 followed a chaotic evolution since 2009, strongly increasing from 2009 to 2011, then getting divided by four in 2012, steadily growing until 2014 and falling again in 2015. It could be noticed that Lithuanian investments in the mobile sector have been following the Early Pure LRIC Group's evolution between 2009 and 2011, and then have been comparable to the Late Pure LRIC Group from 2012 to 2015, with a slower decrease in 2015 though.

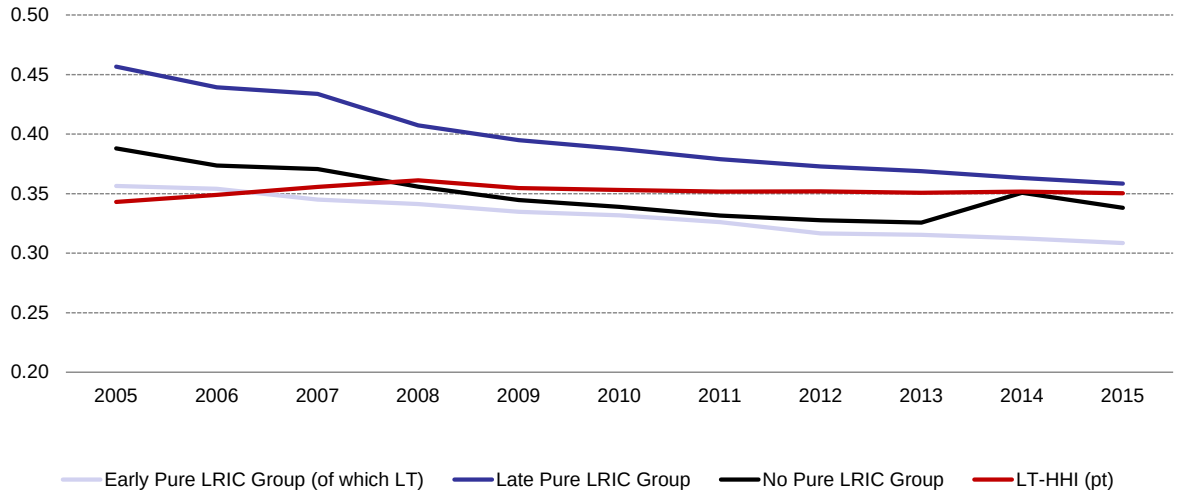
Figure 351 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Lithuanian mobile market. The level of concentration in Lithuania can be observed with the HHI presented in Figure 352, remaining fairly constant since 2008. In 2005 it was at the same level as the Early Pure LRIC Group, but did not evolve, and is now in 2015 at the same level as the Late Pure LRIC Group.

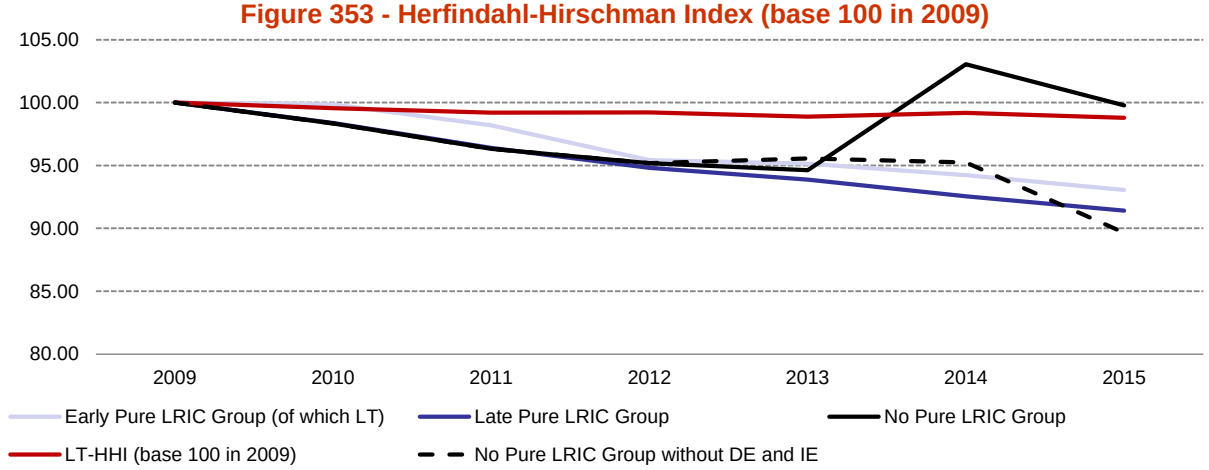
Figure 352 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the stability of the market concentration in Lithuania can be observed with Figure 353 which displays the HHI as base 100 in 2009 and shows the very steady trend of the Lithuanian HHI whereas it has been decreasing for all groups, with an exception for the No Pure LRIC Group in 2014 subsequently to two important mergers.

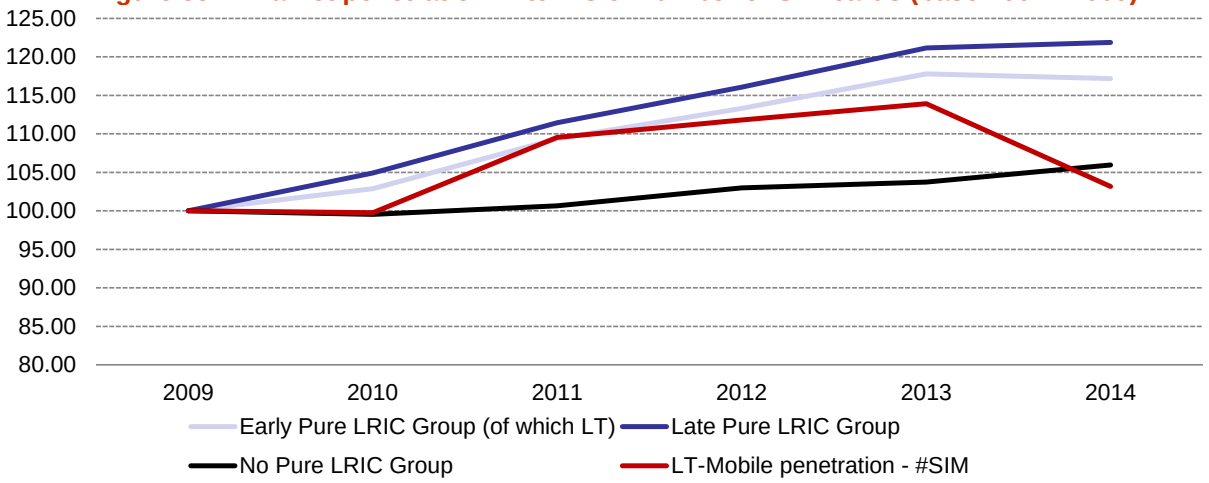
Figure 353 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Lithuanian market penetration in terms of number of SIM presented in Figure 354 increased between 2010 and 2013, following a similar curve to the Early Pure LRIC Group over this period, and then almost fell to its 2010 level in 2014 whereas it remained constant for the Early Pure LRIC Group.

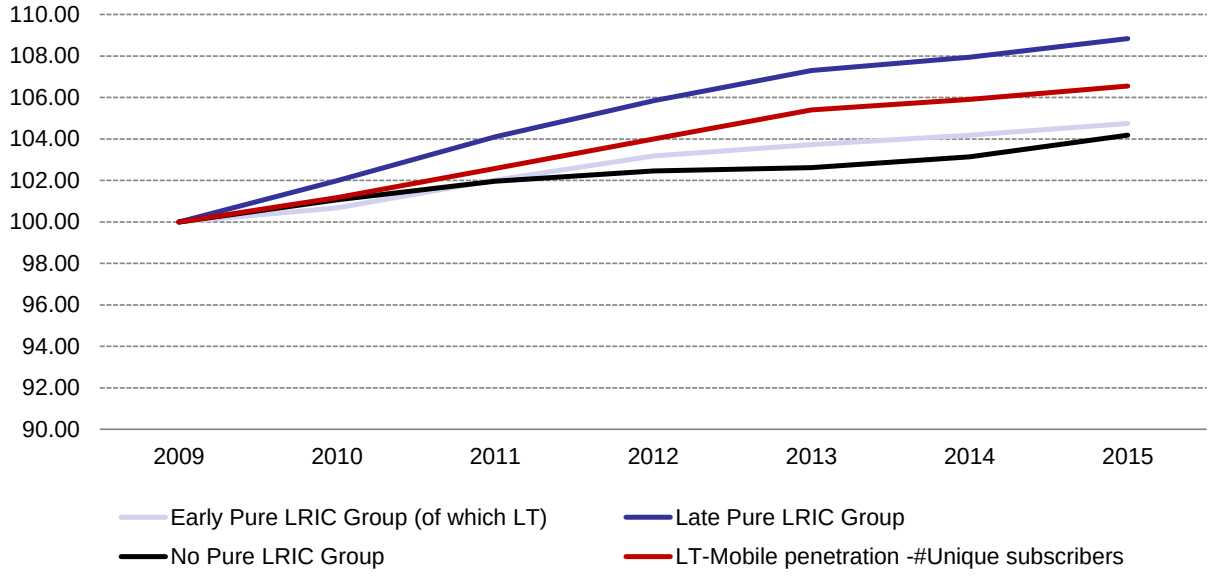
Figure 354 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

On the other hand; it can be observed in Figure 355 that the market penetration in terms of unique subscribers in Lithuania has been increasing from 2009 to 2015 more than its group average.

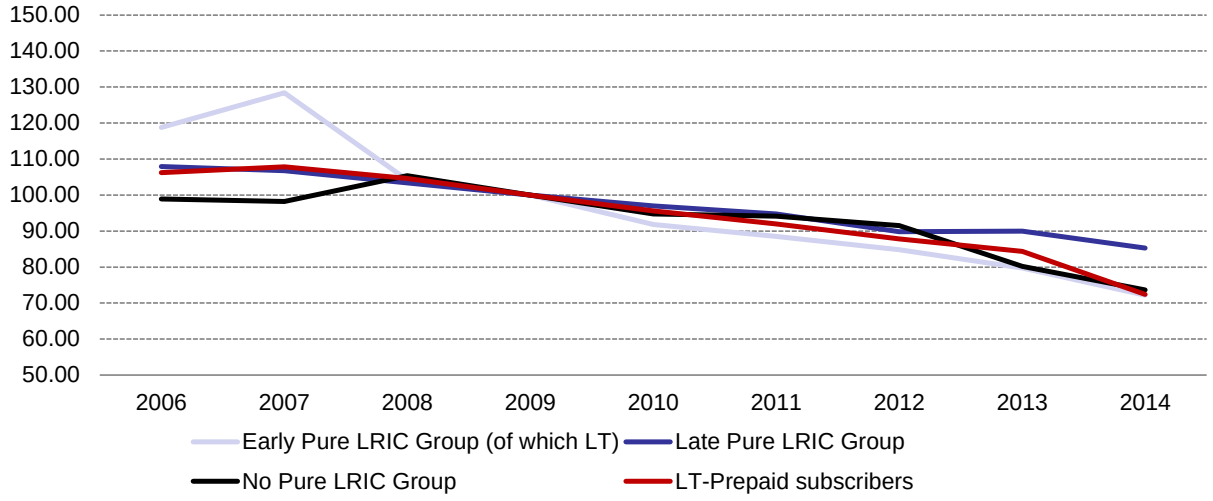
Figure 355 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 356 shows the share of prepaid subscribers in Lithuania from 2005 to 2014. It can be observed that it has been constantly decreasing since 2005 for Lithuania and the three groups. The trend followed by Lithuania for the share of prepaid customers has been similar to the Late Pure LRIC Group from 2005 to 2013. It has then declined faster.

Figure 356 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 357 shows the amount of minutes of mobile calls in Lithuania. It has been increasing since 2009 following a relatively comparable trend as the trend of the Late Pure LRIC group.

Figure 357 - All mobile calls - traffic (base 100 in 2009)

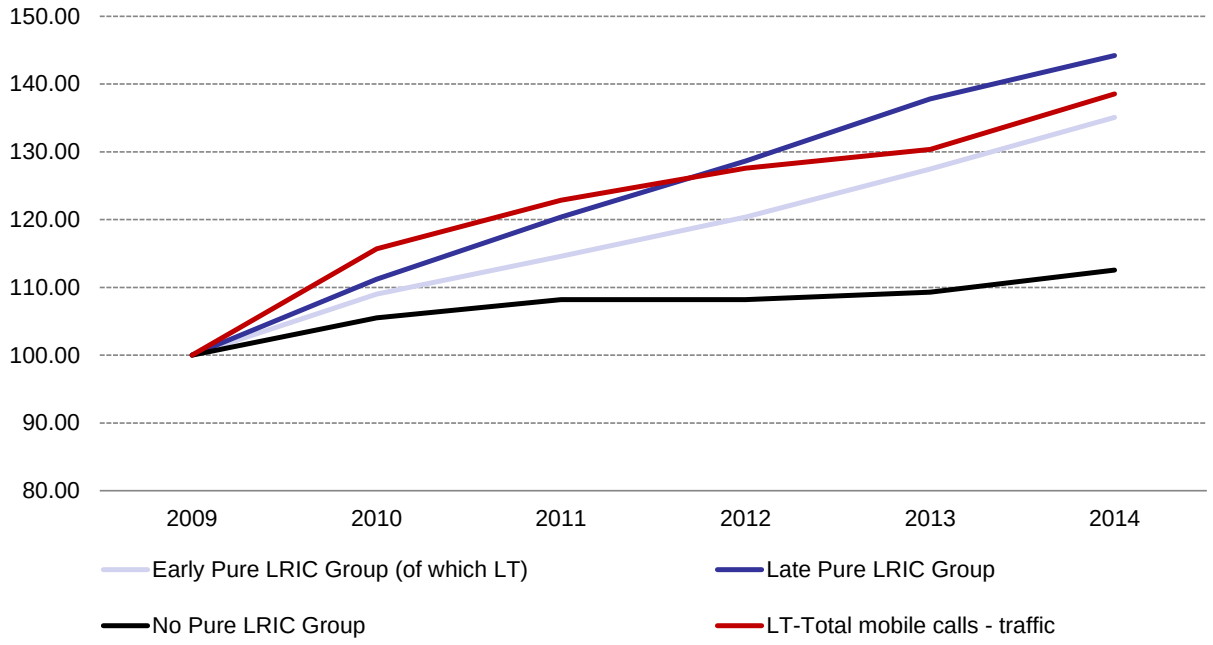


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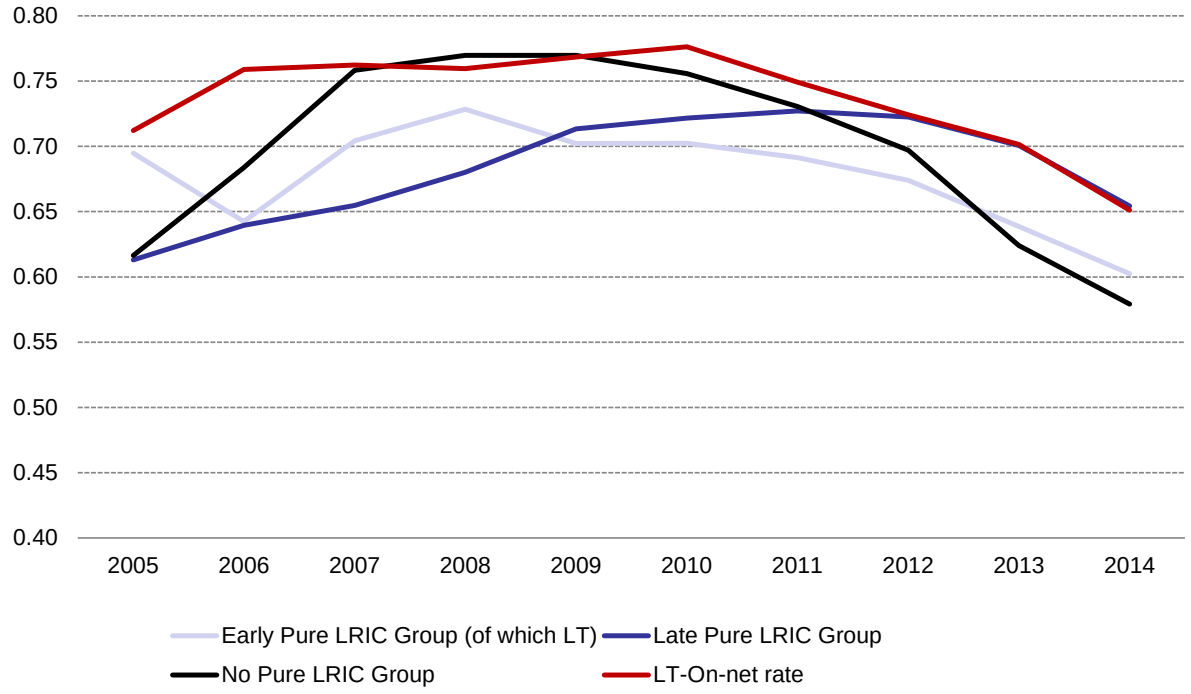
Figure 358 shows the share of on-net mobile calls, slowly increasing from 2005 to 2010 for Lithuania before decreasing after 2010. It has been way above the Early Pure LRIC Group average from 2005 to 2014 although it followed a roughly comparable evolution.

Figure 358 - On-net rate of mobile calls (%)



Source: RRT

8.16.1.2 *Evolution of retail mobile offers*

According the RRT, flat rate offers in Lithuania first appeared on the market in 2008. This kind of offers became dominant in 2011, only including voice calls.

At the end of 2012, operators started to offer unlimited voice calls in their flat rate plans, and in 2014, unlimited SMS and data.

In the recent years RRT noticed that operators are also offering bundles with usage of Facebook, Deezer, Spotify or other apps.

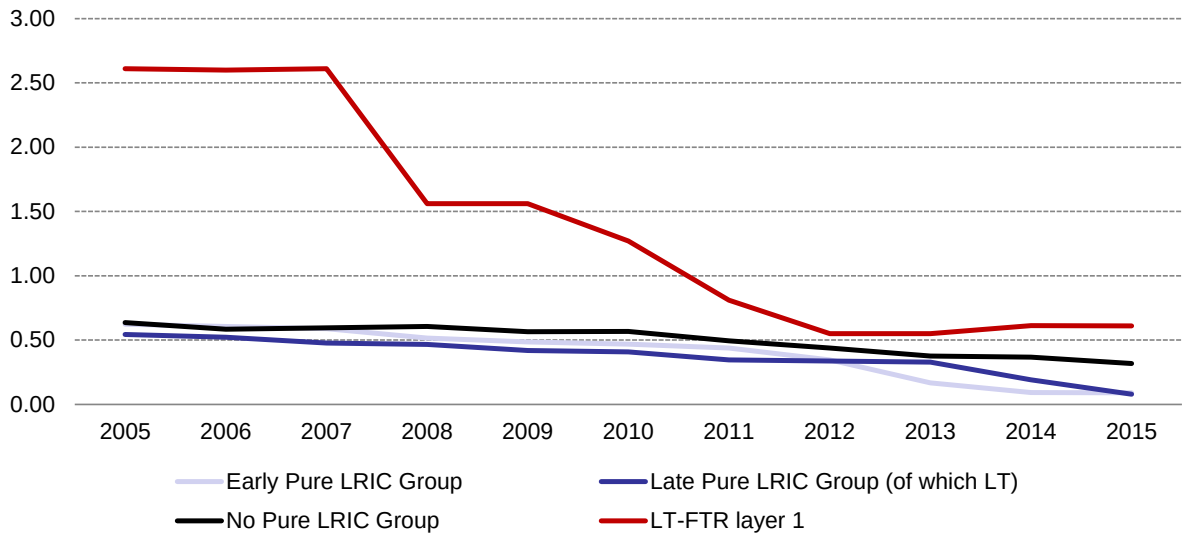
RRT stated that MTR reduction was not the most condition to trigger the evolutions of the retail market, since Lithuania has a three-player market with an equivalent share of traffic.

8.16.2 Fixed market

8.16.2.1 *Quantitative analysis*

The level of FTRs in Lithuania has been significantly greater than the average of all countries until 2012 although it has been constantly decreasing. Since 2012, the level of Lithuanian FTRs has remained the same, and is above all groups' weighted averages as presented with Figure 359.

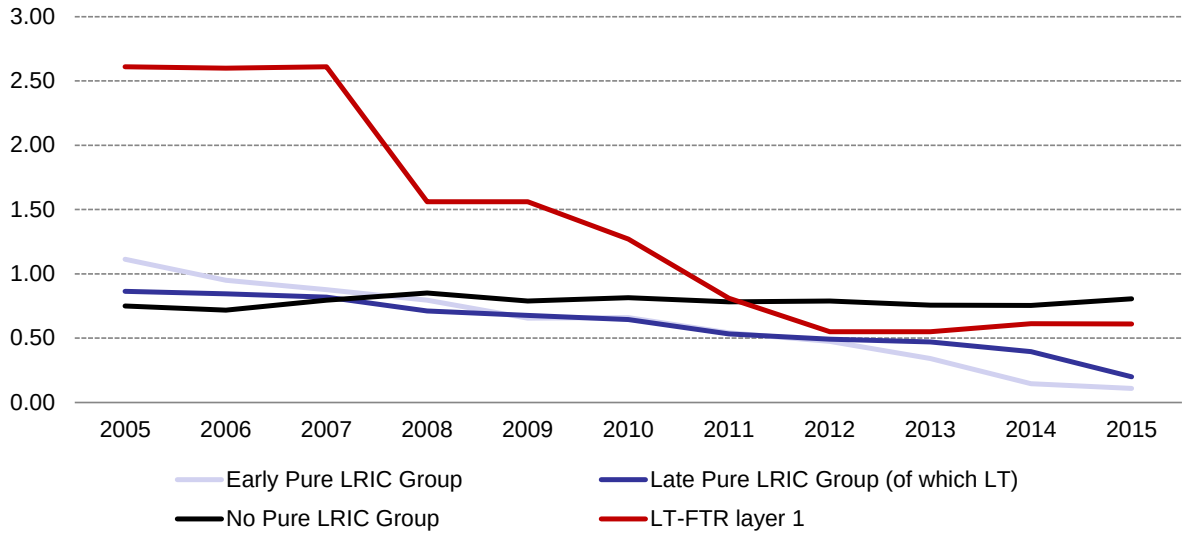
Figure 359 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 360 shows the flat average for the three groups as opposed to the previous figure. The main difference is related to the No Pure LRIC Group average FTR compared to the Lithuanian FTR level which has been lower since 2012.

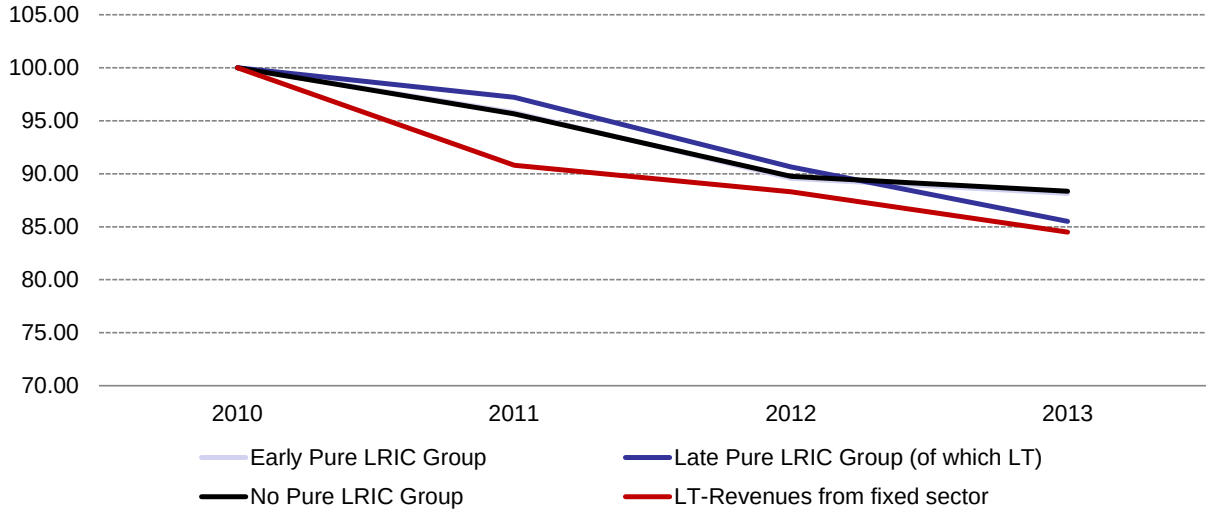
Figure 360 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 361 shows the decline of revenues from the fixed-line market since 2010 for Lithuania. The evolution of revenues in Lithuania has not been following any group's trend, but has been decreasing since 2010 like all groups, and its overall decrease between 2010 and 2013 has been very close to all groups as well.

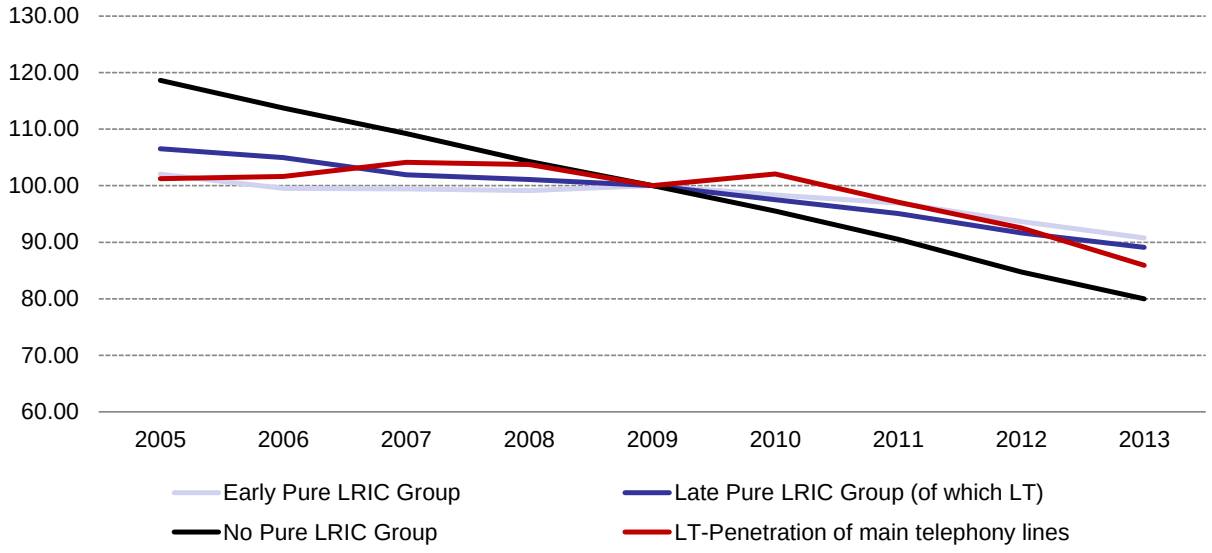
Figure 361 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Lithuania presented in Figure 362 has been relatively steady between 2005 and 2010, and then started decreasing following a comparable downward trend to the No Pure LRIC Group after 2010.

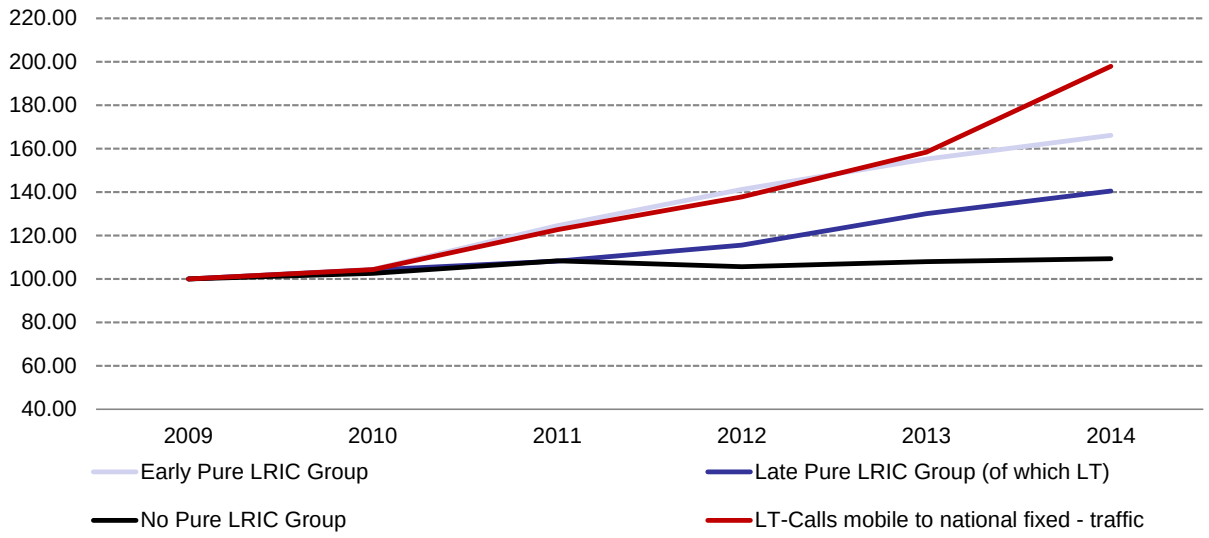
Figure 362 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Lithuania, presented in Figure 363, has shown a steady increase between 2009 and 2014 and has been following the same trend as the Early Pure LRIC Group until 2013. It then increased faster whereas the latter started bottoming-out.

Figure 363 - Traffic of mobile calls to national fixed (base 100 in 2009)[158]



Source: RRT

8.16.2.2 *Evolution of retail fixed offers*

According to RRT, the pricing strategy of fixed operators changed over the past 7 years due to regulation and competitive pressure from mobile operators. In 2009, TEO LT, AB was indeed forbidden to differentiate prices for on-net and off-net calls to fixed operators.

In 2009 operators started offering flat rate plans under the pressure of mobile competition. These plans offered:

- A particular allowance for on-net calls and calls to other fixed networks,
- And calls to mobile were charged an additional fee.

Flat rate plans are now offered by all fixed operators. The volume of calls from fixed networks is 9 times lower than the volume of calls originated on mobile networks.

According to RRT, this was triggered by the competitive pressure of mobile operators rather than the reduction of FTRs and MTRs.

Lithuanian operators also stated that the large difference between MTR and FTR has a negative impact on the fixed telephony's competitiveness.

8.16.3 Summary

The tables below summarize, for each metric, the difference between Lithuania and the average metric for the Early pure LRIC Group for the mobile market and for the No Pure LRIC Group for the fixed market in order to highlight how Lithuania is positioned against its pair countries.

Figure 364 - Differences between Lithuania and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and

[158] From number of minutes

	Lithuania
Mobile revenues	Decreased more than all groups
Mobile investments	Followed no particular trend
Mobile retail prices	Not available
Mobile penetration	Followed no particular trend. Increased like all groups
Competition in mobile	Lower level than Early Pure LRIC Group. Remained stable whereas Early Pure LRIC Group increased
On-net rate	Way higher than its group but followed a comparable trend

Source: TERA Consultants

Figure 365 – Differences between the No Pure LRIC Group and Lithuania for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Lithuania
Fixed revenue	Slightly lower than the No Pure LRIC Group but follows a comparable trend
Traffic	Much faster increase than the No Pure LRIC Group
Main telephony lines	Slower decrease than the No Pure LRIC Group

Source: TERA Consultants

8.17 Luxembourg

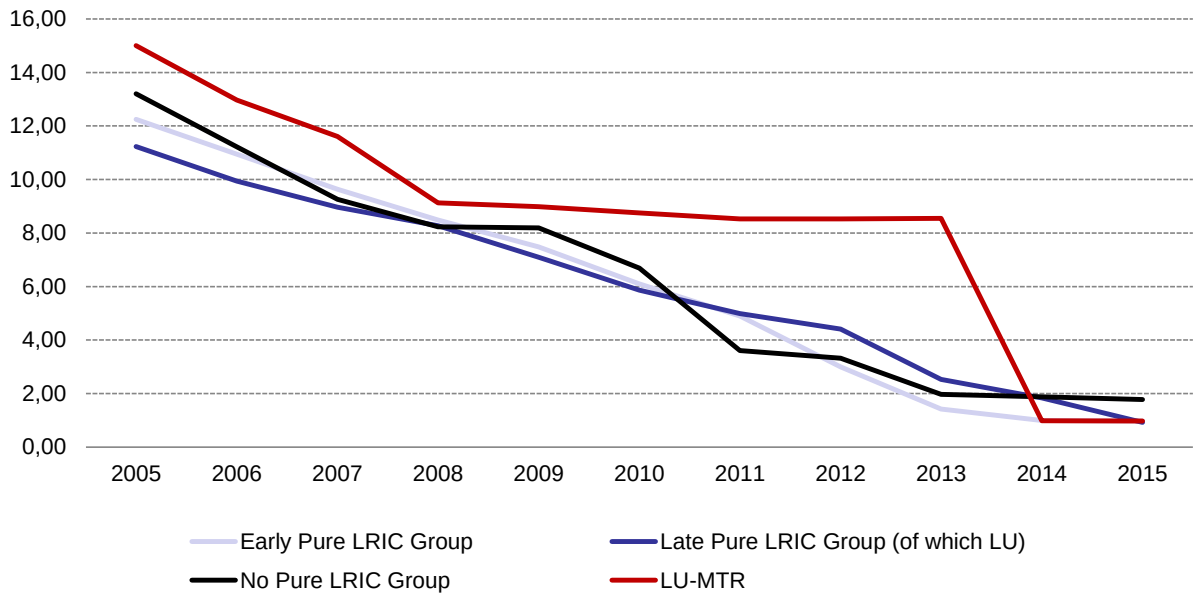
The incumbent in Luxembourg is POST, founded in 1992 and fully state-owned. There are three major players in the mobile sector: POST, Tango (launched 1998) owned by Belgacom and Orange (launched in 2004) owned by Mobistar also present in Belgium. Since the NRA ILR chose to implement the pure LRIC approach in 2014 for MTRs and in 2015 for FTRs, the country has been ranked in the "Late Pure LRIC group" for both fixed and mobile sectors.

8.17.1 Mobile market

8.17.1.1 *Quantitative analysis*

MTRs in Luxembourg were among the highest in Europe until 2014. Figure 366 shows that MTRs have been constantly remaining higher than all other countries average until the adoption of the Pure LRIC approach in 2014. In 2015 MTRs equal the average of the countries which have adopted the Pure LRIC method before and after 2013:

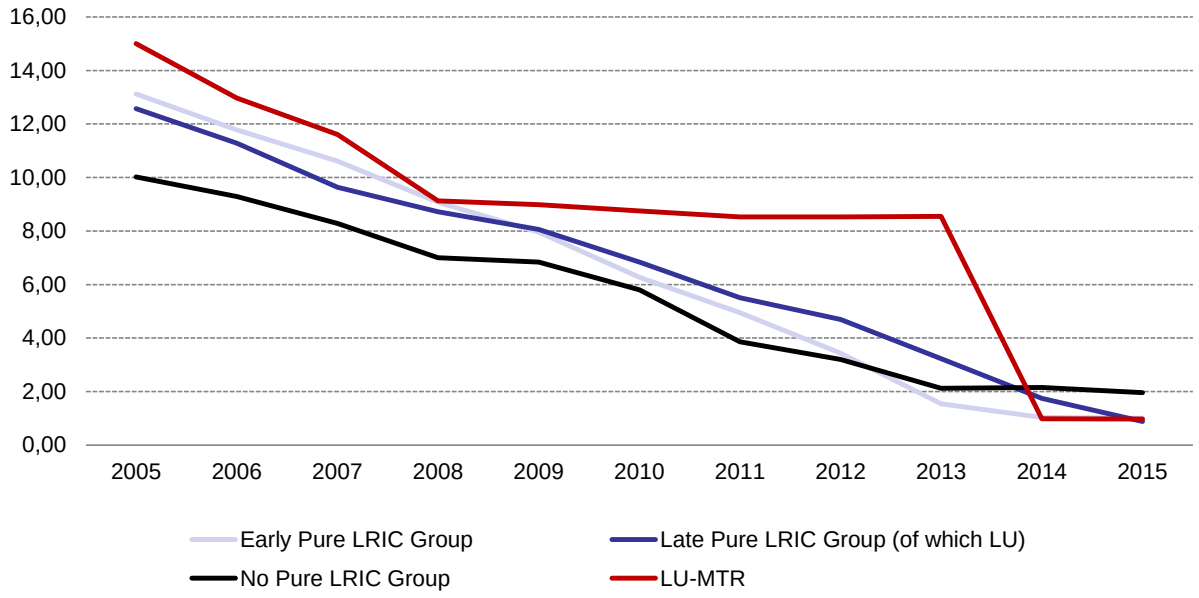
Figure 366 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 367). The trend is approximately the same as the weighted average trend: MTRs in Luxembourg are three times the average MTR in Europe in 2013 but declined very fast over the last past two years and are now below European standards in 2015.

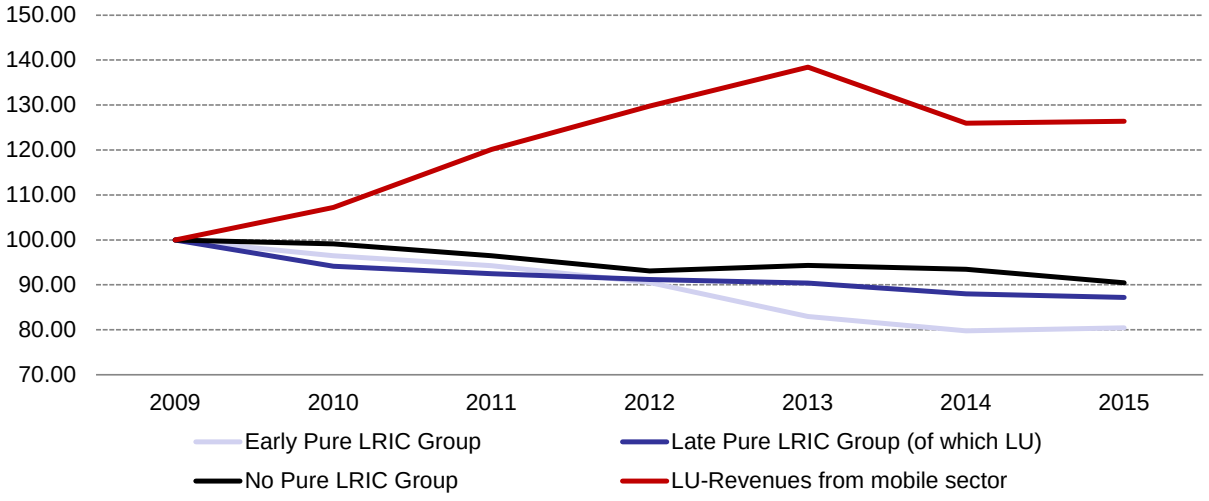
Figure 367 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 368 have been strongly increasing from 2009 to 2013 whereas they have been decreasing for all groups. They have then fallen a little in 2014, and remained constant in 2015, not following any group particular trend.

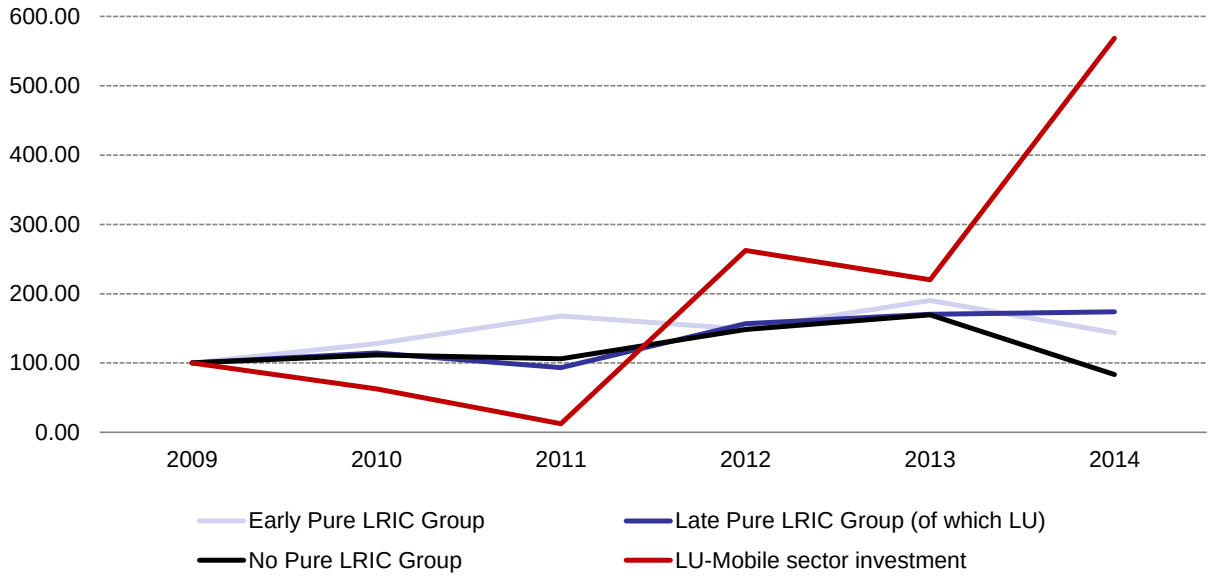
Figure 368 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in Luxembourg's mobile sector have followed a reverse trend compared to European countries, as observed with Figure 369. Whereas they have been increasing for all groups from 2009 to 2011, they were almost divided by ten over the same period in Luxembourg. On the other hand, they have been surging ever since when in the meantime, they have been decreasing for all groups.

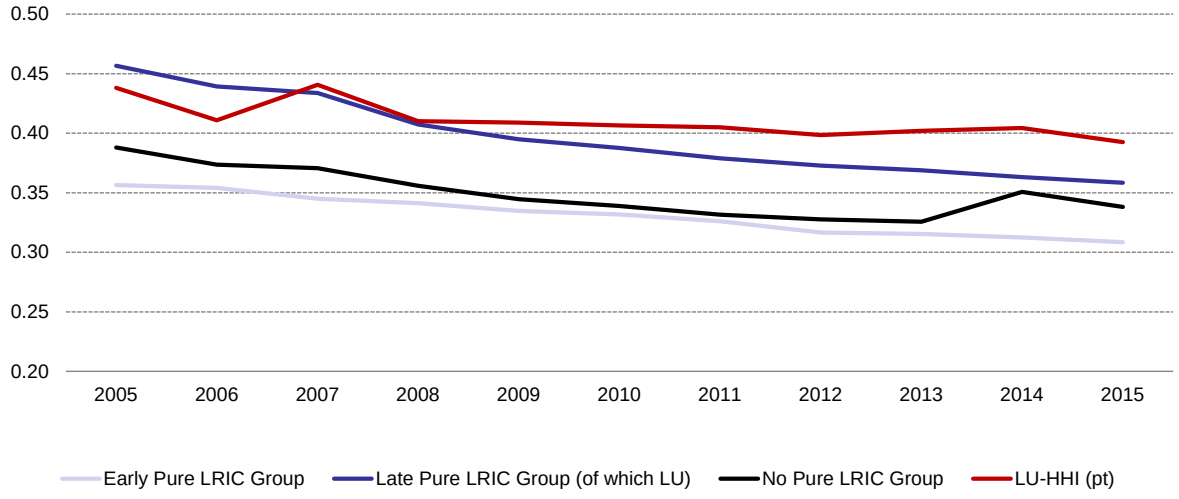
Figure 369 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Luxembourg mobile market. The improvement of competition in the mobile market can be noticed with the constant and slow decrease of the Herfindahl-Hirschman Index since 2007. However, it is in 2015 higher than all groups since concentration has been decreasing faster in other countries since 2008.

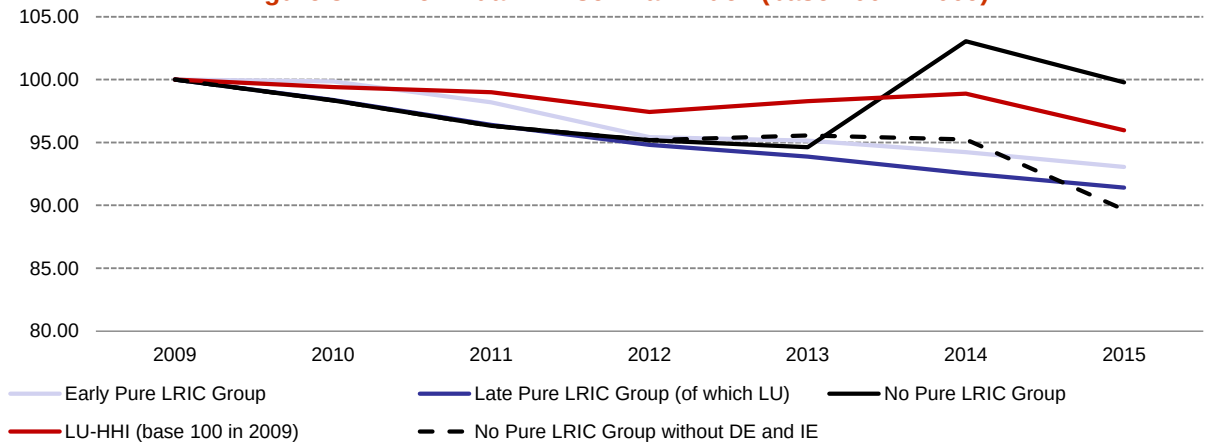
Figure 370 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the slow evolution of the level of concentration in Luxembourg since 2009 can be noticed in Figure 370: the HHI (as base 100 in 2009) has been continuously dropping, but slower than all groups, with an exception with No Pure LRIC Group 2014's surge.

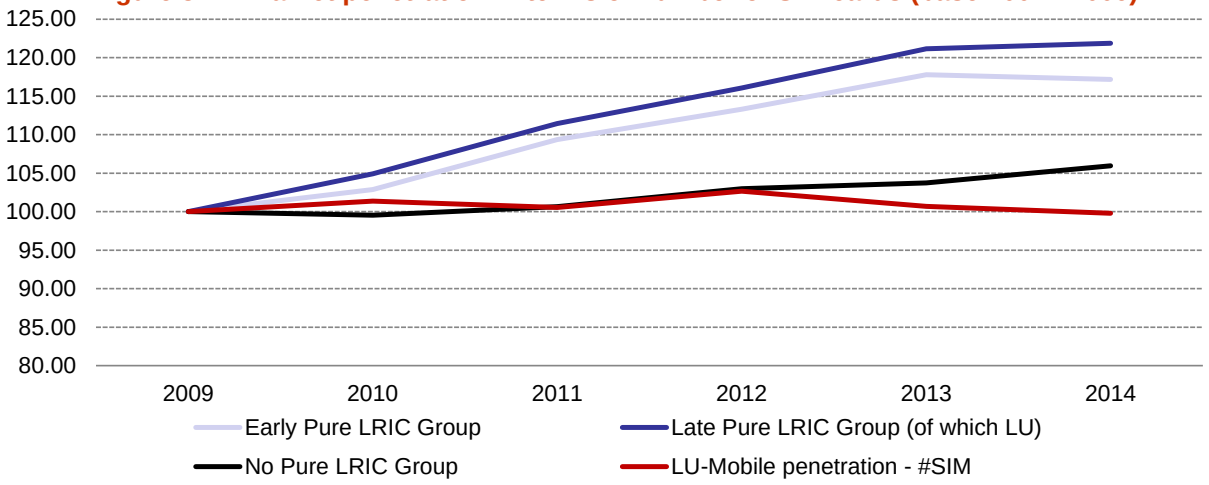
Figure 371 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The market penetration in terms of number of SIM in Luxembourg has been fairly constant since 2009, comparable to No Pure LRIC Group from 2009 to 2012, whereas it has been increasing for Late Pure LRIC Group since 2009.

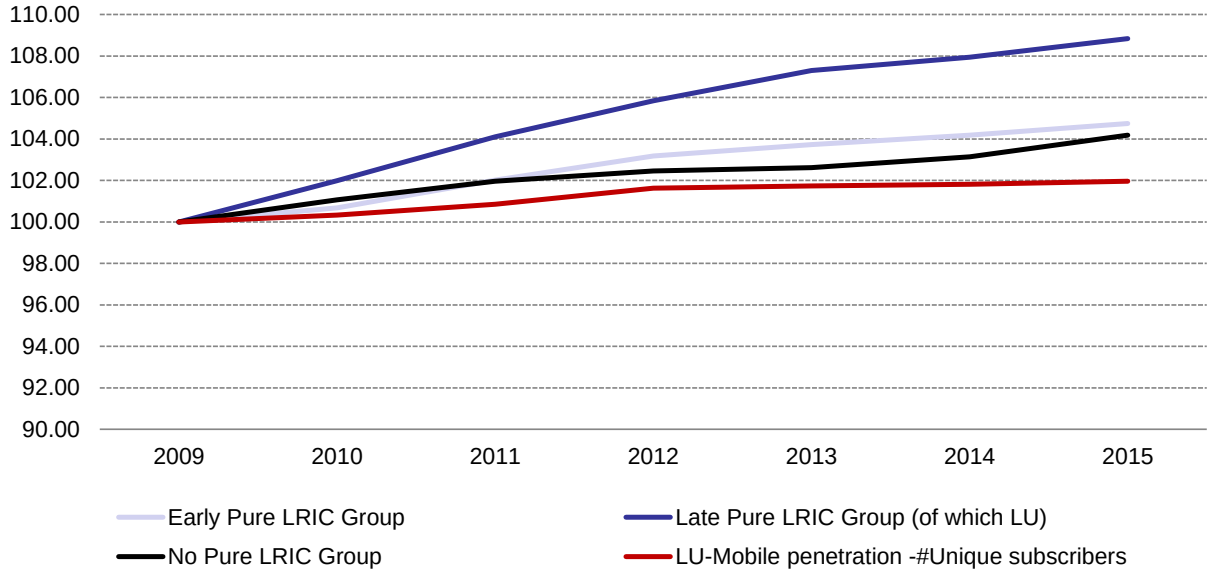
Figure 372 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The same observation holds with respect to market penetration in terms of unique subscribers (see Figure 373), as Luxembourg evolution has been slower than all groups and only steadily increased since 2009.

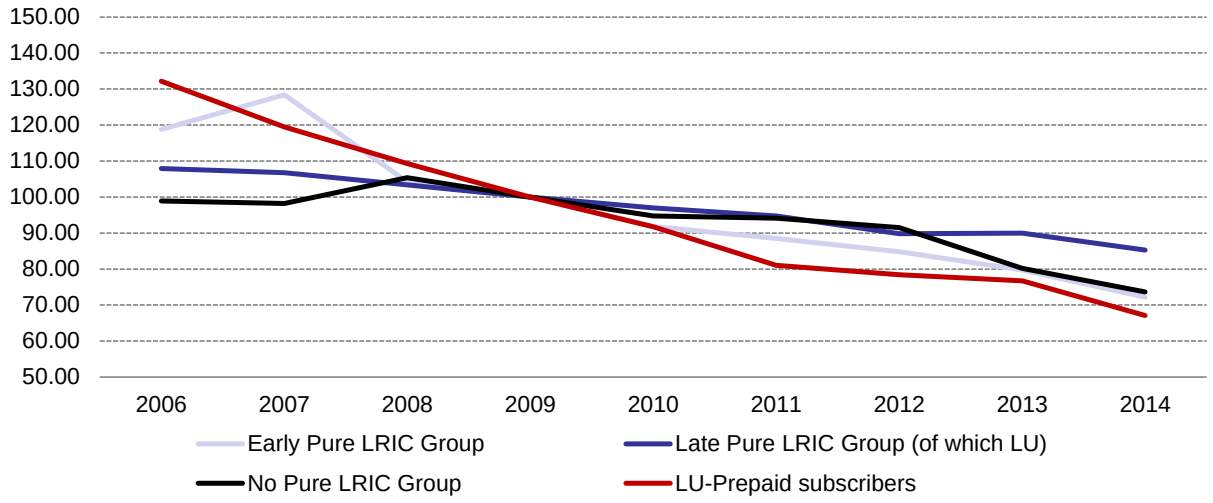
Figure 373 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 374 shows the share of prepaid subscribers in Luxembourg and for the three groups. It has been continuously dropping in Luxembourg, more than for the three groups since 2006. The share of prepaid customers in Luxembourg is therefore relatively low compared to the European average level (26%).

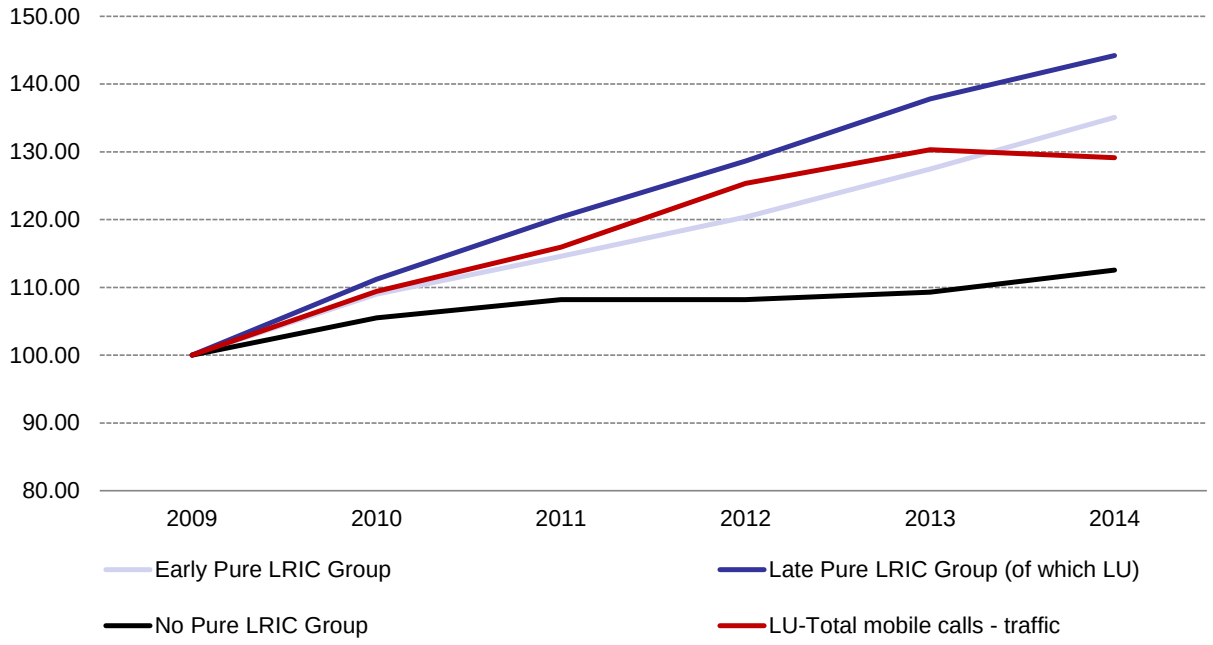
Figure 374 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 375 shows the evolution of the total amount of minutes of mobile calls in Luxembourg. It increased constantly in Luxembourg between 2009 to 2013 with a stronger increase than the Early and No Pure LRIC Groups, but slower than Late Pure LRIC Group. It has then remained constant in 2014.

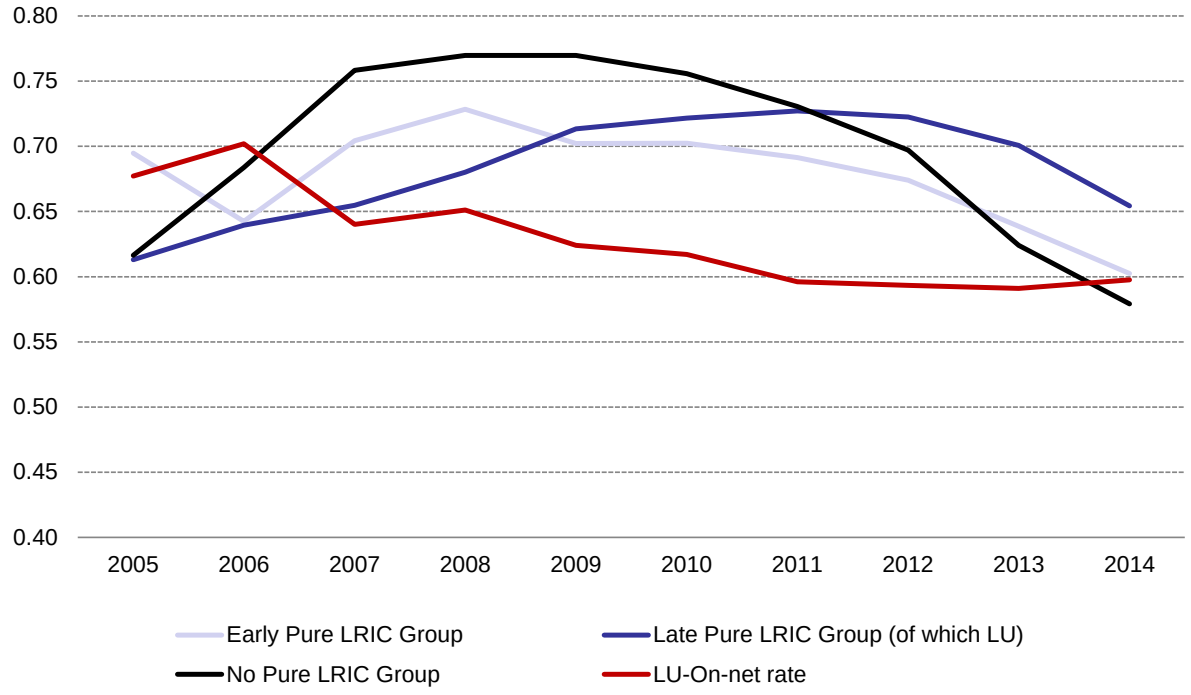
Figure 375 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

More specifically, Figure 376 shows the share of on-net mobile calls in Luxembourg. It can be observed that it fell between 2005 and 2011, and then bottomed-out at a lower level than all groups. In 2014, it is at the same level as the Early Pure LRIC Group, far below its group average.

Figure 376 - On-net rate of mobile calls (%)



Source: ILR

8.17.1.2 *Evolution of retail mobile offers*

According to the ILR, flat rate plans in Luxembourg have been quite common for several years, which included at first mostly on-net calls. These offers evolved towards flat rates including calls to any network, and recently, EU destinations.

The first flat rate including on-net/off-net differentiation appeared in 2007/2008.

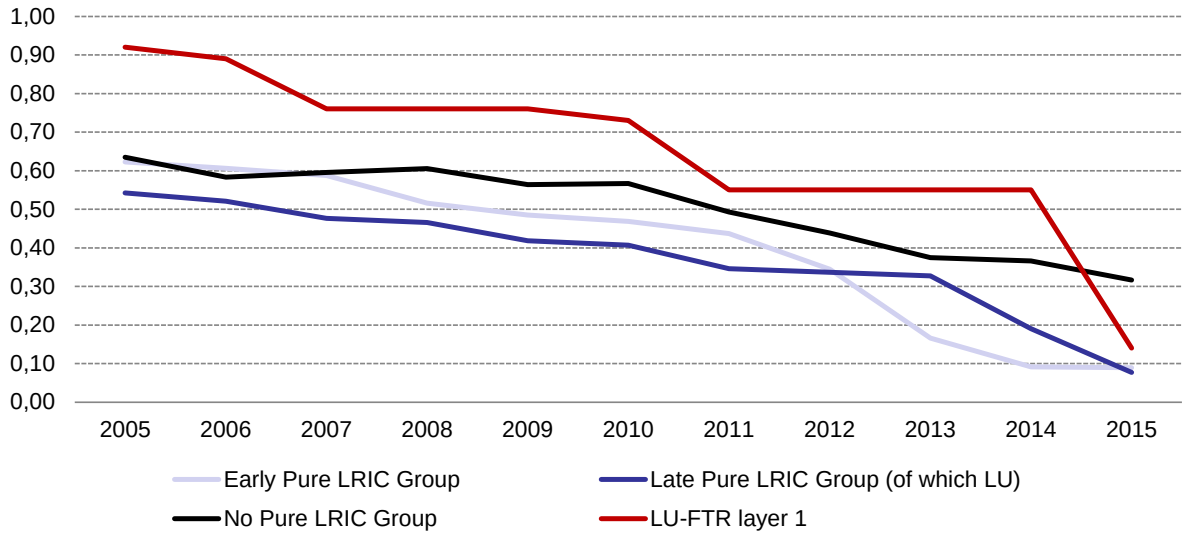
According to ILR, these changes did not occur thanks to the level of MTR.

8.17.2 Fixed market

8.17.2.1 *Quantitative analysis*

The level of the Luxembourgish FTRs has been above the weighted average FTR for all groups between 2005 and 2015 as observed in Figure 377. Since 2011, it has remained unchanged and is in 2015 above all groups' weighted averages.

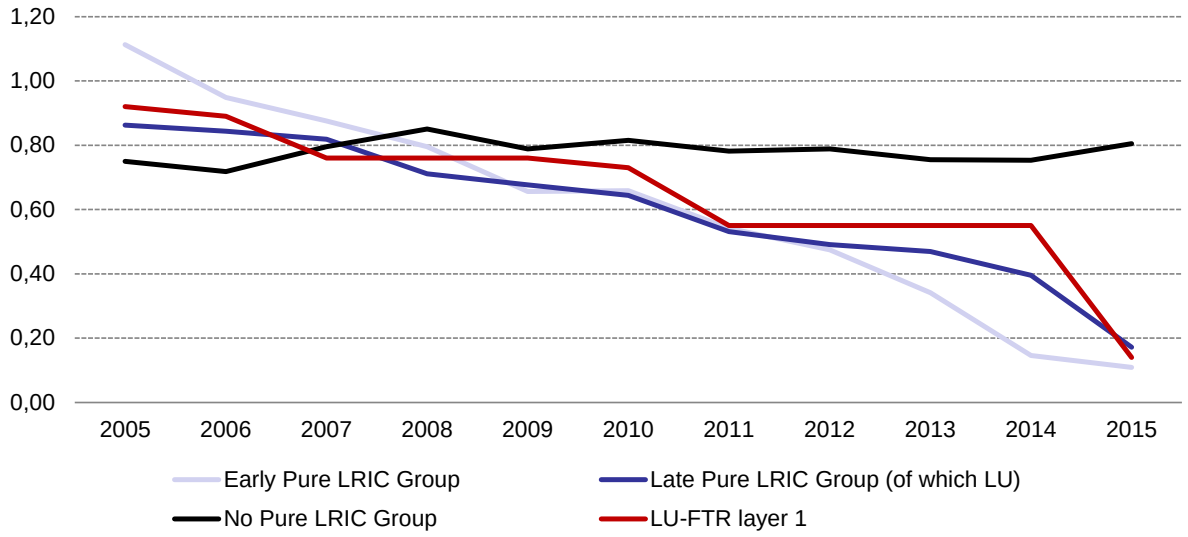
Figure 377 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 378 shows the flat average for the three groups as opposed to the previous figure. When considering flat averages, it can be observed that the Luxembourg's FTR has been above the Early and Late Pure LRIC Groups since 2008, but has been remaining lower than the No Pure LRIC Group. It is still in 2015 above the Early and Late Pure LRIC Groups.

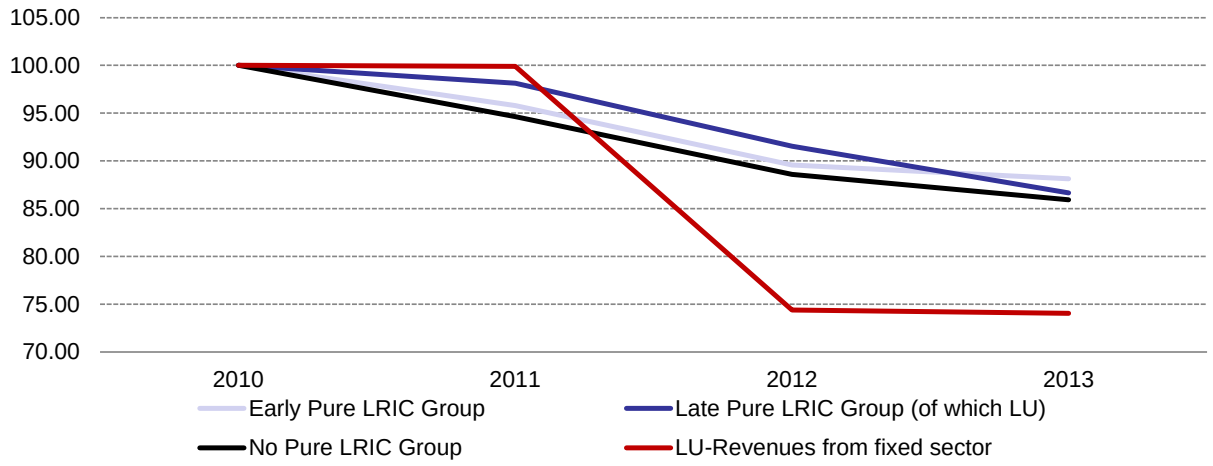
Figure 378 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 379 shows the shrunk of revenues from fixed-line market in 2012 for Luxembourg, whereas it has been constant between 2010 and 2011, then between 2012 and 2013. Revenues in Luxembourg have therefore not followed the trend of any group (each group has seen its revenues decreasing since 2010).

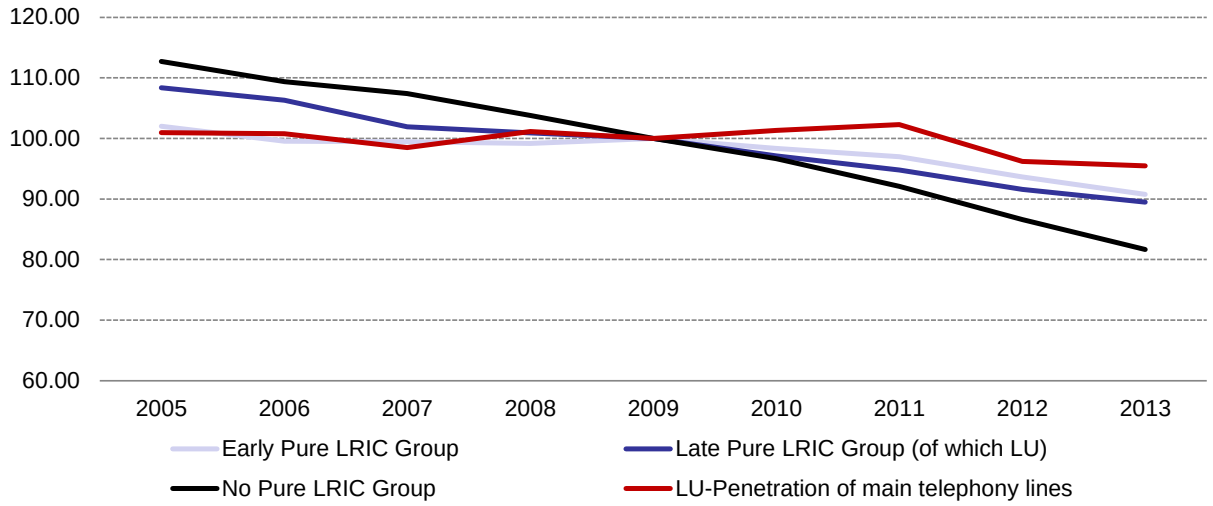
Figure 379 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Luxembourg has been remaining fairly steady from 2005 to 2011, and then started slowly decreasing whereas it has been declining for the Late Pure LRIC Group since 2005.

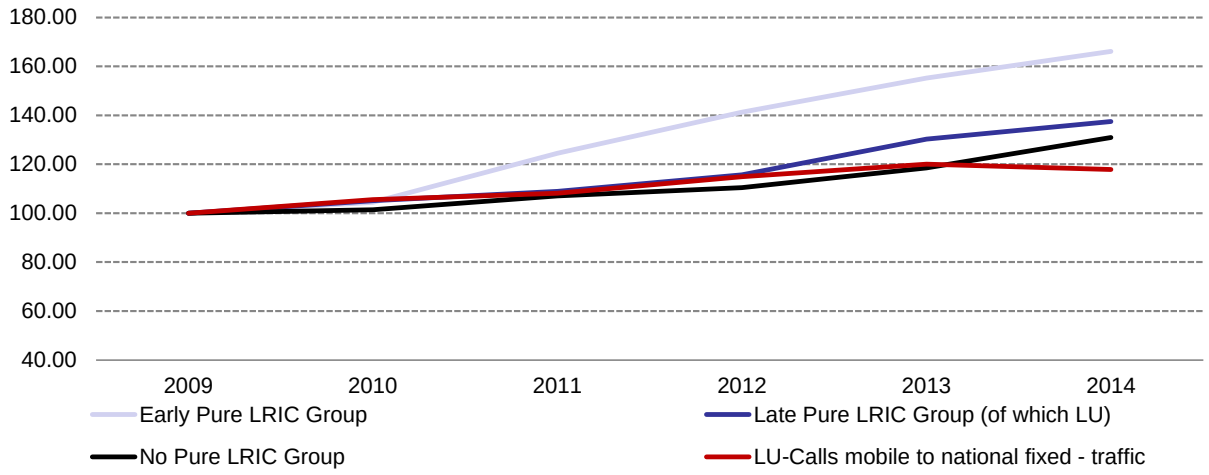
Figure 380 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Luxembourg, presented in Figure 381, has shown a steady growth between 2009 and 2013 and seems to bottom out since 2013, following a roughly comparable trend to the Early Pure LRIC Group.

Figure 381 Traffic of mobile calls to national fixed (base 100 in 2009)



Source: ILR

8.17.2.2 *Evolution of retail fixed offers*

According to the ILR, almost all retail fixed offers have evolved towards bundled products including broadband and flat rates to fixed calls as well as limited flat rate to EU destinations. However, neither calls to international nor calls to mobile are included in those bundles.

According to ILR, these changes have taken place despite the FTR level.

8.17.3 Summary

The tables below summarize, for each metric, the difference between Luxembourg and the average metric for the Late pure LRIC Group in order to highlight how Luxembourg is positioned against its pair countries.

Figure 382 - Differences between Luxembourg and its group for the mobile market

Metrics	Differences between the Late Pure LRIC Group and Luxembourg
Mobile revenues	Increased more than all groups until 2013
Mobile investments	Increased more than all groups since 2011
Mobile retail prices	Not available
Mobile penetration	Same trend as No Pure LRIC Group in terms of unique subscribers and SIM cards
Competition in mobile	Lower level than all groups, followed roughly the same trend as No Pure LRIC Group
On-net rate	Way lower than its group

Source: TERA Consultants

Figure 383 – Differences between the Late Pure LRIC Group and Luxembourg for the fixed market

Metrics	Differences between the Late Pure LRIC Group and

	Luxembourg
Fixed revenue	Much faster decrease than all groups
Traffic	Slightly slower increase than the Late Pure LRIC Group
Main telephony lines	Slower decrease than all groups

Source: TERA Consultants

8.18 Latvia

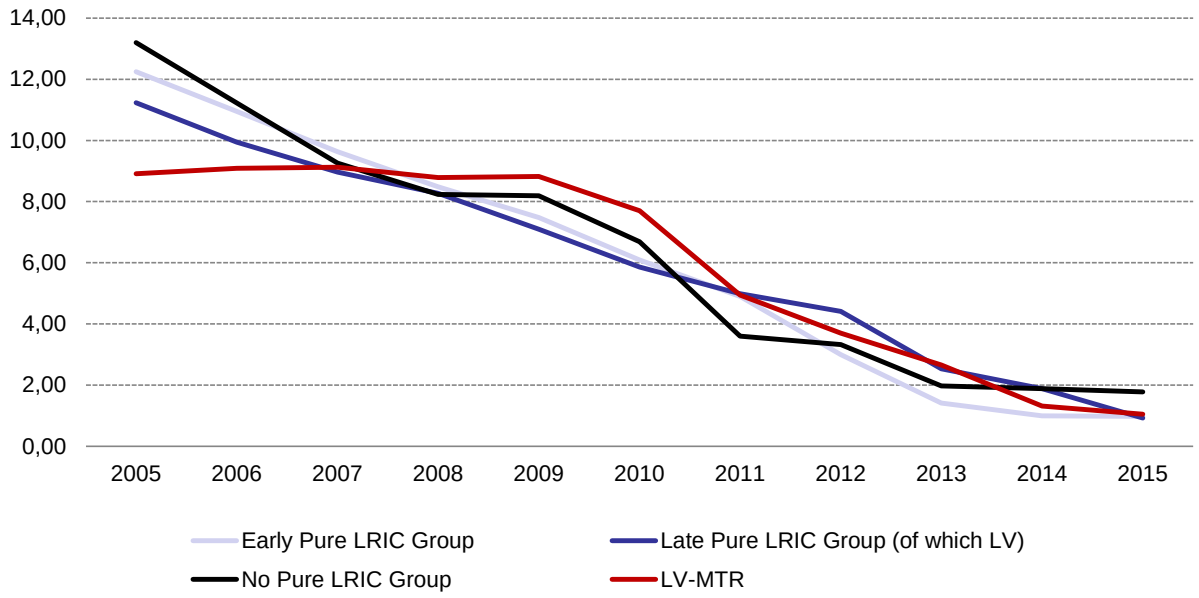
Latvian operators are Lattelecom, the incumbent founded in 1992 is 51% state-owned. There are four mobile MNOs with LMT, Tele2, Bite and Triatel. The Latvian regulator did not implement the pure LRIC approach for setting MTRs, but has been benchmarking countries using the Pure LRIC approach since 2014 and is then allocated to the "Late Pure LRIC Group".

8.18.1 Mobile market

8.18.1.1 *Quantitative analysis*

Figure 384 compares the level of Latvian MTRs with the weighted average MTRs of the three groups. From 2005 to 2009, Latvian MTRs evolved without following the European downward trend, since it was in 2005 way lower than all groups. Since 2009, it has been constantly decreasing and has been since 2014 at the same level as countries which implemented the Pure LRIC approach.

Figure 384 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

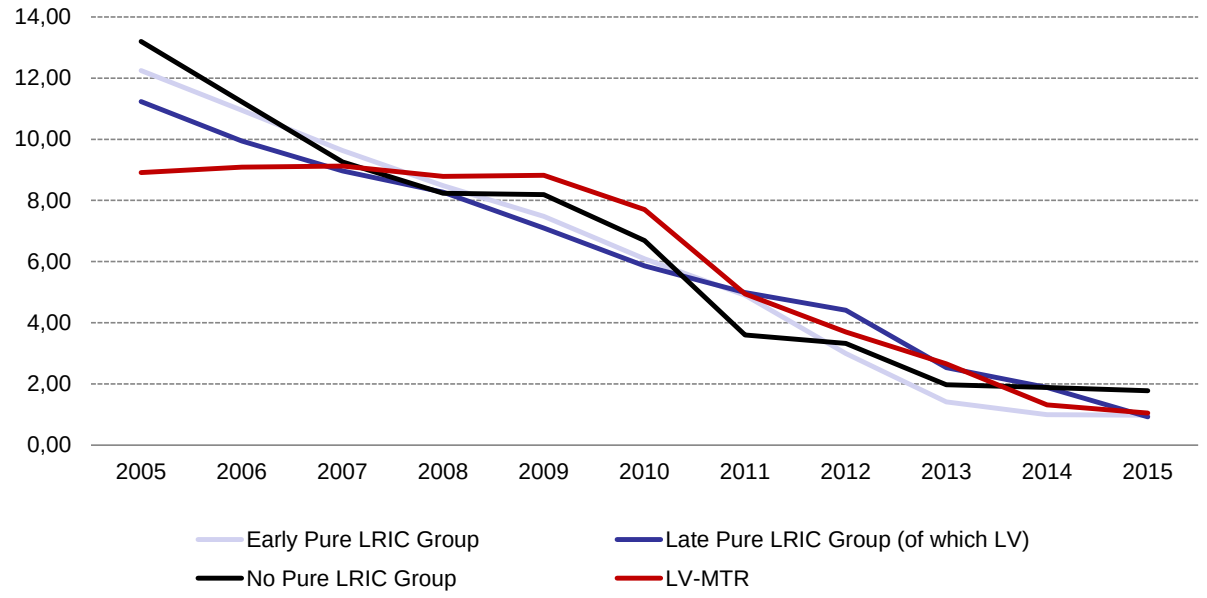
A flat average MTR has also been calculated for each group (see Figure 385). The trend is approximately the same as the weighted average trend with Latvian MTRs remaining in the medium range since 2009.

Figure 385 - Mobile termination rates / flat average (EURcts/min)

Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 386 have been decreasing since 2009 in Latvia, and in all groups. The trend of mobile revenues in Latvia can however be compared since 2010 to the evolution of revenues in the Late Pure LRIC Group.

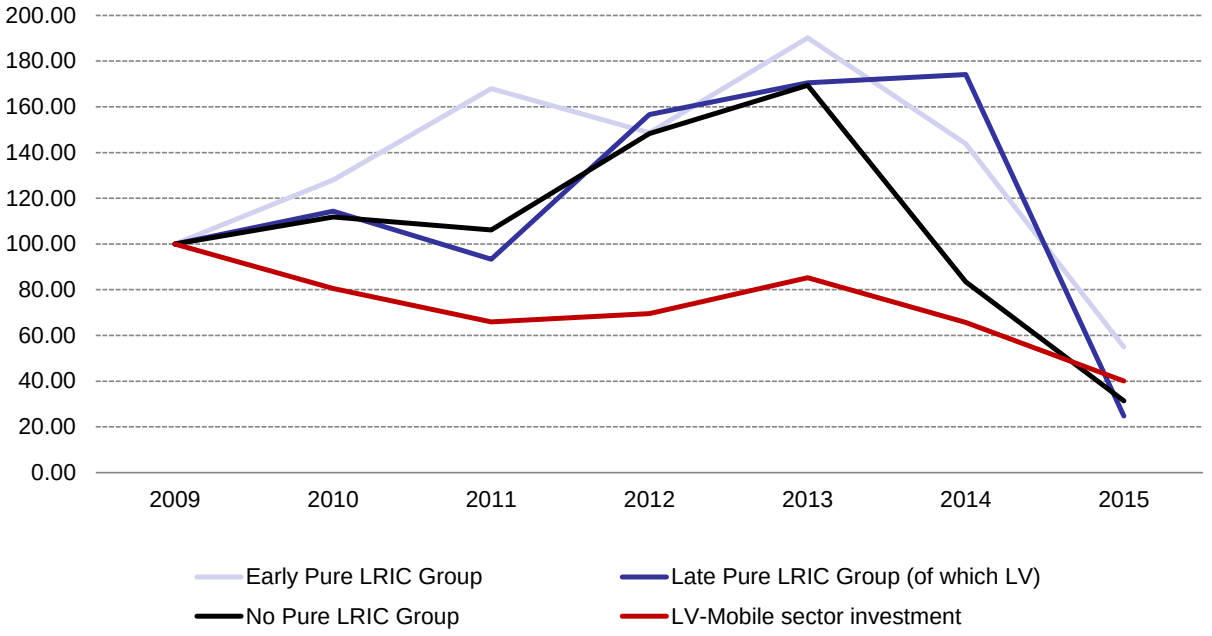
Figure 386 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

As for the revenues, investments (see Figure 387) in the mobile sector have also continued to decline between 2009 and 2015, being divided by two over this period. It has not been following any group particular trend, although the decrease has been stronger since 2013, such as the Early and No Pure LRIC Groups.

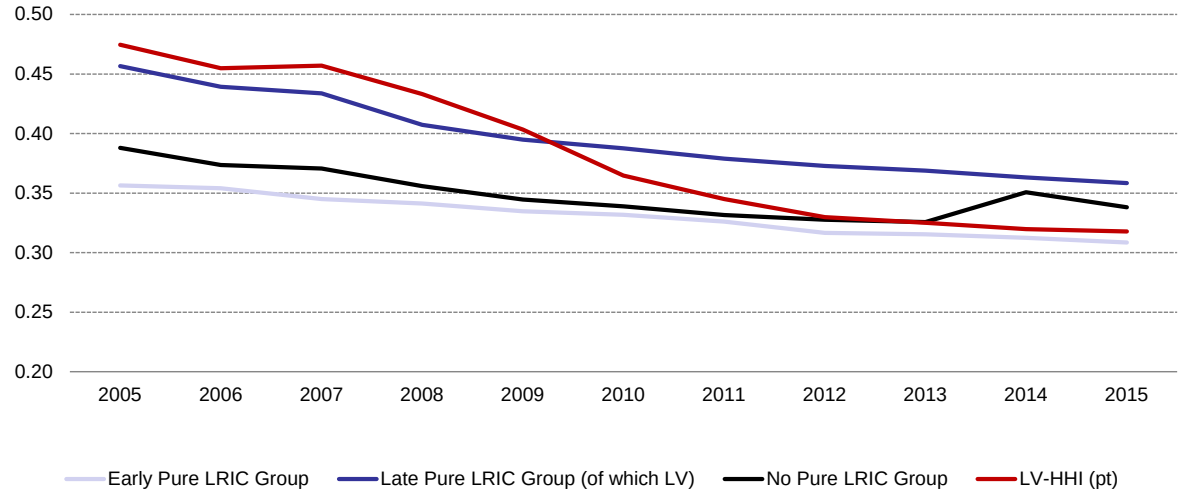
Figure 387 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Latvian mobile market. The improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005, starting one point above the Late Pure LRIC Group curve at 0.47 to reach 0.32 in 2015, four points below its group average, as shown in Figure 388.

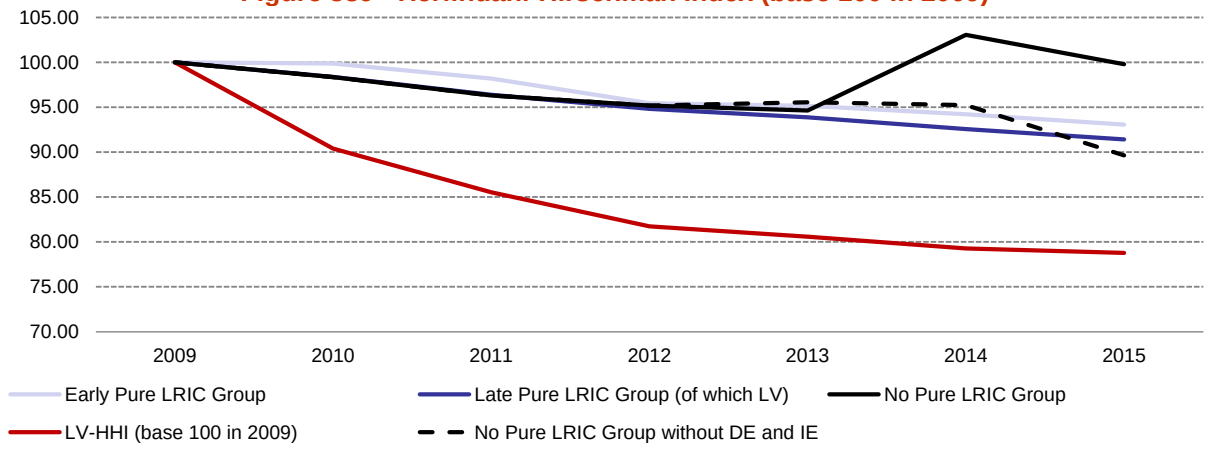
Figure 388 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Latvia since 2009 can be noticed in Figure 389: the HHI (as base 100 in 2009) has been continuously dropping and is now significantly inferior to the average of Late Pure LRIC.

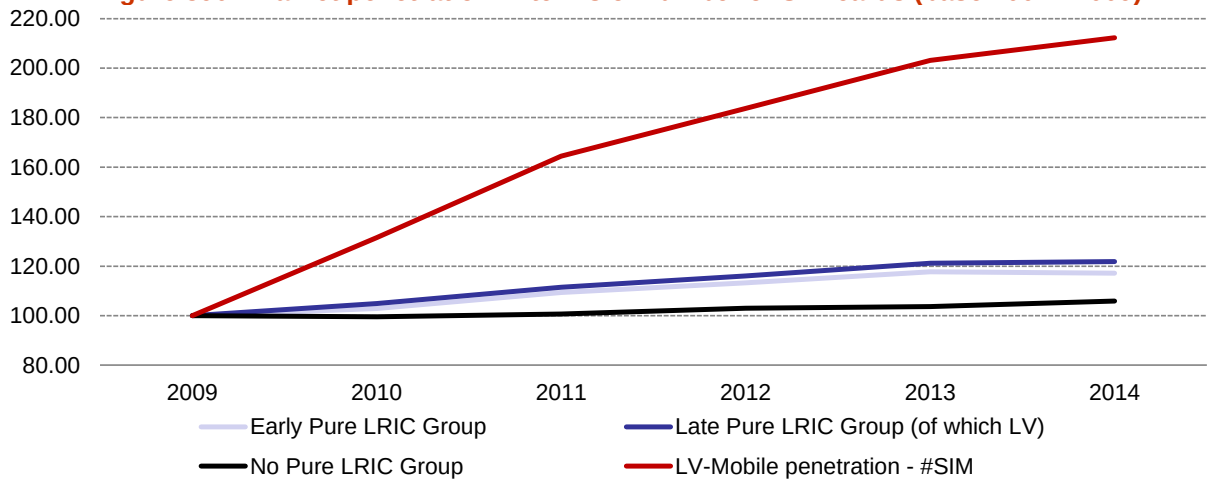
Figure 389 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Latvian market penetration in terms of number of SIM has been surging since 2009, more than doubled whereas Late Pure LRIC Group only rose by 20% over the same period, as observed in Figure 390.

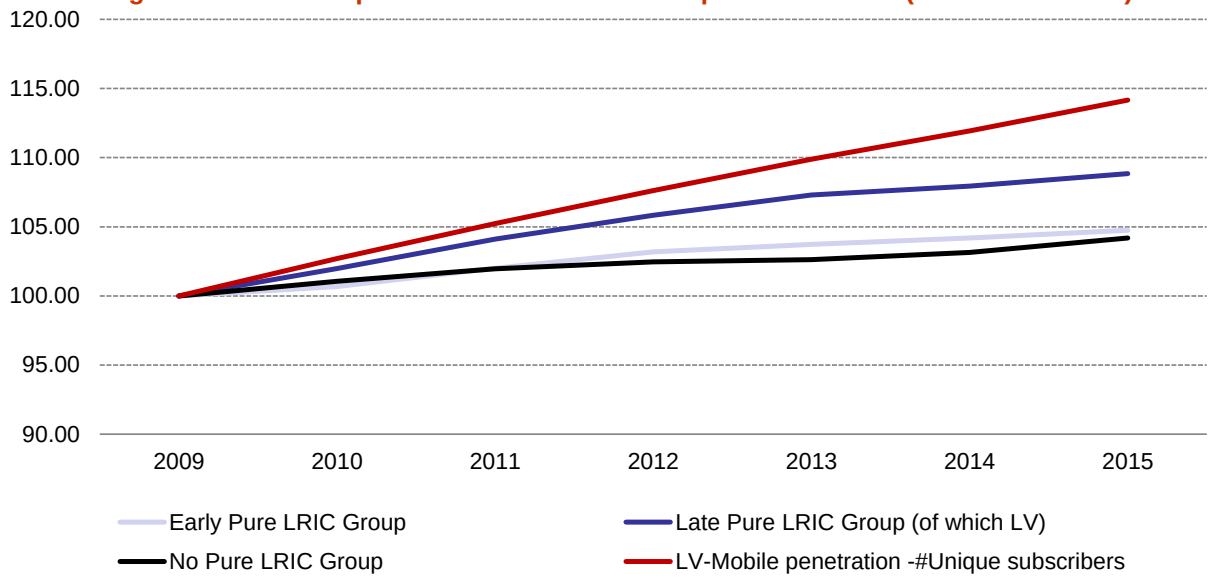
Figure 390 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

On the other hand, the market penetration in terms of unique subscribers observed in Figure 391 has also been increasing, with a more comparable trend to the Late Pure LRIC Group, although the increase was a bit stronger since 2013.

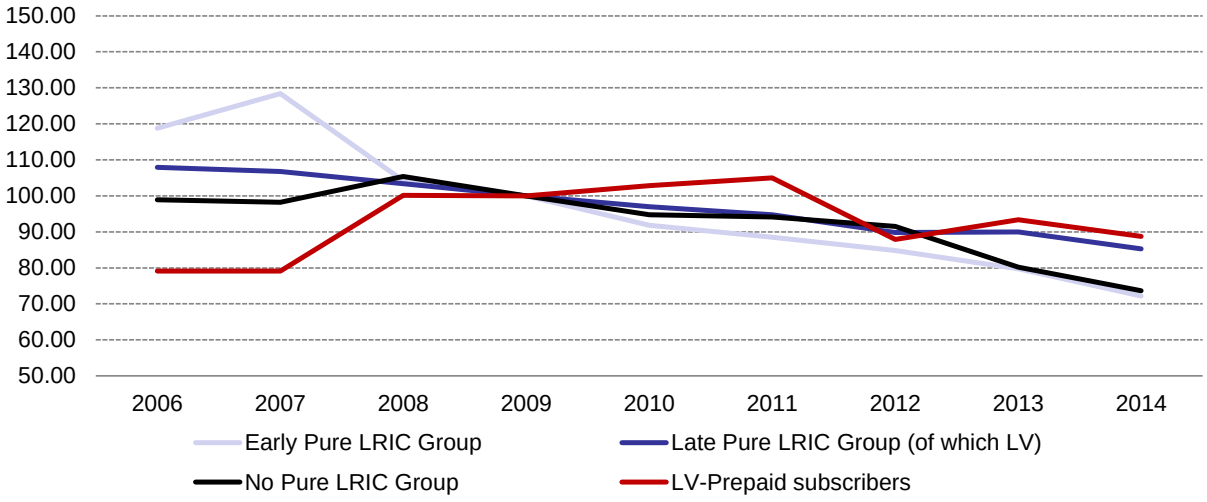
Figure 391 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 392 shows the evolution of the share of prepaid subscribers in Latvia since 2006. It can be observed that it has been increasing from 2006 to 2011 whereas it was decreasing for all groups over the same period. It then started declining in Latvia like all groups. In 2015, the share of prepaid customers in Latvia is close to the average at a European level (around 50%).

Figure 392 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

8.18.1.2 *Evolution of retail mobile offers*

According to Latvian regulator, in the past years new kinds of retail offers with unlimited free on-net and off-net calls, SMS and data included have been developed by operators. On the other hand, flat rate plans offering international calls have not.

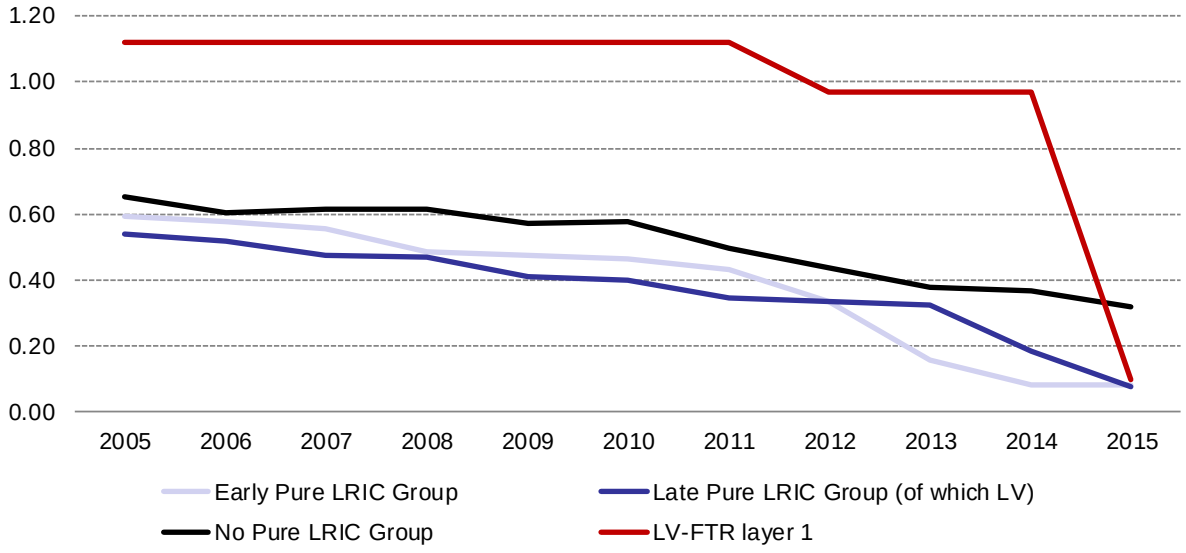
The Latvian regulator stated that the appearance of this kind of offers was probably influenced by lower MTR.

8.18.2 Fixed market

8.18.2.1 *Quantitative analysis*

The level of the Latvian FTRs has been above in average to all countries until 2015. However, the Latvian FTRs level became inferior to the No Pure LRIC Group average in 2015, and it now equals the Late and Early Pure LRIC groups levels.

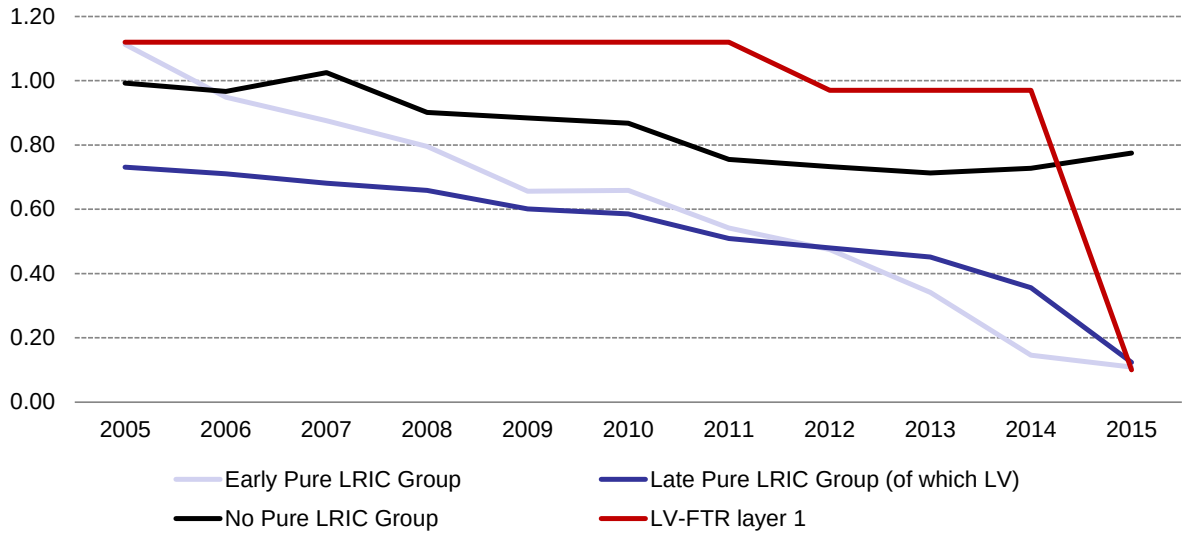
Figure 393 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 393 shows the flat average for the three groups as opposed to the previous figure. Latvian FTRs have been way closer to the flat averages of the three groups than the weighted averages.

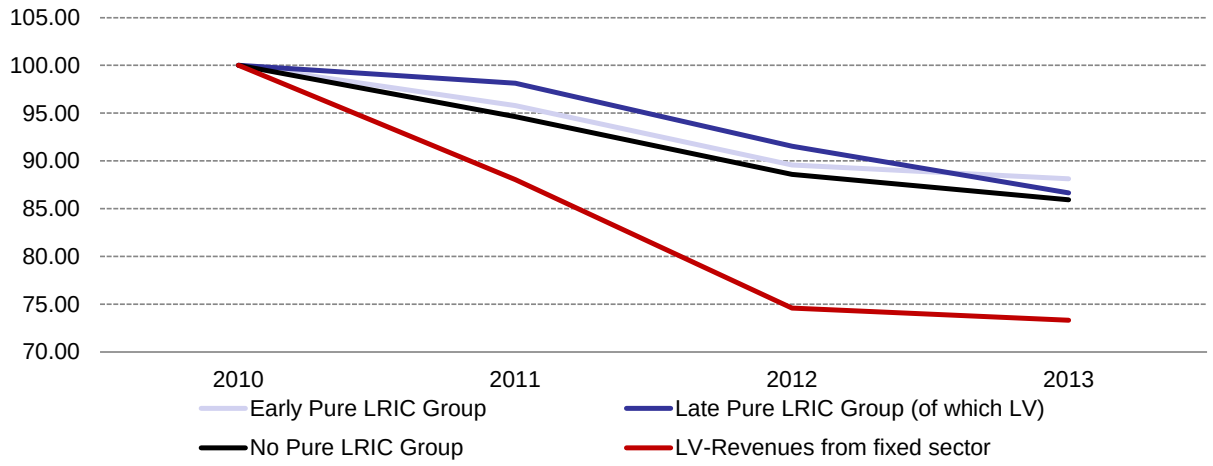
Figure 394 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 394 shows the fall of revenues of the fixed-line market since 2010 for Latvia. In 2013 compared to 2010 Latvian revenues have decreased much more than the average of its group.

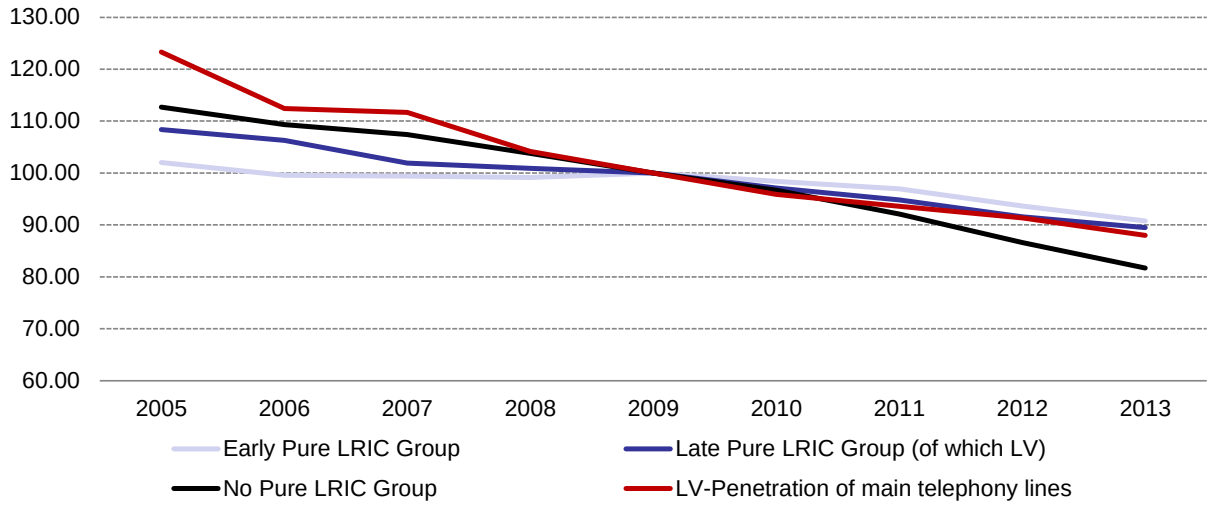
Figure 395 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Latvia has shown a constant and slow decrease since 2005, with a similar penetration to the Late Pure LRIC Group, also steadily decreasing as shown in Figure 396.

Figure 396 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.18.2.2 *Evolution of retail fixed offers*

The Latvian regulator did not notice any particular change in the retail fixed market.

8.18.3 Summary

The tables below summarize, for each metric, the difference between Latvia and the average metric for the Late pure LRIC Group in order to highlight how Latvia is positioned against its pair countries.

Figure 397 - Differences between Latvia and its group for the mobile market

Metrics	Differences between the Late Pure LRIC Group and Latvia
Mobile revenues	Decreased more than all groups

Mobile investments	No particular trend followed
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of unique subscribers as Late Pure LRIC group. Bigger penetration for Latvia in terms of SIM cards
Competition in mobile	Increased more than all groups, starting at a lower level than all groups

Source: TERA Consultants

Figure 398 – Differences between the Late Pure LRIC Group and Latvia for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Latvia
Fixed revenue	Much faster decrease than all groups
Traffic	Not available
Main telephony lines	Very close to the Late Pure LRIC Group

Source: TERA Consultants

8.19 Malta

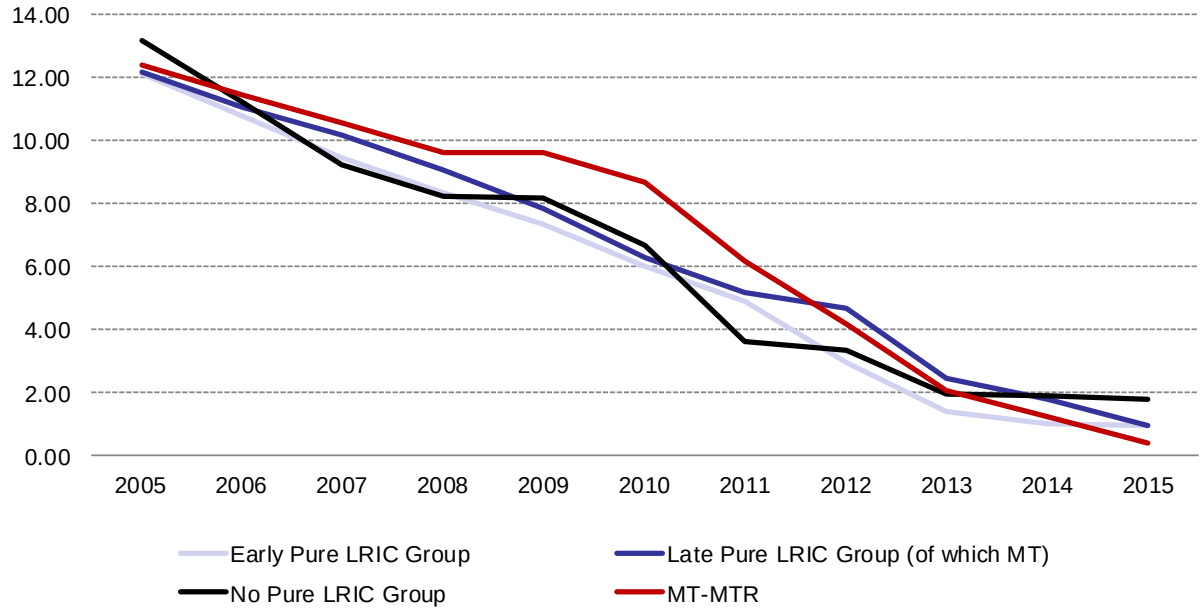
The Maltese telecommunications market is served in the mobile sector by three operators since Melita Mobile was founded in 2009. The Maltese incumbent is GO plc. The company remained entirely state-owned until 1997. The sale of a 40% stake occurred in 1997, then the remaining 60% stake was sold in 2006. The operator is challenged in the mobile market by Vodafone (1997) which is the leader in terms of market share. Since the Maltese regulator MCA adopted the pure LRIC approach in 2014, the country has been allocated to the "Late Pure LRIC Group" for the study. Malta is also one of the very few MS which have implemented the Pure LRIC approach for FTRs earlier than for MTRs, in this case in 2013. The country has then been allocated to the Early Pure LRIC Group for the fixed sector analysis.

8.19.1 Mobile market

8.19.1.1 *Quantitative analysis*

MTRs in Malta have been constantly decreasing, following the European downward trend since 2005 (see Figure 399). Since Malta has set its MTRs on a Pure LRIC basis since 2014, MTRs are at the same level as countries from the Early Pure LRIC Group in 2014, and are even lower in 2015.

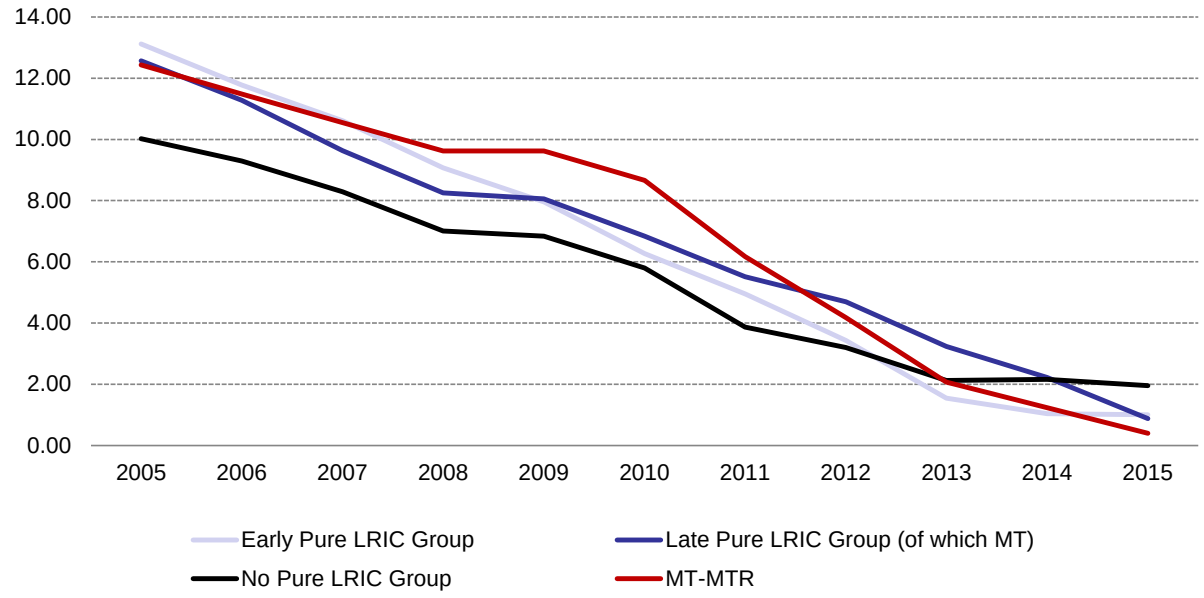
Figure 399 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 400). The trend is approximately the same as the weighted average trend with Malta MTR being on the same level as the Early Pure LRIC Group in 2014, and lower in 2015.

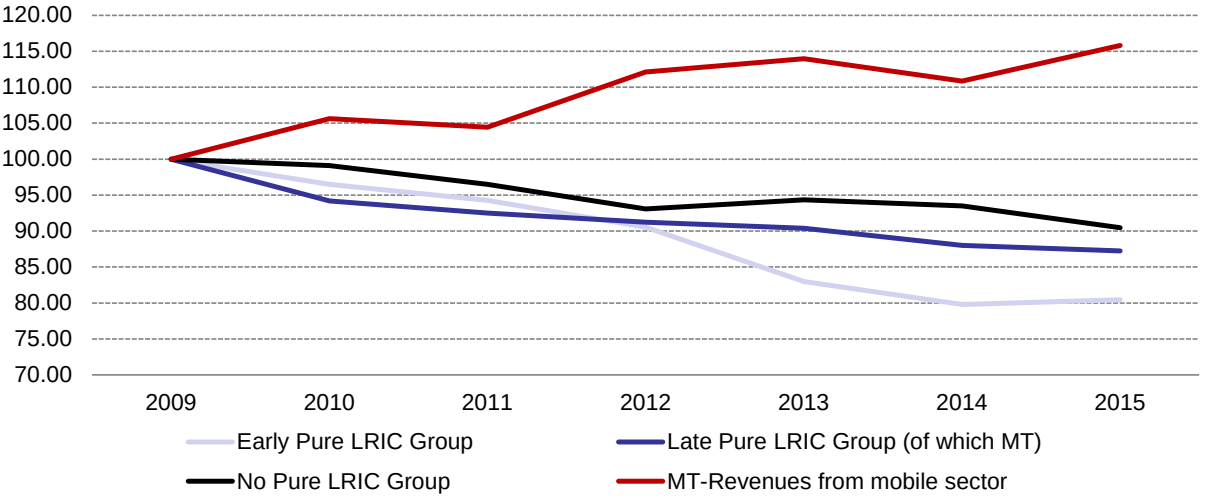
Figure 400 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 401 have been continuously increasing since 2009, whereas they have been declining for all groups. Malta has therefore not been following any particular group trend in terms of revenues.

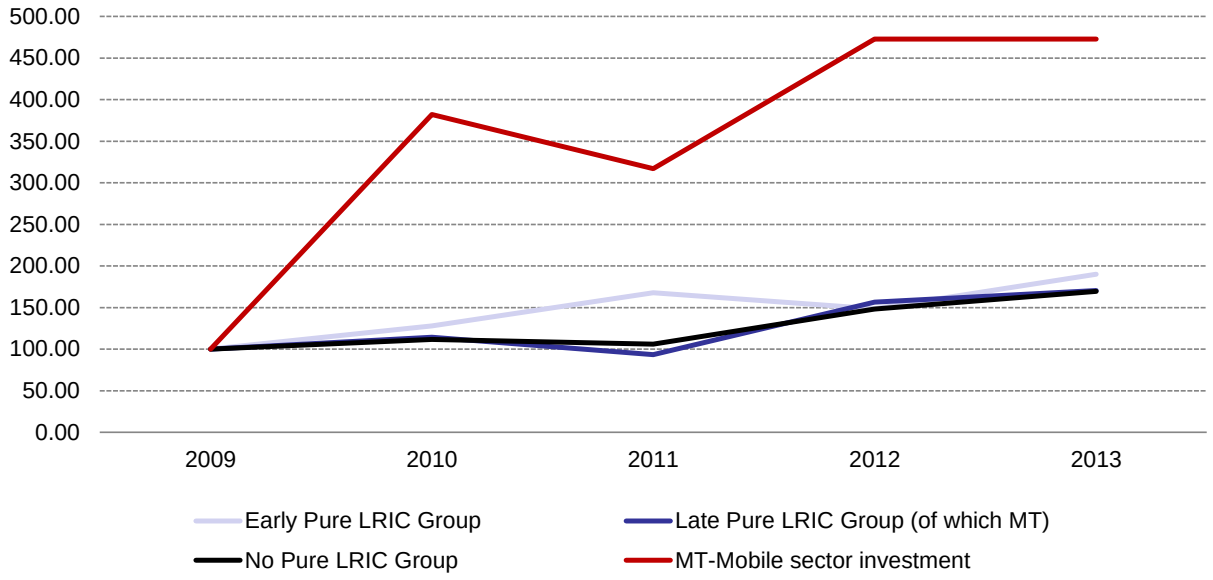
Figure 401 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

As for the revenues, investments (see Figure 402) in the mobile sector have also been surging since 2009, especially in 2010.

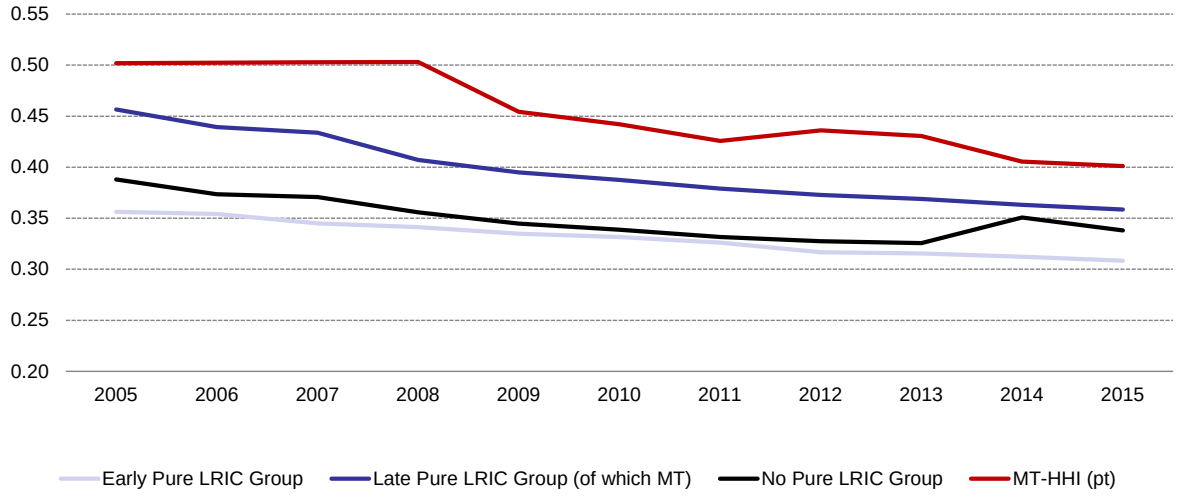
Figure 402 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Maltese mobile market since the entry of Melita Mobile in 2008. The improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2008. It is however still high compared to all groups in 2015.

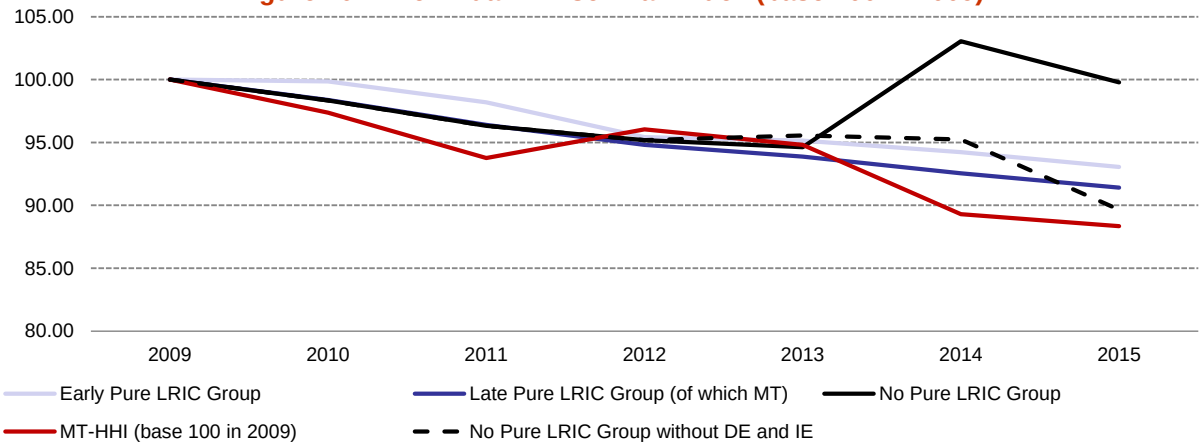
Figure 403 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Malta since 2009 can be noticed in Figure 404: the HHI (as base 100 in 2009) has been continuously dropping following roughly the Late Pure LRIC Group's trend.

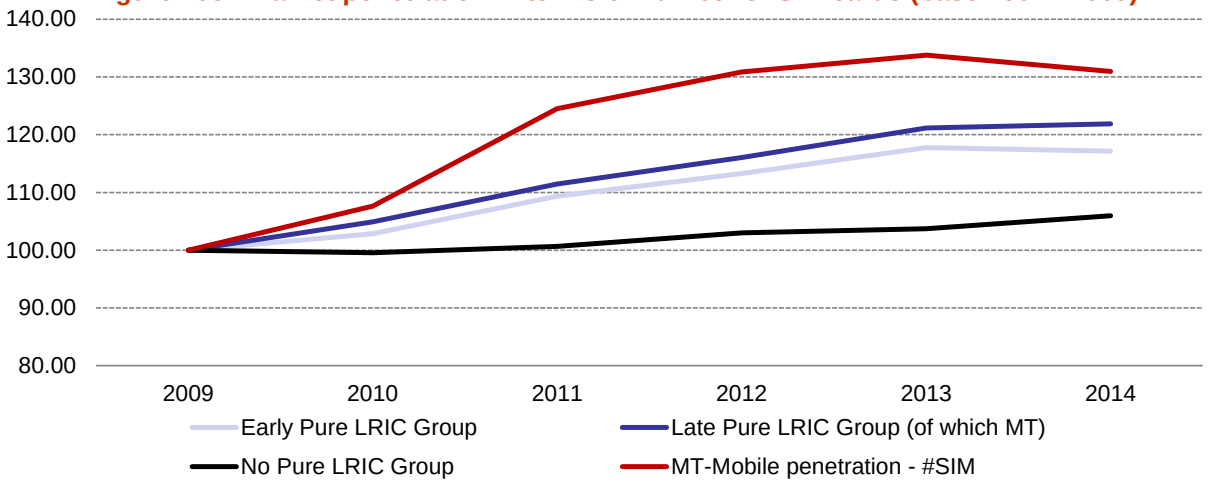
Figure 404 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Maltese market penetration in terms of number of SIM has been strongly growing since 2009, especially between 2010 and 2011. It has been increasing more than its group average, and is in 2015 relatively high at the European level.

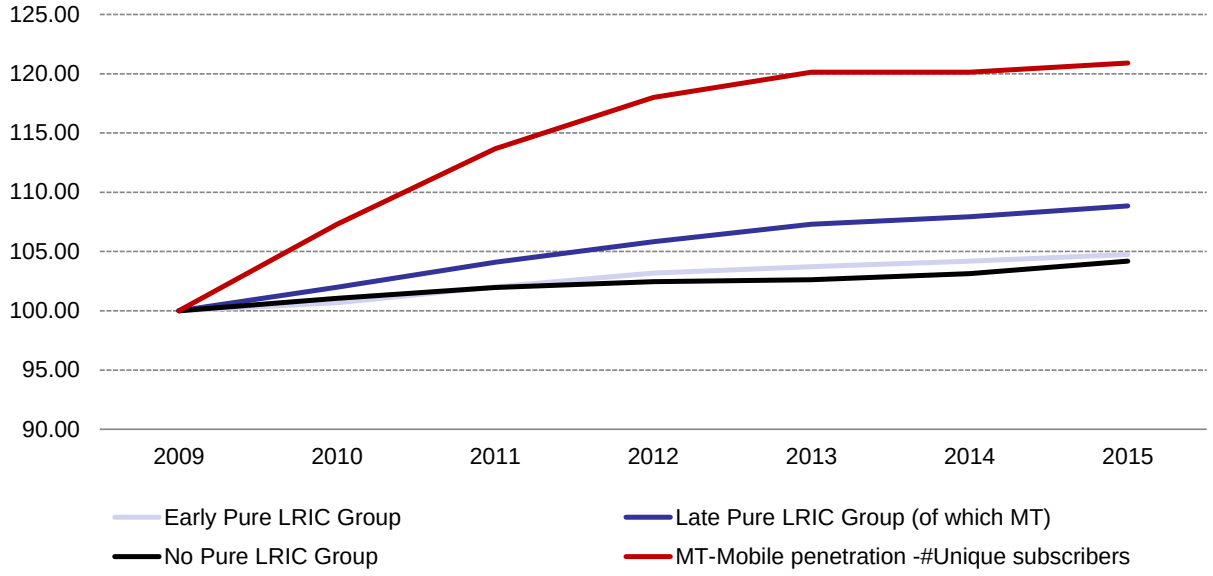
Figure 405 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 406 that the market penetration in terms of unique subscribers in Malta has significantly increased from 2009 to 2013 then it has remained quite constant between 2013 and 2015. Since 2009 it has been increasing far more than all groups and is in 2015 fairly high compared to European MS.

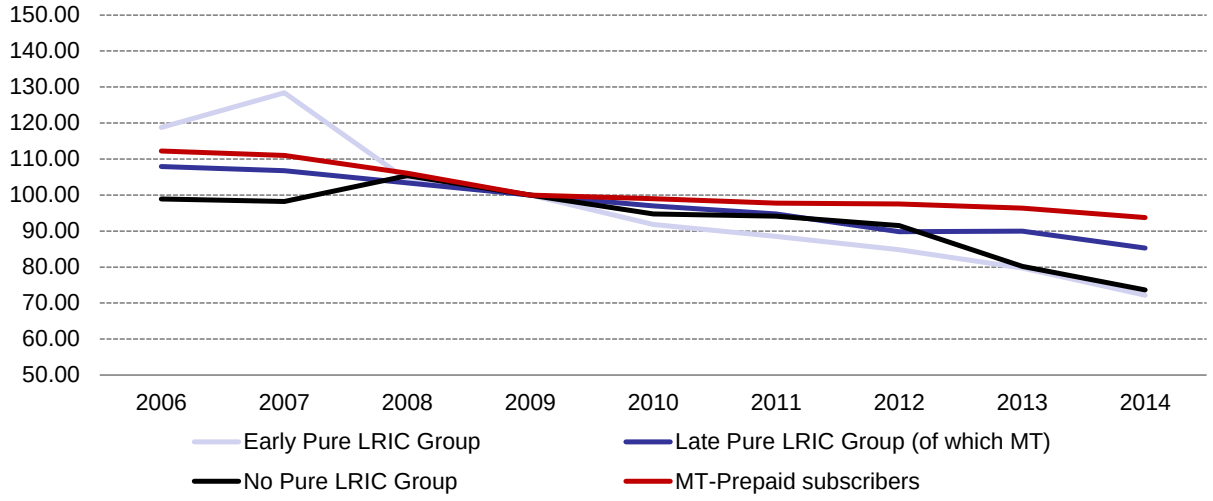
Figure 406 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 407 shows the share of prepaid subscribers in Malta, compared to the average of the three groups. It can be observed that it has been on a downward trend for Malta, but has been decreasing slower than the three groups. It is therefore in 2015 pretty high compared to European countries (around 80%).

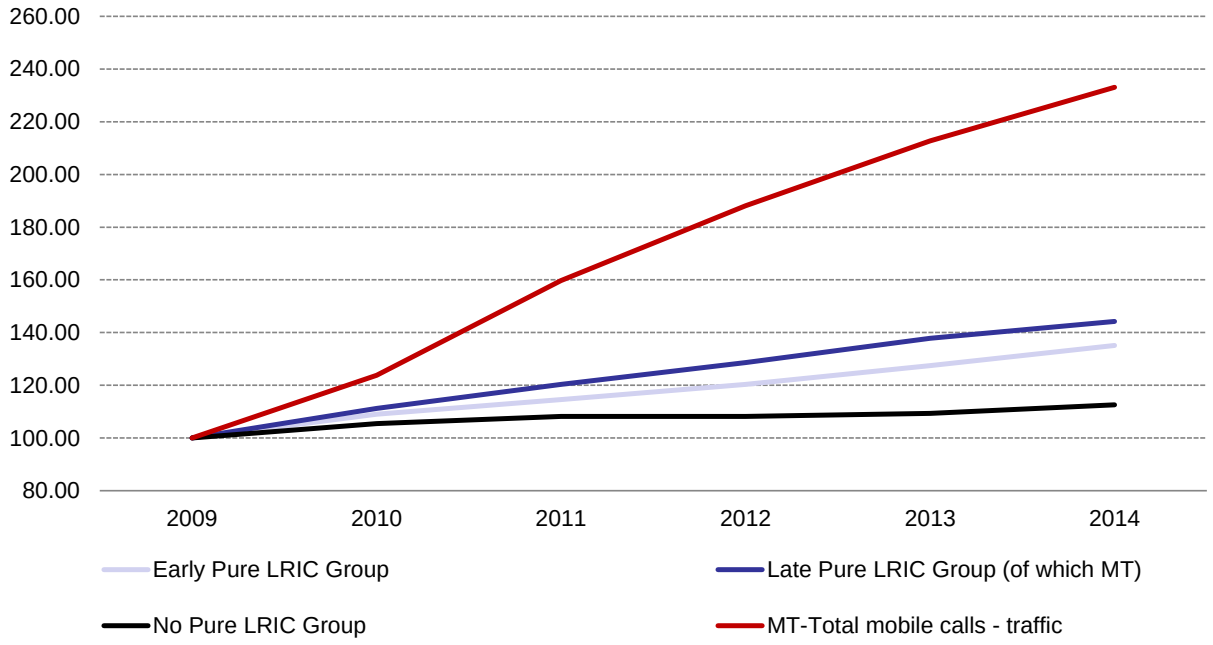
Figure 407 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 408 shows the evolution of the total amount of minutes of mobile calls. It can be noticed that it has been strongly increasing in Malta since 2009, and in particular since 2010. Since 2009 it has been growing by 130%, more than any other group.

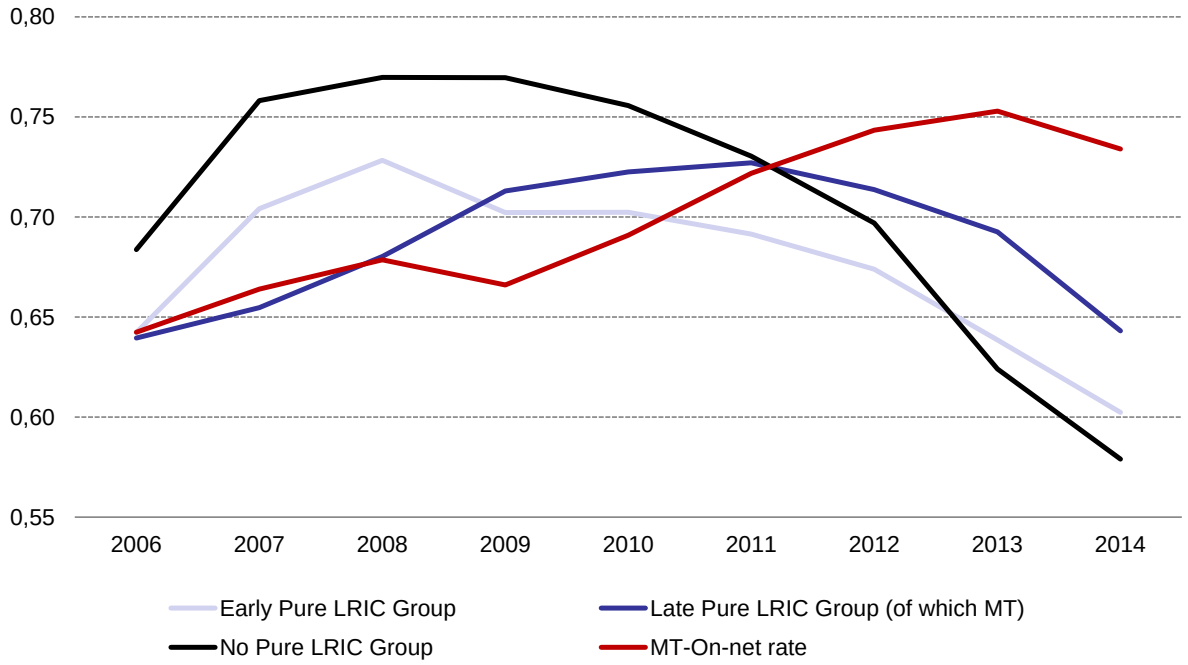
Figure 408 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 409 shows the share of on-net mobile calls, slowly increasing from 2005 to 2010 for Malta before increasing faster until 2012, and then levelling-off at a rather high level compared to the three groups. It is consistent with the observation from MCA that "*on-net/off-net differentiation persists in Malta*".

Figure 409 - On-net rate of mobile calls (%)



Source: MCA

8.19.1.2 *Evolution of retail mobile offers*

In recent years, MCA has observed a general decline of monthly fees associated with postpaid plans. However, the decrease is more prevalent in the case of mobile-to-mobile on net calls than off-net mobile calls or call to fixed networks.

With respect to prepaid mobile plans, MCA observed that changes were much less pronounced, with plans only offering more minutes allowance than previously.

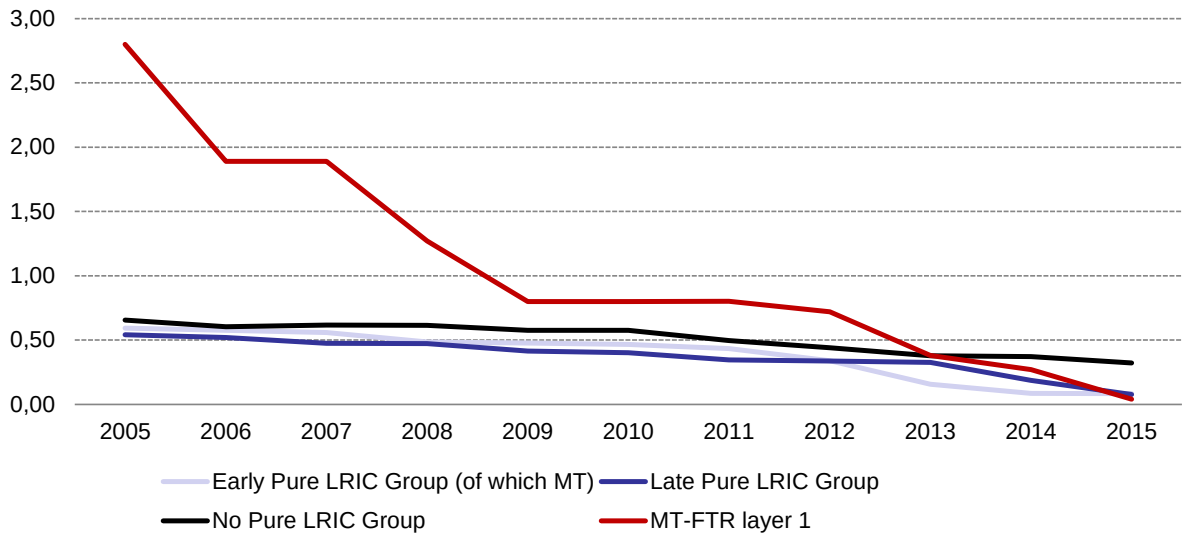
MCA considered that lower MTR have contributed to the developments of such offers, although it is not fully representative of the declines.

8.19.2 Fixed market

8.19.2.1 *Quantitative analysis*

The level of the Malta's FTR has been superior in average to all countries until 2013. However, the level of FTR in Malta became inferior to No Pure LRIC Group average from 2013. In 2015 Maltese FTRs are at the same level as the Early and Late Pure LRIC Groups, as presented in Figure 410.

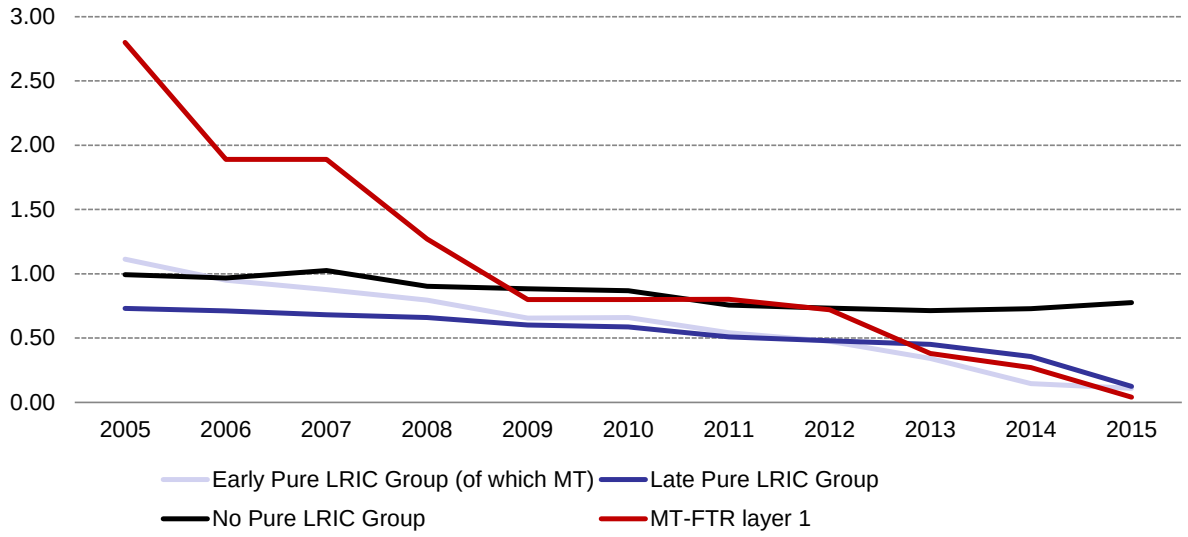
Figure 410 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 411 shows the flat average for the three groups as opposed to the previous figure. The main difference is related to the No Pure LRIC Group average FTR compared to the Maltese FTRs which have been lower since 2009 (against 2013 with weighted averages above).

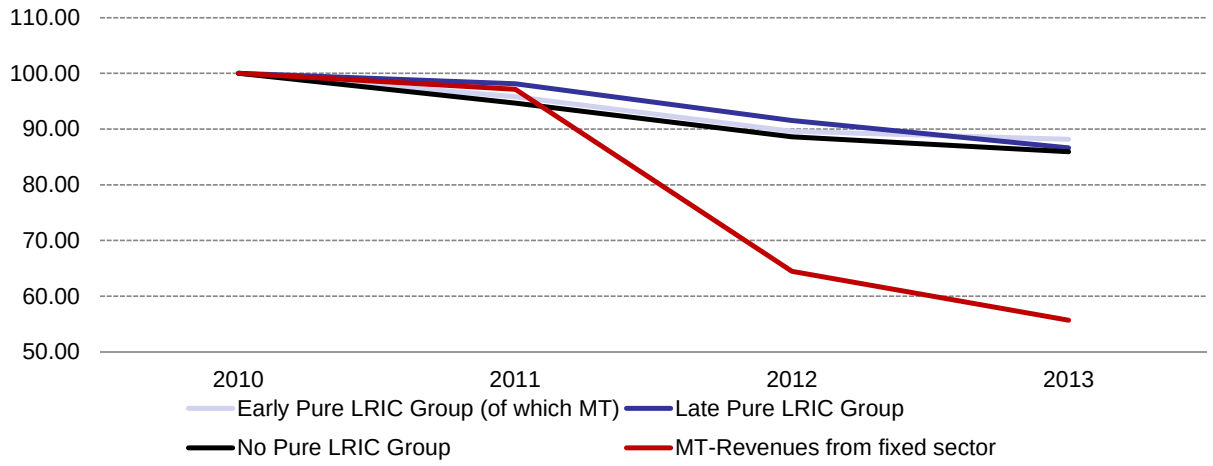
Figure 411 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 412 shows the strong fall in revenues from the fixed-line market since 2010 for Malta, especially in 2012. Since 2010, fixed revenues in Malta have been divided by almost two, whereas all groups only lost around 15% over the same period.

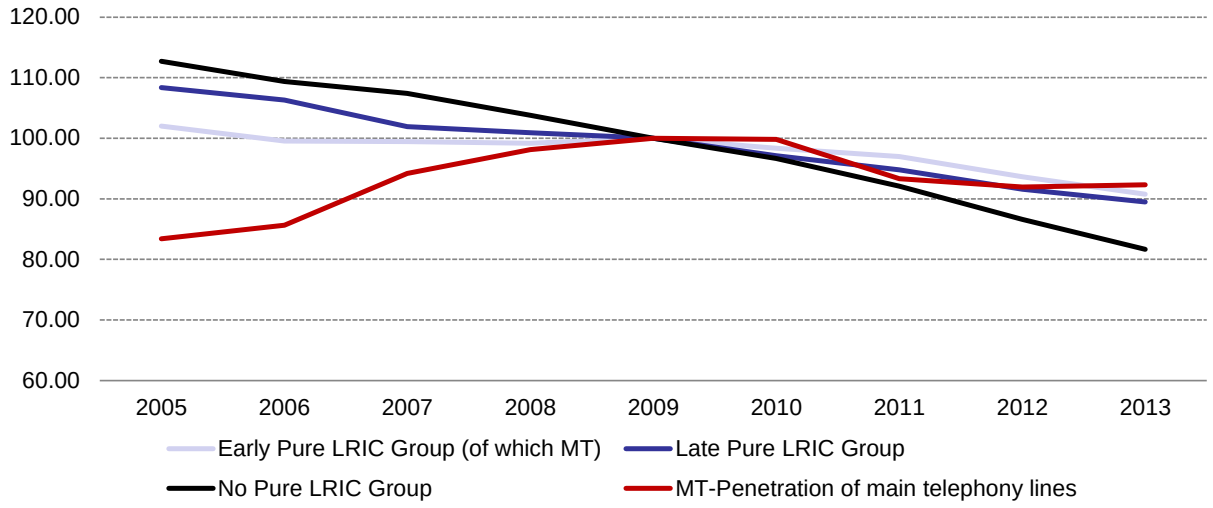
Figure 412 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Malta continuously grew between 2005 and 2010, and then started decreasing following a comparable trend to the Early and Late Pure LRIC Groups.

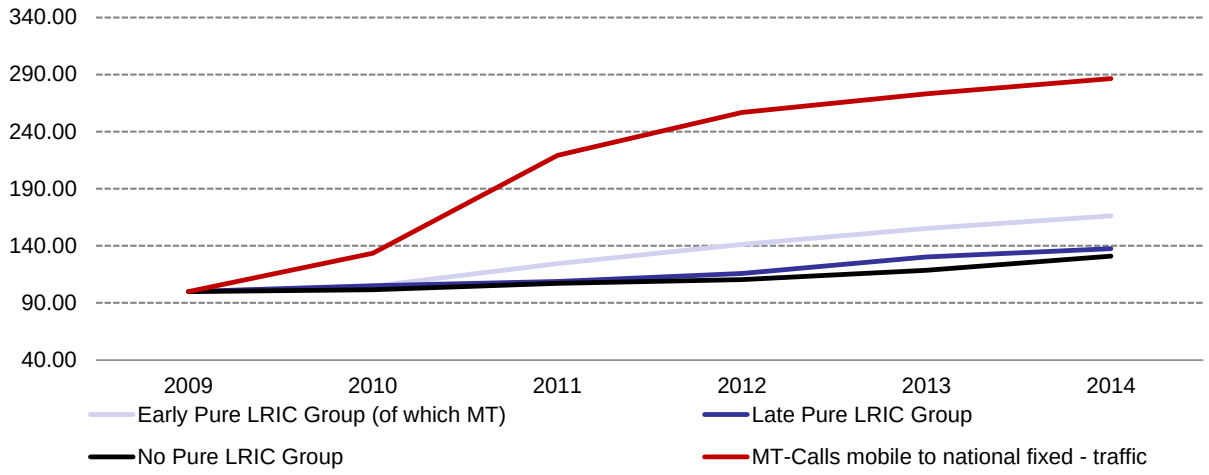
Figure 413 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile national calls to fixed lines in Malta, presented in Figure 414, showed a strong increase between 2009 and 2014, especially between 2010 and 2012. It has been increasing way more than any other group since 2009.

Figure 414 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: MCA

8.19.2.2 *Evolution of retail fixed offers*

According to MCA, retail fixed offers in Malta are mostly flat rate plans offering a given number of minutes. Plans including calls to fixed networks are cheaper than plans with calls to mobile, and there is a differentiation between prices for on-net and off-net calls.

MCA noticed that fixed line call rates have been declining over the past few years and attributed this decline to the lower FTR.

8.19.3 Summary

The tables below summarize, for each metric, the difference between Malta and the average metric for the Late pure LRIC Group in order to highlight how Malta is positioned against its pair countries.

Figure 415 - Differences between Malta and its group for mobile networks

Metrics	Differences between the Late Pure LRIC Group and Malta
Mobile revenues	Increased faster than all groups
Mobile investments	Increased more than all groups
Mobile retail prices	Not available
Mobile penetration	Increased more than all groups in terms of SIM cards and unique subscribers
Competition in mobile	Lower level than all groups
On-net rate	Increasing whereas it has been decreasing for all groups
Fixed revenue	Decreased more than all groups

Source: TERA Consultants

Figure 416 – Differences between the Early Pure LRIC Group and Malta for the fixed market

Metrics	Differences between the Early Pure LRIC Group and Malta

Fixed revenue	Much faster decrease than all groups
Traffic	Much faster increase than all groups
Main telephony lines	Very close to the Early Pure LRIC Group

Source: TERA Consultants

8.20 Netherlands

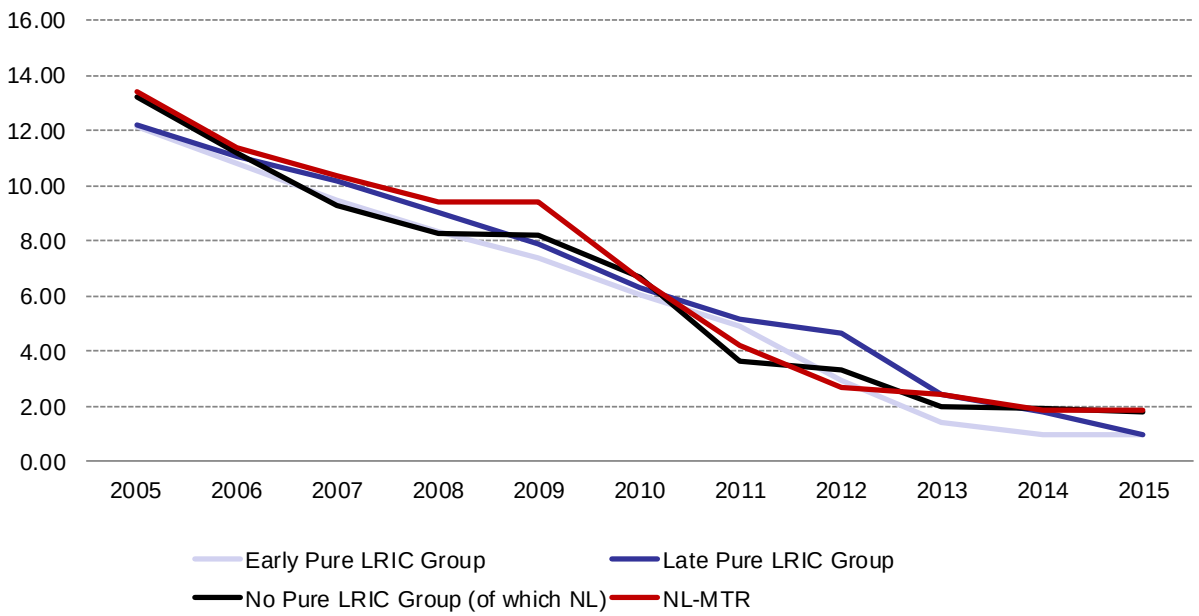
The Dutch telecommunications market incumbent is KPN in both mobile and fixed markets. It was privatized in 1989. Its main competitors in the mobile market are Vodafone (launched in 1995) and T-Mobile, (launched in 1999) especially after the purchase of Orange Netherlands in 2007. Telfort which was absorbed by KPN in 2005 also recently launched its own LTE services while Liberty Global acquired the remaining stake of Ziggo. The Dutch regulator ACM is using the BU-LRAIC+ method for FTR and MTR calculation, and is then allocated to the "No Pure LRIC group" for the study.

8.20.1 Mobile market

8.20.1.1 *Quantitative analysis*

The MTRs in Netherlands compared with the three groups have been continuously dropping since 2005, following the European downward trend (see Figure 417). Since 2013 however, it has been fairly constant consequently to the non-implementation of Pure LRIC, and is in 2015 at the same level as the No Pure LRIC Group.

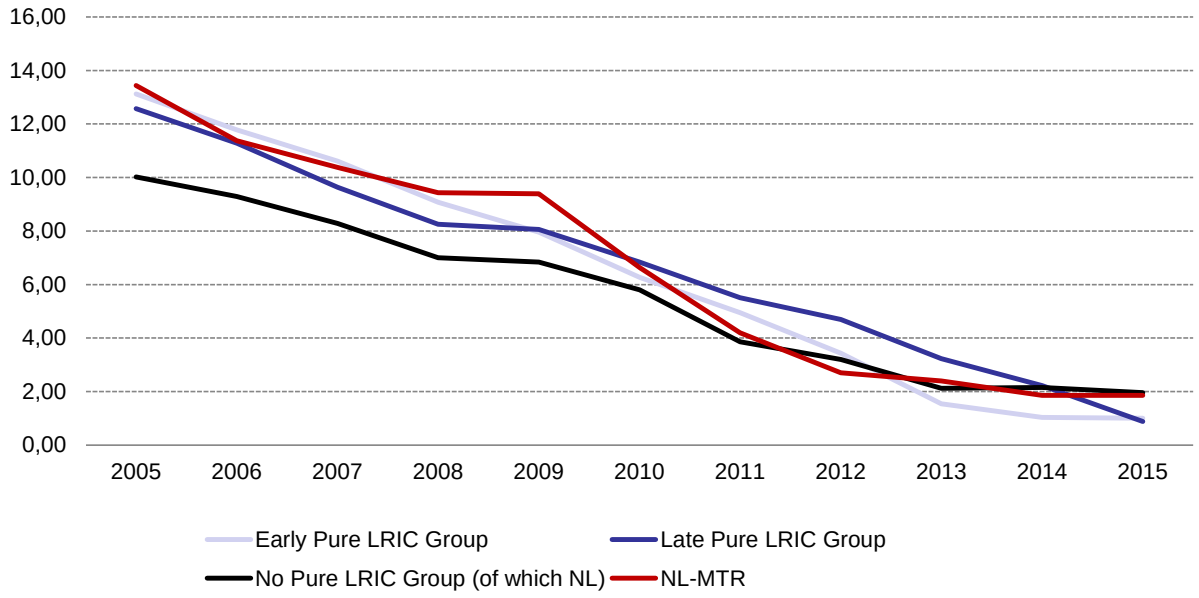
Figure 417 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 418). The trend is approximately the same as the weighted average trend with Netherlands' MTRs being at the same level as the No Pure LRIC Group since 2013.

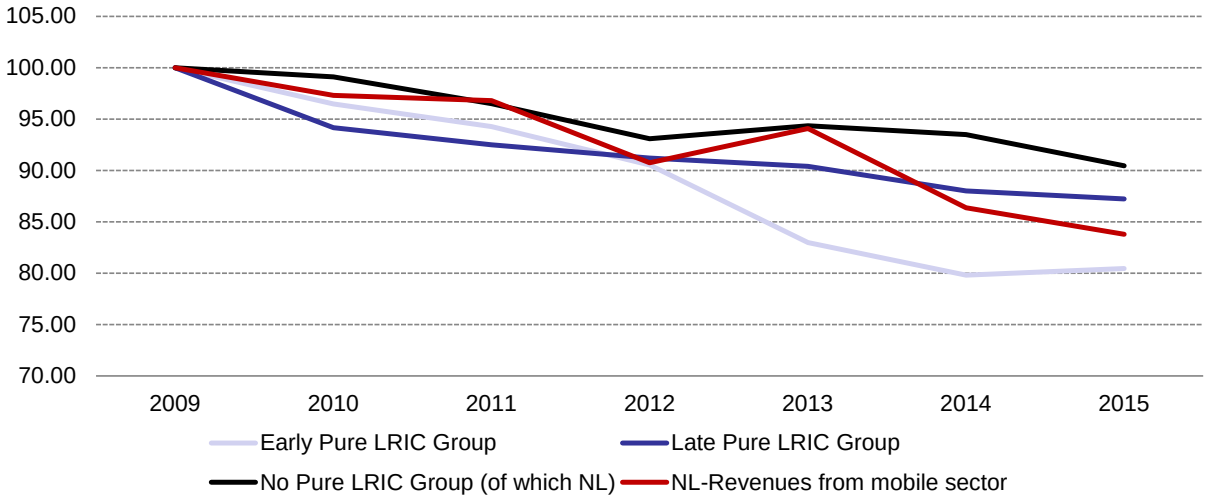
Figure 418 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 419 have been decreasing since 2009 like all groups. However, the evolution of revenues in the Netherlands has not been following any particular trend, although its overall evolution is closer to Late Pure LRIC Group between 2009 and 2015.

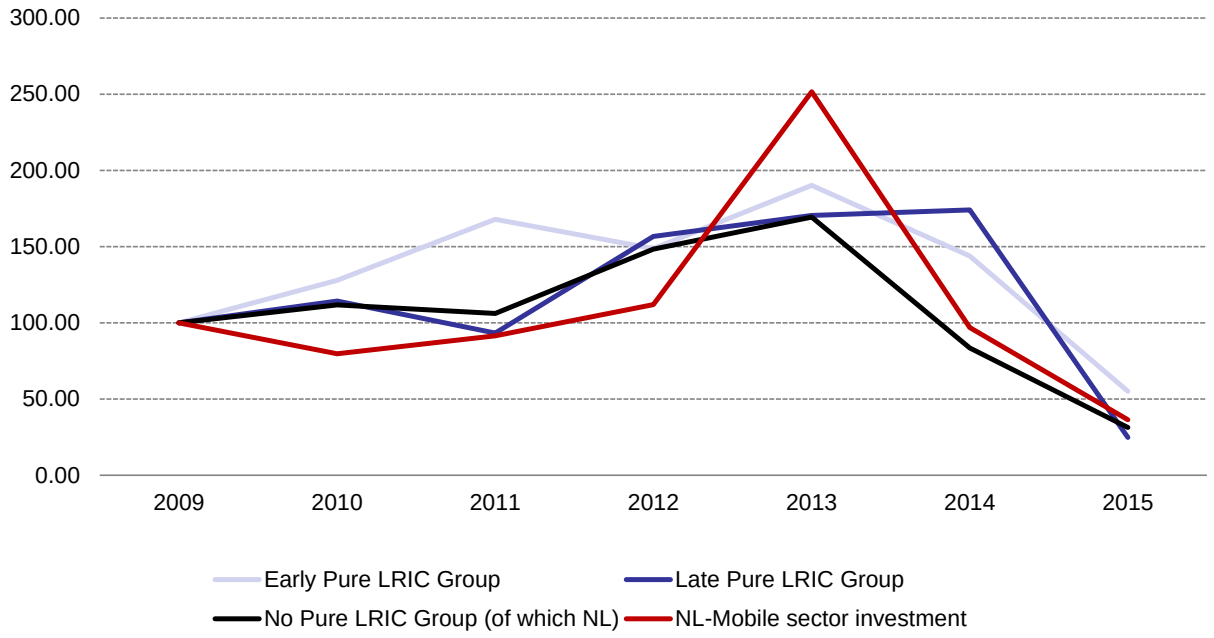
Figure 419 - Mobile revenues (base 100 in 2009)



Source: GSMA

Investments in Netherlands' mobile sector presented in Figure 420 were relatively steady between 2009 and 2012, then surged in 2013, and then have shrunk such as yje No Pure LRIC Group between 2013 and 2015.

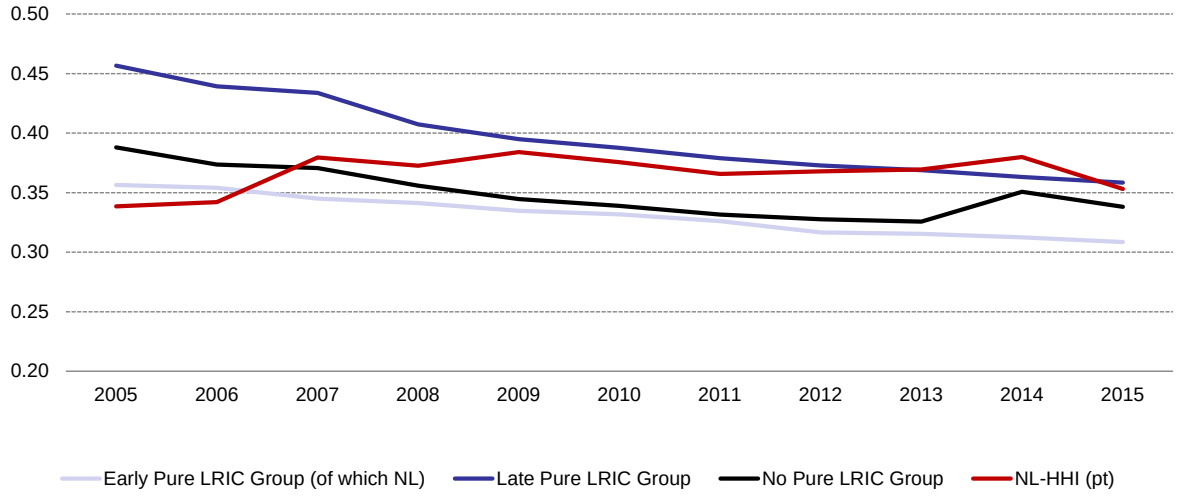
Figure 420 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Dutch mobile market since the recent entry of Tele2. However, the dominance of the incumbent KPN has been increasing Dutch mobile market concentration as observed with Figure 421, and its HHI is in 2015 despite a slight decrease, still higher than the No Pure LRIC Group's average.

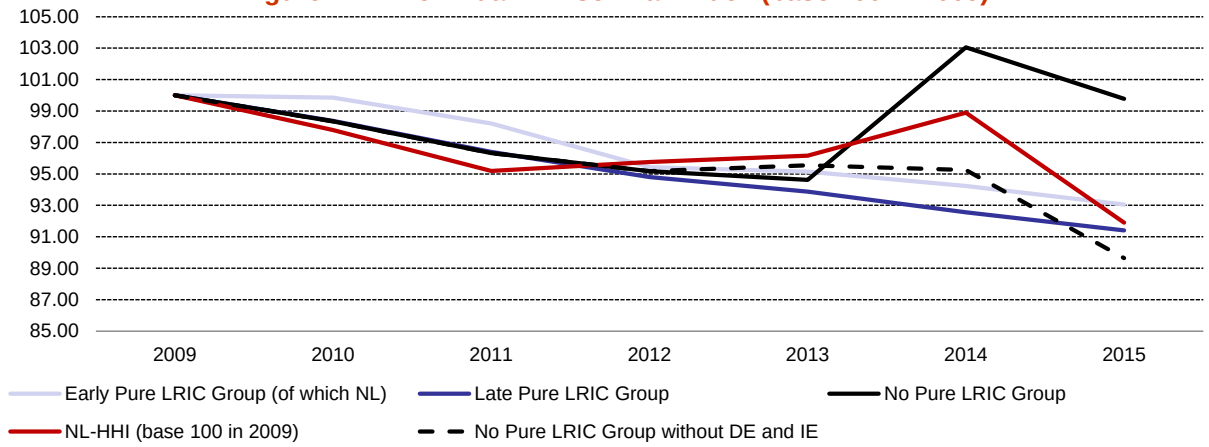
Figure 421 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the evolution of the level of concentration in Netherlands since 2009 can be observed in Figure 422: the HHI (as base 100 in 2009) has been decreasing from 2009 to 2011, then increased until 2014, and decreased in 2015 subsequently to the entry of Tele2.

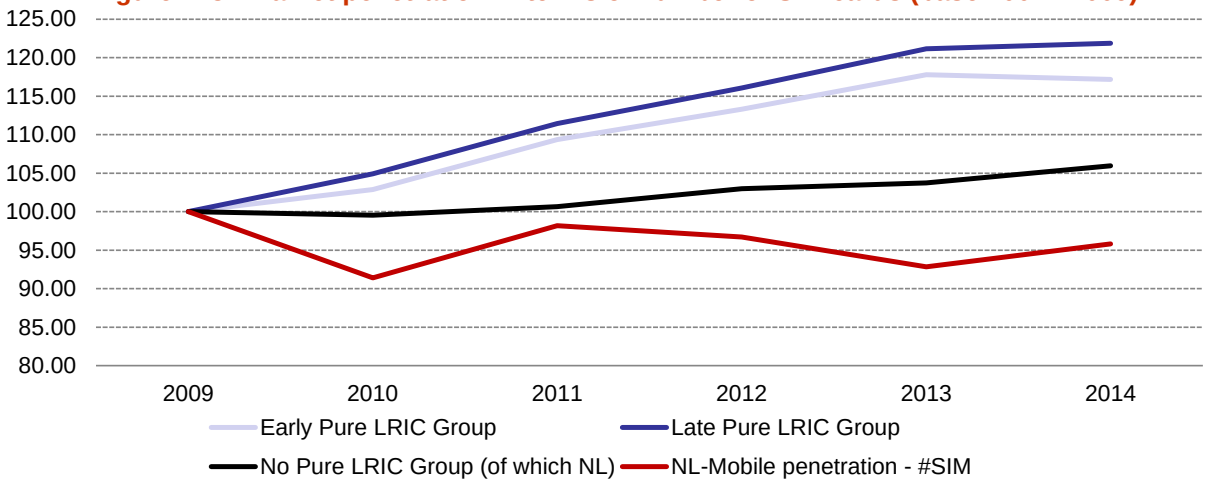
Figure 422 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Dutch market penetration in terms of number of SIM has been overall decreasing by5% since 2009 whereas it has been increasing for all groups, as observed with Figure 423. It is therefore in 2014 at a fairly low level compared to the other European countries.

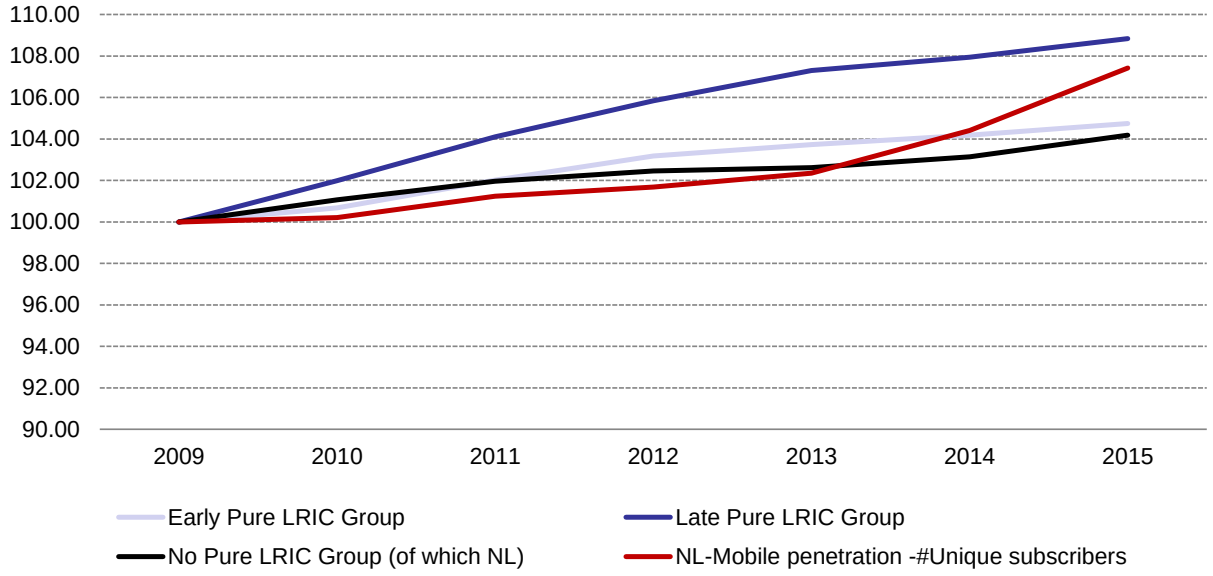
Figure 423 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

On the other hand, the market penetration in terms of unique subscribers has been increasing since 2009 as shown in Figure 424, with a comparable trend to the Early and No Pure LRIC Groups between 2009 and 2013. It then increased faster so that it is in 2015 relatively high compared to European countries.

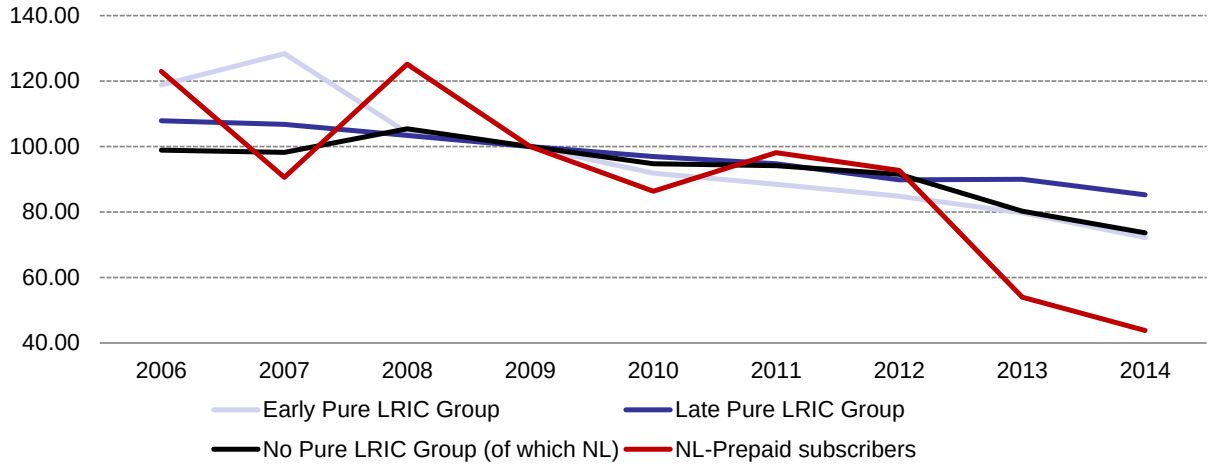
Figure 424 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 425 shows the evolution of the share of prepaid subscribers in Netherlands compared to the three groups. It can be observed that it has overall been decreasing more since 2008 than in all groups, especially since 2012. In 2014, it is at 20% among the lowest share of prepaid customers in the EU.

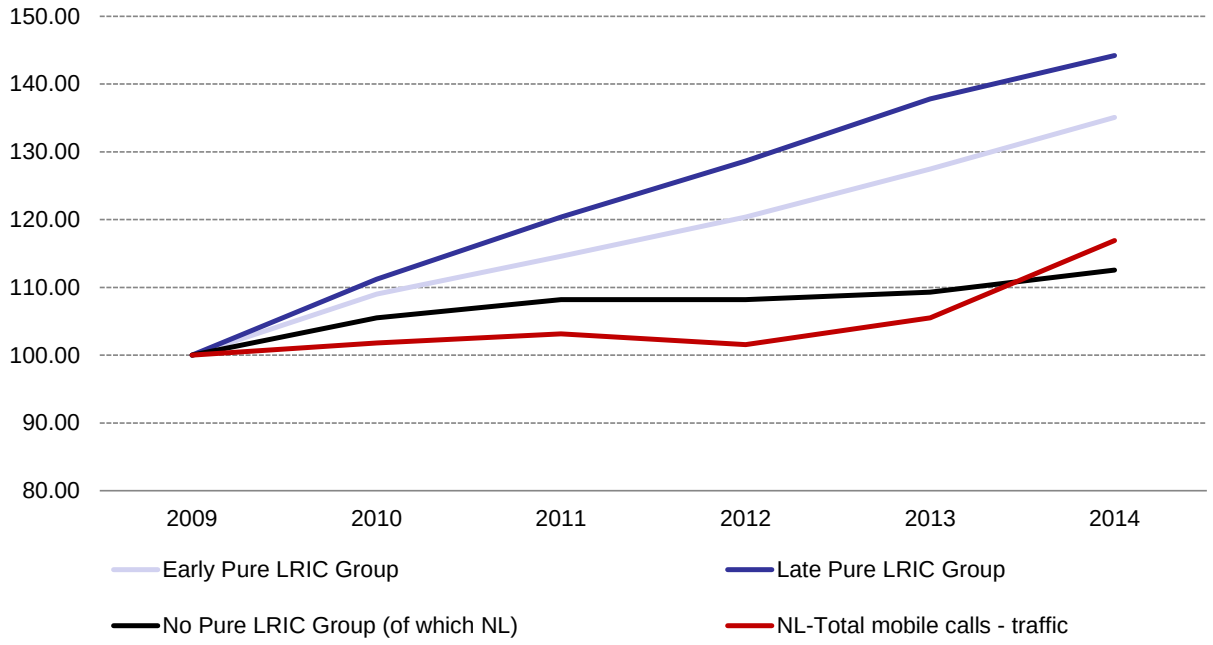
Figure 425 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 426 shows the evolution of the amount of minutes of mobile calls in the Netherlands. It can be observed that it has been steadily increasing since 2009, with a recent surge in 2013 and 2014. Since 2009 it has been roughly following the No Pure LRIC Group's trend.

Figure 426 - Total minutes of mobile traffic (base 100 in 2009)



NRAs Replies to questionnaire

8.20.1.2 *Evolution of retail mobile offers*

The Dutch regulator ACM lists below the developments of retail mobile offers since 2013 focusing on changes in voice and SMS:

- In 2013:
  - KPN: Introduction of subscriptions with unlimited voice and SMS
  - Vodafone: Introduction of "Red' subscriptions with unlimited voice and SMS
- In 2014:
  - KPN: launched unlimited SMS and unlimited calls
  - Vodafone: added a postpaid roaming bundle and a subscription including 1GB of data
  - Tele2: introduced unlimited calls and SMS
- In 2015:
  - T-Mobile: included roaming calls to its bundles

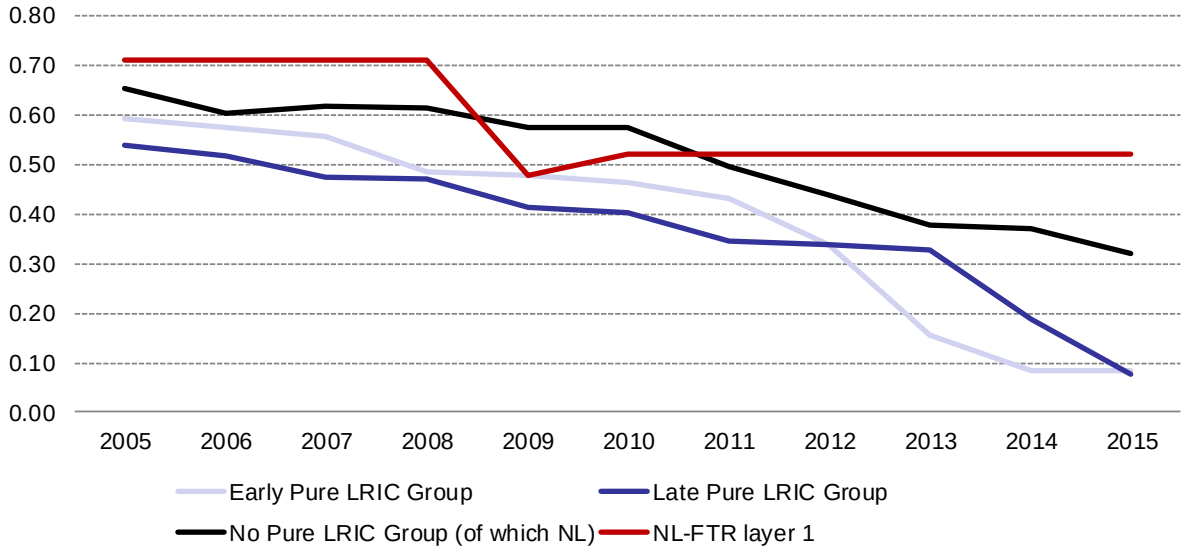
ACM did not state weather these changes were influenced by lower MTR or not.

8.20.2 Fixed market

8.20.2.1 *Quantitative analysis*

The level of Dutch FTRs observed in Figure 427 where it is compared to the weighted average FTRs of the three groups, has experienced a single cut in 2009, and has been remaining constant ever since, at a higher level than all groups' weighted averages since 2011.

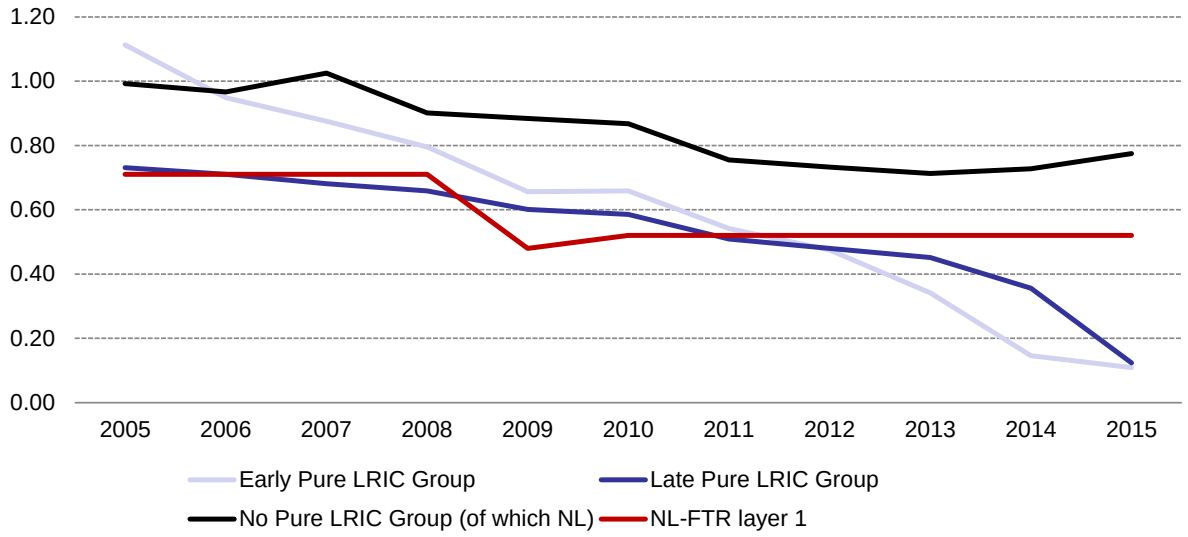
Figure 427 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 428 shows the flat average for the three groups as opposed to the previous figure. The main difference is related to the No Pure LRIC Group average FTR compared to the Dutch FTR level which has been lower since 2005 whereas it was higher when considering weighted averages.

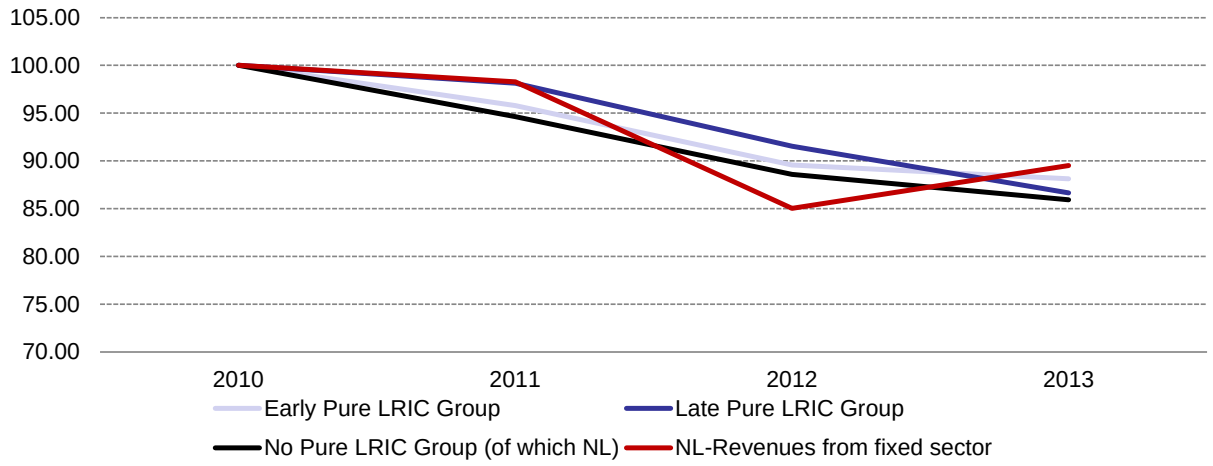
Figure 428 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 429 shows the fall in revenues from the fixed-line market since 2009 for both the Netherlands and countries of the No Pure LRIC Group. In 2013 compared to 2009, Netherlands' revenues have decreased as much as the average of its group, despite a stronger decline in 2012, caught up in 2013.

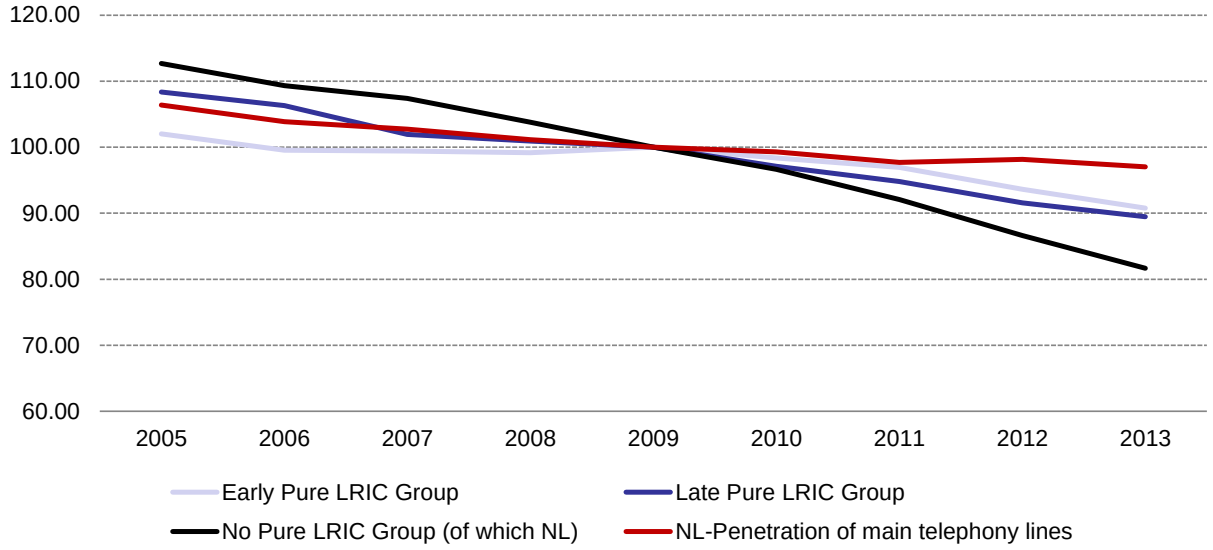
Figure 429 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Netherlands has shown a constant and slow decrease since 2005, slower than its group's average, as shown with Figure 430. In 2013 it was fairly high in comparison to other European countries.

Figure 430 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.20.2.2 *Evolution of retail fixed offers*

ACM did not notice any particular change in the retail fixed market

8.20.3 Summary

The tables below summarizs, for each metric, the difference between Netherlands and the average metric for the No pure LRIC Group in order to highlight how Netherlands is positioned against its pair countries.

Figure 431 - Differences between Netherlands and its group for the mobile market

Metrics	Differences between the No Pure LRIC Group and

	Netherlands
Mobile revenues	Closer to Late Pure LRIC Group
Mobile investments	Same trend as No Pure LRIC group
Mobile retail prices	Not available
Mobile penetration	Closer to No Pure LRIC Group in terms of SIM cards and unique subscribers than all groups
Competition in mobile	Closer in absolute value to Late Pure LRIC Group but followed the same trend as No Pure LRIC Group

Source: TERA Consultants

Figure 432 – Differences between the No Pure LRIC Group and Netherlands for the fixed market

Metrics	Differences between the No Pure LRIC Group and Netherlands
Fixed revenue	Different evolution than the No Pure LRIC Group
Traffic	Not available
Main telephony lines	Slower decrease than all groups

Source: TERA Consultants

8.21 Poland

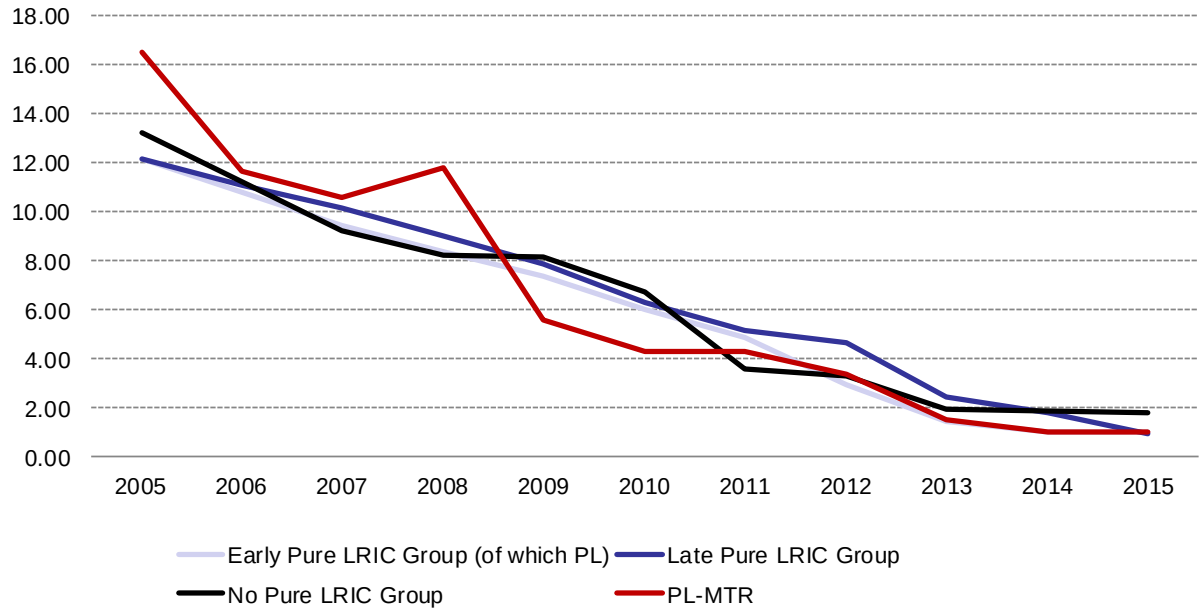
The Polish telecommunications market counts a number of operators of which the incumbent Orange Polska founded in 1991 as TPSA following the division of the state-owned entity Polish Post, Telegraph and Telephone. The first stakes were bought by France Telecom (Orange) in 2000 until the complete privatization of the company in 2010. The mobile market counts numerous other operators: Deutsche Telekom's mobile brand T-Mobile, active since 1996, as well as Plus (1996), Play (2006), and Aero2 (2009) result of the merger between CenterNet and Mobyland. UKE, the Polish regulator decided to implement the Pure LRIC approach in 2013 for MTR. The country has then been allocated to the "Early Pure LRIC group". Poland however, is using the BU LRAIC+ to set FTRs, it has then been allocated to the No Pure LRIC Group for the fixed sector analysis.

8.21.1 Mobile market

8.21.1.1 *Quantitative analysis*

MTRs in Poland were among the highest in Europe in 2005. They have then been decreasing following the European downward trend since 2005. It has been very close to the Early Pure LRIC Group since 2011 and is in 2015 consistent with countries which implemented Pure LRIC, as observed with Figure 433.

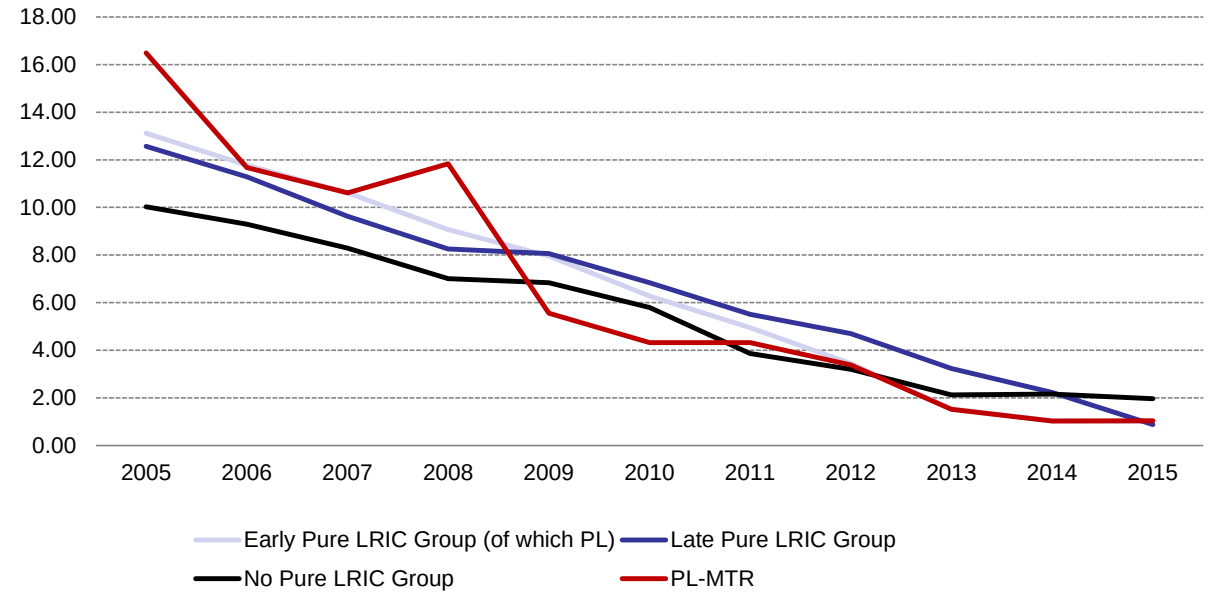
Figure 433 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 434) as opposed to weighted average above. Both figures are very similar.

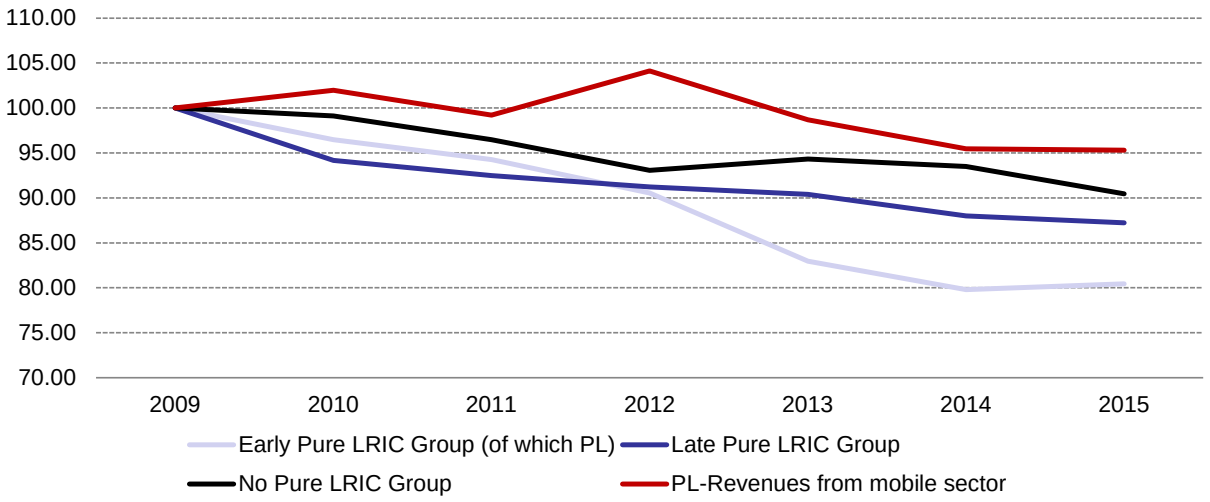
Figure 434 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 435 have been fairly steady since 2009, only slightly decreasing in comparison to all groups.

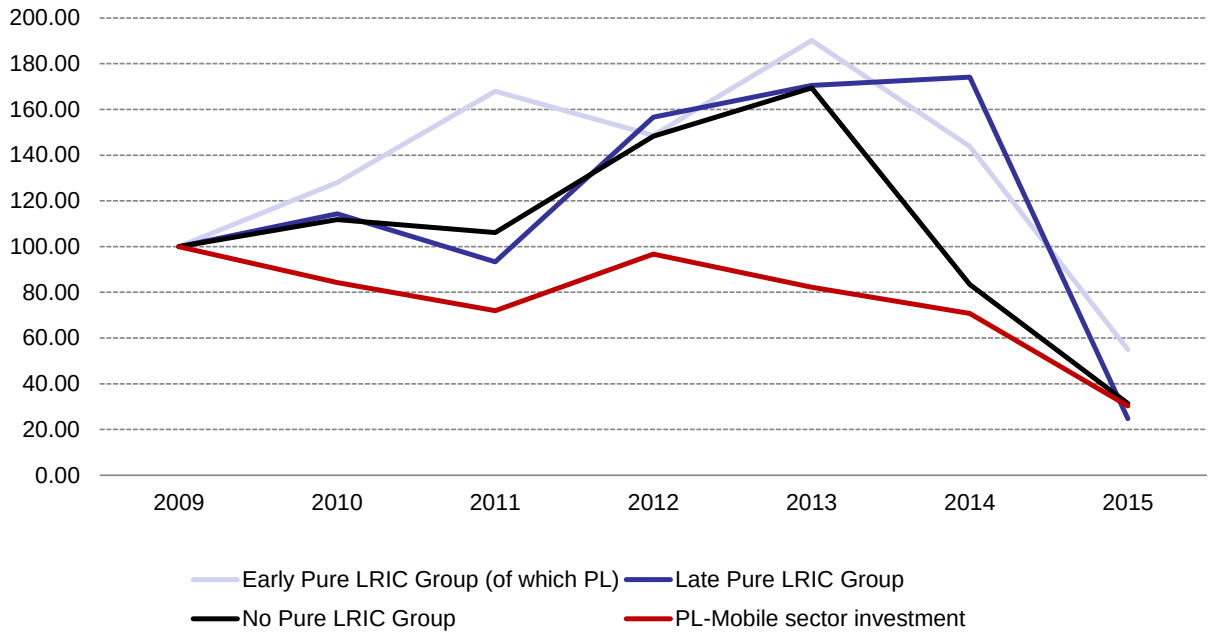
Figure 435 - Mobile revenues (base 100 in 2009)



Source : GSMA

Investments on the other hand, have been continuously dropping since 2009 as shown in Figure 436. Between 2012 and 2015, they have been divided by more than two, less than the three groups' investments, divided by three over the same period.

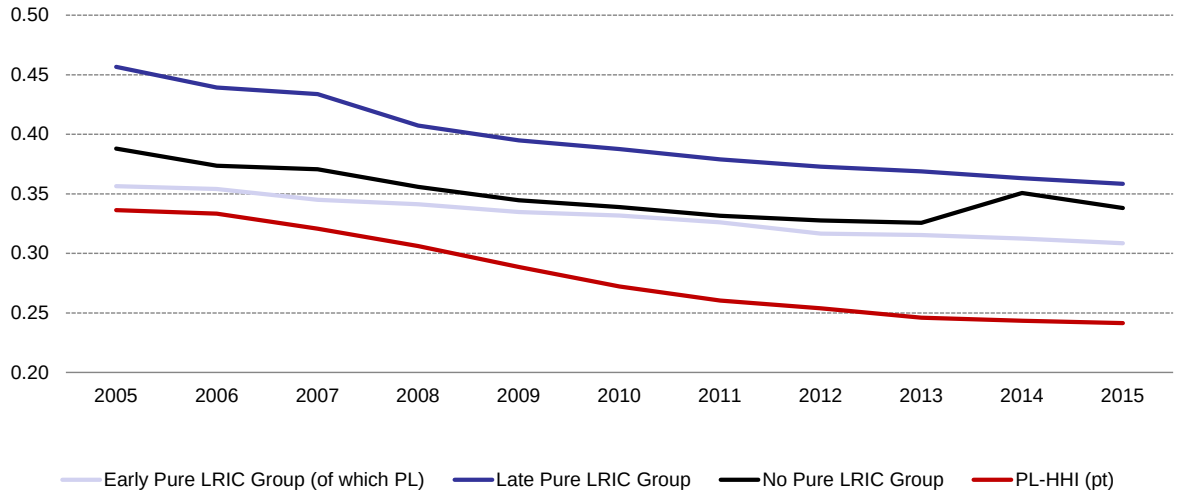
Figure 436 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Polish mobile market. The improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005 witnessing the constant increase of Play since its entry in 2006, as noticed with Figure 437. It can also be observed that the level of concentration in Poland is way lower than all groups in 2015.

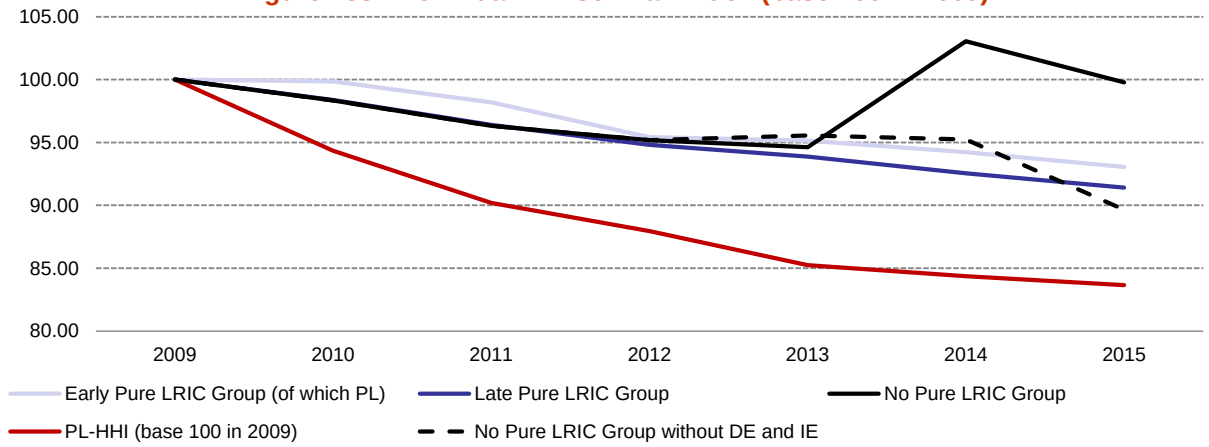
Figure 437 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Poland since 2009 can be noticed in Figure 438: the HHI (as base 100 in 2009) has been continuously dropping and is now significantly inferior to the average of Early Pure LRIC and other groups of countries.

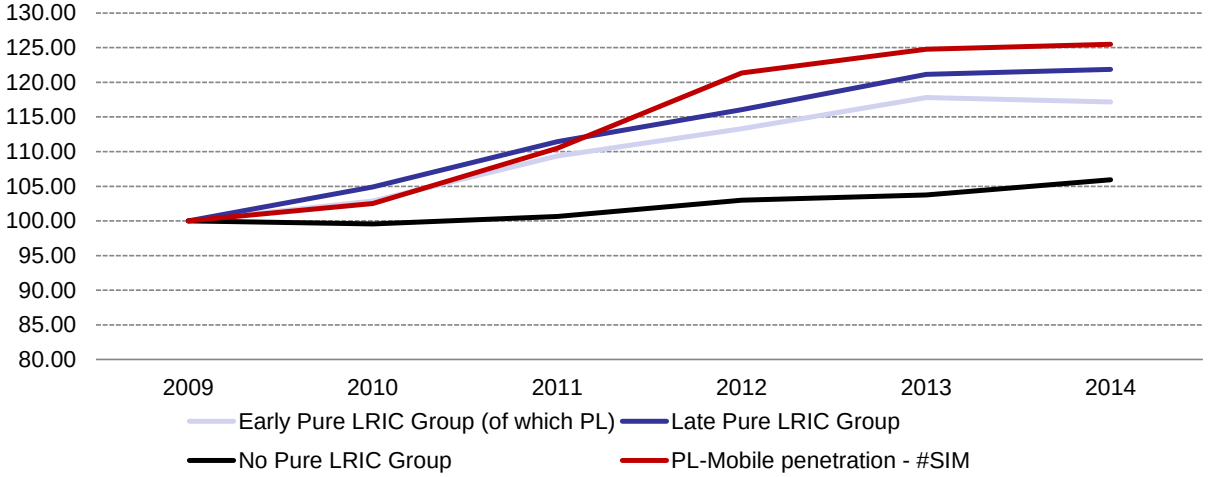
Figure 438 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The market penetration in terms of number of SIM in Poland has been increasing since 2009 following a comparable trend to the Late Pure LRIC Group.

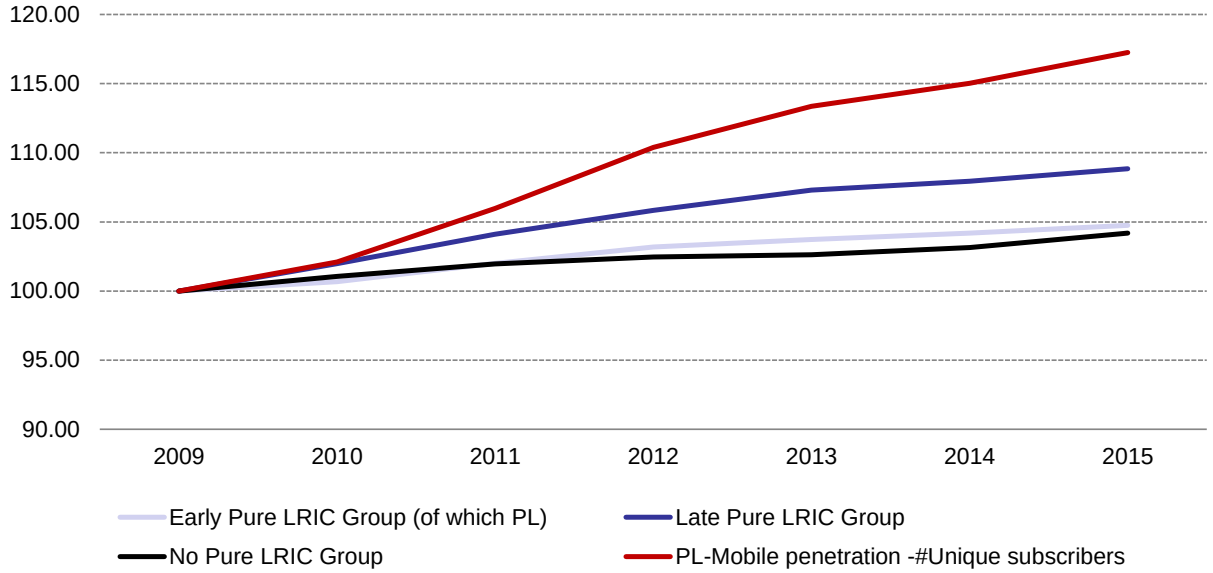
Figure 439 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

With respect to market penetration in terms of unique subscribers, it can be observed in Figure 439 that it has been continuously growing, more than the three groups' averages. Such as the penetration in terms of SIM cards, it is although still close to the European average.

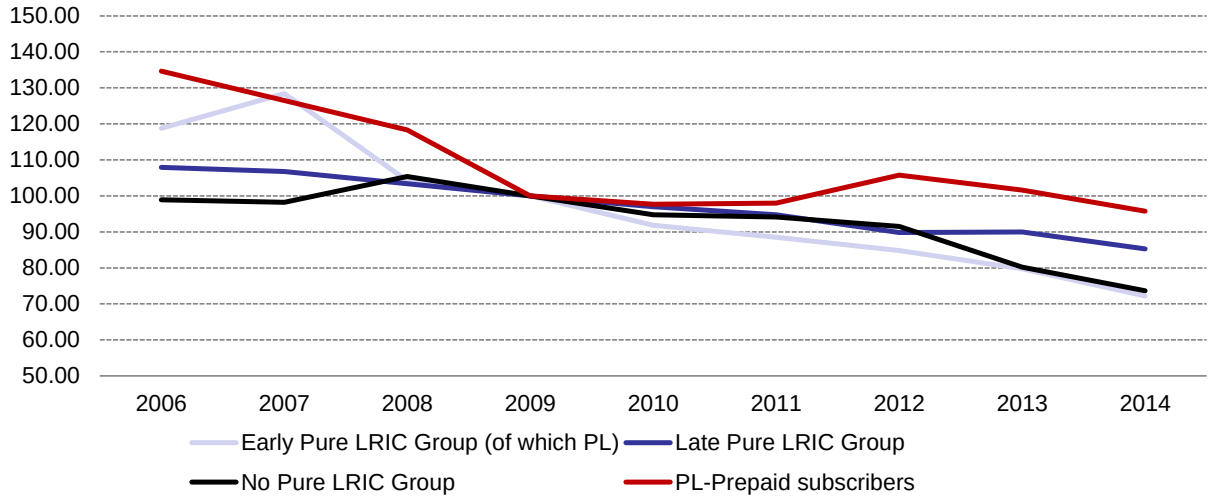
Figure 440 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 441 shows the evolution of the share of prepaid subscribers in Poland compared to the three groups. It has been falling from 2005 to 2009, and then remained fairly constant around 50% whereas all groups kept on decreasing after 2009.

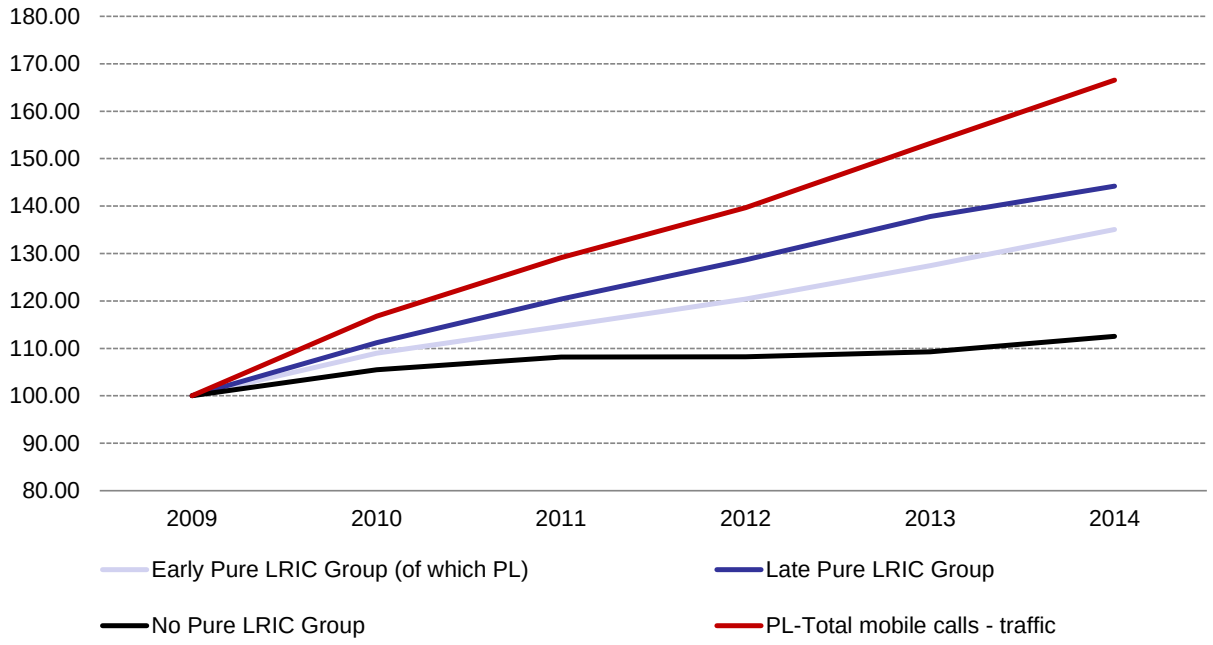
Figure 441 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 442 shows the total amount of minutes of mobile calls in Poland. It can be observed that it has been strongly increasing since 2009, twice more than the Early Pure LRIC Group in 2014.

Figure 442 - Total minutes of mobile calls (base 100 in 2009)



NRAs Replies to questionnaire

8.21.1.2 *Evolution of retail mobile offers*

According to the regulator UKE, flat rate offers are currently dominant in the retail mobile market. Most contracts are now offering subscriptions with unlimited domestic calls, as well as unlimited SMS.

UKE also noticed that prices have been on a downward trend for many years.

On the other hand, rates for calls outside EU have been set on a higher level than rates for calls within EU.

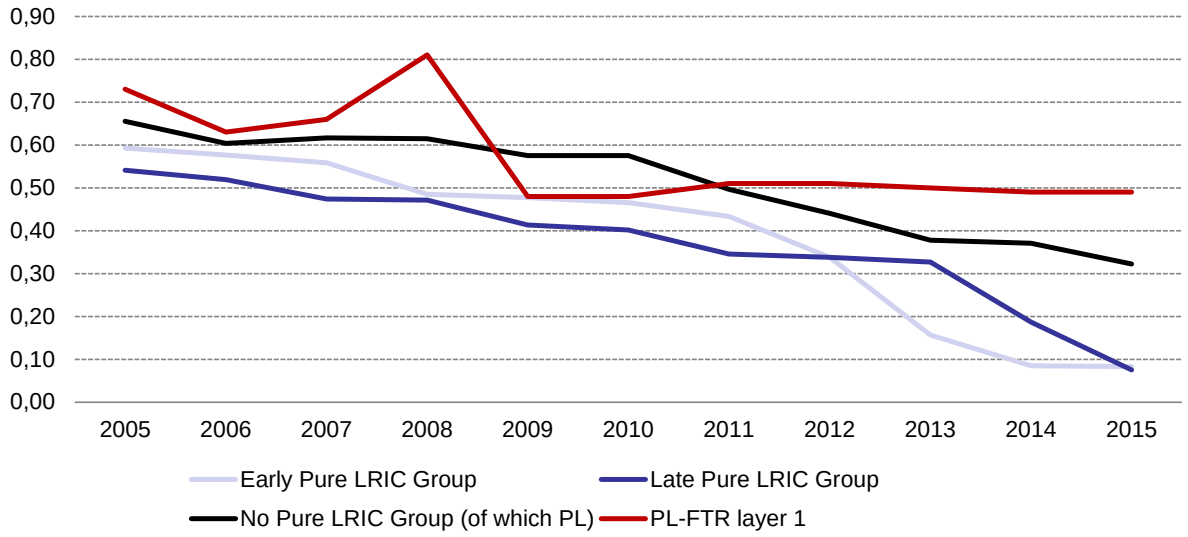
UKE observed that flat rate offers were introduced during consultation for the implementation of Pure LRIC. These changes have then been attributed to the lower MTR.

8.21.2 Fixed market

8.21.2.1 *Quantitative analysis*

Figure 443 compares the level of FTRs in Poland with the three groups' weighted averages. It can be observed that it has been remaining unchanged since 2009 whereas all groups kept on decreasing. FTRs in Poland are therefore higher than all groups in 2015.

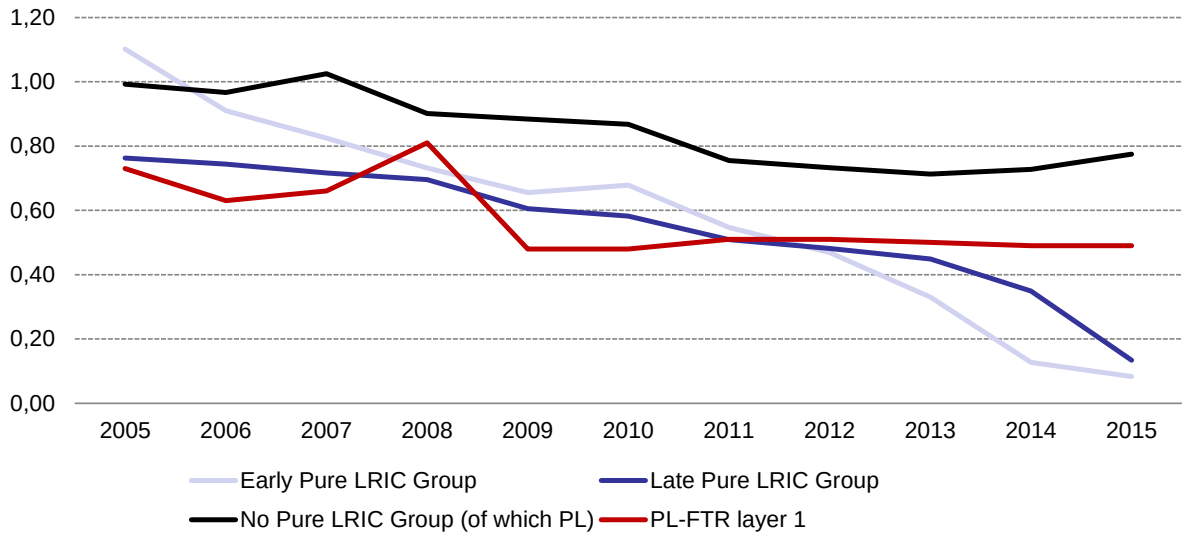
Figure 443 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 444 shows the flat average for the three groups as opposed to the previous figure. The main difference is related to the No Pure LRIC Group average FTR compared to the Polish FTR level which has been lower since 2005.

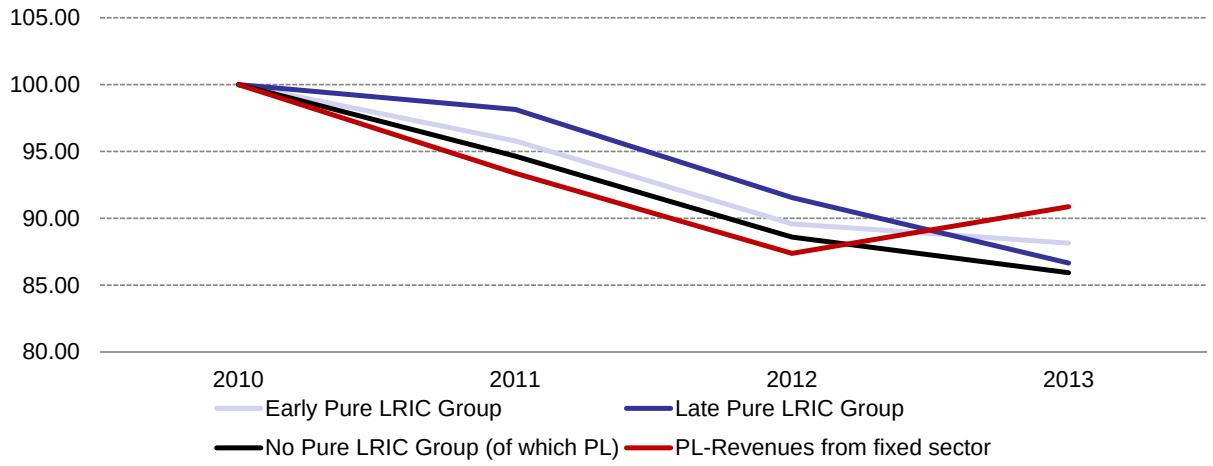
Figure 444 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 445 shows the evolution of revenues from fixed-line market since 2010 for both Poland and the three groups. It can be observed that revenues declined between 2010 and 2012 for Poland like all groups, and have then increased in 2013 whereas all groups kept on decreasing.

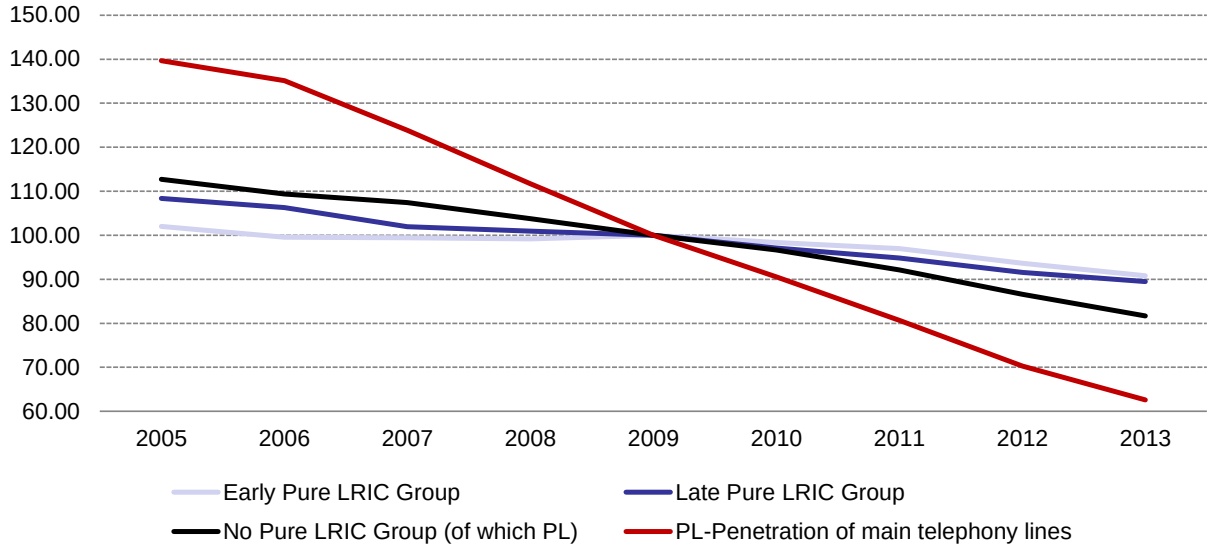
Figure 445 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Poland has shown a constant and faster decrease than all groups since 2005 as shown in Figure 446. It is therefore in 2013 way lower than most countries in Europe, at 18%.

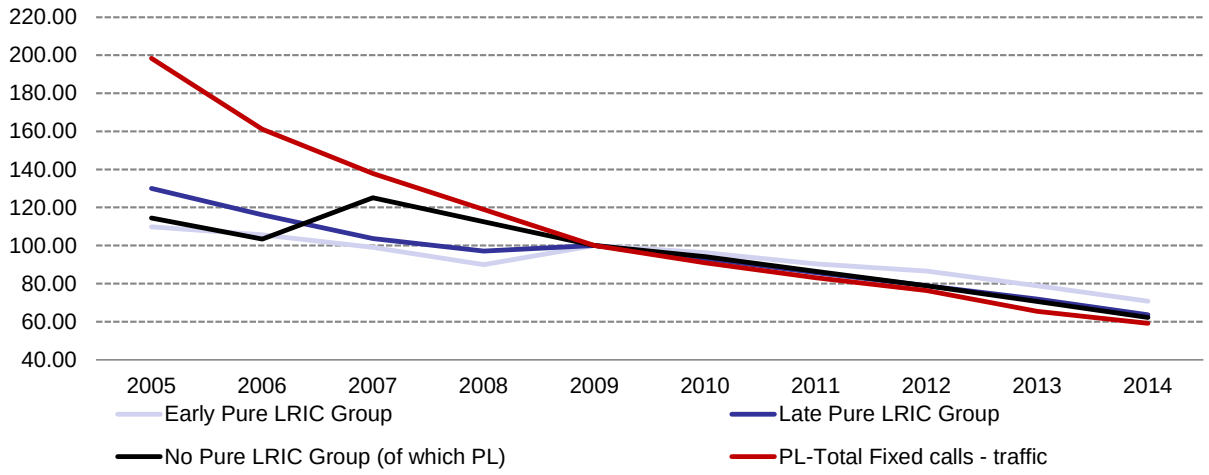
Figure 446 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The total amount of minutes of fixed national calls in Poland, presented in Figure 447, has shown a steady decline between 2009 and 2014 following a comparable trend to the No Pure LRIC Group.

Figure 447 Total minutes of fixed calls (base 100 in 2009)



Source: UKE

8.21.2.2 *Evolution of retail fixed offers*

Concerning retail fixed offers, UKE noticed that unlimited calls are standard in Poland for both traditional and VoIP operators.

8.21.3 Summary

The tables below summarize, for each metric, the difference between Poland and the average metric for the Early pure LRIC Group for the mobile market and the No Pure LRIC Group for the fixed market in order to highlight how Poland is positioned against its pair countries.

Figure 448 - Differences between Poland and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Poland
Mobile revenues	Closer to No Pure LRIC Group
Mobile investments	Followed no particular trend
Mobile retail prices	Not available
Mobile penetration	Close to Late Pure LRIC Group in terms of SIM cards and unique subscribers
Competition in mobile	More competition than all groups, increased faster than all groups

Source: TERA Consultants

Figure 449 – Differences between the No Pure LRIC Group and Poland for the fixed market

Metrics	Differences between the No Pure LRIC Group and Poland
Fixed revenue	Roughly similar to the No Pure LRIC Group
Traffic	Very close to all groups
Main telephony lines	Much faster decrease than all groups

Source: TERA Consultant

8.22 Portugal

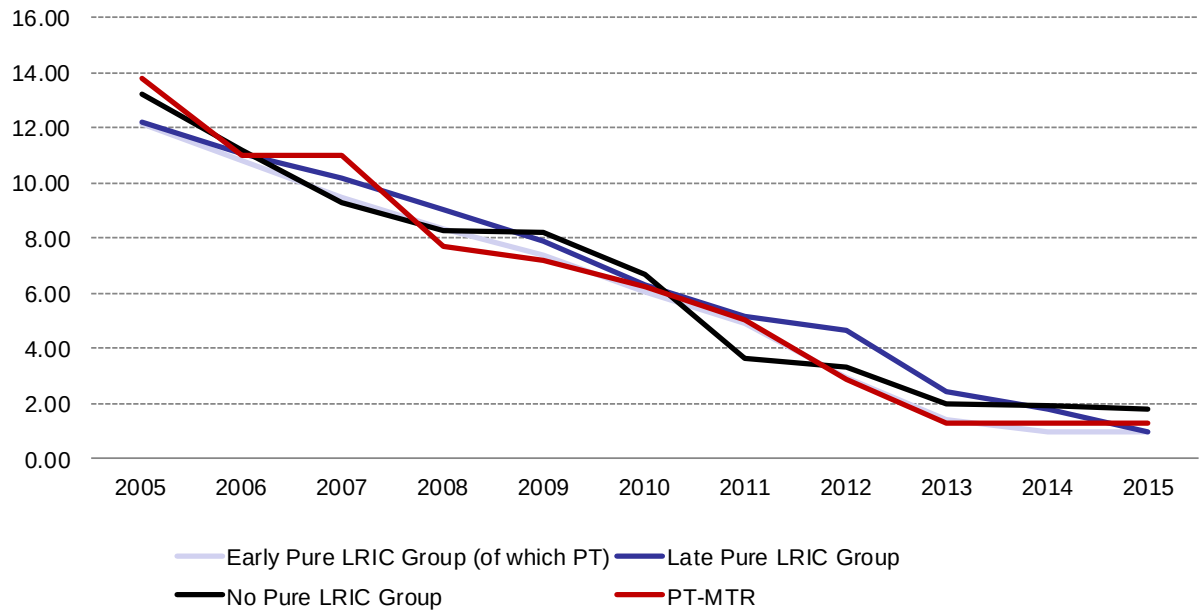
The Portuguese incumbent is Portugal Telecom founded in 1994 and separated into PT Comunicações and PT Multimédia in 2007. PT Comunicações merged in 2014 with MEO – Serviços de Comunicações e Multimédia, S.A. resulting from then on in MEO which is the leader in both fixed and mobile markets. PT Multimédia, renamed ZON after separation from PT Comunicações, merged with Optimus in 2014, being the name of the new resulting company NOS. The market is also addressed by Vodafone since 1992. The Portuguese regulator ANACOM implemented the pure LRIC approach in 2012 and is then allocated to the "Early Pure LRIC group" for this study.

8.22.1 Mobile market

8.22.1.1 *Quantitative analysis*

Figure 450 shows the evolution of MTRs in Portugal compared to the three groups' weighted averages. It can be observed that it has been decreasing like all groups since 2005, and has been close to the average of other countries. It is since the adoption of the Pure LRIC approach in 2013 at the same level as the Early Pure LRIC group.

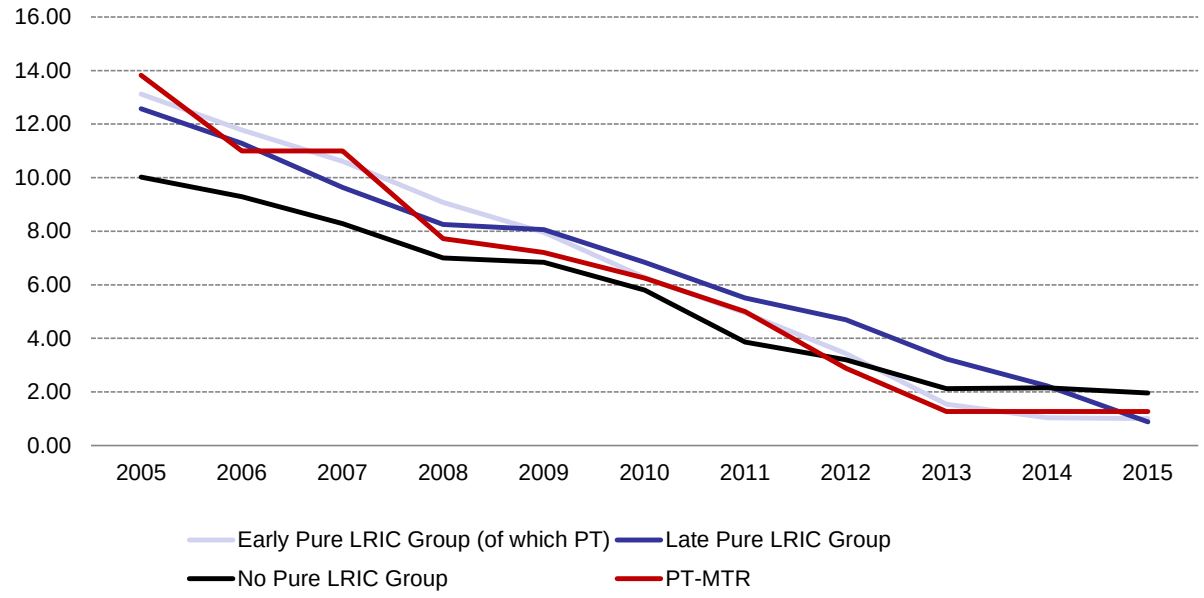
Figure 450 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 451). The trend is approximately the same as the weighted average trend, with Portuguese MTRs declining like all groups, and being at the same level as the Early Pure LRIC Group since 2013.

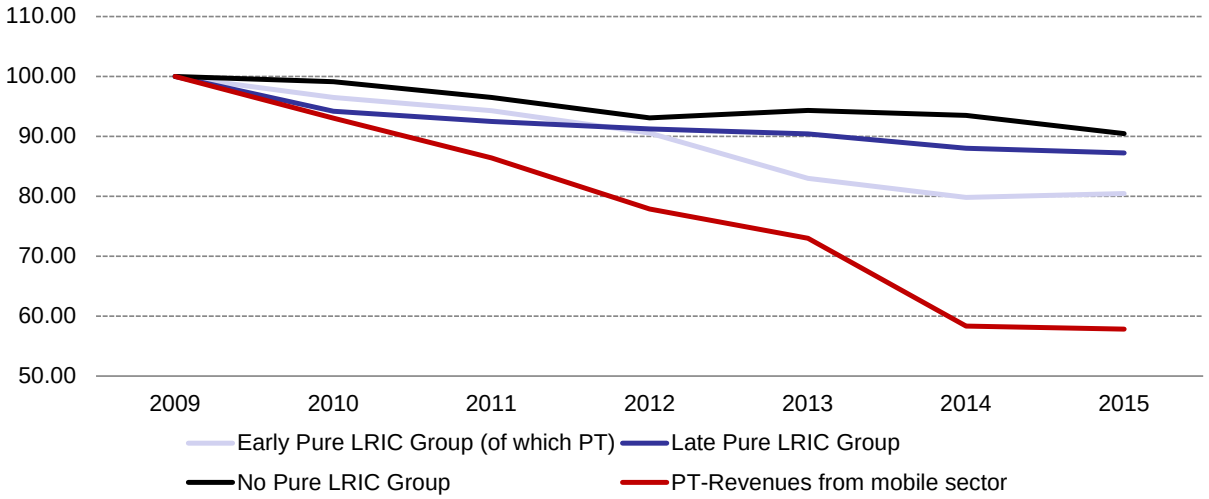
Figure 451 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 452 continuously dropped in Portugal between 2009 and 2014, and seems to bottom-out ever since. Revenues in Portugal have been almost divided by two between 2009 and 2015 whereas the Early Pure LRIC Group only suffered a 20% decrease.

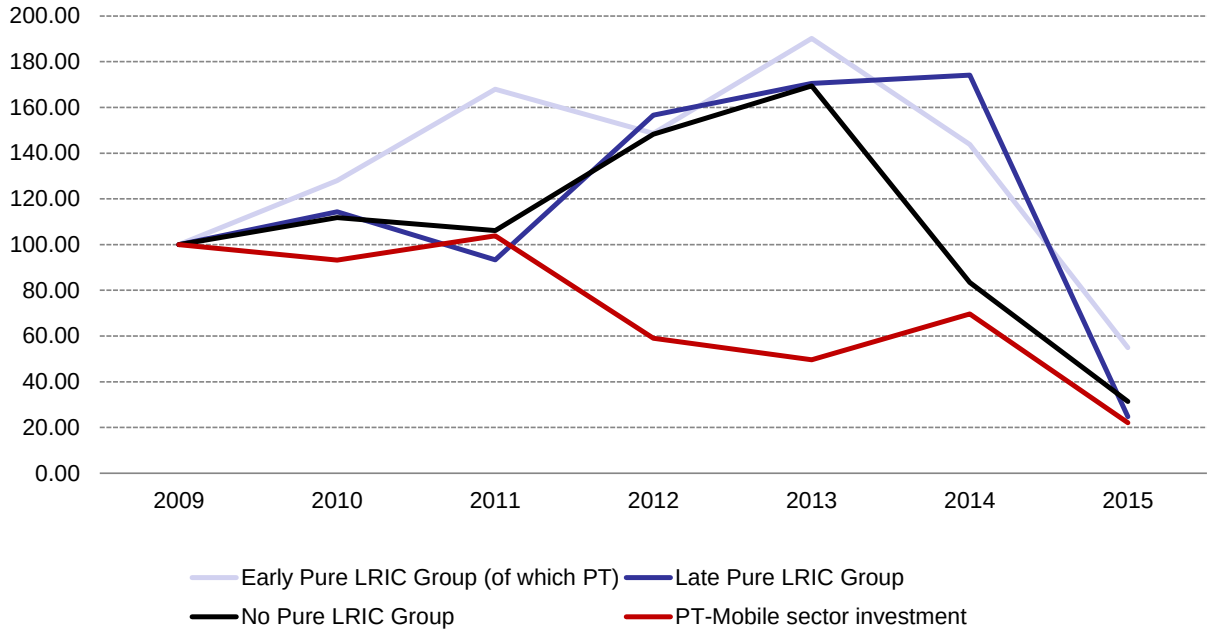
Figure 452 - Mobile revenues (base 100 in 2009)



Source : GSMA

As for the revenues, investments (see Figure 453) in the mobile sector have also been decreasing since 2009. The evolution of investments in Portugal has been comparable between 2009 and 2011 to the Late and No Pure LRIC Groups, which then increased whereas Portuguese mobile investment declined.

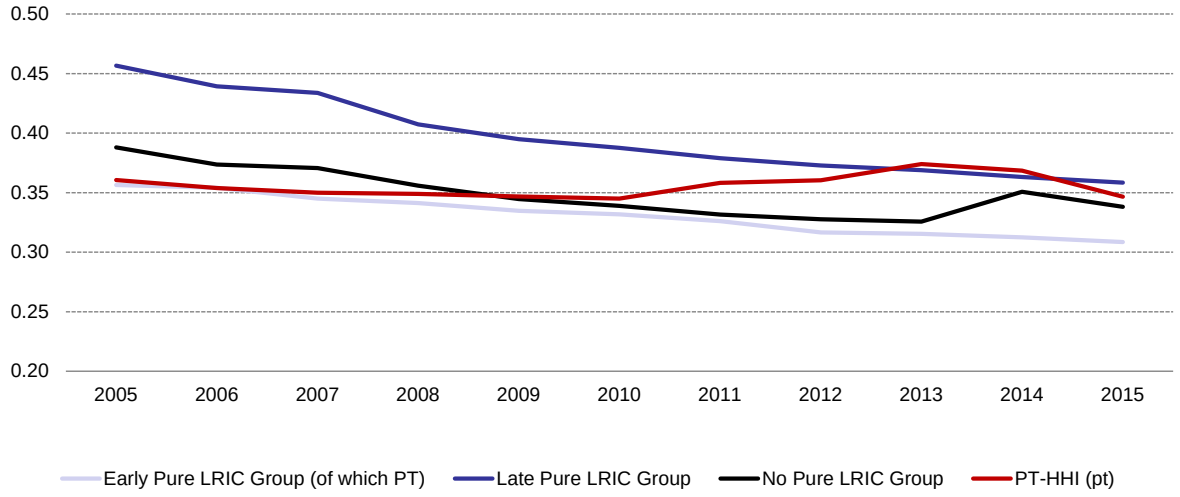
Figure 453 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Portuguese mobile market. Despite different mergers, the concentration of Portuguese mobile market measured with the HHI (see Figure 454) has not evolved since 2005, and is now at the same level as Late and No Pure LRIC Groups whereas it was comparable to the Early Pure LRIC Group in 2005.

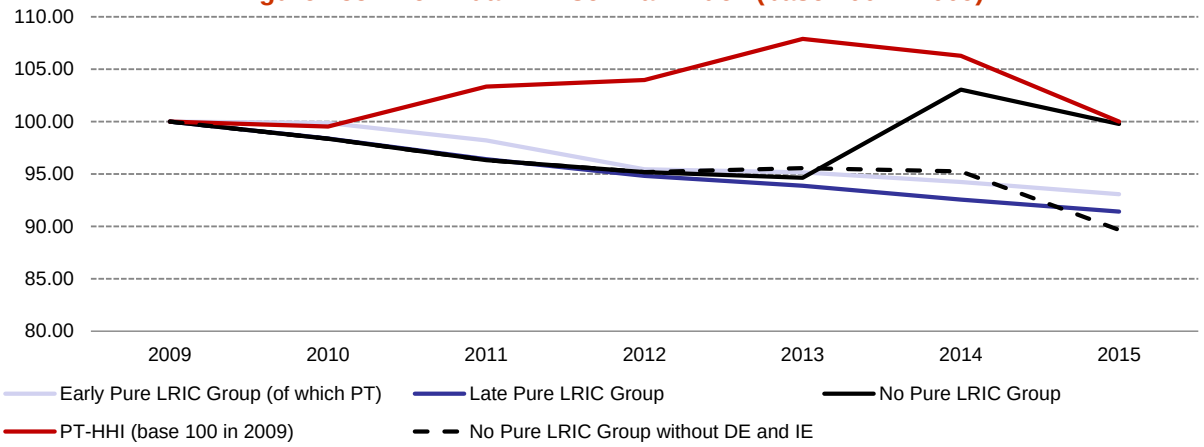
Figure 454 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the stagnation of the level of concentration in Portugal since 2009 can be noticed in Figure 455: the HHI (as base 100 in 2009) has been slightly increasing from 2009 to 2013 and decreased a bit after 2013. In comparison, the HHI in the Early Pure LRIC Group has been continuously decreasing since 2009.

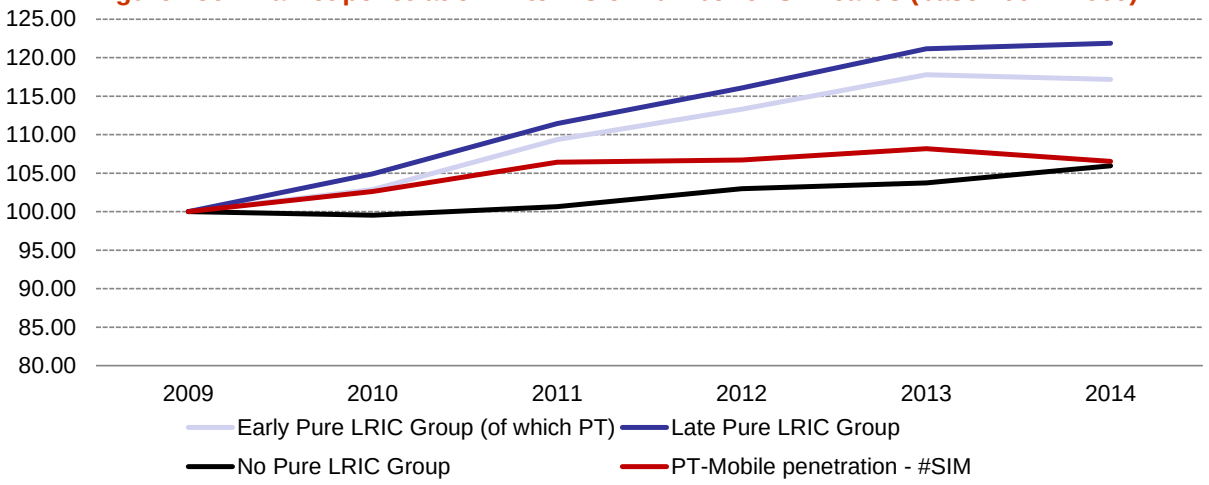
Figure 455 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Portuguese market penetration in terms of number of SIM presented in Figure 456 has been very slightly increasing since 2009, even decreasing in 2014. Its evolution from 2009 to 2014 is comparable to the No Pure LRIC Group.

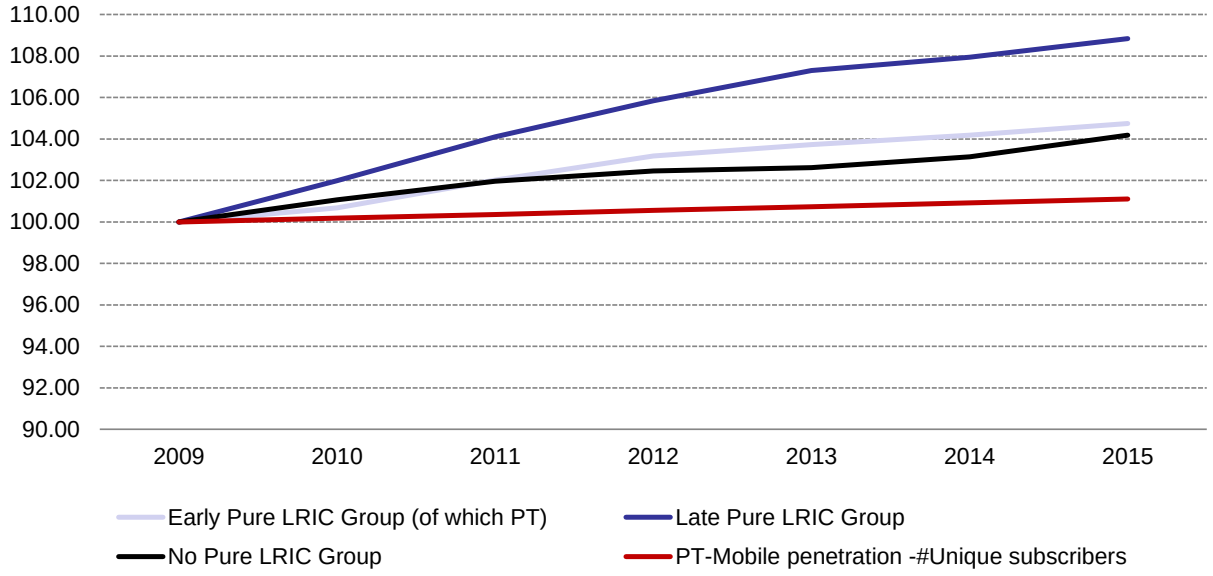
Figure 456 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The same trend can be observed concerning the market penetration in terms of unique subscribers with Figure 457. It has been slightly increasing in Portugal, and has been increasing a bit more for the Early Pure LRIC Group.

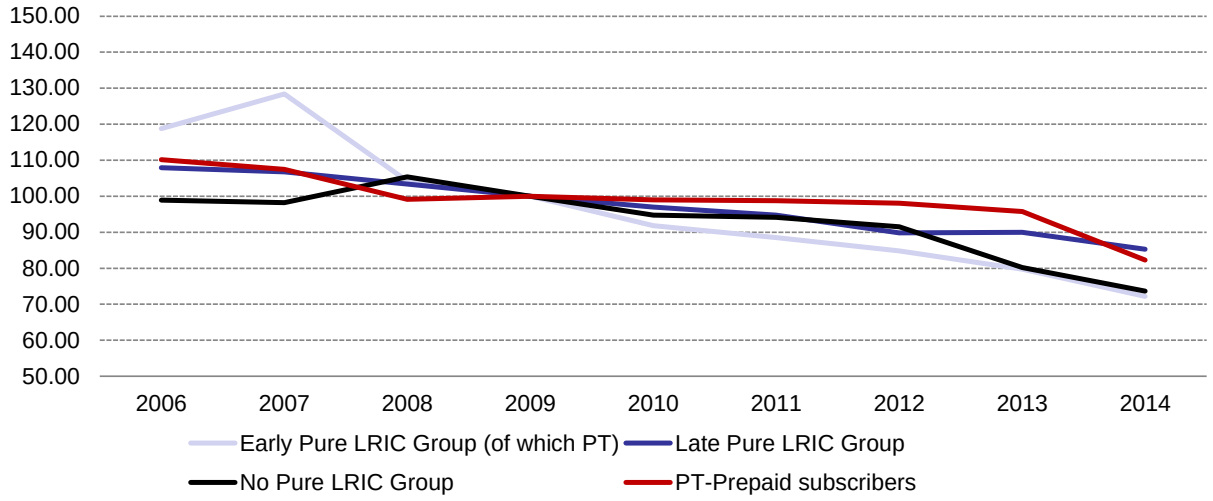
Figure 457 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 458 presents the share of prepaid subscribers since 2006 for Portugal and the three groups. It can be noticed that it remained fairly constant in Portugal from 2008 whereas it decreased for all groups over the same period. In 2014 though, it decreased by 10%, more than all groups. In 2014, the share of prepaid customers in Portugal remains at 60% relatively high compared to European countries.

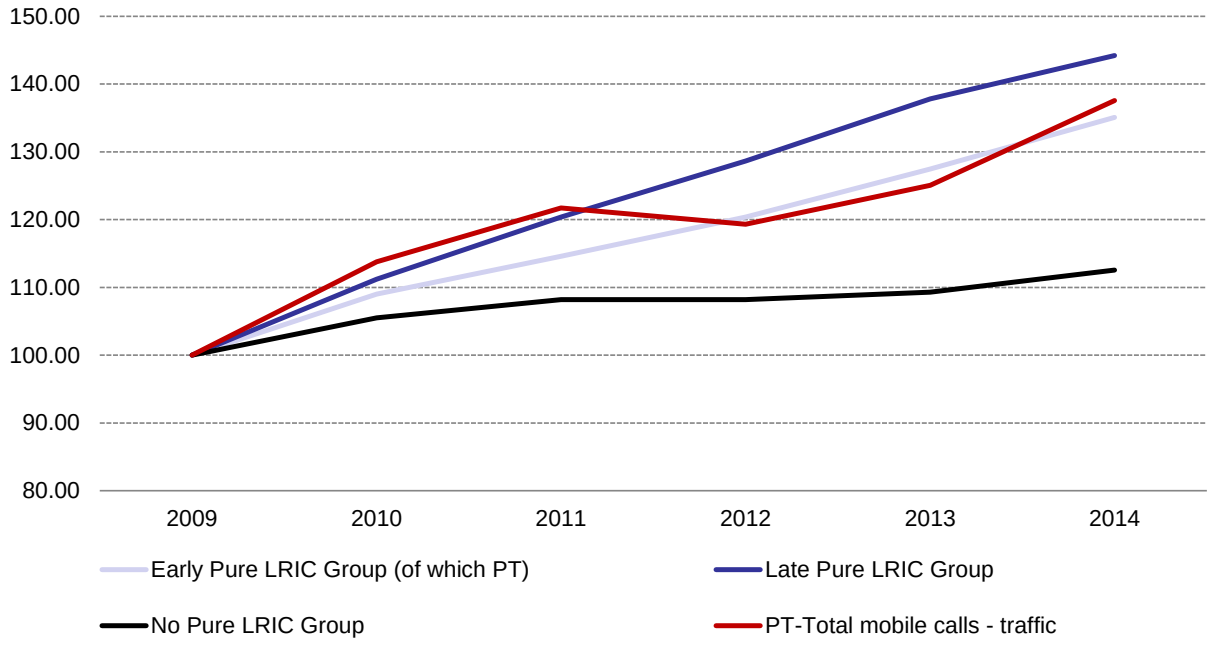
Figure 458 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 459 shows the evolution of the total amount of minutes of mobile calls. It can be noticed it increased between 2009 and 2011, then decreased in 2012, and then increased again in 2013 and 2014. Since 2012, the Portuguese mobile call traffic has followed the Early Pure LRIC Group's trend.

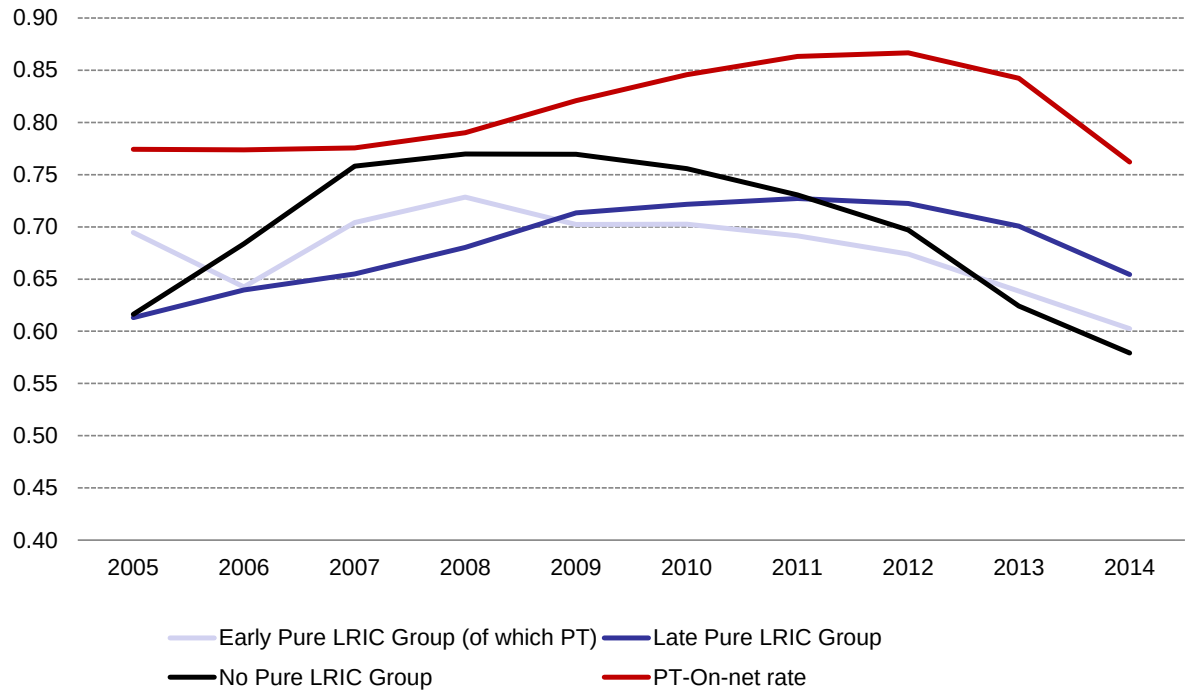
Figure 459 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 460 shows the share of on-net mobile calls, slowly increasing from 2006 to 2012 for Portugal before falling after 2012. It has been since 2006 constantly higher than all groups, and its evolution has been closer to the Late Pure LRIC Group than the Early Pure LRIC Group.

Figure 460 - On-net rate of mobile calls (%)



Source: ANACOM

8.22.1.2 *Evolution of retail mobile offers*

In 2005, ANACOM ruled a 41% decrease of MTR over an 18 months period. Following this decision, the 3 MNOs launched simultaneously low-cost prepaid undifferentiated offers.

In 2010, ANACOM announced of 46% reduction of MTR, which was followed by new low-cost undifferentiated plans.

In December 2012, MTR were set on a Pure LRIC basis by ANACOM. Subsequently, one operator launched a bundle offering converging fixed and mobile contents for the first time, and by the end of the year, its main competitor launched a similar offer.

In 2014, 48% of offers are flat rate offering unlimited calls to fixed and mobile networks, 26% are flat rate for on-net calls and 12% offer calls to international.

ANACOM summarizes the recent mobile trend:

- No differentiation between on-net and off-net calls,
- Unlimited traffics,
- Multiple play offers.

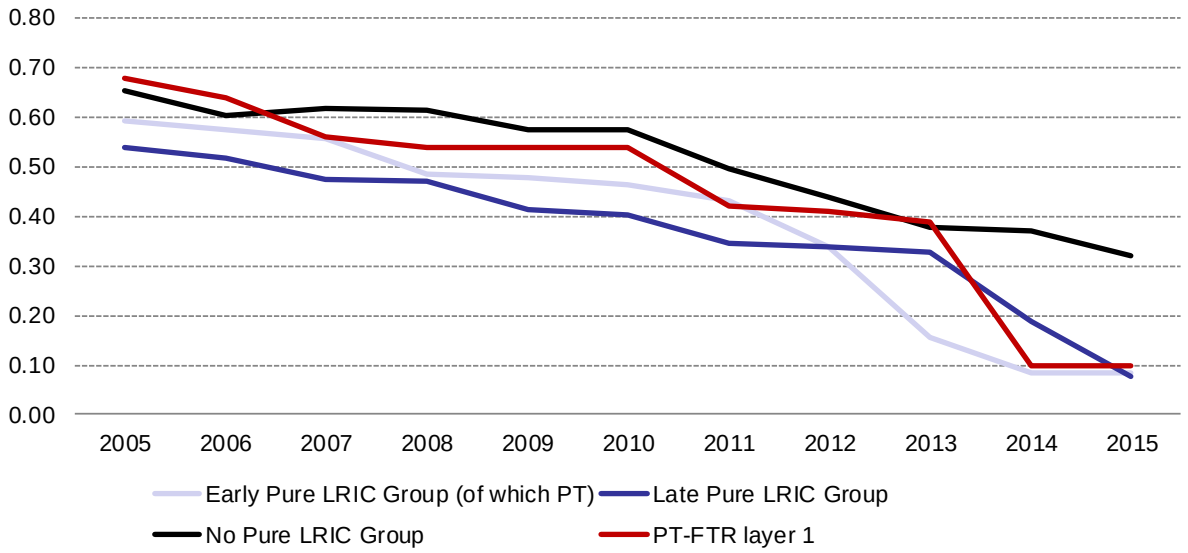
ANACOM stated that lower MTR played an important role in the appearance of those offers.

8.22.2 Fixed market

8.22.2.1 *Quantitative analysis*

Figure 461 compares the level of FTRs in Portugal to the weighted averages of the three groups. It can be observed that FTRs in Portugal steadily decreased between 2005 and 2014, and then suddenly shrunk in 2014 in order to set it at a Pure LRIC level. It is by then at the same level as the Early Pure LRIC Group

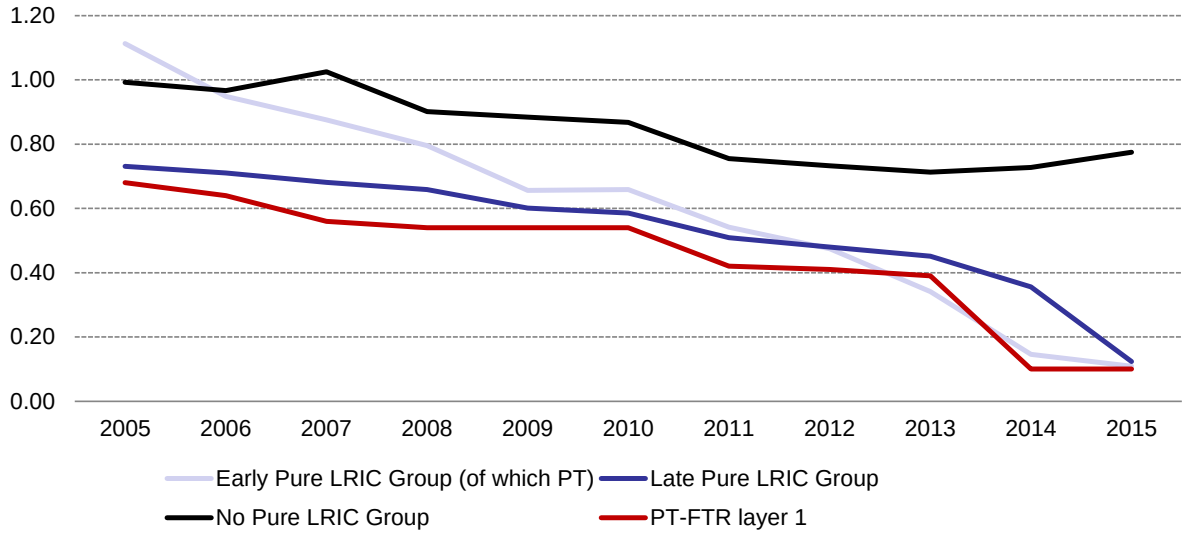
Figure 461 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 462 shows the flat average for the three groups as opposed to the previous figure. The trend is very similar to the previous figure, but flat averages are higher than weighted averages, which shows that Portuguese FTRs are among the lowest in Europe since 2005.

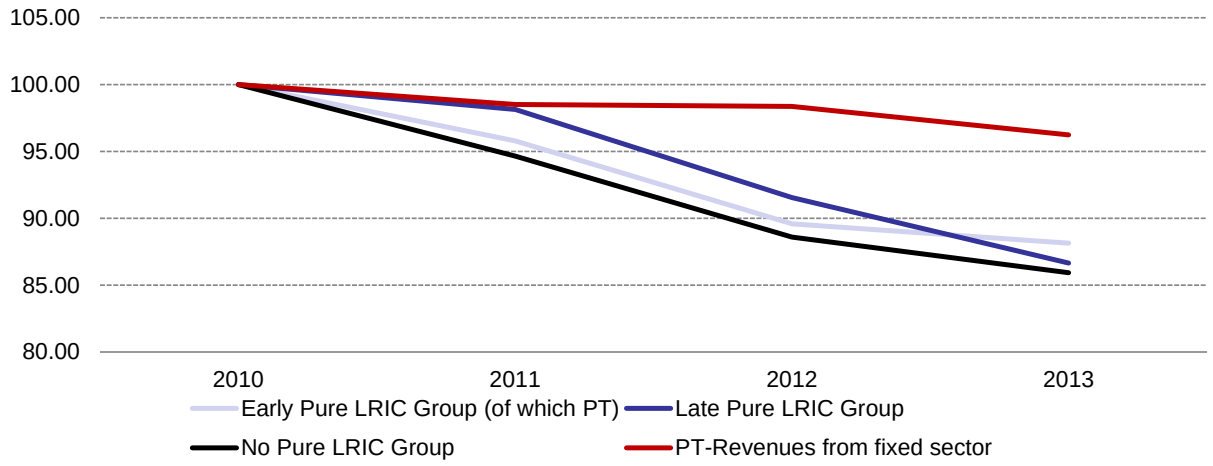
Figure 462 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 463 shows the evolution of revenues from the fixed-line market since 2010 Portugal. It can be observed that revenues have been steadily decreasing, way slower than all groups since 2010.

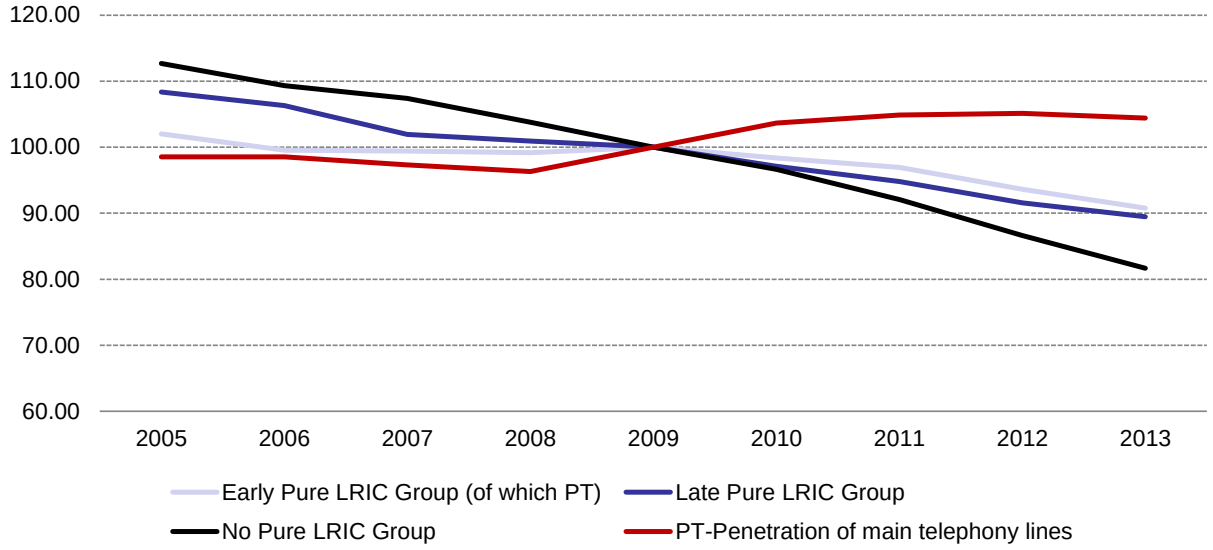
Figure 463 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Portugal has shown a constant and slow increase since 2008 whereas all groups have seen their penetration declining over the same period. In 2013, the market penetration in Portugal is close to the average of other countries.

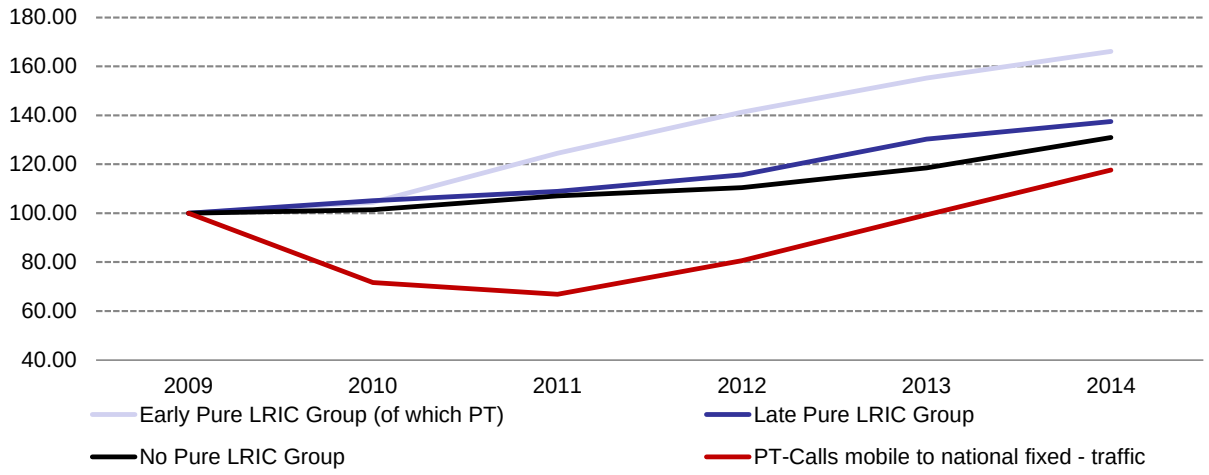
Figure 464 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Portugal, presented in Figure 465, declined between 2009 and 2011, then steadily increased from 2011 to 2014. Since 2011, the evolution of mobile traffic to fixed has been closer to the Late Pure LRIC Group than the Early Pure LRIC Group.

Figure 465 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: ANACOM

8.22.2.2 *Evolution of retail fixed offers*

According to ANACOM, in 2011 bundled offers including fixed telephony service represented 70.9% of the fixed telephony service, and 77% offered unlimited calls to national fixed networks, with or without restrictions such as calls at night, week-end or holidays.

In 2013, one operator launched an offer with converging fixed and mobile services for the first time.

In 2014, bundled offers represented 91.2% of fixed telephony service, with 96% offering unlimited calls, with or without restrictions.

According to ANACOM, all 4P and 5P offers include unlimited calls to fixed national networks, and off-peak unlimited calls to fixed international networks.

8.22.3 Summary

The tables below summarize, for each metric, the difference between Portugal and the average metric for the Early pure LRIC Group in order to highlight how Portugal is positioned against its pair countries.

Figure 466 - Differences between Portugal and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Portugal
Mobile revenues	Faster decrease than all groups
Mobile investments	Did not increase like all groups in 2011, decreased in 2015 like all groups
Mobile retail prices	Not available
Mobile penetration	Same trend as No Pure LRC Group followed in terms of #SIM cards. Lower penetration for Portugal in terms of Unique Subscribers than all groups
Competition in mobile	Decrease of competition following different mergers

On-net rate	Way higher than all groups

Source: TERA Consultants

Figure 467 – Differences between the Early Pure LRIC Group and Portugal for the fixed market

Metrics	Differences between the Early Pure LRIC Group and Portugal
Fixed revenue	Much slower decrease than all groups
Traffic	Similar evolution to the Early Pure LRIC Group since 2011
Main telephony lines	Increased whereas all groups decreased

Source: TERA Consultants

8.23 Romania

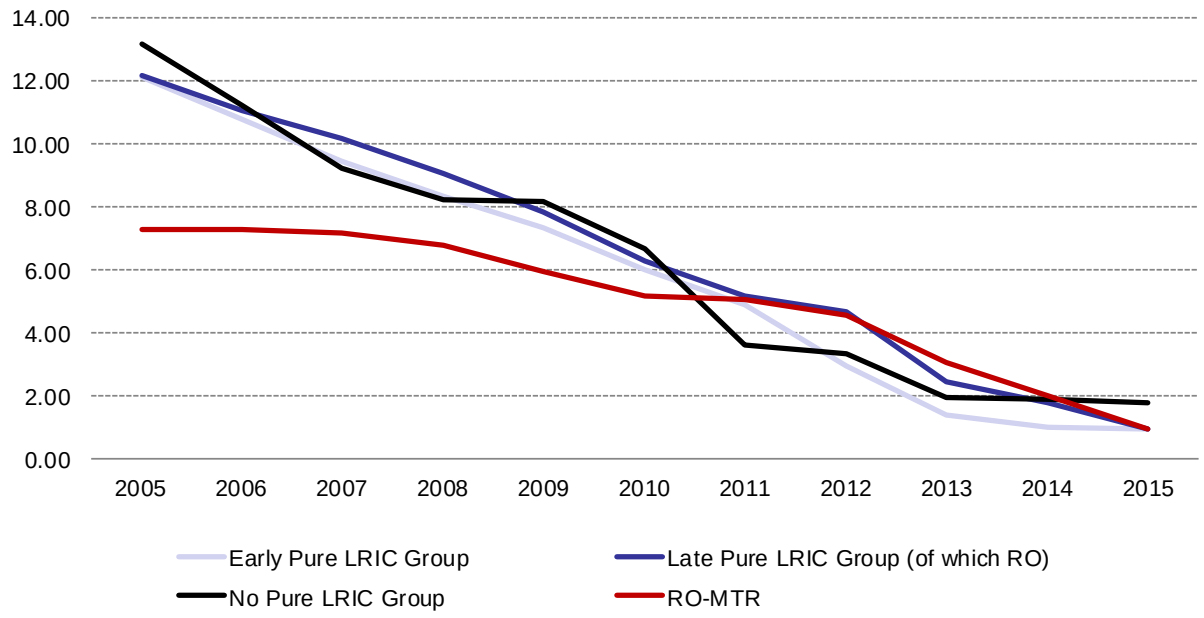
The Romanian telecommunications market is now served by four operators of which the incumbent Telekom Romania, result of the merger between Romtelecom (1991) and Cosmote Romania (2000). The other providers are RCS&RDS (1993), also the largest fixed operator, Vodafone (1997) and the leader on the mobile market, Orange (1997). The Romanian regulator ANCOM implemented the pure LRIC approach for MTR in 2014; the country has then been allocated to the Late Pure LRIC Group for the mobile market.

8.23.1 Mobile market

8.23.1.1 *Quantitative analysis*

Figure 468 compares the level of Romanian MTR to the three groups' weighted averages. It can be observed that it has been below all groups from 2005 to 2010, but decreased slower than all groups. Therefore it was in 2013 higher than all groups, before it was set on Pure LRIC and reached the same level as Late Pure LRIC group in 2014 and 2015.

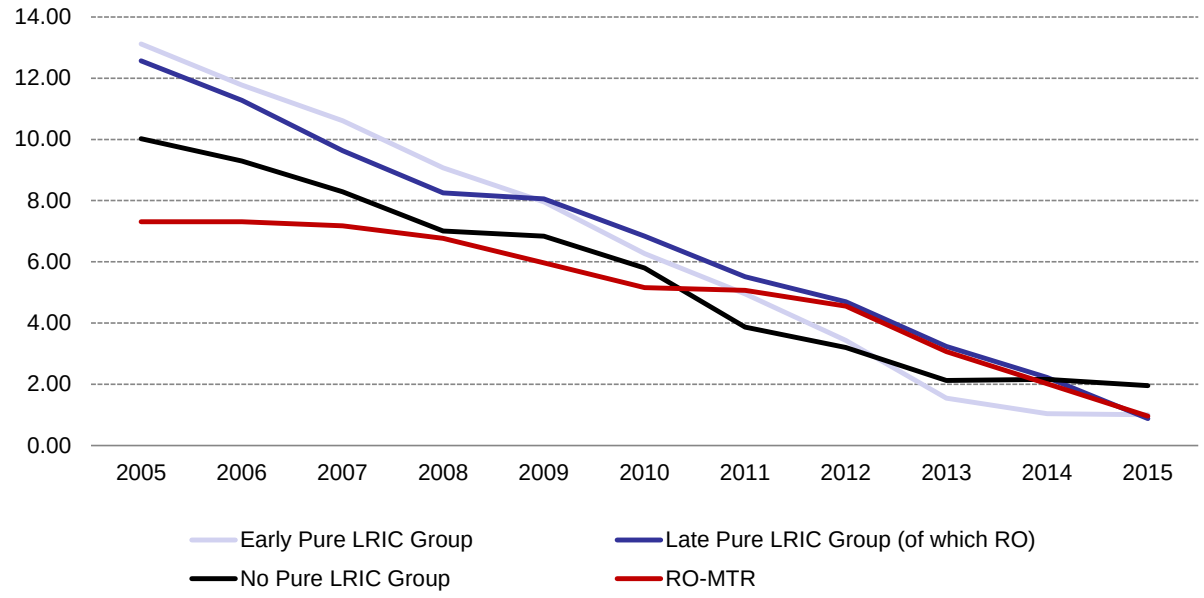
Figure 468 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 469). The main difference is that Romanian MTR followed more closely the Late Pure LRIC Group average from 2012 to 2015.

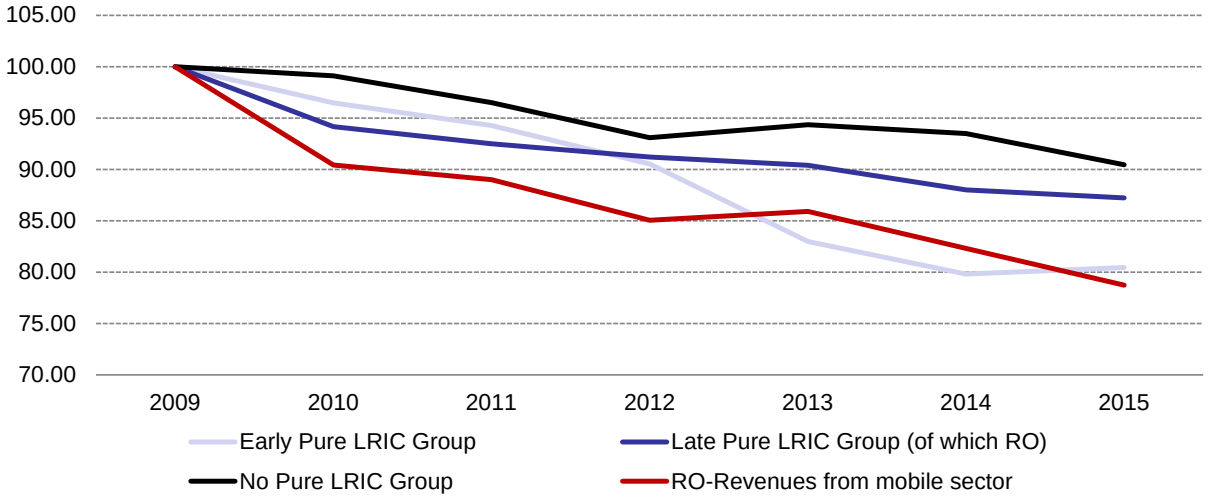
Figure 469 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 470 have been continuously decreasing from 2009 to 2015. Their decline has been more comparable since 2013 to the Early Pure LRIC Group than the Late Pure LRIC Group.

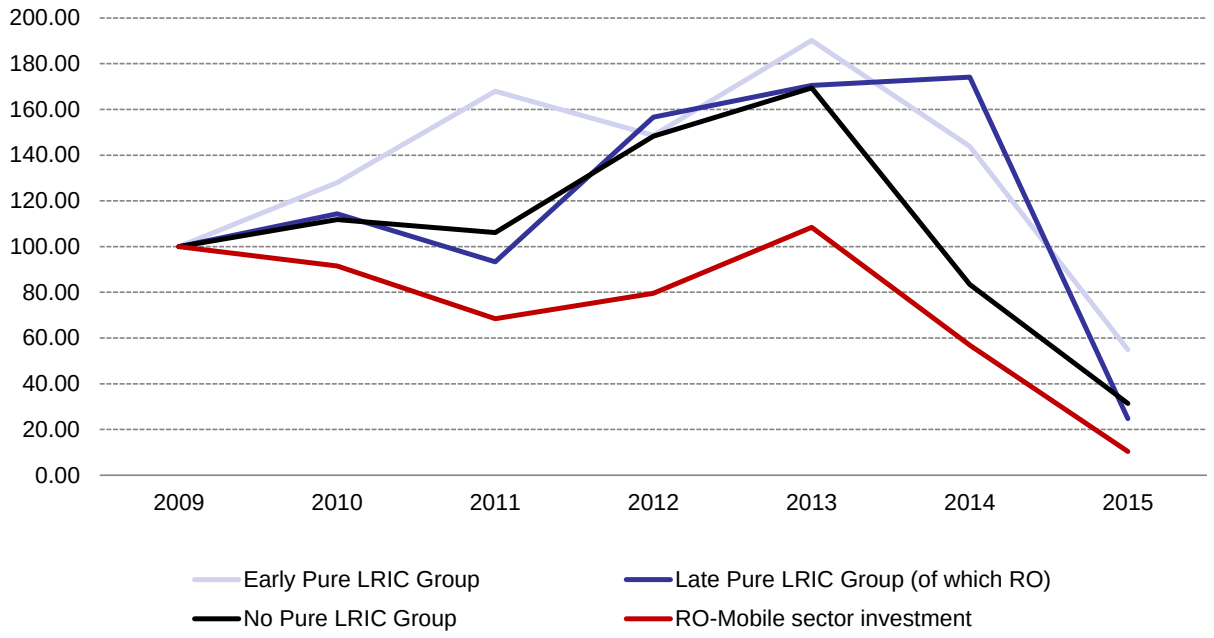
Figure 470 - Mobile revenues (base 100 in 2009)



Source: GSMA

Investments in the Romanian mobile sector presented in Figure 471 decreased between 2009 and 2011, then have been growing until 2013, and fell from 2013 to 2015. Their trend has then been more comparable to the No Pure LRIC Group than the Late Pure LRIC Group.

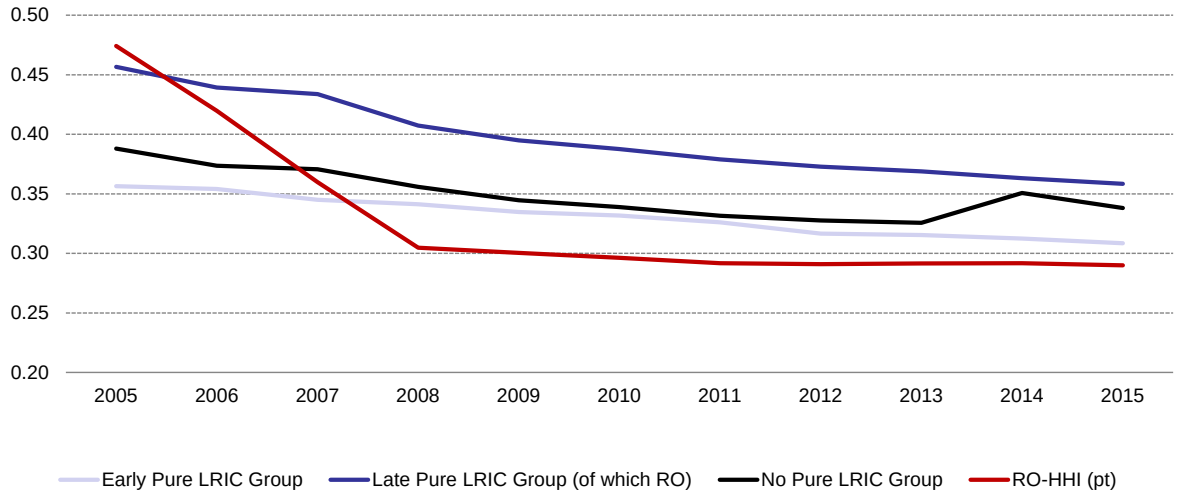
Figure 471 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Romanian mobile market since the entry of DigiMobil in 2007. The evolution of the level of concentration in the mobile market measured with the HHI presented in Figure 472 has shown a strong decrease from 2005 to 2007, and has then been steadily decreasing since 2008. Since 2008, It has been remaining below the Early Pure LRIC Group's average, and far below the Late Pure LRIC Group.

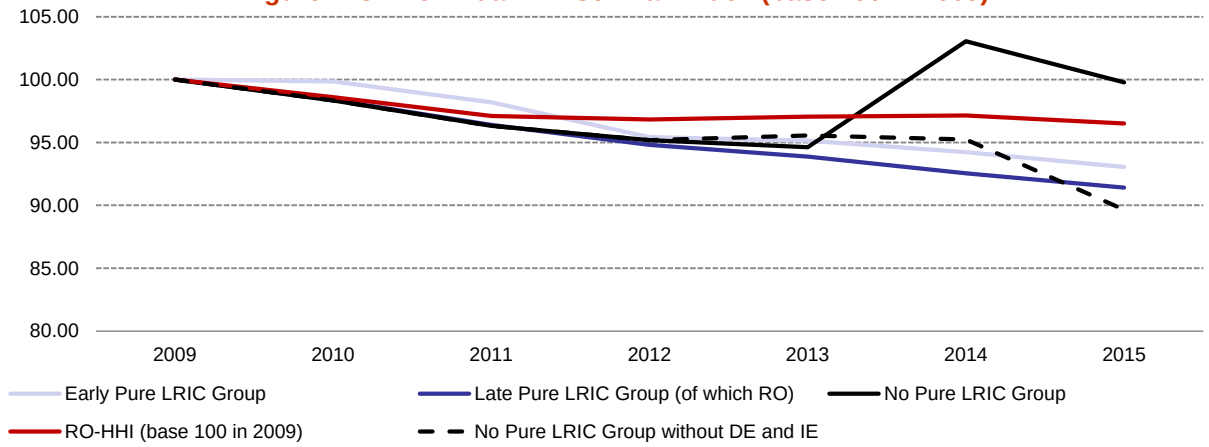
Figure 472 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the slow decrease of the level of concentration in Romania since 2009 can be noticed in Figure 473: the HHI (as base 100 in 2009) has been continuously dropping, but slower than the Late Pure LRIC Group.

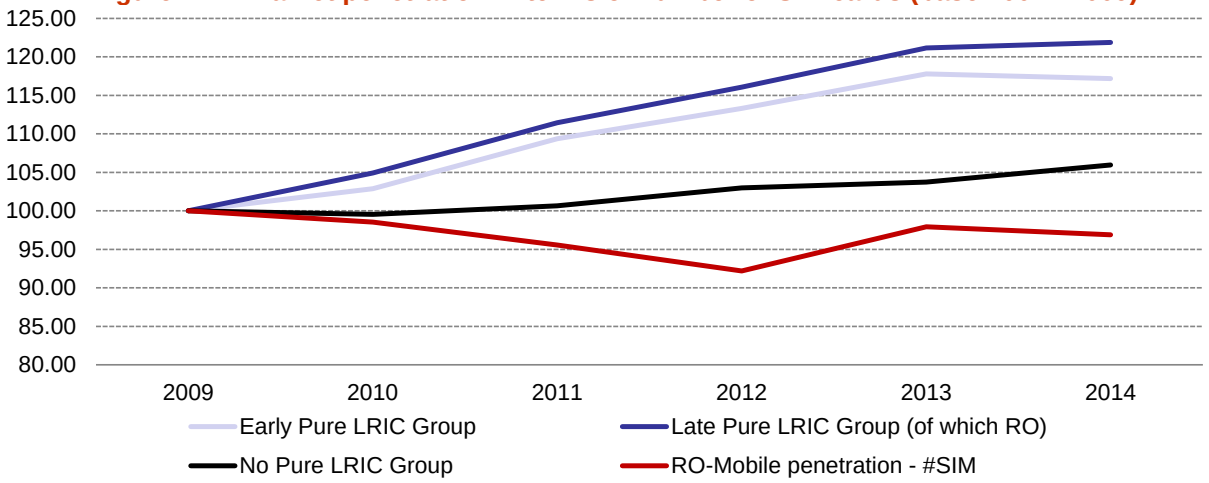
Figure 473 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Romanian market penetration in terms of number of SIM presented in Figure 474 slighted decreased between 2009 and 2012, then increased in 2013, and remained constant in 2014. Over the same period, all groups have been increasing, especially the Late Pure LRIC Group, whereas the Romanian market penetration has decreased overall since 2009.

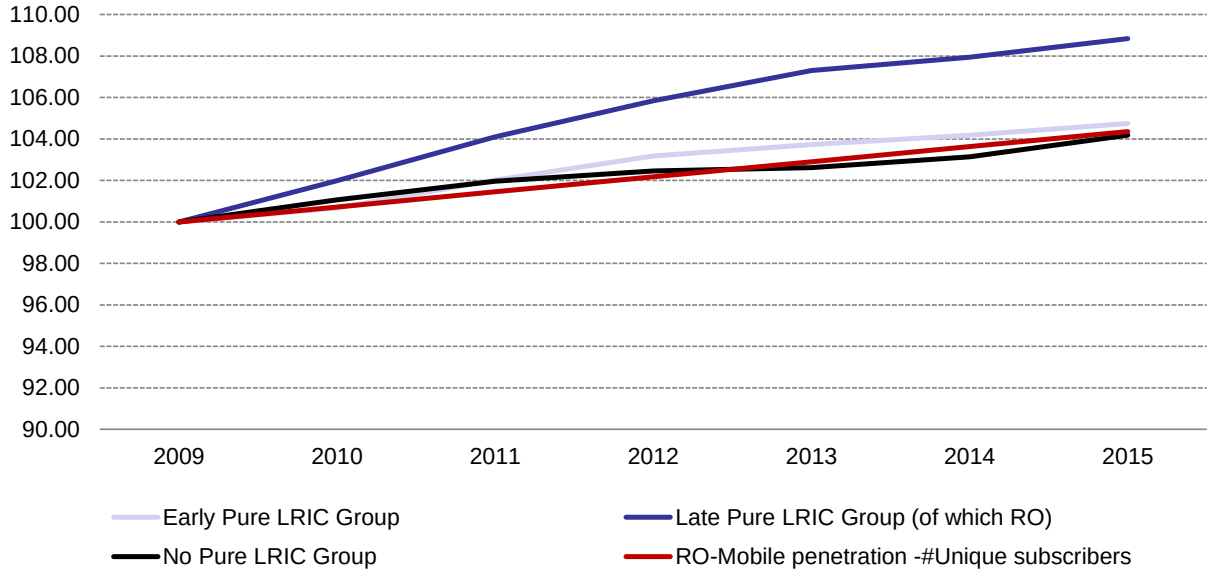
Figure 474 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

With respect to the market penetration in terms of unique subscribers, it can be observed with Figure 475 that it has been increasing in Romania since 2009, with a comparable growth to the Early and No Pure LRIC Groups, rather than the Late Pure LRIC Group.

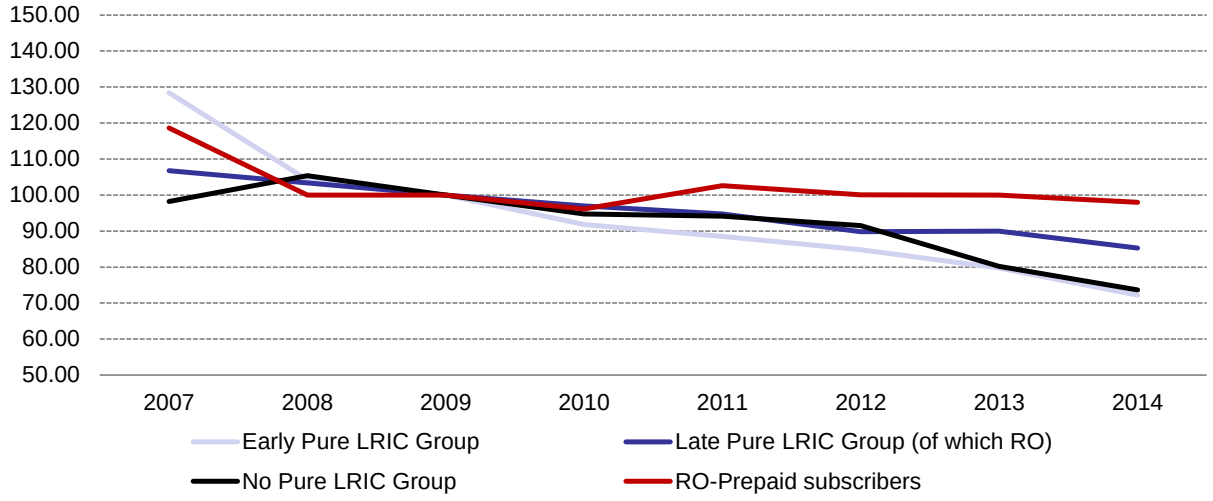
Figure 475 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 476 shows the share of prepaid subscribers in the Romanian mobile market, compared to the three groups. It can be observed that it has been fairly constant since 2008, whereas all groups have been declining over the same period. It is therefore in 2014 relatively high compared to other European countries (58%).

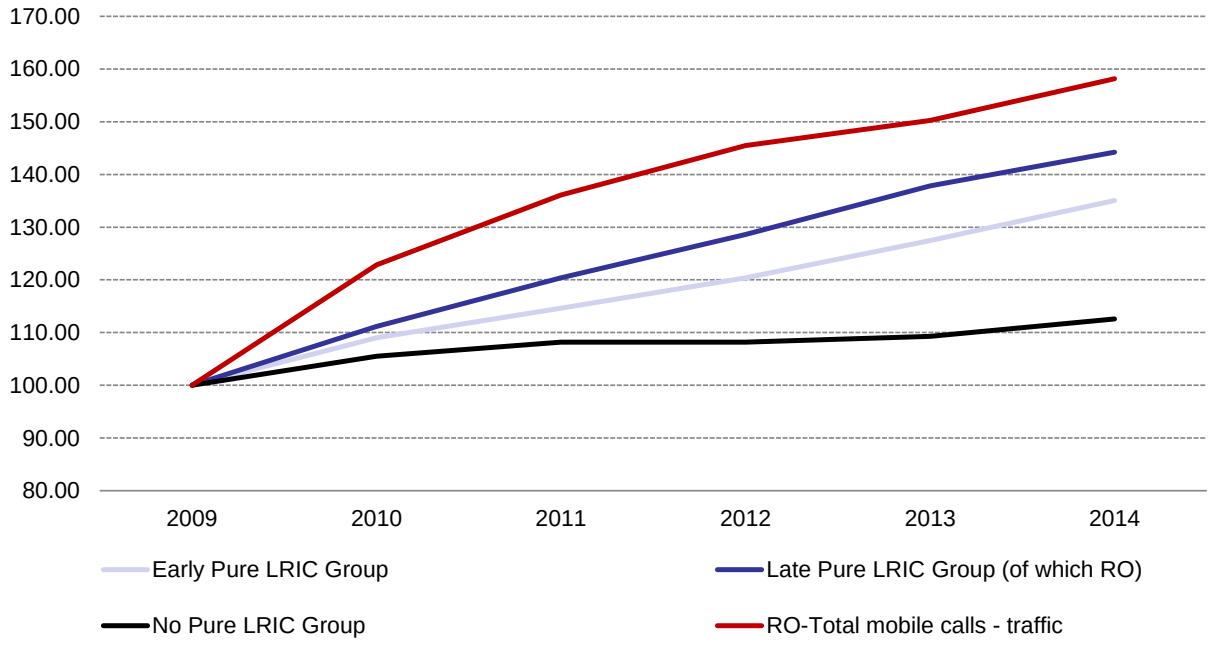
Figure 476 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 477 shows the total amount of minutes of mobile calls in Romania since 2009. It can be observed that it has been constantly growing, more than the Late Pure LRIC Group, and the other groups.

Figure 477 - Total minutes of mobile traffic (base 100 in 2009)



NRAs Replies to questionnaire

8.23.1.2 *Evolution of retail mobile offers*

According to ANCOM, Romania has the most numerous and heterogeneous mobile offers in Europe with 6 operators and no less than 400,000 offers.

ANCOM has noticed changes in the retail mobile offers regarding:

- On-net/off-net differentiation,
- Flat rate for calls to fixed and mobile, and
- Introduction of calls to European countries.

ANCOM summarizes below the various types of offers that were introduced in the mobile markets and the corresponding launching periods:

- In 2012, the first offer with flat rate calls was launched, which included not only calls to European fixed networks, but also to mobile networks;
- Also, in 2012, the first “unlimited” offer was introduced, which included unlimited on-net & off-net mobile calls, fixed calls, international calls to Zone 1 (fixed & mobile networks in Europe, US, Canada & Israel), on-net SMS & MMS & video calls and 500MB internet traffic;
- In 2013, the first two major mobile operators launched “unlimited” tariff plans;
- In 2014, the major fixed and mobile alternative operator launched its “unlimited” tariff plans.

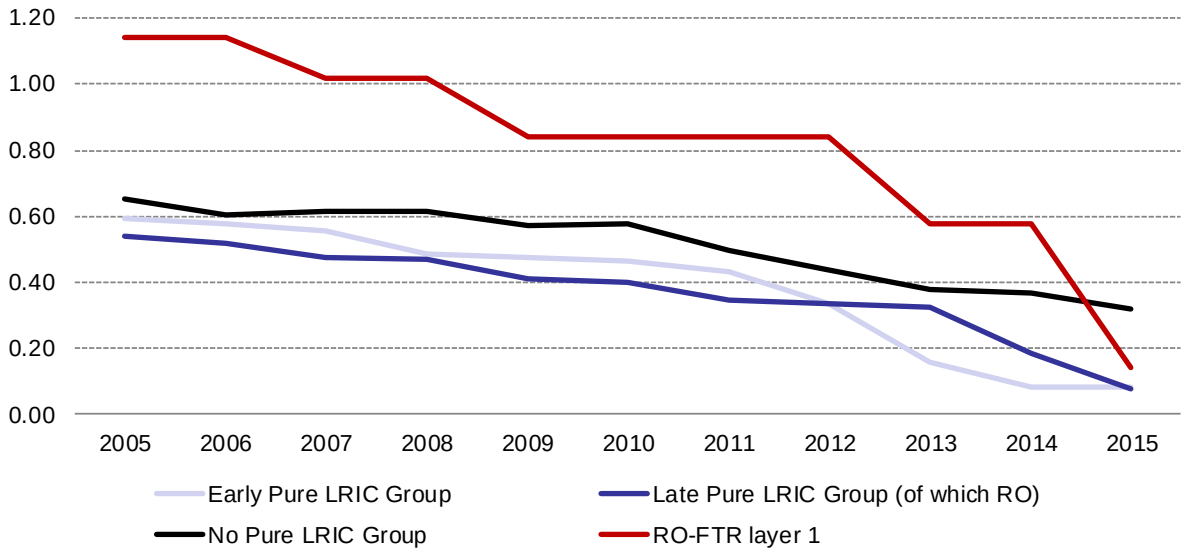
ANCOM stated that the trend of market offers reflected the consumer’s preference, but also considered that lower MTR led operators to launch those kinds of offers with more flat rate and unlimited calls to various destinations.

8.23.2 Fixed market

8.23.2.1 *Quantitative analysis*

The level of Romanian FTRs has been superior in average to all countries until 2015. The Romanian FTR level became inferior to the No Pure LRIC Group average in 2015 after the implementation of the Pure LRIC approach, but remains higher than both Early and Late Pure LRIC Groups weighted averages, as shown in Figure 478.

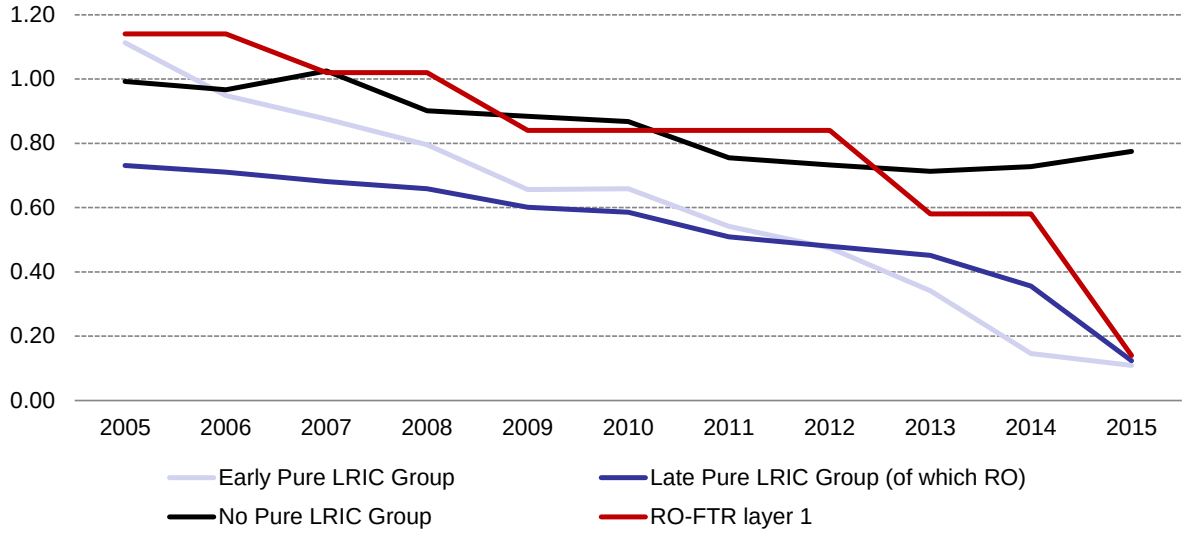
Figure 478 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 479 shows the flat average for the three groups as opposed to the previous figure. When considering flat averages instead of weighted averages, it can be observed that Romanian FTRs are more consistent with the European level of FTR. In 2015 in particular, Romanian FTRs are at the same level as the Late Pure LRIC Group.

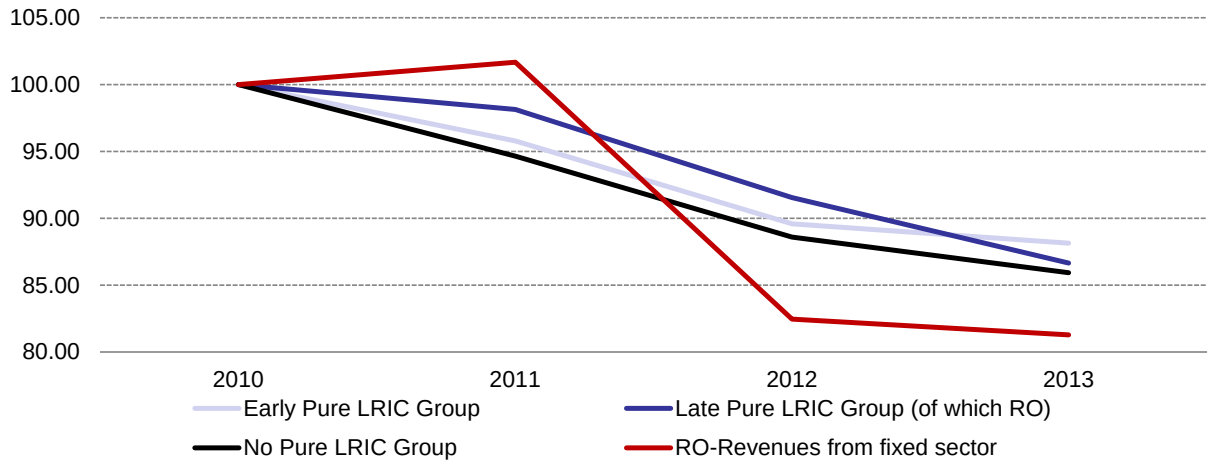
Figure 479 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 480 shows the fall of revenues from the fixed-line market since 2010 for Romania. They have been decreasing more than its group average, especially in 2012 where it was cut by 20% after it had been slightly increasing from 2010 to 2011.

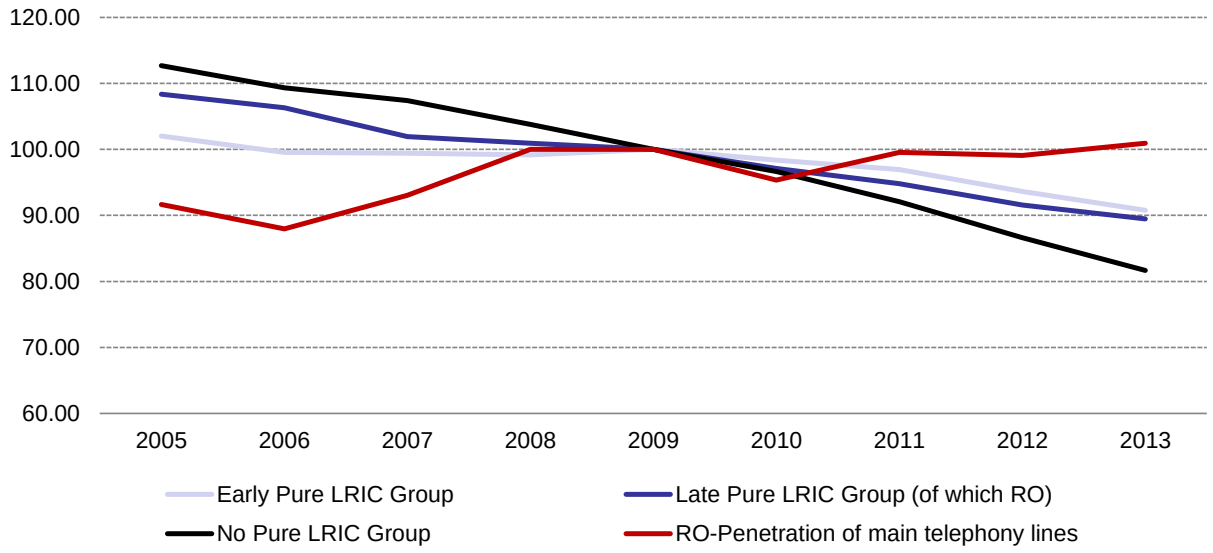
Figure 480 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Romania increased between 2005 and 2008, and then remained constant whereas it was declining for all groups, as observed in the figure below. In 2013 however, the market penetration of main telephony lines in Romania is fairly low compared to European countries.

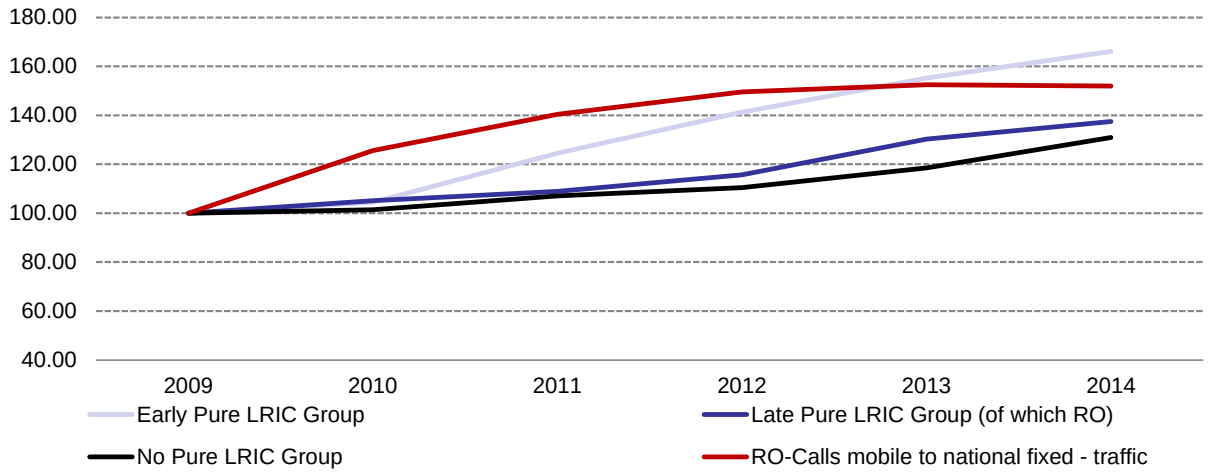
Figure 481 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Romania, presented in Figure 481, has shown a steady growth between 2009 and 2012 and seems to bottom out since 2012. Since 2009, its evolution has been roughly comparable to the Late Pure LRIC Group's trend.

Figure 482 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: ANCOM

8.23.2.2 *Evolution of retail fixed offers*

Concerning the fixed retail market, ANCOM noticed that despite the decrease of fixed telephony usage, operators still launched new kinds of offers during the past few years in response to competitive pressure from the mobile sector. These offers can include flat rate minutes to national or international, and unlimited minutes to national fixed networks.

ANCOM also provided few examples of those offers:

- In 2008, the incumbent launched its first tariff plan which included international calls;
- In 2009, the incumbent launched tariff plans with unlimited on-net calls (to be specific, virtually unlimited - 4000 mins), off-net F2F calls, flat rate F2M calls and international calls to European fixed networks or US & Canada fixed & mobile networks;
- In 2009, the 3rd player in the fixed telephony market launched its first extra-tariff option with international calls included to 16 European countries (fixed networks) and to fixed & mobile networks from US & Canada;
- In 2011, the 3rd player in the fixed telephony market launched flat rate tariff plans with calls to fixed and mobile networks in Romania or to fixed networks from 20 European countries;
- In 2013, the incumbent launched unlimited tariff plans to various destinations.

ANCOM stated that lower FTRs may have led to the development of these kinds of offers, as well as competitive pressures from the mobile market.

8.23.3 Summary

The tables below summarize, for each metric, the difference between Romania and the average metric for the Late pure LRIC Group in order to highlight how Romania is positioned against its pair countries.

Figure 483 - Differences between Romania and its group for the mobile network

Metrics	Differences between the Late Pure LRIC Group and Romania

Mobile revenues	Faster decrease for Romania than Late Pure LRIC Group
Mobile investments	Decreased after 2013 like Early and No Pure LRIC Groups
Mobile retail prices	Not available
Mobile penetration	Close to the Early Pure LRIC group in terms of number of SIM cards and unique subscribers
Competition in mobile	Trend close to the Early Pure LRIC Group

Source: TERA Consultants

Figure 484 – Differences between the Late Pure LRIC Group and Romania for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Romania
Fixed revenue	Much faster decrease than all groups
Traffic	Different trend followed than all groups
Main telephony lines	Very different trend followed than all groups

Source: TERA Consultants

8.24 Spain

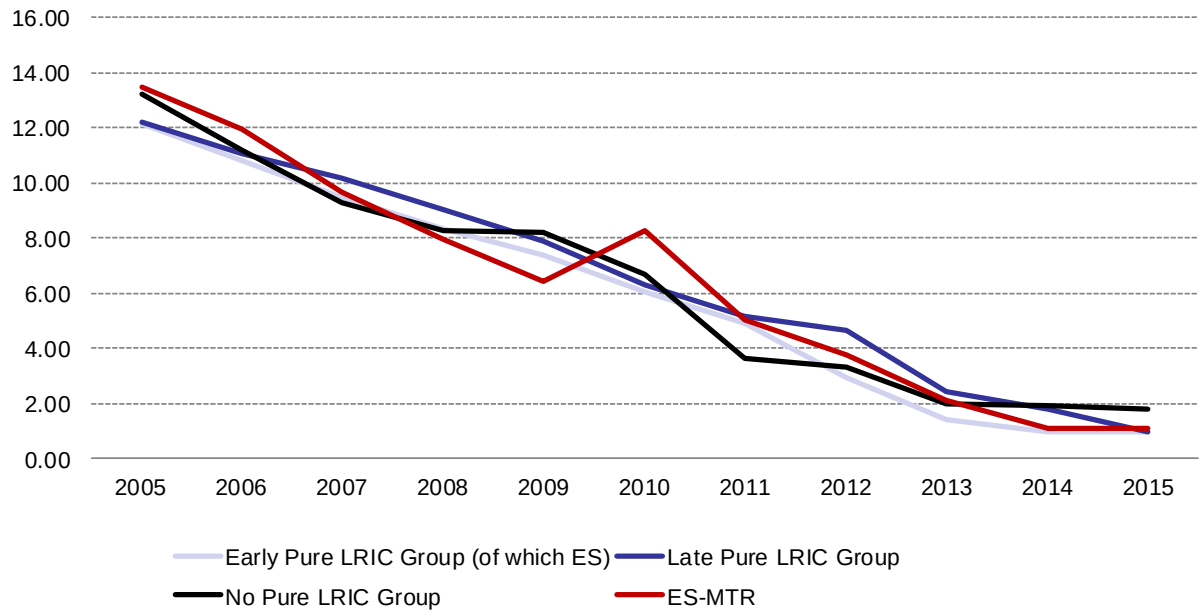
The telecommunications market in Spain is one of the largest in Europe and is dominated by the incumbent Telefonica (1924). The mobile market counts four MNOs: Telefonica's mobile brand Movistar (launched 1995), challenged by Orange (launched 2005) and Vodafone (launched 2000), and the most recent Yoigo launched in 2006 by TeliaSonera. The fall in mobile prices has been allowed especially by the regulation of roaming and MTR driven by the regulator CNMC which decided to implement the pure LRIC approach in 2011 with a two years glide path ending in 2013. Spain has then been ranked allocated to the Early Pure LRIC group for this study.

8.24.1 Mobile market

8.24.1.1 *Quantitative analysis*

Figure 485 compares the level of MTRs in Spain with the weighted averages for the three groups. It can be observed that Spanish MTRs have been decreasing following the European downward trend. Since it has been set on a Pure LRIC level in 2013, it has been close to the Early Pure LRIC Group's average.

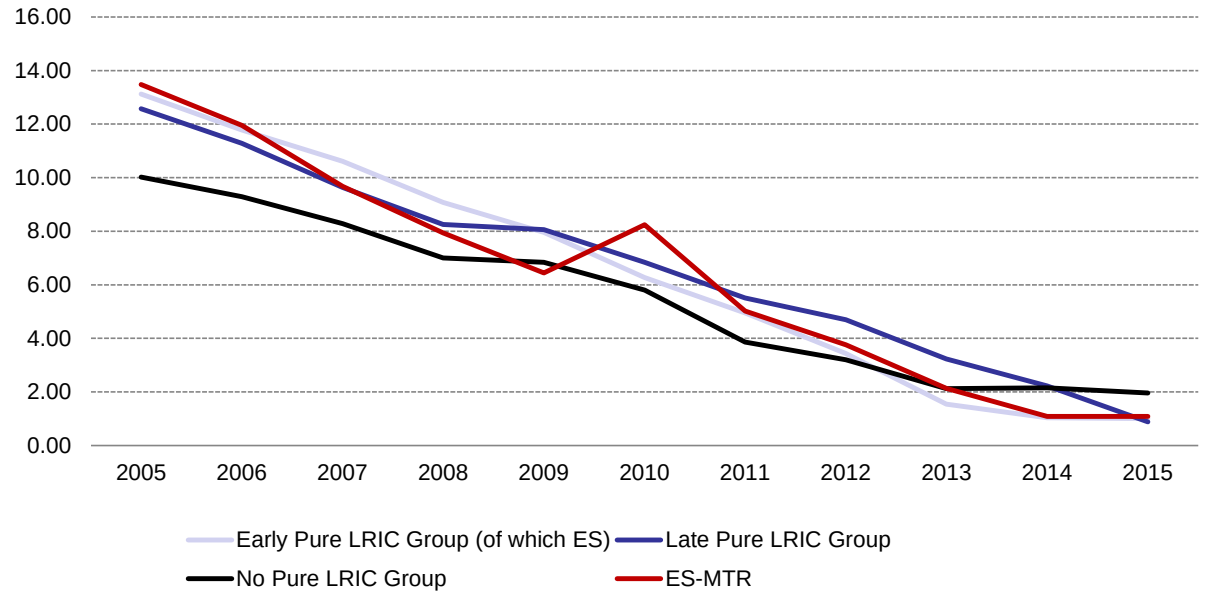
Figure 485 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 486). The trend is approximately the same as the weighted average trend with Spanish MTR being at the same level as the Early Pure LRIC Group since 2013.

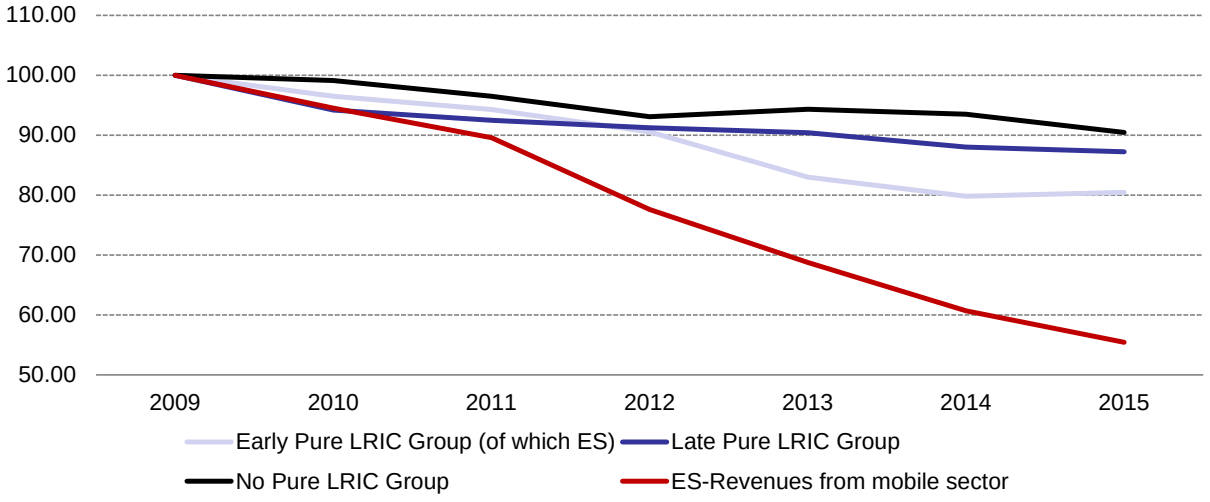
Figure 486 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 487 shows the fall in revenues in the Spanish mobile sector since 2009. Between 2009 and 2015, it has been almost divided by two, whereas the decrease of the three groups was less important (between 10% and 20%).

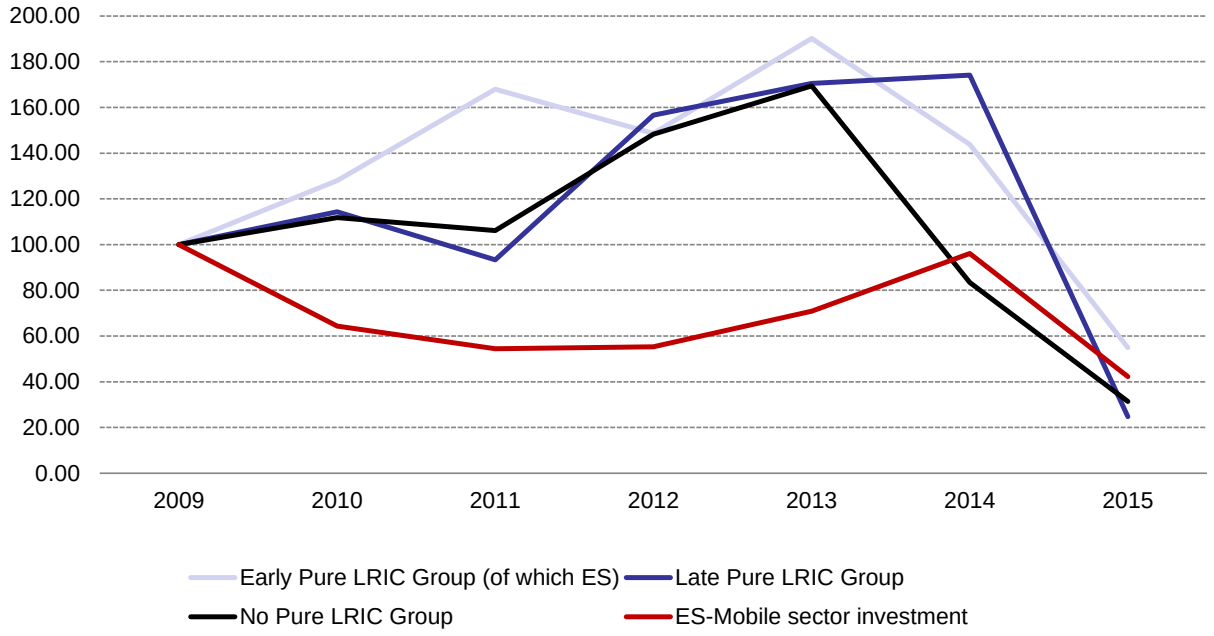
Figure 487 - Mobile revenues (base 100 in 2009)



Source : GSMA

Investments in the Spanish mobile market analyzed in Figure 488 have been decreasing from 2009 to 2011, then went back to their 2009 level in 2014, before being divided by two in 2015. Spanish investments have started decreasing in 2015, like the Late Pure LRIC Group whereas the Early and No Pure LRIC Groups have been decreasing since 2014.

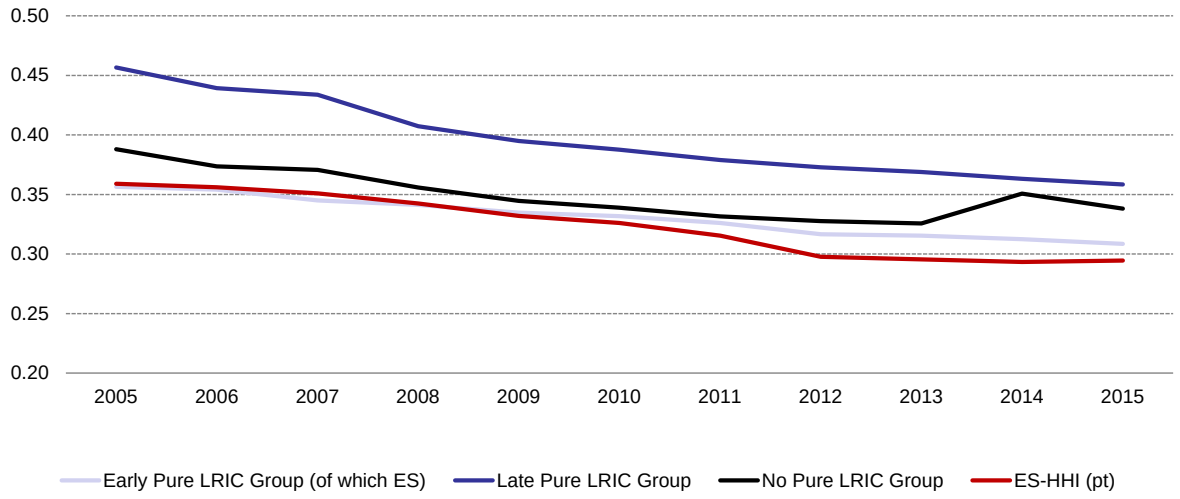
Figure 488 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators are competing in the Spanish mobile market. The level of concentration in Spain observed in Figure 489 has been constantly decreasing since 2005, and has been very close to the Early Pure LRIC Group's average over this period.

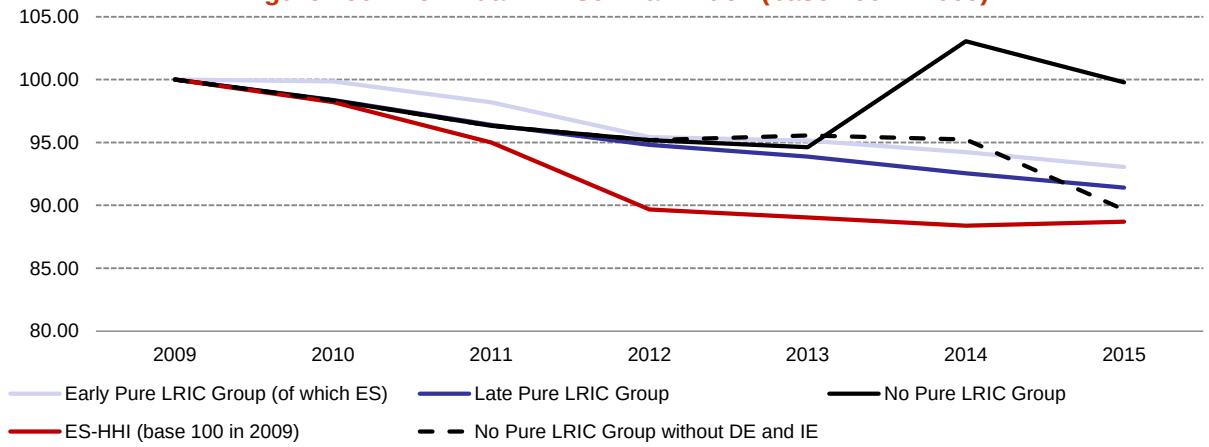
Figure 489 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Spain since 2009 can be noticed in Figure 490: the HHI (as base 100 in 2009) has been continuously dropping and is now inferior to the average of Early Pure LRIC and other groups of countries.

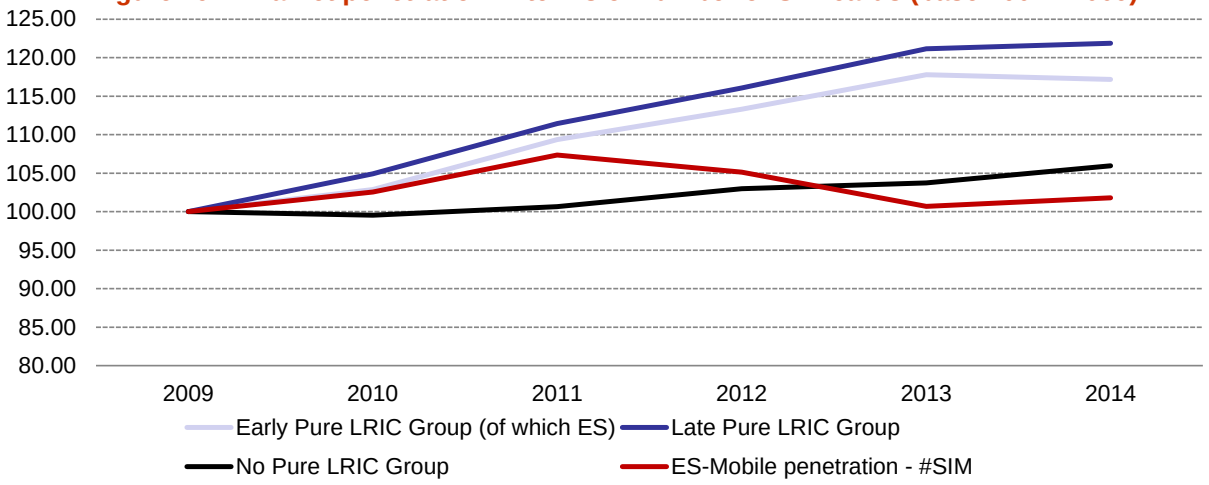
Figure 490 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Spanish market penetration in terms of number of SIM presented in Figure 491 has been increasing from 2009 to 2011, and then decreased from 2011 to 2013 to its 2009 level. It has not been following the trend of any group.

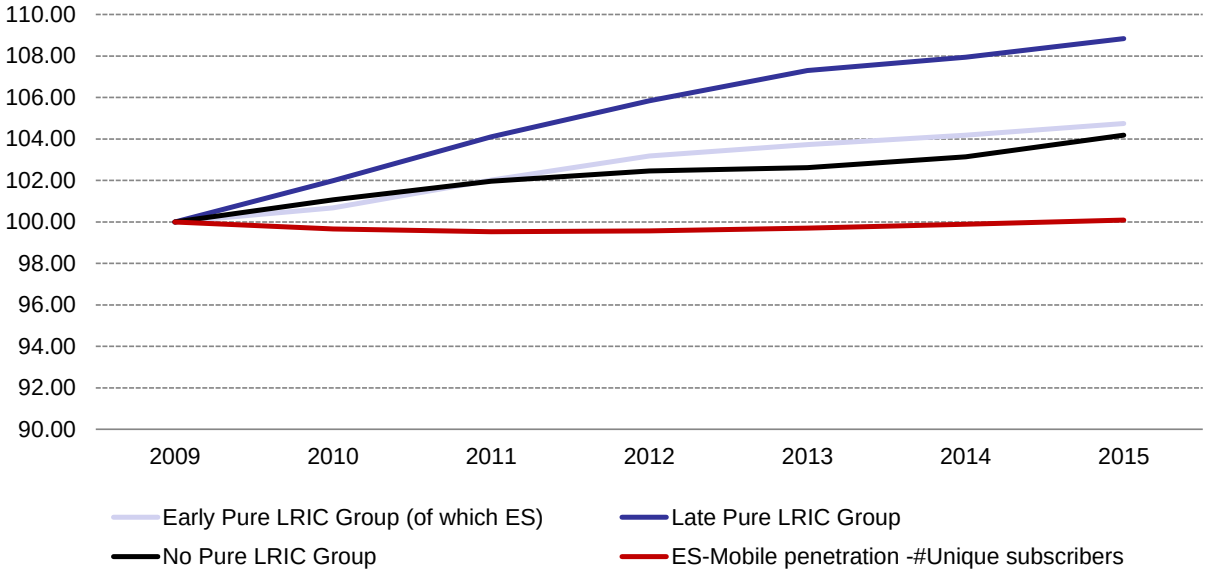
Figure 491 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

With respect to the market penetration in terms of unique subscribers observed with Figure 491, it can be observed that it has been remaining constant since 2009 whereas it has been increasing for all groups. It is therefore in 2015, a bit lower than the European average.

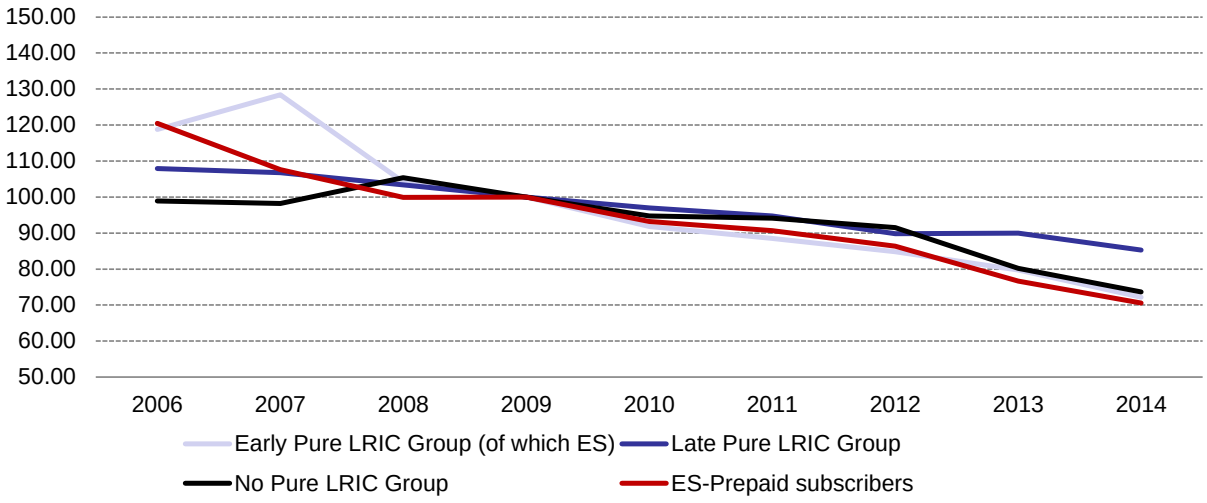
Figure 492 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 492 shows the share of prepaid subscribers in the market since 2006. It can be observed that it has been continuously dropping for both Spain and the Early Pure LRIC Group since 2008. The share of prepaid customers in 2014 is at 28% in Spain, lower than most MS.

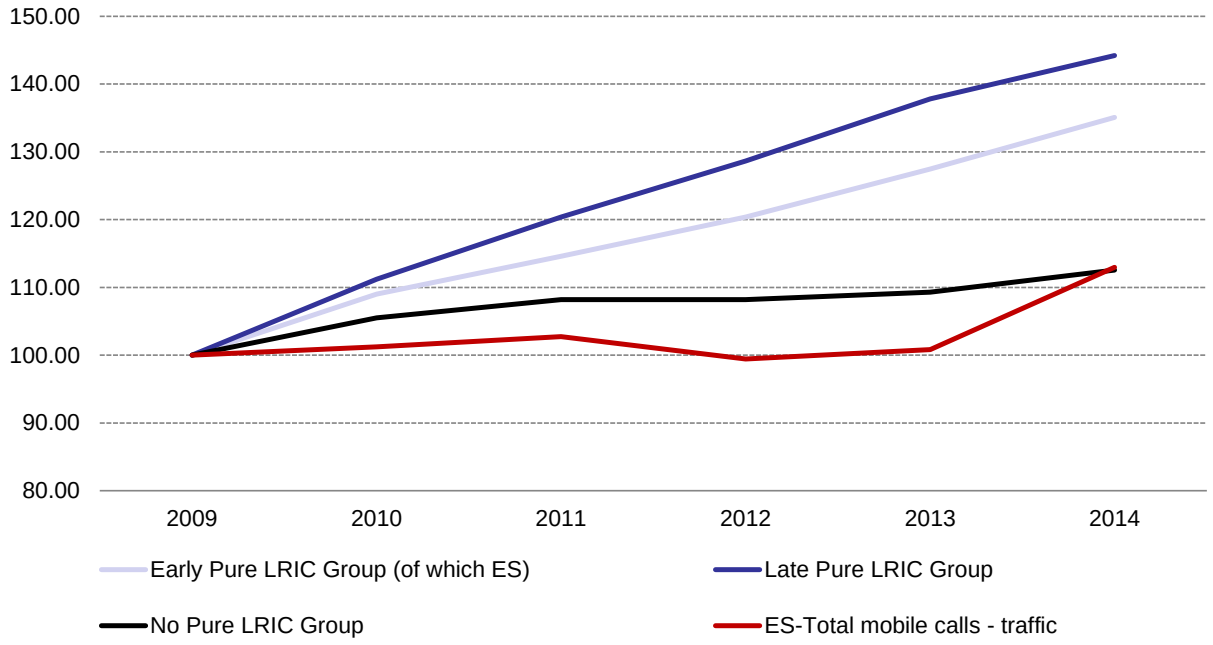
Figure 493 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 493 shows the evolution of the amount of minutes of mobile calls in Spain. It can be observed that it was fairly constant between 2009 and 2013 and has then increased in 2014. Its overall evolution since 2009 is equivalent to the one of the No Pure LRIC Group.

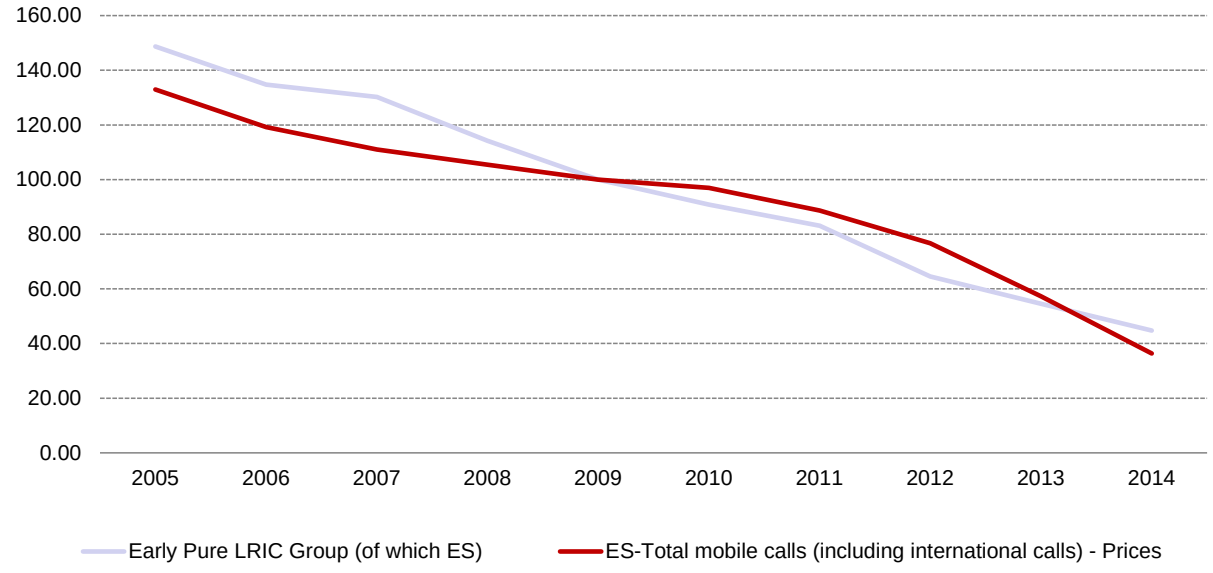
Figure 494 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Prices for mobile calls have shown a steady decline since 2005, with a very similar decrease to those observed in the Early Pure LRIC group. They cannot be compared to the Late and No Pure LRIC groups due to the lack of data though, as shows Figure 495.

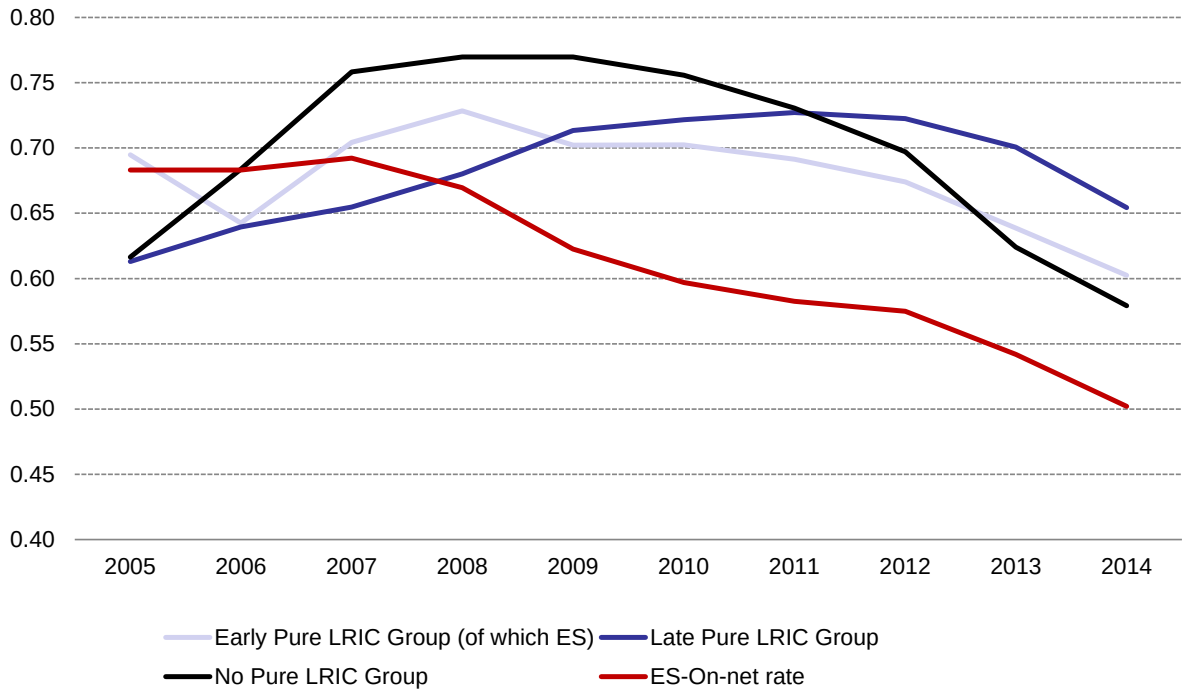
Figure 495 - Prices of fixed calls to national mobile (base 100 in 2009)



Source: CNMC

Figure 496 shows the share of on-net mobile calls for Spain and the three groups. It can be observed that it has been continuously dropping since 2007 in Spain, reflecting the observation of CNMC about the "*ending of on-net/off-net differentiation*". Spain and the Early Pure LRIC Group have followed a fairly similar curve since 2009, although the absolute level has been lower in Spain.

Figure 496 - On-net rate of mobile calls (%)



Source: CNMC

8.24.1.2 *Evolution of retail mobile offers*

Concerning the retail mobile offers in Spain and the major impacts of the drop of MTRs, CNMC considers that it may have helped in:

- Ending the on-net/off-net differentiation,
- Introducing of flat rate offers, and general decline of retail prices,
- Introducing convergent offers including fixed and mobile.

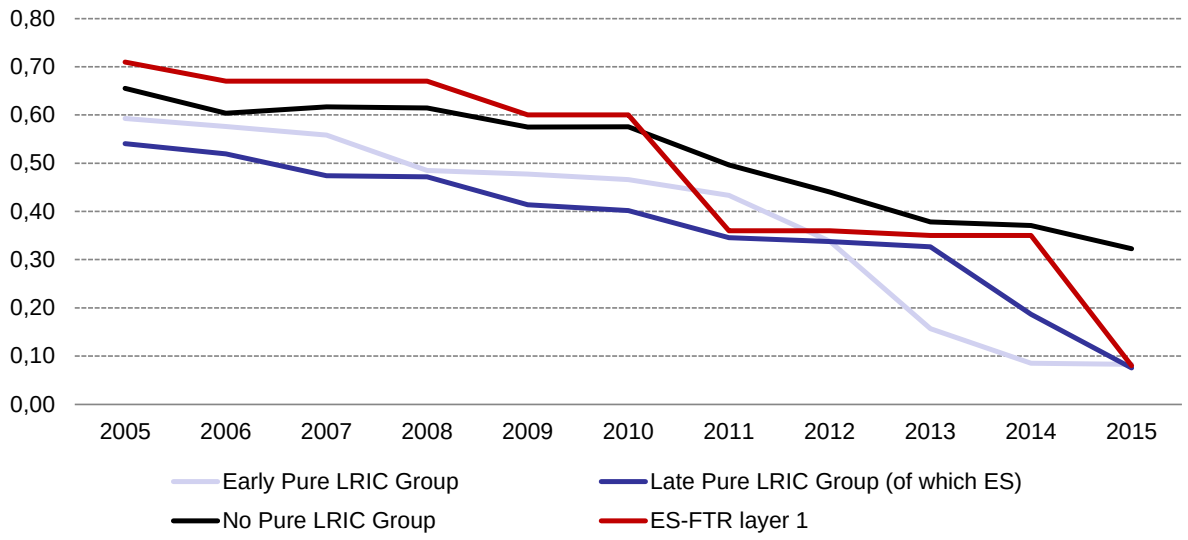
However CNMC noticed that this was not the only driver of these evolutions, and other key factors such as the entry of new MVNOs thanks to market 15 joint SMP regulation that increased competition pressure in mobile markets had to be taken into account.

8.24.2 Fixed market

8.24.2.1 *Quantitative analysis*

Figure 497 compares the level of FTRs in Spain with the weighted average for the three groups. It can be observed that it has been decreasing step by step with a first strong decline in 2011, followed by another one in 2015 to set FTRs on Pure LRIC. In 2015, Spanish FTRs are therefore at the same level as the Early and Late Pure LRIC Groups.

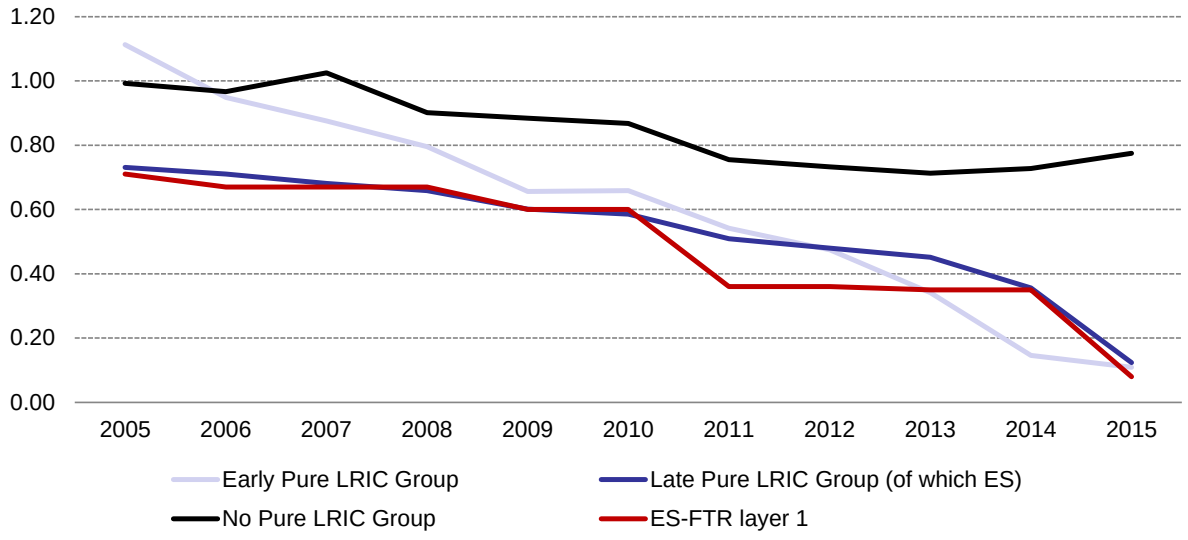
Figure 497 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 498 shows the flat average for the three groups as opposed to the previous figure. The main difference that can be observed is the lower level of Spanish FTRs in comparison to the three groups when considering flat averages.

Figure 498 - Fixed termination rates flat average - layer 1 (EURcts/min)

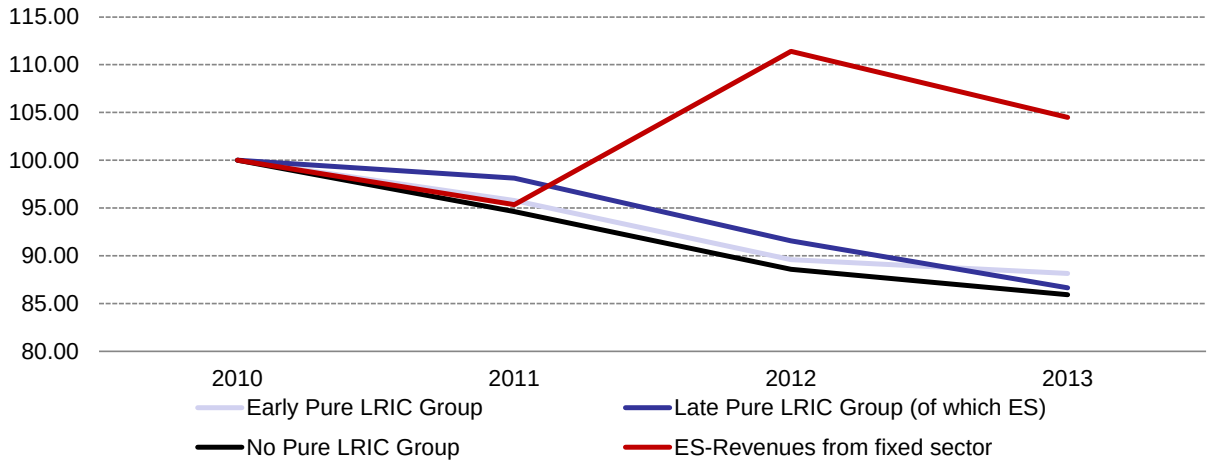


Source: TERA Consultants from BEREC & EC reports

Figure 499 shows the evolution of revenues from the fixed-line market since 2010 for Spain and the three groups. It can be observed that it decreased in Spain between 2010 and 2011 like in all groups, then strongly increased in 2012, and eventually decreased again in 2013.

Since all groups have been continuously dropping since 2010, Spain has not followed the trend of any group in terms of evolution of revenues.

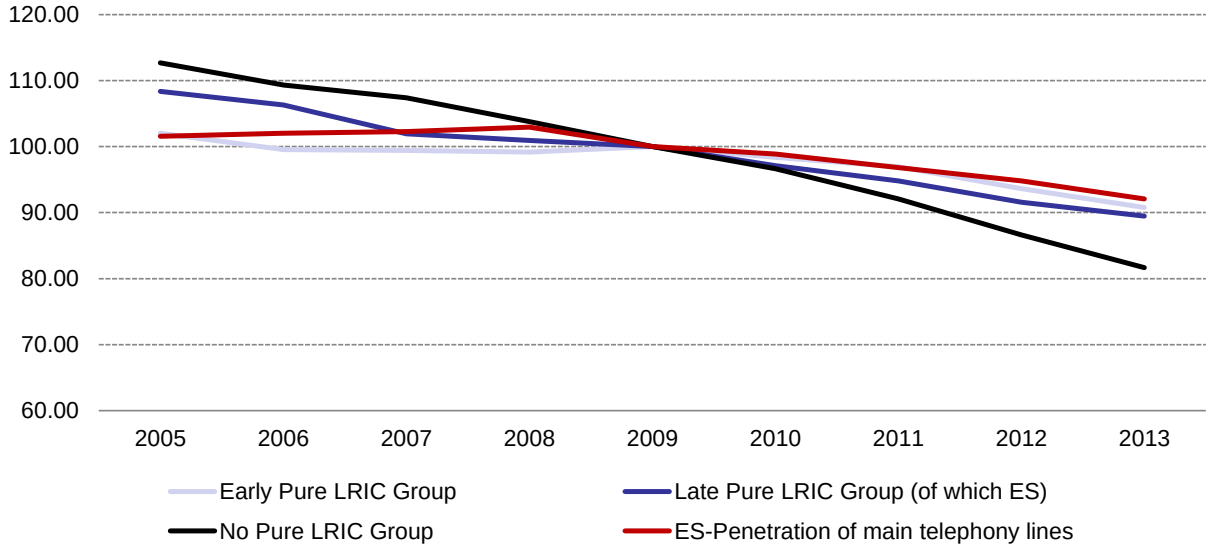
Figure 499 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Spain has shown a constant and slow decrease since 2008 with a similar evolution of the penetration to the Early Pure LRIC Group, also steadily decreasing as shown in Figure 500.

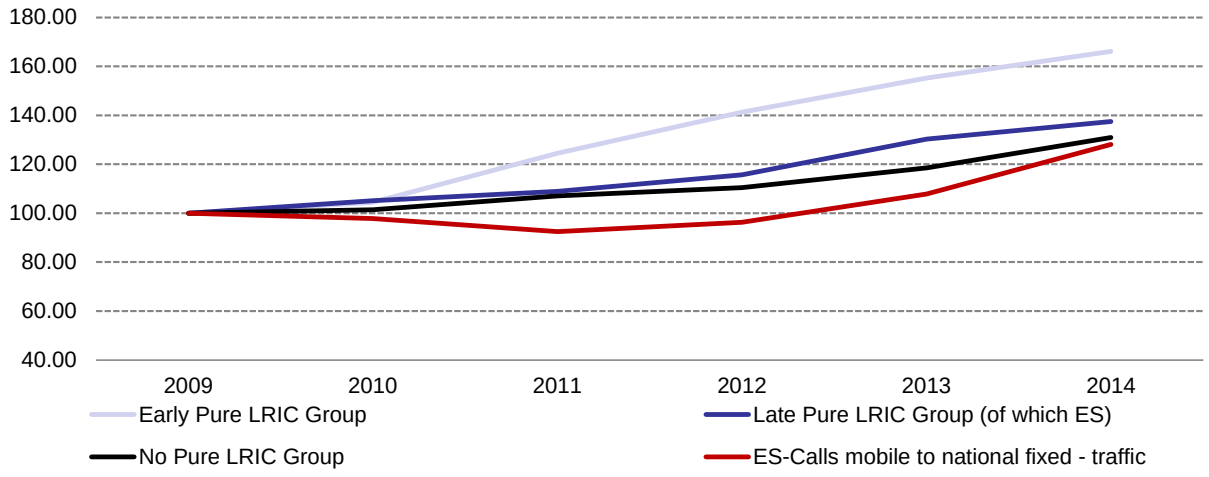
Figure 500 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Spain, presented in Figure 501, has shown a steady decline between 2009 and 2011 and has been increasing ever since, following a comparable trend to the Early Pure LRIC Group since 2011.

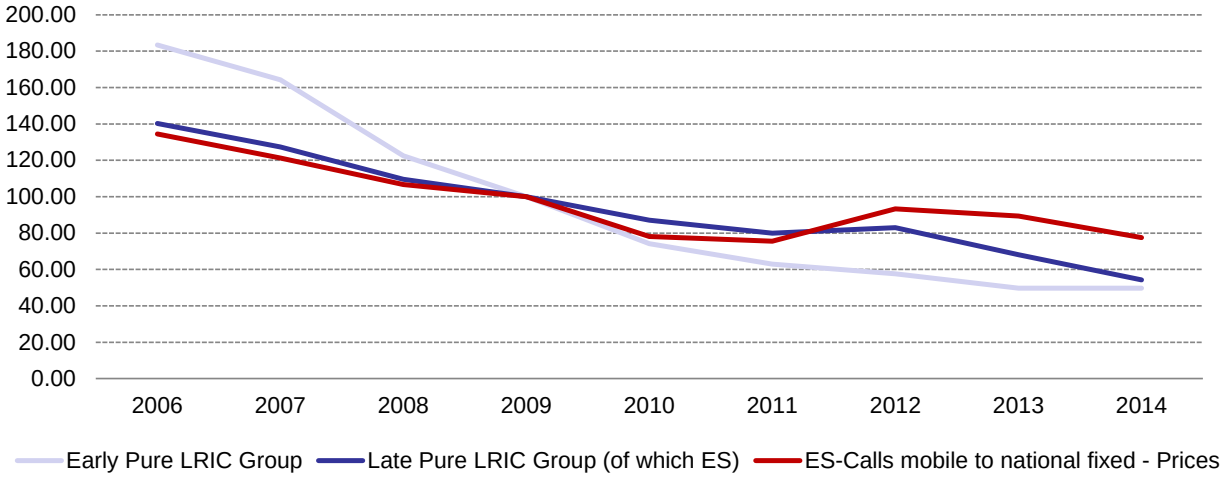
Figure 501 - Traffic of mobile calls to national fixed (base 100 in 2009)



Source: CNMC

Figure 502 shows the evolution of retail prices for mobile calls to national fixed in Spain and for the three groups. They continuously dropped between 2005 and 2011 like the Early Pure LRIC Group's average, then slightly increased in 2012, and decreased again from 2012 to 2014.

Figure 502 - Prices of mobile calls to national fixed (base 100 in 2009)



Source: CNMC

8.24.2.2 *Evolution of retail fixed offers*

According to CNMC, the general evolutions observed in Europe for the fixed retail market, such as the development of bundled offers including flat rate for fixed calls and broadband, appeared earlier in Spain (around 2008) than in other European countries. This is explained by the regulation and the imposition of capacity based interconnection to SMP operators.

Since the Pure LRIC approach has been implemented late (2014) for FTR, no particular changes have been observed following the decrease of FTRs. CNMC noticed that it was actually the reduction of MTR that allowed introducing packages of fixed-to-mobile calls in previous bundles.

8.24.3 Summary

The tables below summarize, for each metric, the difference between Spain and the average metric for the Early pure LRIC Group in order to highlight how Spain is positioned against its pair countries.

Figure 503 - Differences between Spain and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Spain
Mobile revenues	Decreased more than all groups
Mobile investments	Did not follow any group's trend
Mobile retail prices	Followed roughly Early Pure LRIC Group's trend
Mobile penetration	Closer to No Pure LRIC Group in terms of SIM cards, constant in terms of unique subscribers whereas all groups increased
Competition in mobile	Close to Early Pure LRIC Group
On-net rate	Lower than its group but followed a comparable trend

Source: TERA Consultants

Figure 504 – Differences between the Late Pure LRIC Group and Spain for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Spain
Fixed revenue	Increased whereas all groups decreased
Traffic	Slower increase than the Late Pure LRIC Group
Main telephony lines	Very close to the Late Pure LRIC Group

Source: TERA Consultants

8.25 Slovakia

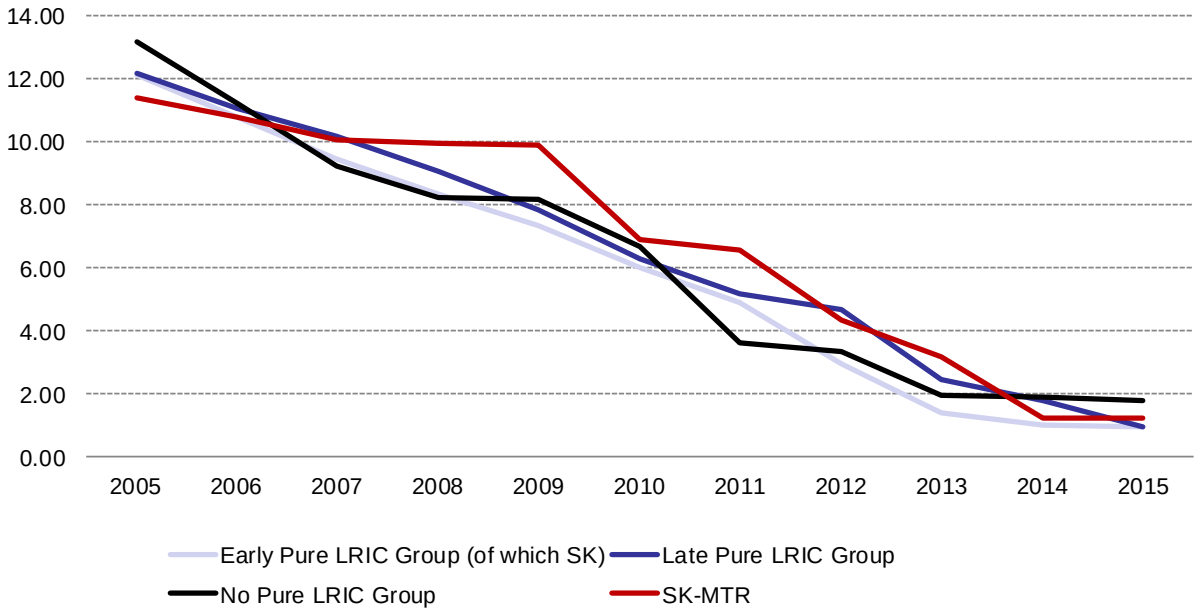
The Slovakian incumbent is Slovak Telekom, which is owned by Deutsche Telekom, and is the leader in the fixed-line market. It is challenged in the mobile sector by two market players: the leader on the market Orange (launched in 1997) and O2 (launched in 2007). The Slovak regulator TUSR adopted the pure LRIC approach in 2013. Therefore Slovakia has been allocated to the "Early Pure LRIC Group" for this study.

8.25.1 Mobile market

8.25.1.1 *Quantitative analysis*

Figure 505 compares the level of MTRs in Slovakia to the three groups' weighted averages. It can be observed that Slovakian MTRs has been relatively high compared to other European countries until they were set on a Pure LRIC basis in 2013. In 2014 and 2015 it is then at the same level as the Early Pure LRIC Group.

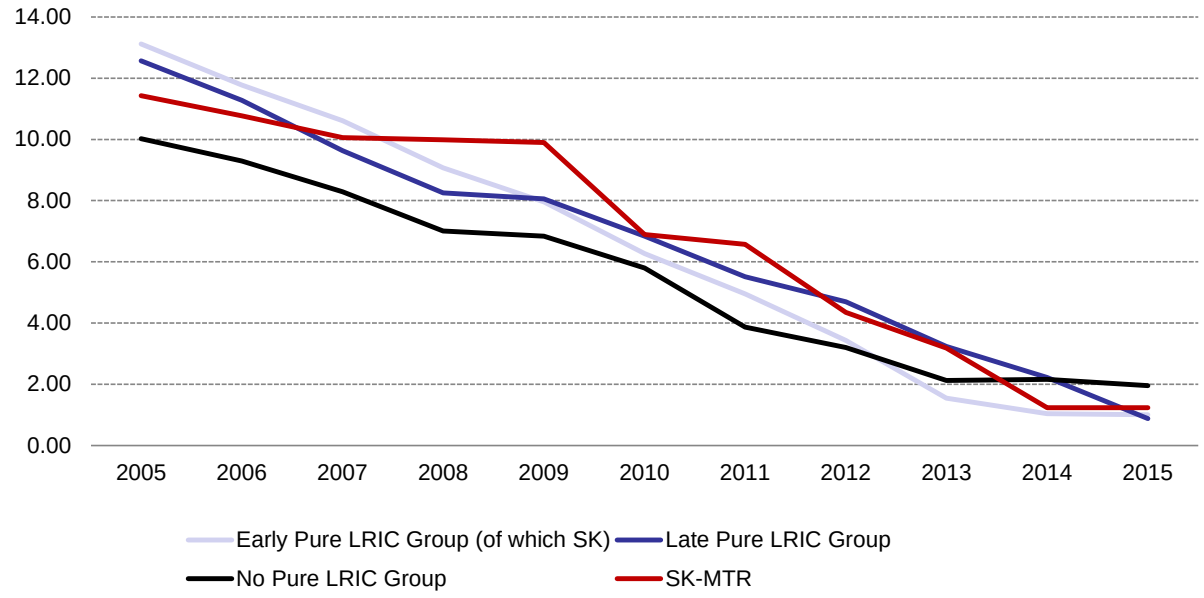
Figure 505 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 506). The trend is approximately the same as the weighted average trend with Slovakian MTRs being relatively high compared to the Early Pure LRIC Group from 2007 to 2013, and then set at the same level with the implementation of the Pure LRIC approach.

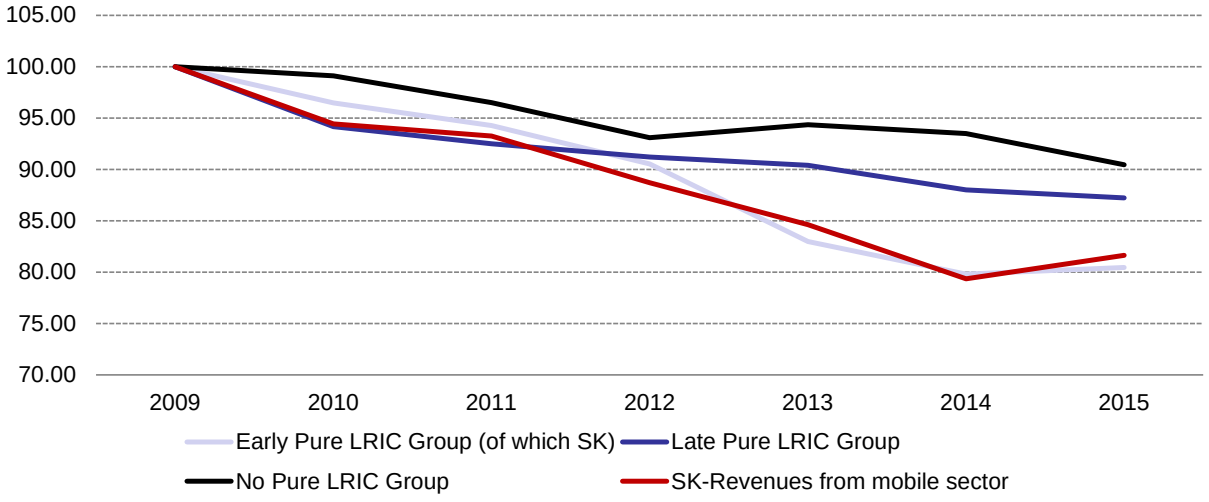
Figure 506 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 507 continuously dropped between 2009 and 2014 in Slovakia. It has then slightly increased in 2015. It can be observed that it has been extremely close to the Early Pure LRIC Group evolution since 2009.

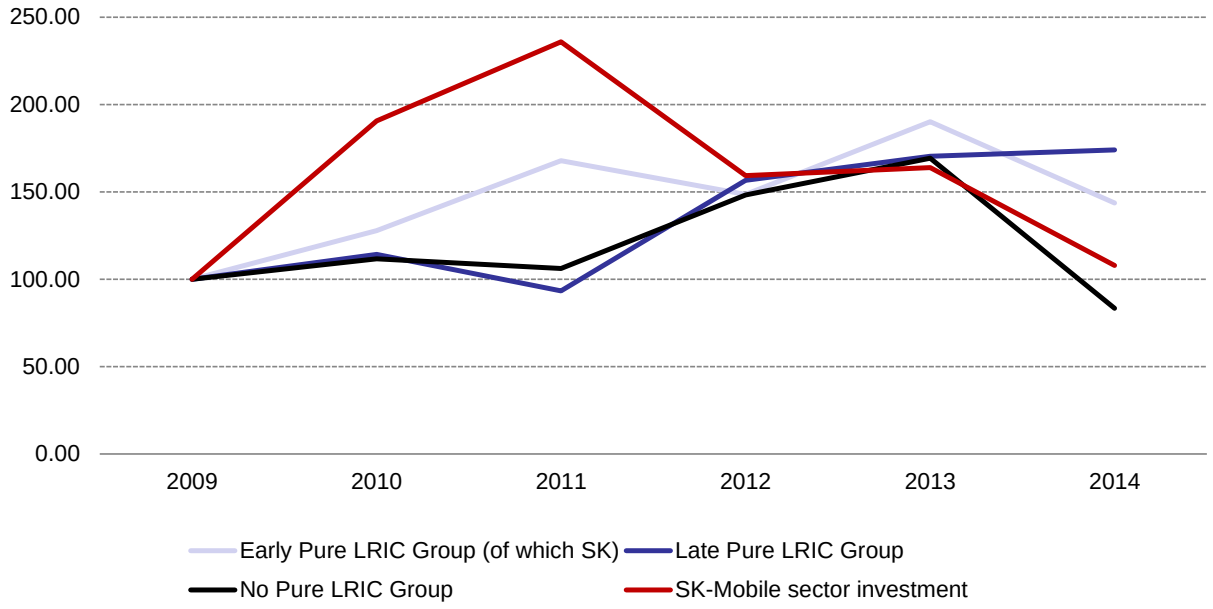
Figure 507 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 508 shows the evolution of investments in the mobile sector in Slovakia. It can be observed that it strongly increased between 2009 and 2011 and then decreased until 2014. Since 2012, Slovakia has been closer in trend to the No Pure LRIC Group than the Early Pure LRIC Group.

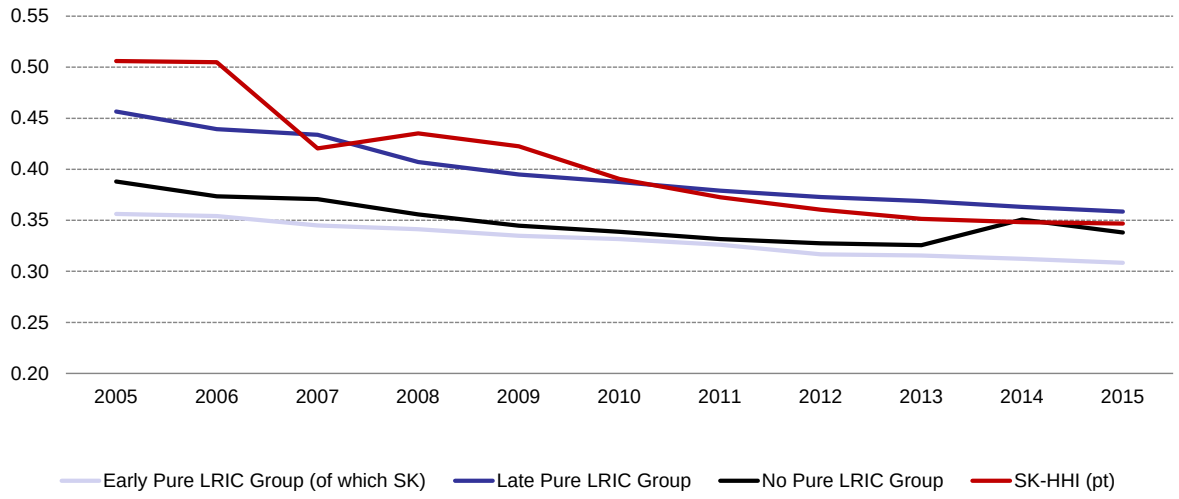
Figure 508 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Three mobile network operators are competing in the Slovakian mobile market since the entry of O2 in 2007. The improvement of competition in the mobile market can be noticed with the constant decrease of the Herfindahl-Hirschman Index since 2005, especially in 2007. However, it has been remaining fairly high, and has been closer since 2010 to the Late Pure LRIC Group.

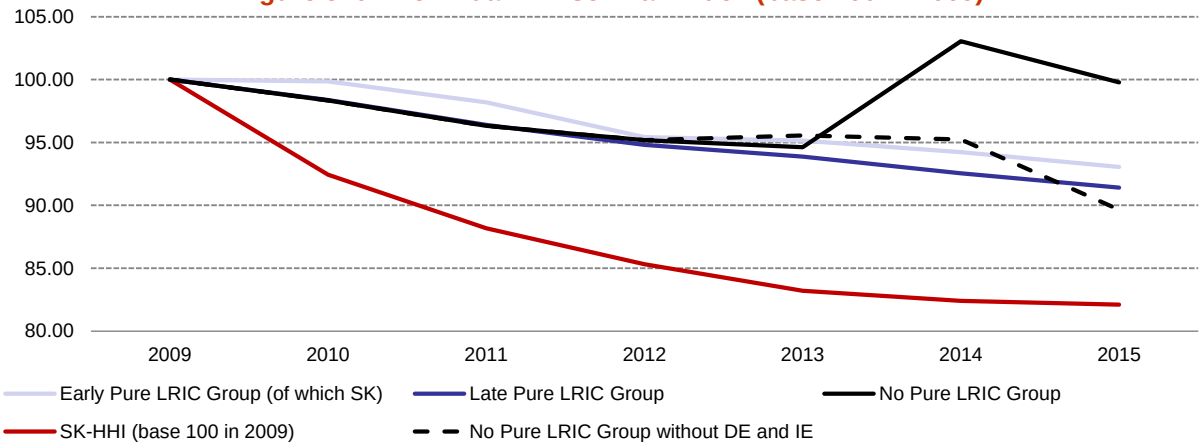
Figure 509 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the lower level of concentration in Slovakia since 2009 can be noticed in Figure 510: the HHI (as base 100 in 2009) has been continuously dropping, although it seems to bottom-out over the past two years.

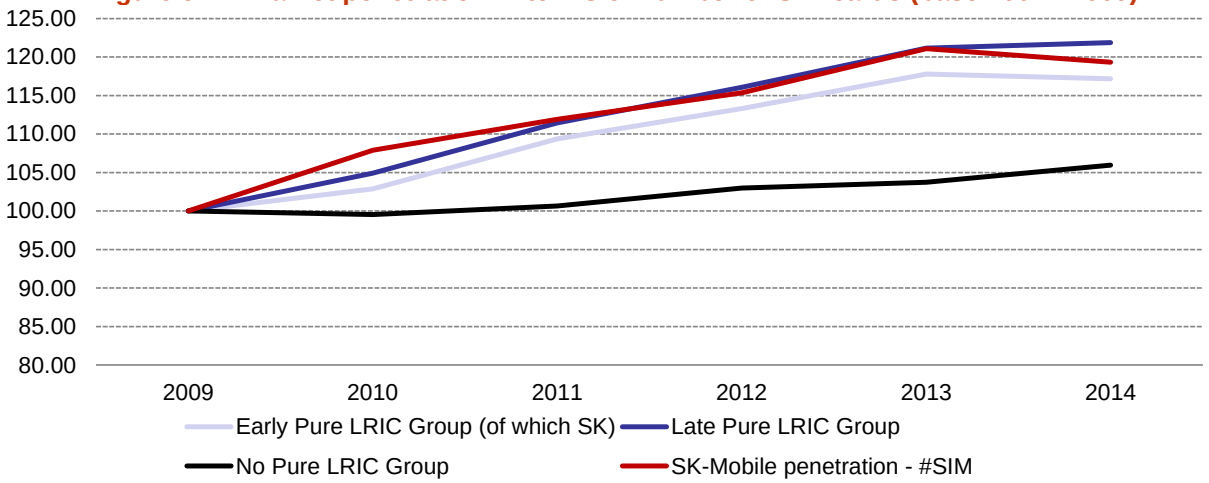
Figure 510 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Slovakian market penetration in terms of number of SIM has shown a steady increase between 2009 and 2013, and has then slightly decreased in 2014, as observed with Figure 511. It can be noticed that its evolution has been fairly close to the Late Pure LRIC Group, and to a lesser extent, to the Early Pure LRIC Group. However, it started from a lower level than most MS, and is still in 2014 lower than European average.

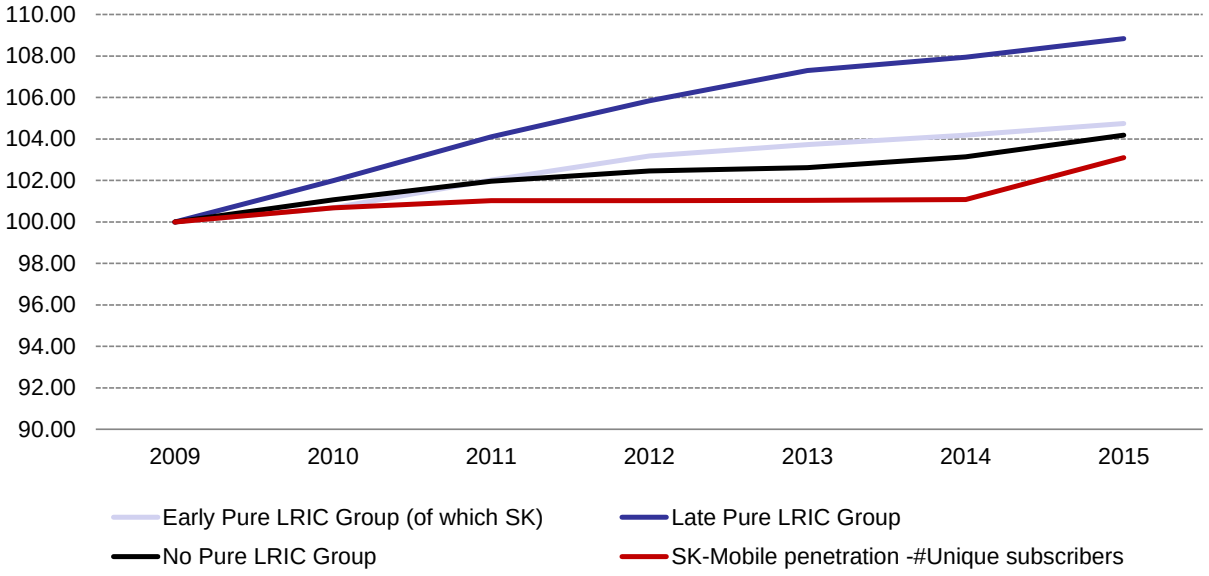
Figure 511 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

It can be observed in Figure 512 that the market penetration in terms of unique subscribers in Slovakia has been slowly increasing since 2009, in a roughly comparable way to the Early and No Pure LRIC Groups. Such as market penetration in terms of SIM cards, it started from a lower level than most MS, and is still in 2015, lower than the European average.

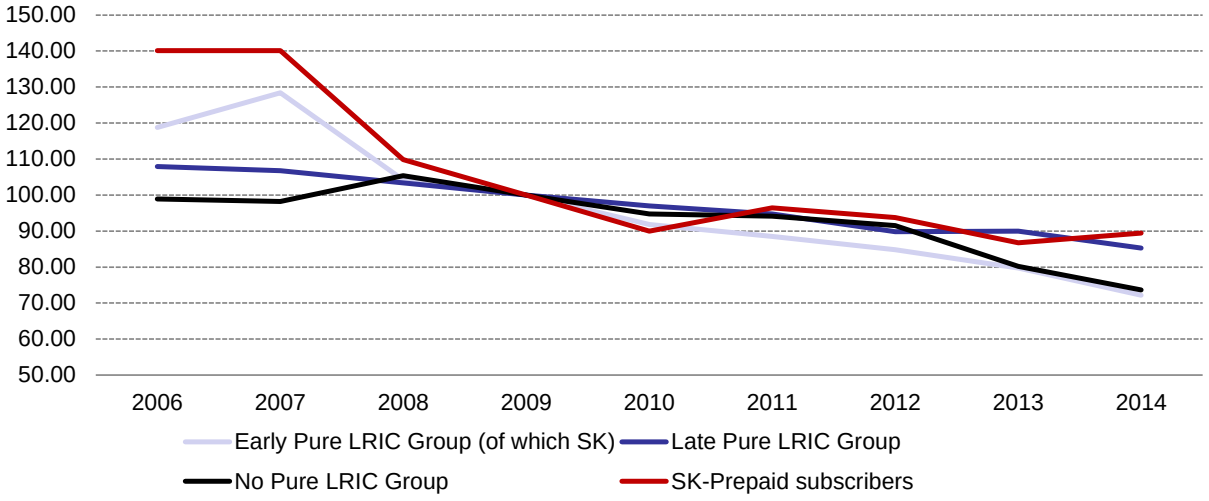
Figure 512 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 513 shows the share of prepaid subscribers in Slovakia compared to the three groups. It can be observed that it strongly decreased between 2007 and 2010 in Slovakia and then seemed to bottom-out whereas all groups kept on decreasing. In 2014, the share of prepaid subscribers in Slovakia is at 33%, and is lower than the European average.

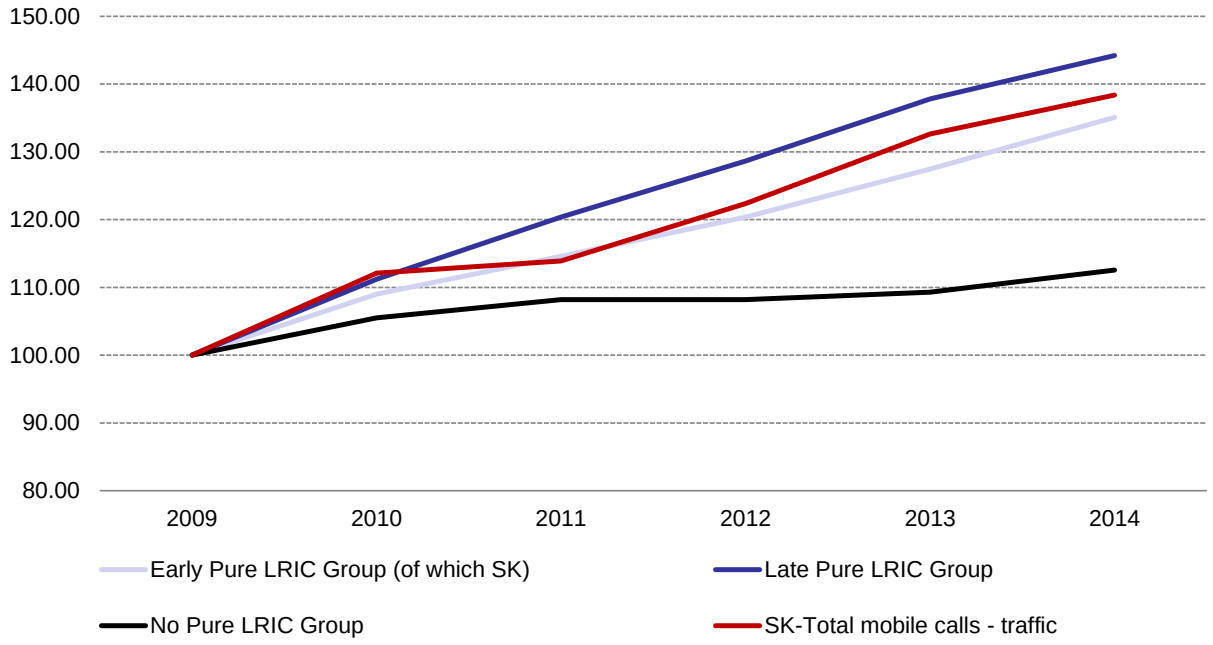
Figure 513 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 514 shows the evolution of the amount of minutes of mobile calls in Slovakia since 2009. It can be observed that it has been constantly increasing since 2009 and has been following a very comparable trend to the Early Pure LRIC Group.

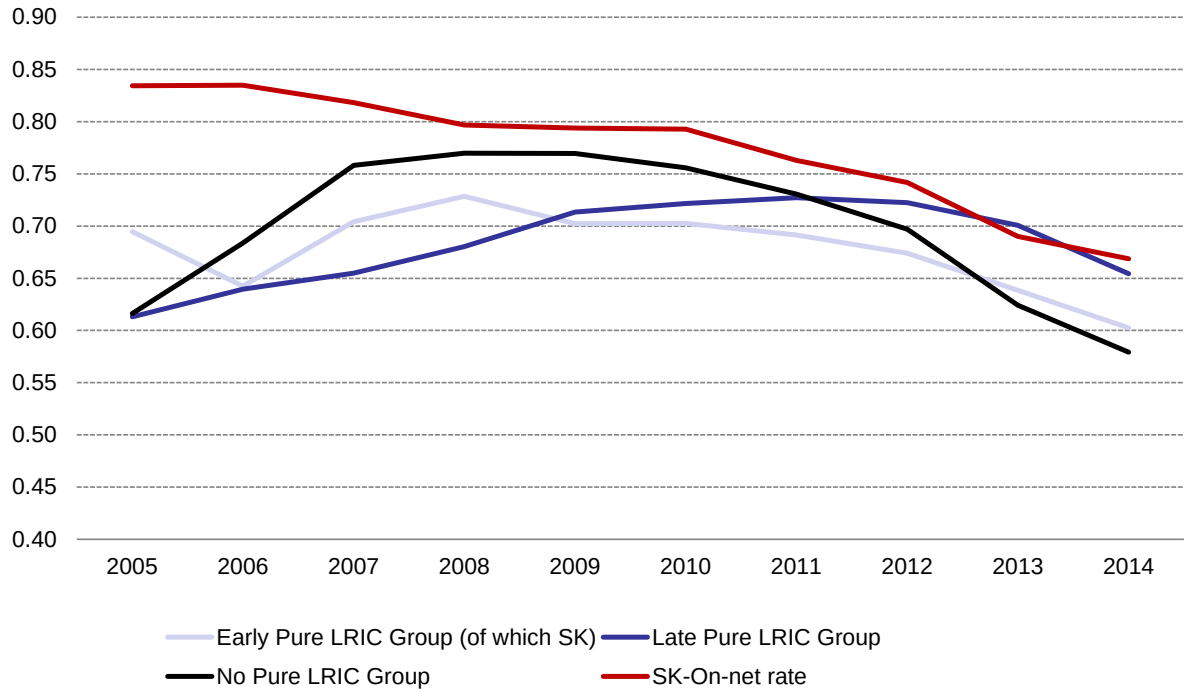
Figure 514 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 515 shows the share of on-net mobile calls for Slovakia and the three groups. It can be noticed that it has been higher in Slovakia than in the Early Pure LRIC Group since 2005. However, the on-net rate has been continuously dropping since 2006, and is now lower than the Late Pure LRIC Group. Nevertheless, the Slovakian regulator TSRU stated that *"on-net/off-net differentiation was still dominant in the Slovakian mobile market."*

Figure 515 - On-net rate of mobile calls (%)



Source: RU

8.25.1.2 *Evolution of retail mobile offers*

In Slovakia, the four mobile operators provide various kinds of offers according to TSRU.

According to the Slovakian regulator, on-net/off-net differentiation is still important in the market, with 66% of volume of on-net calls in 2015. A slight decrease was allowed by the appearance of "flat" and "semi-flat" calling plans in 2011 which provided unlimited calls to fixed and certain mobile networks.

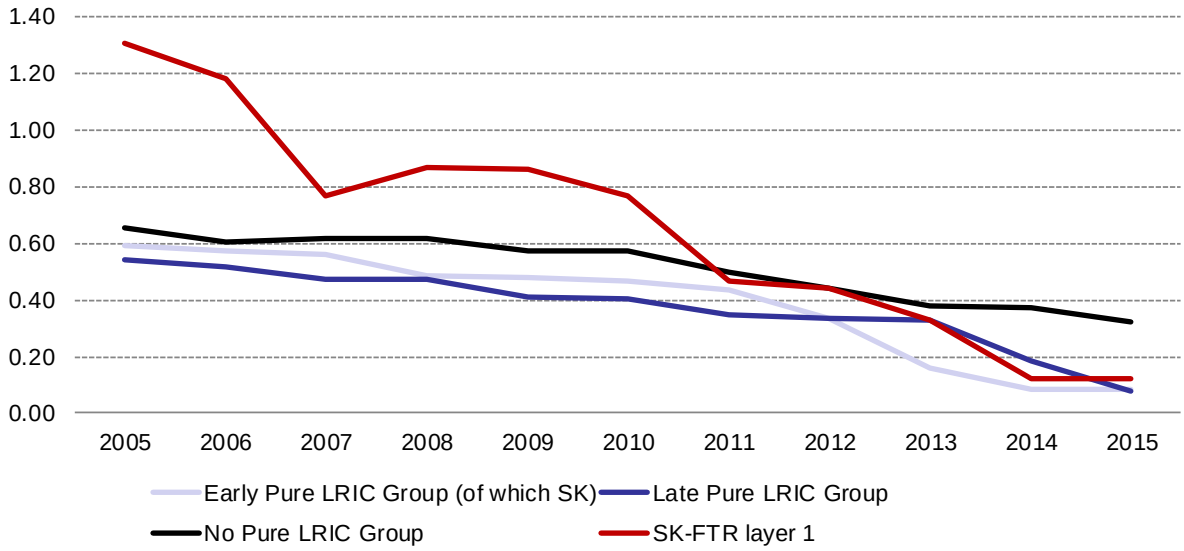
TSRU also noticed a general reduction in retail prices for mobile calls.

8.25.2 Fixed market

8.25.2.1 *Quantitative analysis*

Figure 516 compares the level of FTRs in Slovakia with the weighted averages of the three groups. It can be observed that it strongly decreased between 2005 and 2007, then in 2011. After 2011, it has been steadily decreasing and has been set on a Pure LRIC basis in 2013.

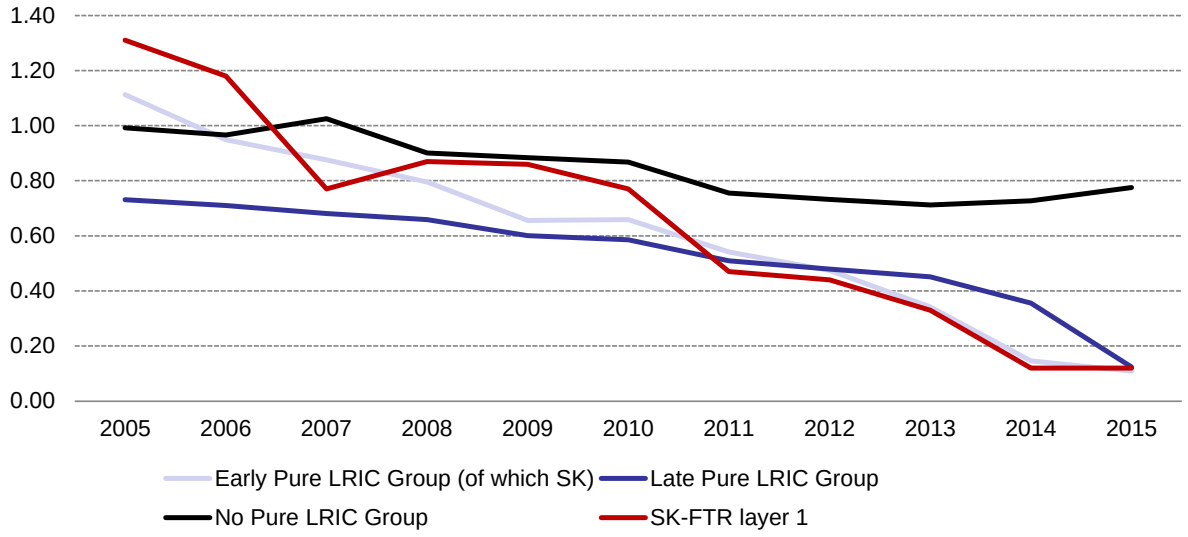
Figure 516 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 517 shows the flat average for the three groups as opposed to the previous figure. FTRs in Slovakia have been relatively lower compared to all groups when considering flat averages.

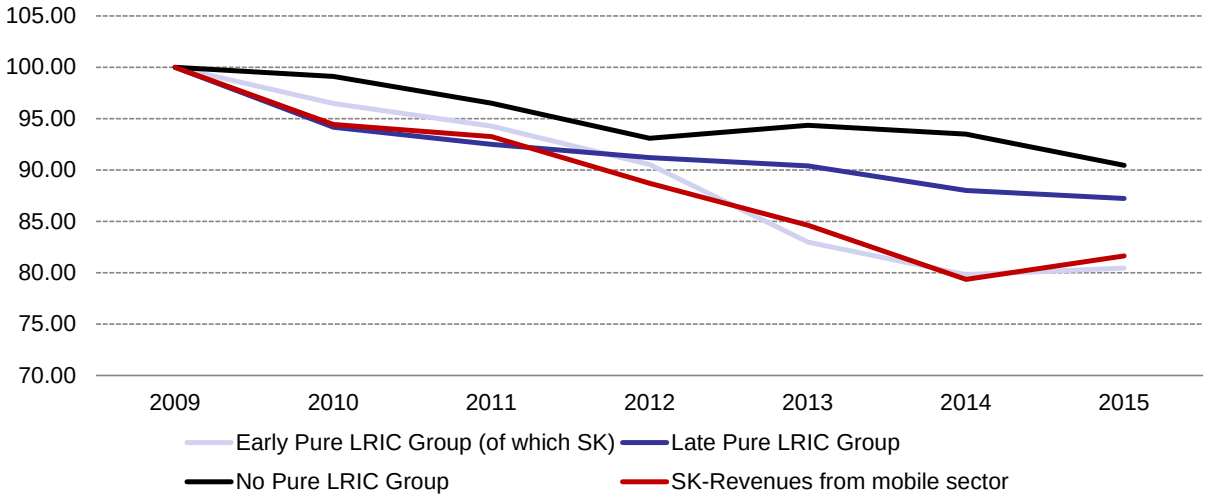
Figure 517 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 518 shows the evolution of revenues from the fixed-line market since 2010 in Slovakia. It can be observed that it has been continuously decreasing since 2010. Their evolution has been extremely close to the Early Pure LRIC Group.

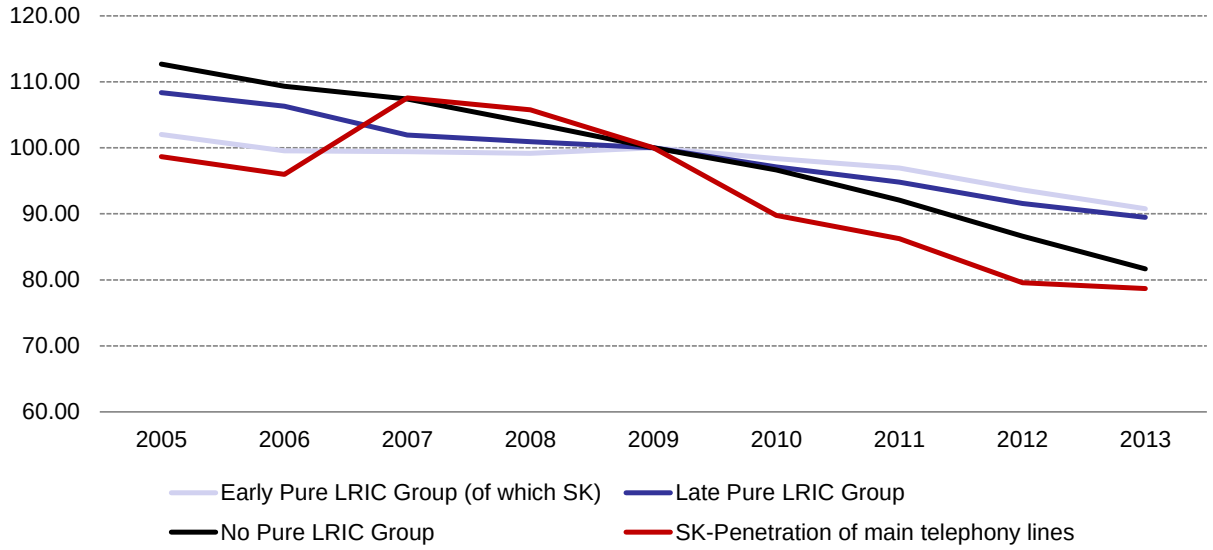
Figure 518 - Fixed revenues (base 100 in 2009)



Source: TERA Consultants from GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Slovakia has shown a constant decrease since 2007, diminishing faster than all groups as observed with Figure 519. Already starting from a lower level than most MS in 2005, it is in 2013 far below the European average.

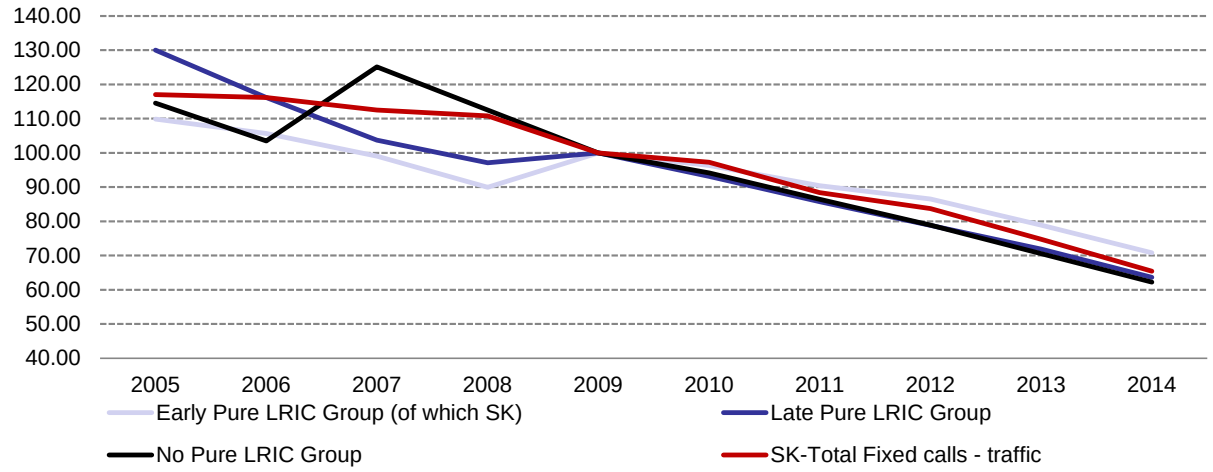
Figure 519 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of all fixed national calls in Slovakia, presented in Figure 520, has shown a steady decline between 2009 and 2014. It has been decreasing faster than the Early Pure LRIC Group, but slower than the Late and No Pure LRIC Groups.

Figure 520 - Traffic of total fixed calls (base 100 in 2009)[159]



Source: RU

8.25.2.2 *Evolution of retail fixed offers*

According to TSRU, fixed voice services in Slovakia have seen a gradual convergence between fixed and mobile services. Voice services are most used by non-residential customers.

TSRU has removed asymmetry in FTRs between operators, which resulted in the elimination of differences for end users of prices to national fixed, and to international fixed (EU countries).

Such as the mobile sector, the difference between on-net and off-net calls is significant, as 80% of calls volume are on-net.

[159] From number of minutes

According to TSRU, the consumer's interests for triple play bundles have increased over the past few years.

8.25.3 Summary

The tables below summarize, for each metric, the difference between Slovakia and the average metric for the Early pure LRIC Group in order to highlight how Slovakia is positioned against its pair countries.

Figure 521 - Differences between Slovakia and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Slovakia
Mobile revenues	Very close to the Early Pure LRIC Group
Mobile investments	Closer to No Pure LRIC Group
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards and unique subscribers than the Early Pure LRIC Group
Competition in mobile	Closer to Late Pure LRIC Group, decreased faster than all groups
On-net rate	Higher than its group but followed a comparable trend

Source: TERA Consultants

Figure 522 – Differences between the Early Pure LRIC Group and Slovakia for the fixed market

Metrics	Differences between the Early Pure LRIC Group and Slovakia
Fixed revenue	Very close evolution to the Early Pure LRIC Group
Traffic	Very close evolution to the Early Pure LRIC Group
Main telephony lines	Faster decrease than all groups

Source: TERA Consultants

8.26 Slovenia

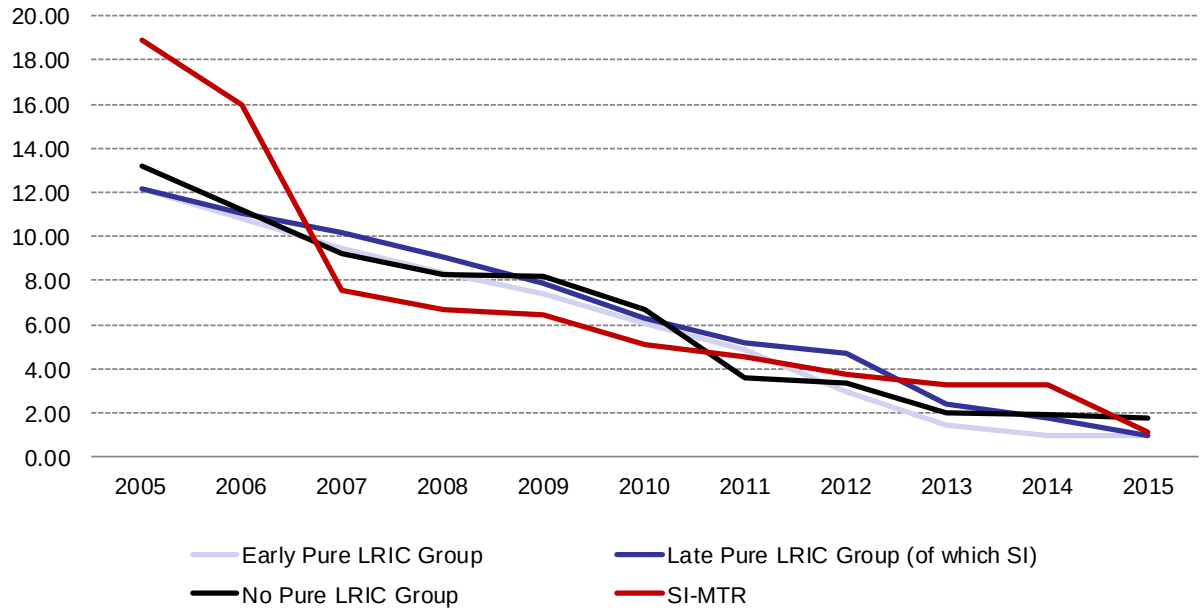
The Slovenian telecommunications market is dominated by the state-owned incumbent Telekom Slovenije. The mobile market is served by four players, including Telekom Slovenije, Si.Mobil, its main competitor founded in 1997, Telemach Mobil and T-2. The Slovenian regulator AKOS chose to implement the pure LRIC approach from 2014, therefore the country has been allocated to the "Late Pure LRIC Group".

8.26.1 Mobile market

8.26.1.1 *Quantitative analysis*

Figure 523 compares the level of MTRs in Slovenia to the three groups' weighted averages. It can be observed that it was way higher than all groups in 2005 (19€cents) and has strongly decreased in 2007. It has then steadily decreased and was set on Pure LRIC in 2014. Slovenian MTRs are therefore in 2015 at the same level as the Late Pure LRIC Group.

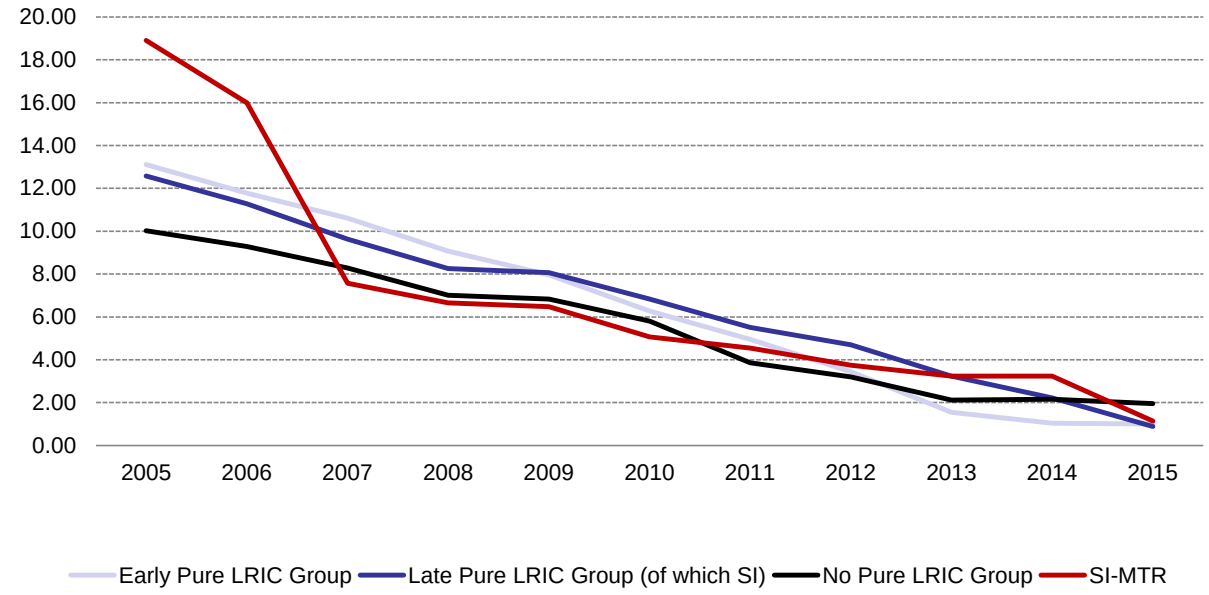
Figure 523 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 524). The trend is very similar to the previous figure, with Slovenian MTRs being far above all groups until 2007, and then slightly decreasing.

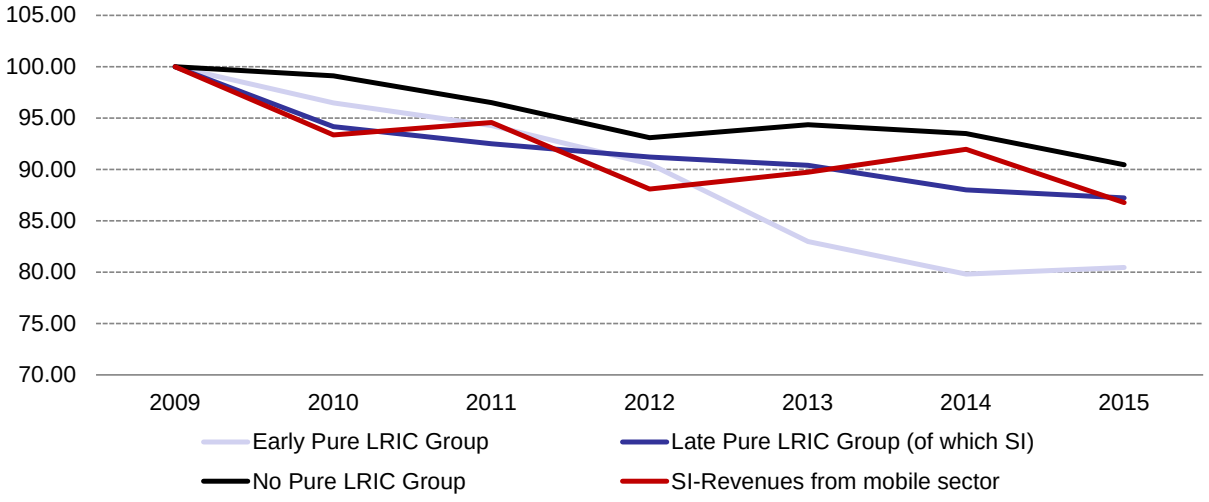
Figure 524 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector in Slovenia presented in Figure 525 have been overall decreasing since 2009. Although they have not been following a similar trend to the Late Pure LRIC Group, their evolution from 2009 to 2015 has been equivalent (-15%).

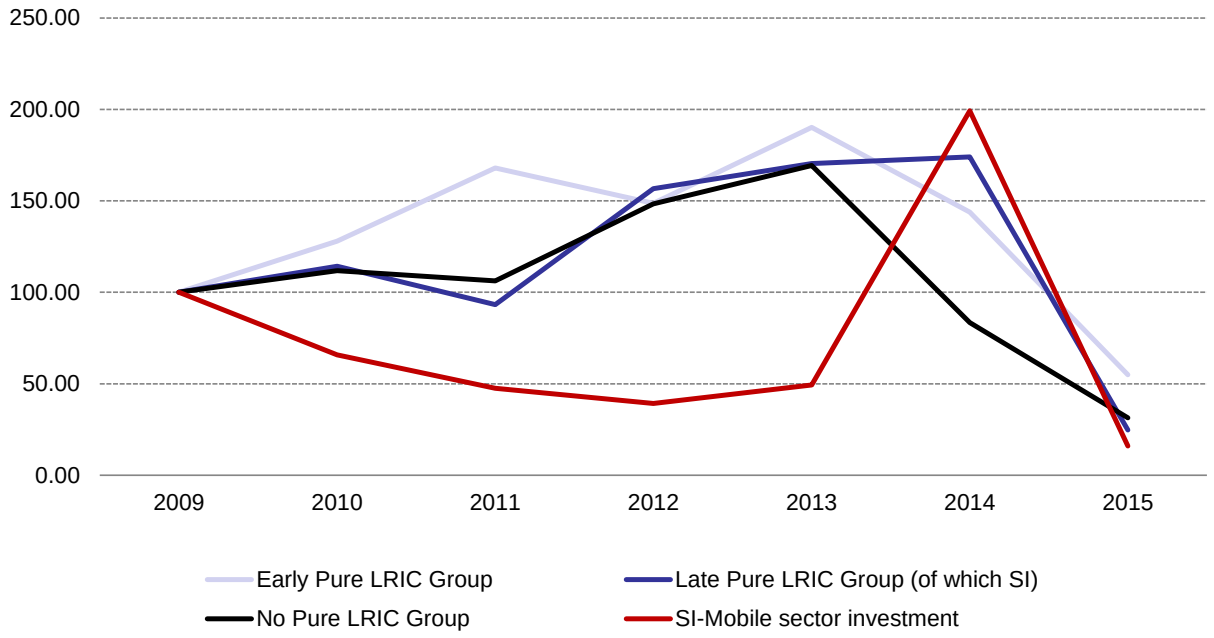
Figure 525 - Mobile revenues (base 100 in 2009)



Source: GSMA

Investments in the mobile sector in Slovenia presented with Figure 526 steadily decreased between 2009 and 2013 (-50%), then sturdily increased in 2014, and shrunk in 2015. Although the strong decline in 2014 is comparable to the Late Pure LRIC Group, investments in Slovenia have not been following the same trend since 2009.

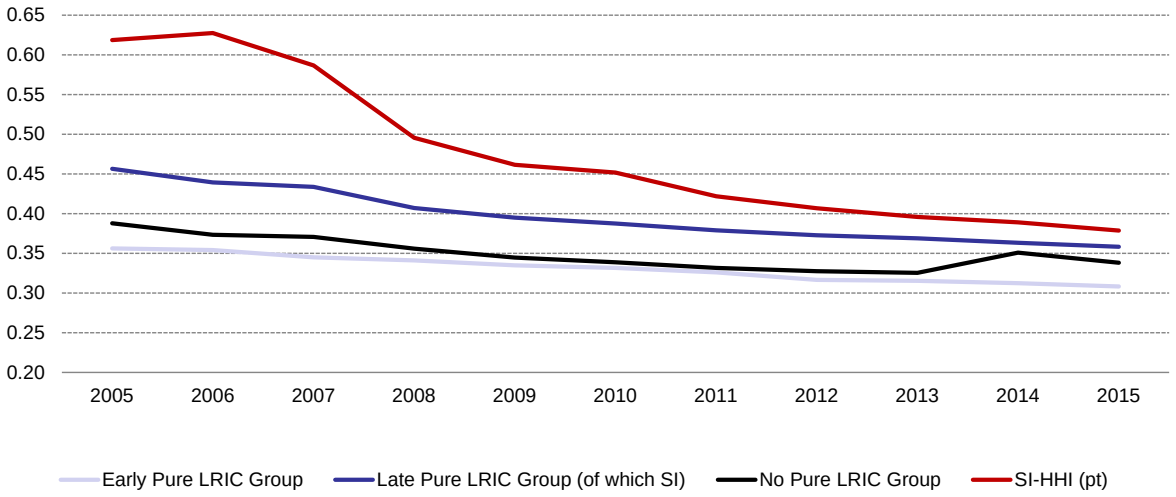
Figure 526 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Four mobile network operators (MNOs) are competing in the Slovenian mobile market, dominated by Telekom Slovenije. The improvement of competition in the mobile market subsequently to the entry of Telemach Mobil in 2007, and T-2 in 2008 can be observed in Figure 527. The HHI measuring the concentration of the market has been continuously dropping since 2006, and is now only slightly higher than its group average.

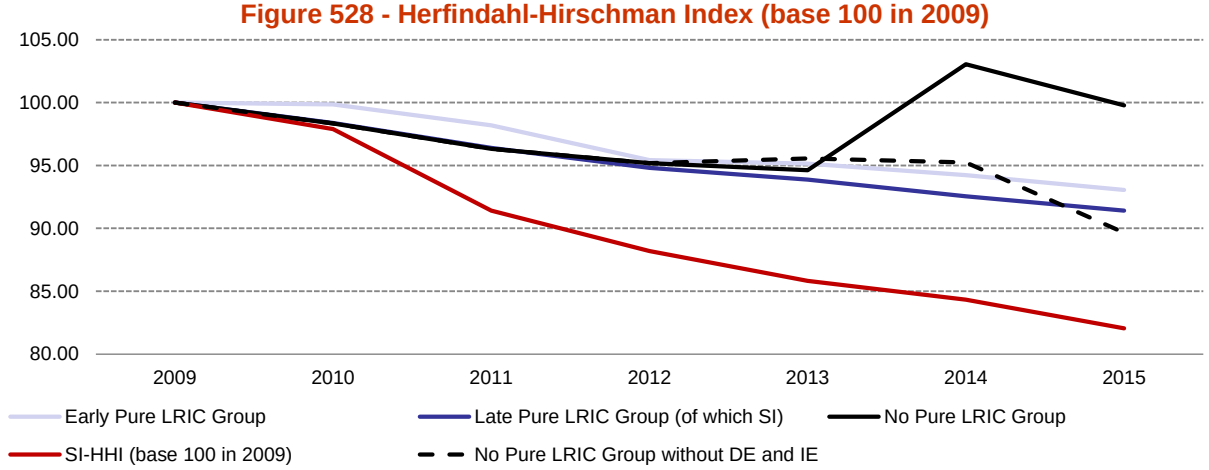
Figure 527 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the decreasing level of concentration in Slovenia since 2009 can be noticed in Figure 528: the HHI (as base 100 in 2009) has been continuously dropping and is now almost on the same level as the Late Pure LRIC Group.

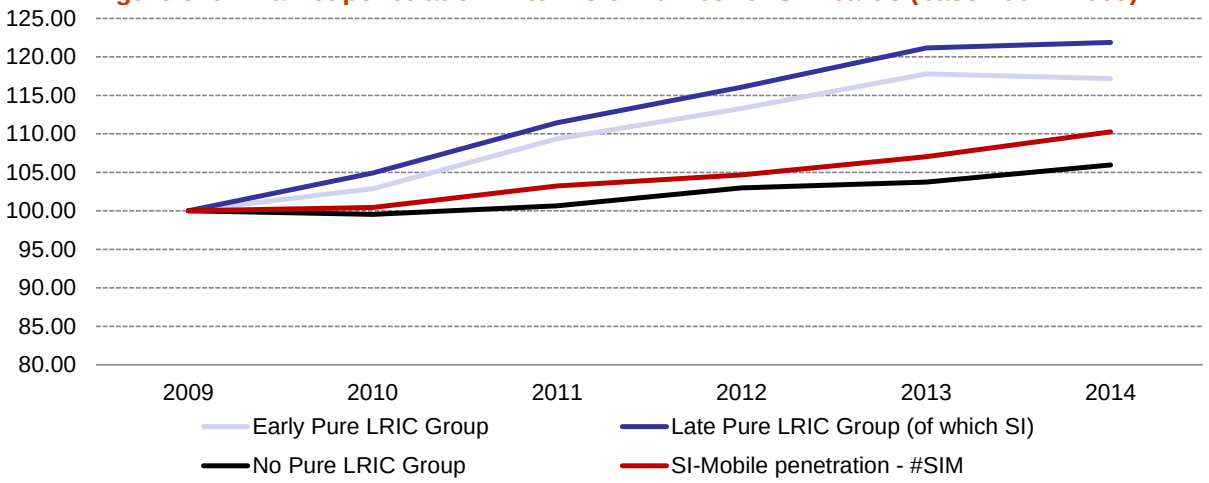
Figure 528 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Slovenian market penetration in terms of number of SIM presented in Figure 529 has been slowly increasing since 2009. It can be noticed that its growth has been closer to the No Pure LRIC Group than the Late Pure LRIC Group. In 2014 it is therefore lower than the European average at 113%.

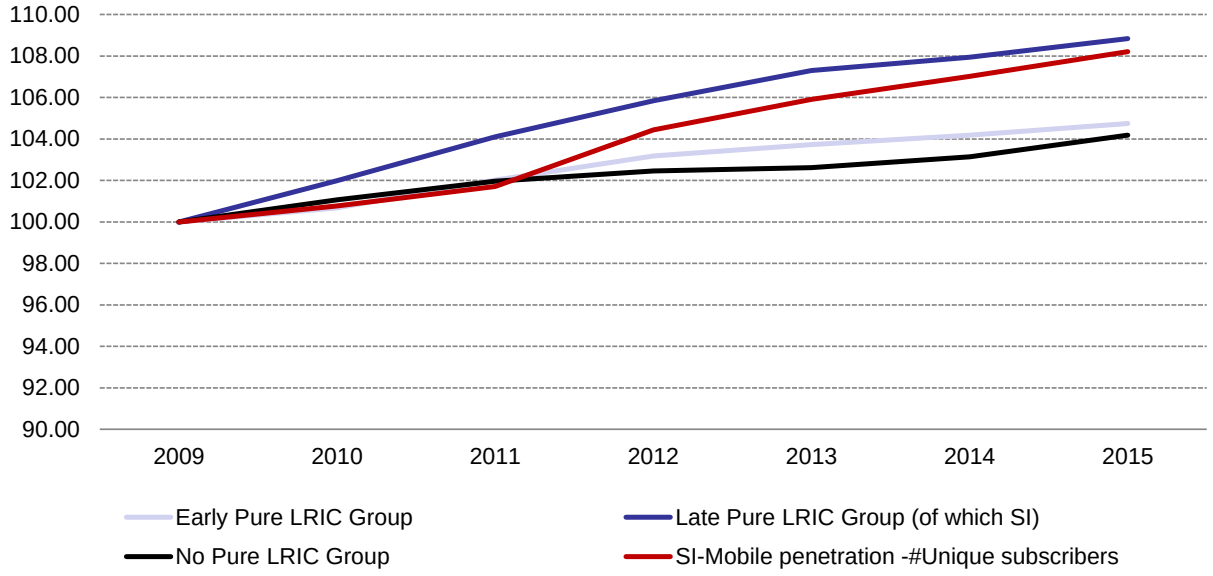
Figure 529 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

On the other hand, the market penetration in terms of unique subscribers presented in Figure 530 has been increasing a bit more, especially since 2011. Its evolution has also been closer to the Late Pure LRIC than other groups. It is though in 2015 still below the European average market penetration.

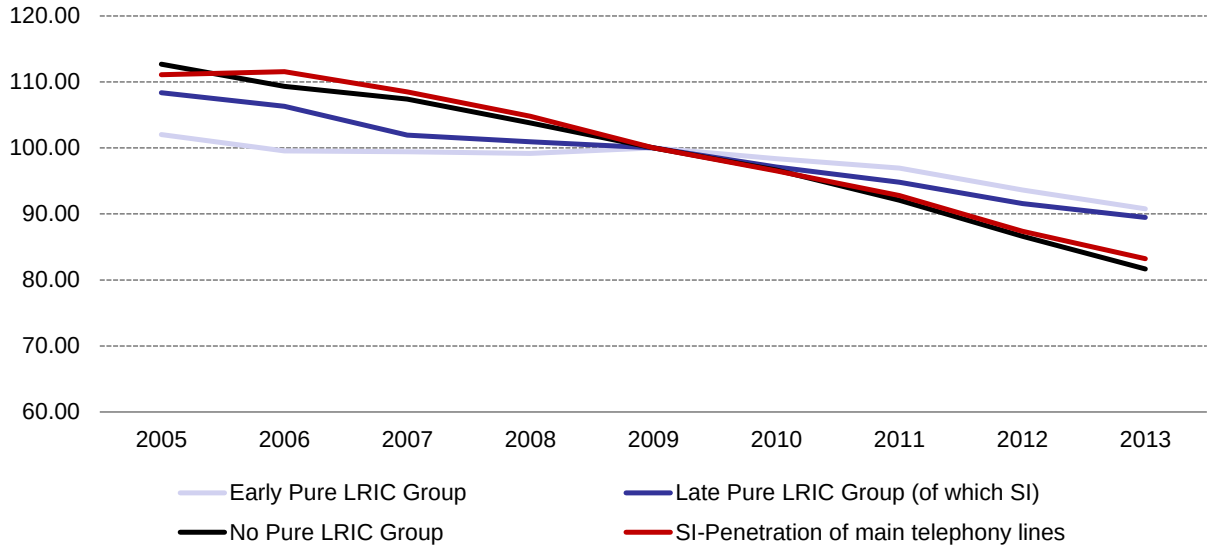
Figure 530 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 531 shows the share of prepaid subscribers in Slovenia compared to the three groups. Since 2006, it has been continuously dropping, with a very similar trend to the Late Pure LRIC Group since 2009. In 2014, the share of prepaid subscribers in Slovenia is lower (27%) than the European average (39%).

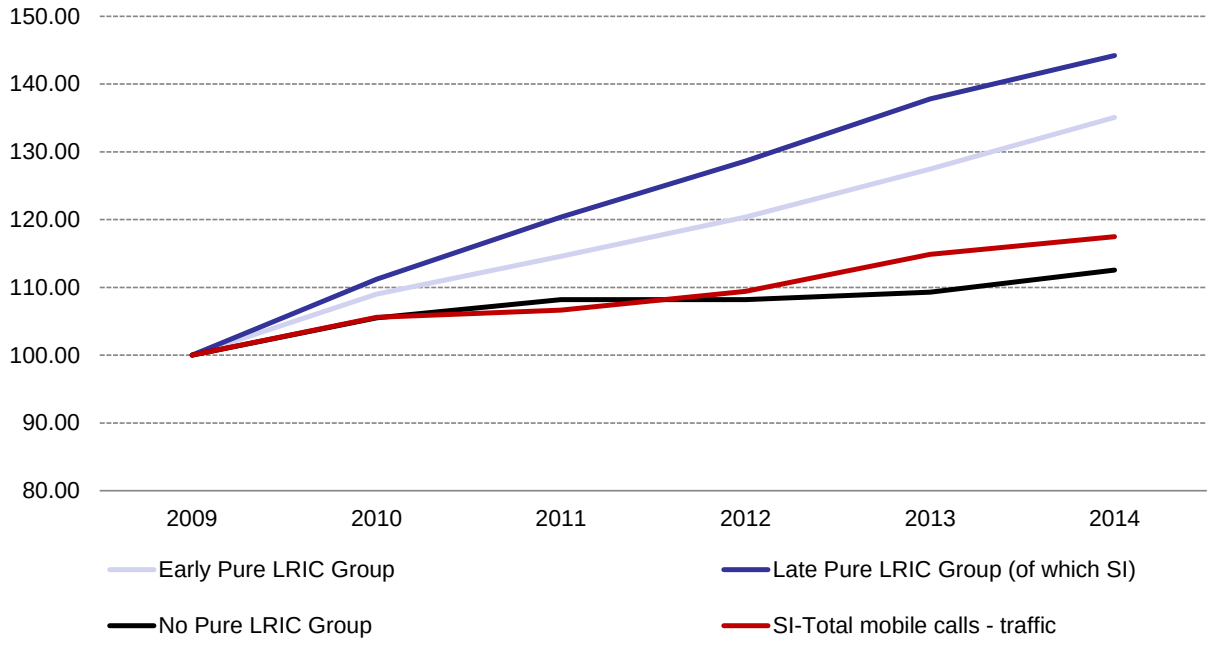
Figure 531 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 532 shows the evolution of the amount of minutes of mobile calls in Slovenia. It can be observed that it has been very slightly increasing since 2009, with a more similar trend to the No Pure LRIC Group than its own group.

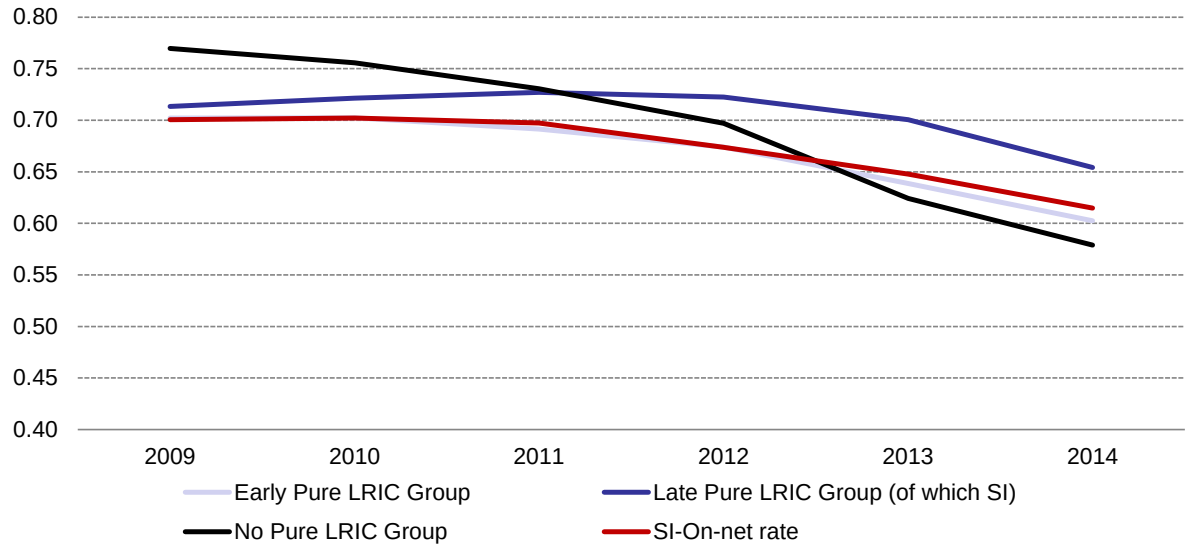
Figure 532 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 533 shows the share of on-net mobile calls in Slovenia since 2009. It can be observed that it has been continuously decreasing, following roughly both the Early and Late Pure LRIC Groups trends, with a closer level to the Early Pure LRIC Group though.

Figure 533 - On-net rate of mobile calls (%)



Source: NRA's answer to questionnaire

8.26.1.2 *Evolution of retail mobile offers*

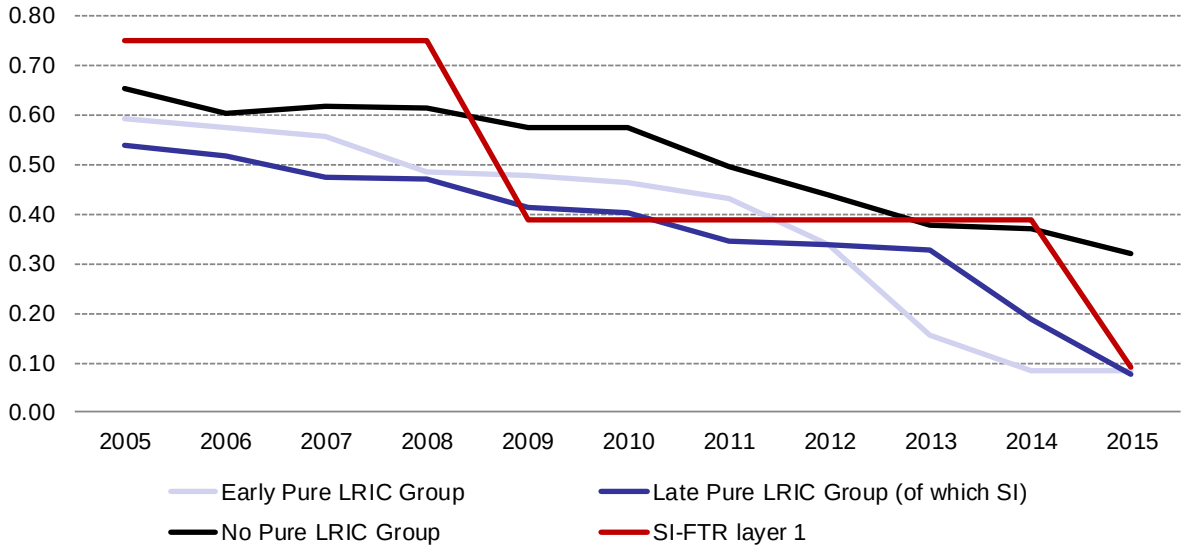
The Slovenian regulator did not answer the questionnaire sent by the EC.

8.26.2 Fixed market

8.26.2.1 *Quantitative analysis*

Figure 534 shows the evolution of the Slovenian FTRs compared to the three groups. It can be observed that Slovenian FTRs have only been changed twice. In 2009 it was divided by two, and in 2015 it was set at the Pure LRIC level, and divided by four.

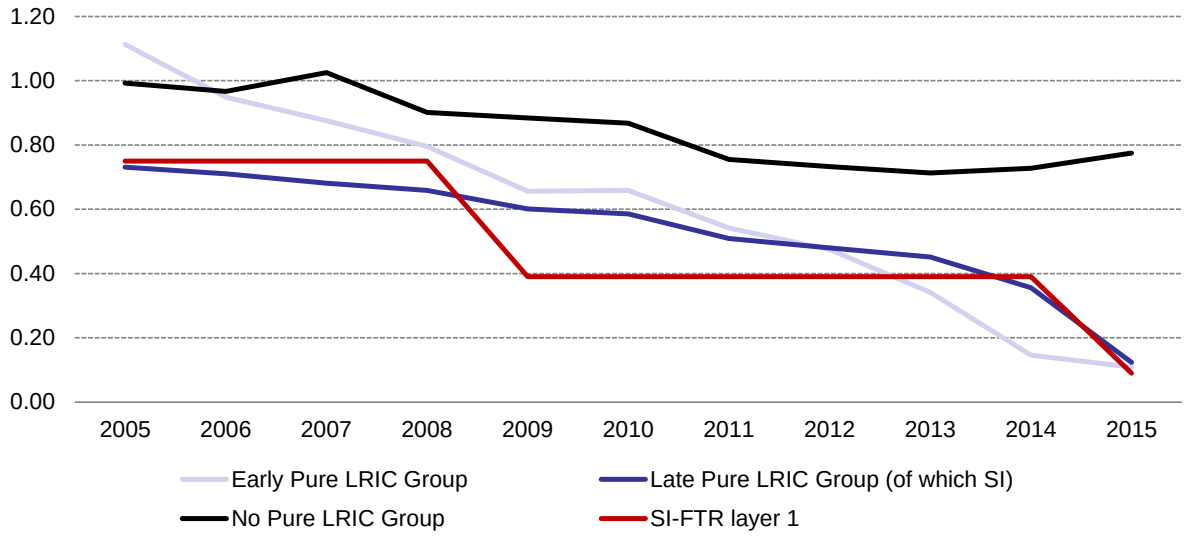
Figure 534 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 535 shows the flat average for the three groups as opposed to the previous figure. The main difference concerns the relative level of Slovenian FTRs which was lower in comparison to all groups when considering flat averages.

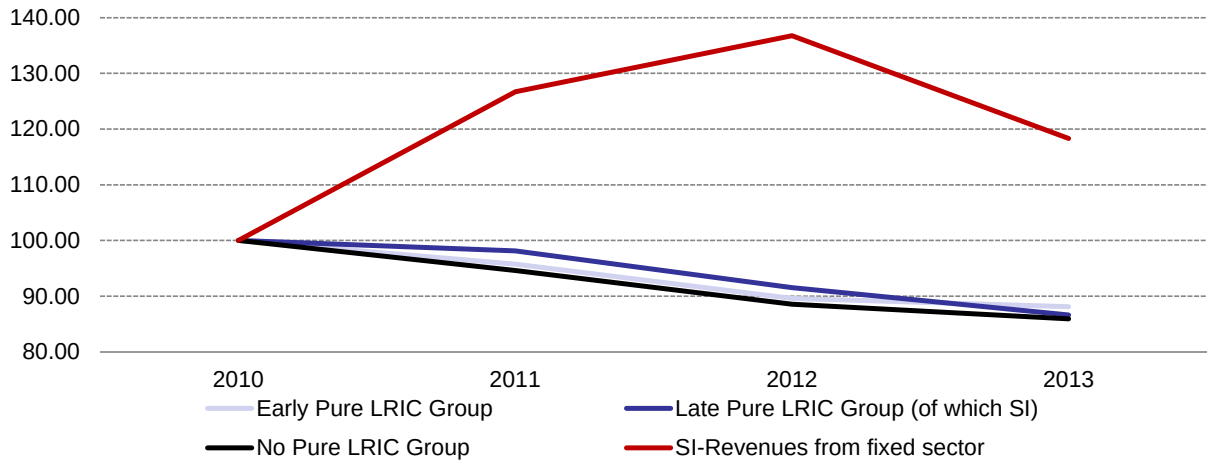
Figure 535 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 536 shows the evolution of revenues from the fixed-line market since 2010 in Slovenia and for the three groups. It can be observed that it strongly increased between 2010 and 2012 and fell in 2013. Revenues from the fixed-line market in Slovenia have not been following any group's trend.

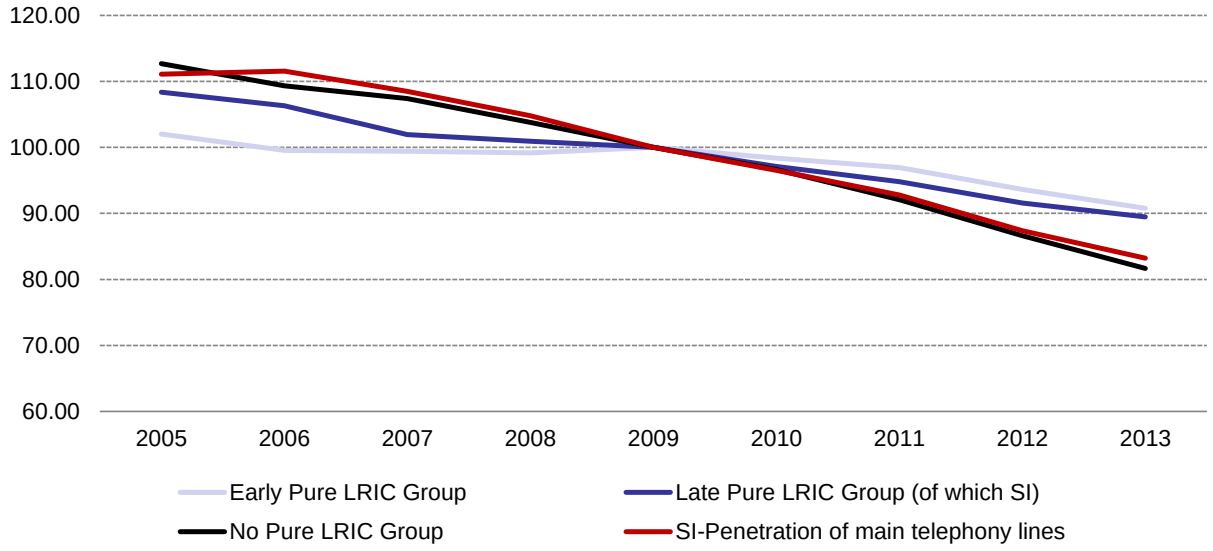
Figure 536 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Slovenia has shown a constant and slow decrease since 2005, with a similar evolution penetration to the No Pure LRIC Group, also steadily decreasing as shown in Figure 537. The Late Pure LRIC Group average penetration has been decreasing slower than the Slovenian one.

Figure 537 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

8.26.2.2 *Evolution of retail fixed offers*

The Slovenian regulator did not answer the questionnaire sent by the EC.

8.26.3 Summary

The tables below summarize, for each metric, the difference between Slovenia and the average metric for the Late pure LRIC Group in order to highlight how Slovenia is positioned against its pair countries.

Figure 538 - Differences between Slovenia and its group for the mobile market

Metrics	Differences between the Late Pure LRIC Group and Slovenia
Mobile revenues	Close to Late Pure LRIC Group
Mobile investments	Same strong decline in 2014 as Late Pure LRIC group
Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards. Bigger penetration for Slovenia in terms of Unique Subscribers
Competition in mobile	Higher than all groups. Decreased more than all groups to catch up
On-net rate	Closer to the Early Pure LRIC Group

Source: TERA Consultants

Figure 539 – Differences between the Late Pure LRIC Group and Slovenia for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Slovenia
Fixed revenue	Increased whereas all groups decreased
Traffic	Not available
Main telephony lines	Faster decrease than the Late Pure LRIC Group

Source: TERA Consultants

8.27 Sweden

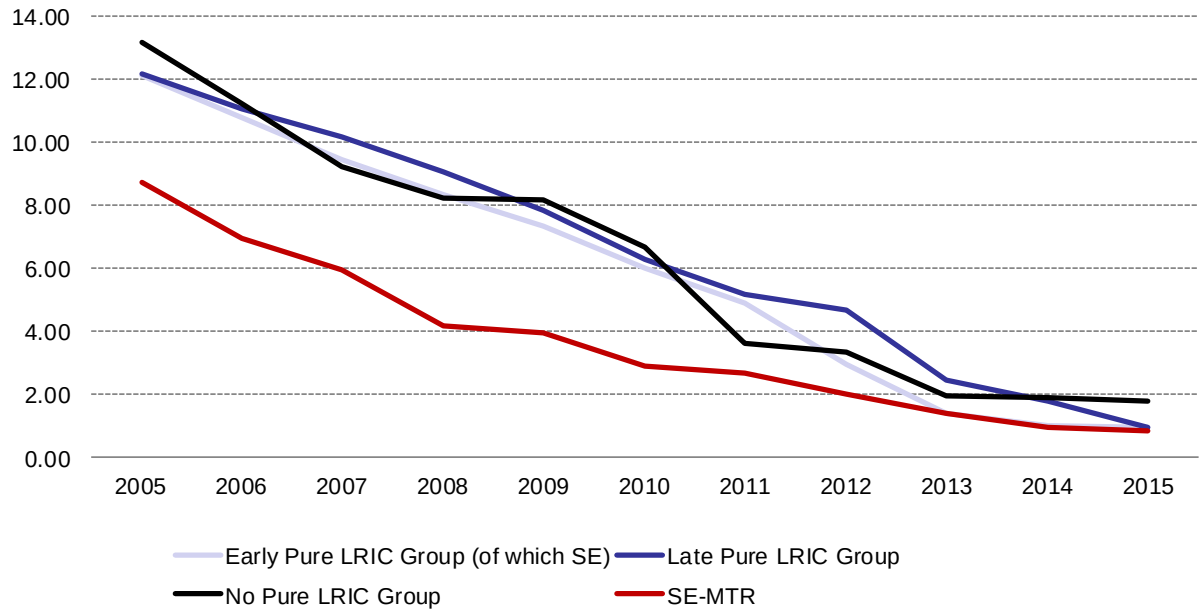
The Swedish telecommunications market is served by multiple operators, especially in the mobile sector with 5 active players, of which the incumbent TeliaSonera. Its main competitor is Tele2 (1993) whose Norwegian subsidiary has been sold to TeliaSonera in February 2015. Other competitors are Telenor (1992), Three (2003) with a common network for Denmark and Sweden, and Net1 (2007). The Swedish regulator PTS implemented the Pure LRIC approach in July 2013 for MTR and has been allocated to the "Early Pure LRIC group" for the mobile sector analysis, but only implemented the Pure LRIC approach for FTRs in 2014, and has then been allocated to the Late Pure LRIC Group for the fixed sector analysis.

8.27.1 Mobile market

8.27.1.1 *Quantitative analysis*

Figure 540 compares the level of MTRs in Sweden with the three groups' weighted average. It can be observed that MTRs in Sweden have been continuously below all groups, and have been at the same level as the Early Pure LRIC Group since 2013 when Swedish MTR were set at a Pure LRIC level.

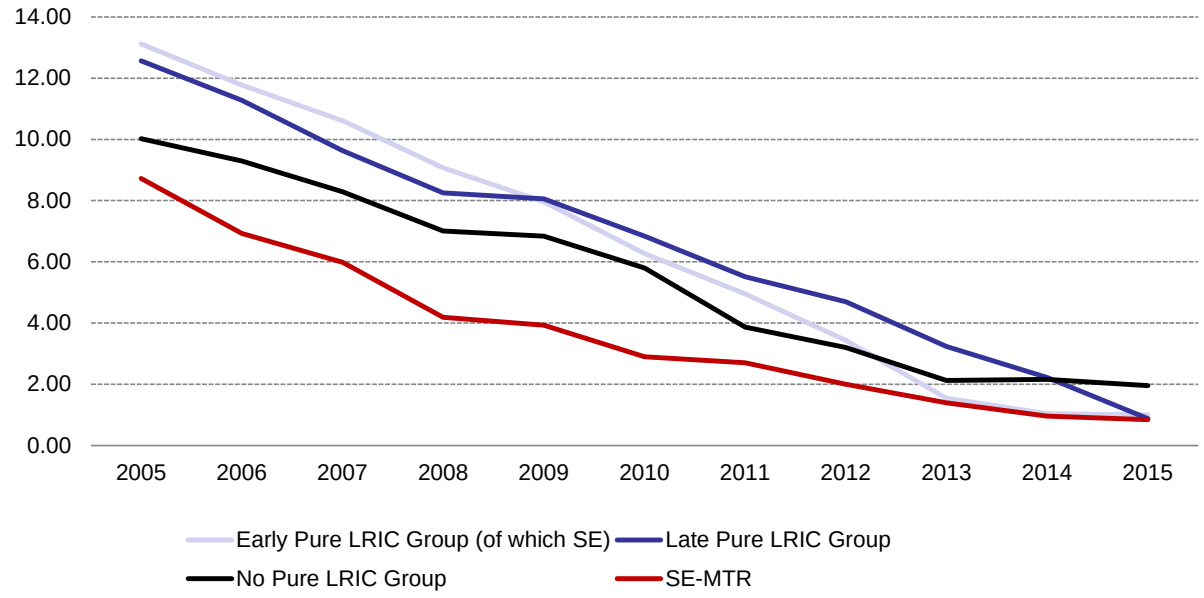
Figure 540 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 541). Swedish MTRs have been below all groups until 2013 when the Early Pure LRIC Group caught up following the implementation of the Pure LRIC approach in the countries which belong to it.

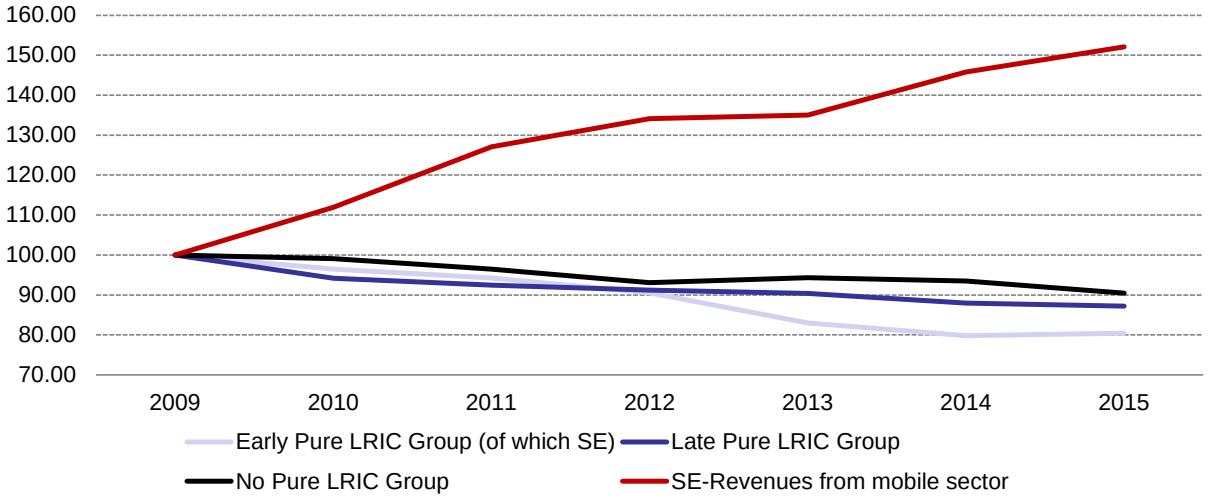
Figure 541 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 542 have been strongly increasing since 2009, whereas they have been decreasing for all groups. Swedish revenues have therefore not been following any group particular trend.

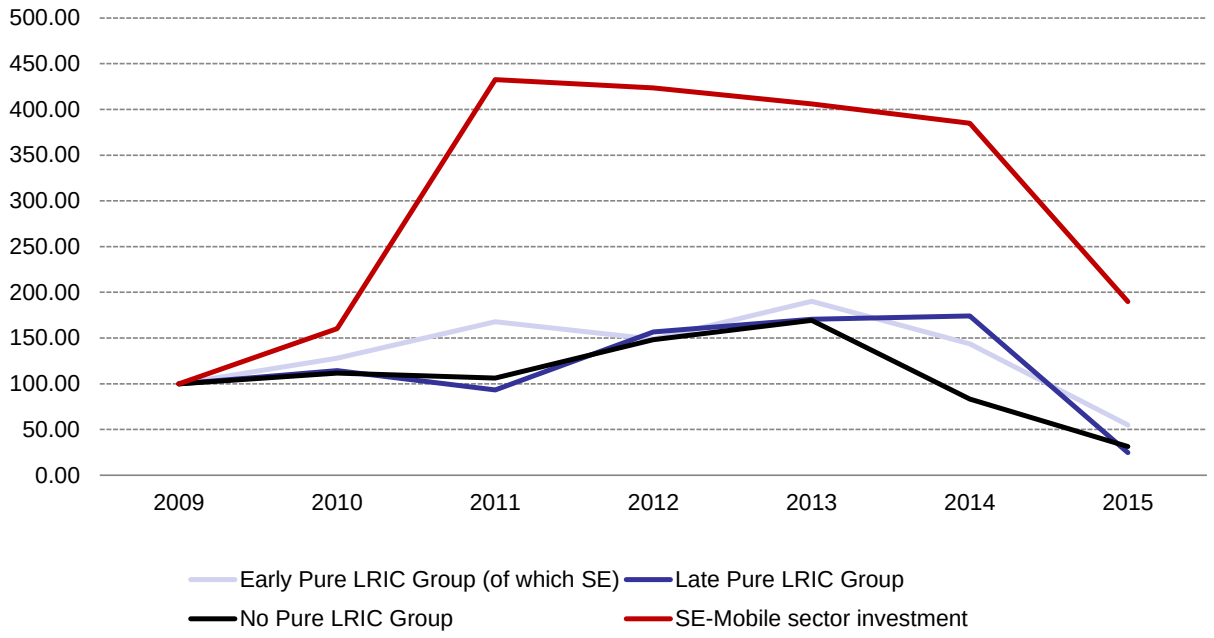
Figure 542 - Mobile revenues (base 100 in 2009)



Source: TERA Consultants from GSMA

Investments in the Swedish mobile sector presented in Figure 543 have strongly increased in 2010, then have been remaining fairly stable until 2014, and sturdily decreased in 2015. Since both Swedish investments growth and decline have been way stronger than any group, it can be said that they did not follow any particular trend.

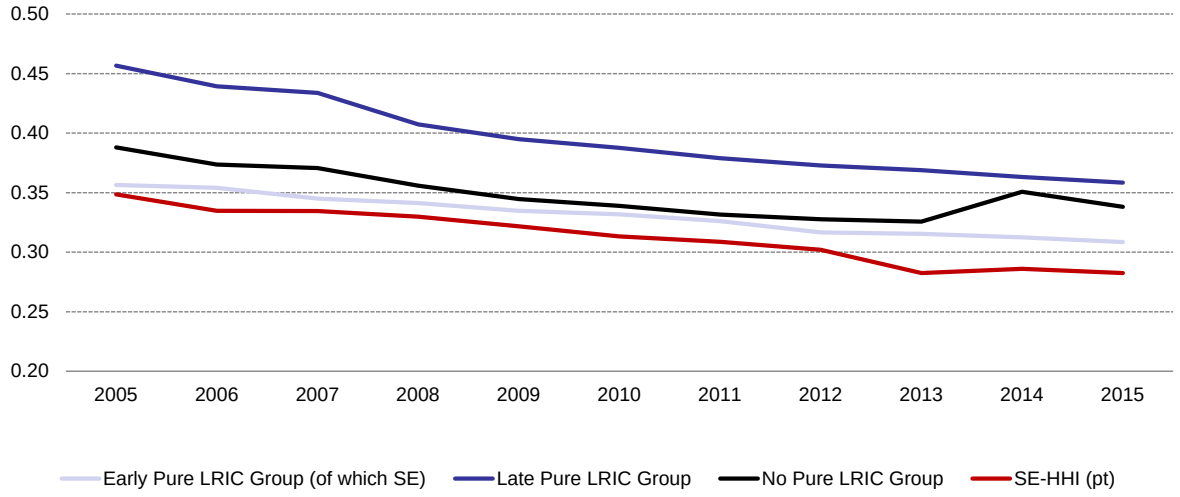
Figure 543 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Five mobile network operators are competing in the Swedish mobile market. The market concentration measured with the HHI presented in Figure 544 has been continuously decreasing and has been fairly close to the Early Pure LRIC level since 2005, although the gap seems to widen for the past three years.

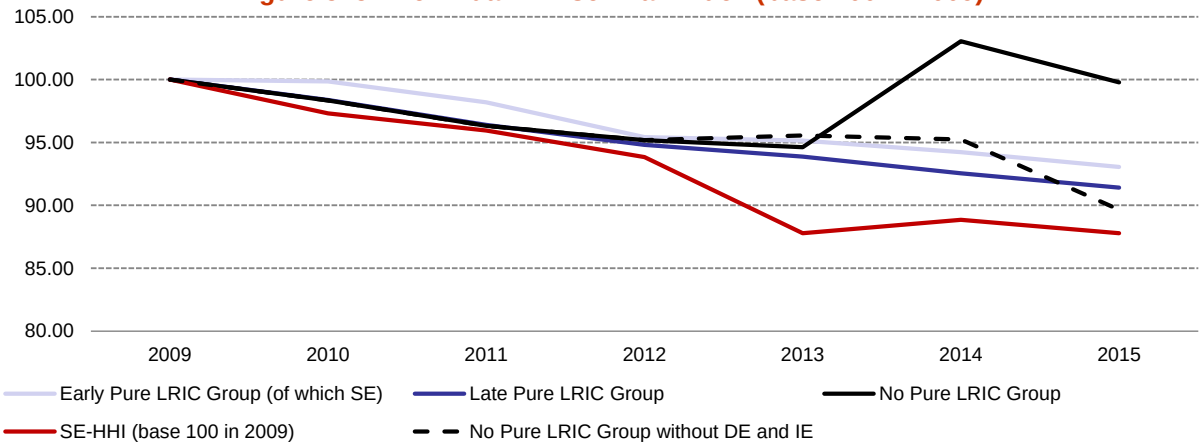
Figure 544 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the lower level of concentration in Sweden since 2009, and the slightly widening gap since 2013 can be noticed in Figure 545: the HHI (as base 100 in 2009) has been continuously dropping and is now inferior to the average of the Early Pure LRIC and other groups of countries.

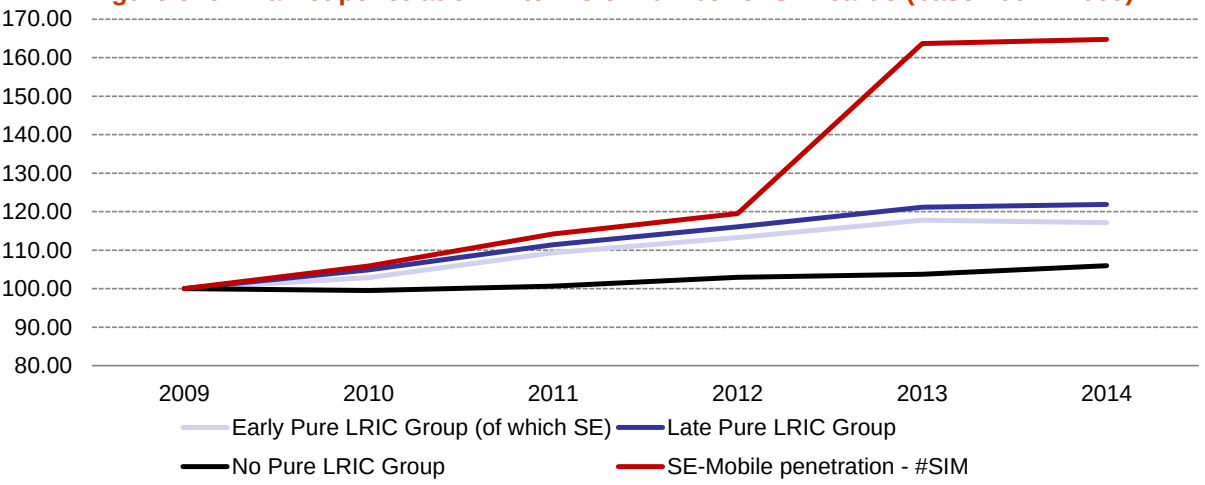
Figure 545 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The Swedish market penetration in terms of number of SIM steadily increased between 2009 and 2012 following the Early and Late Pure LRIC Groups trends. In 2013 however, it strongly increased and is now among the highest in Europe.

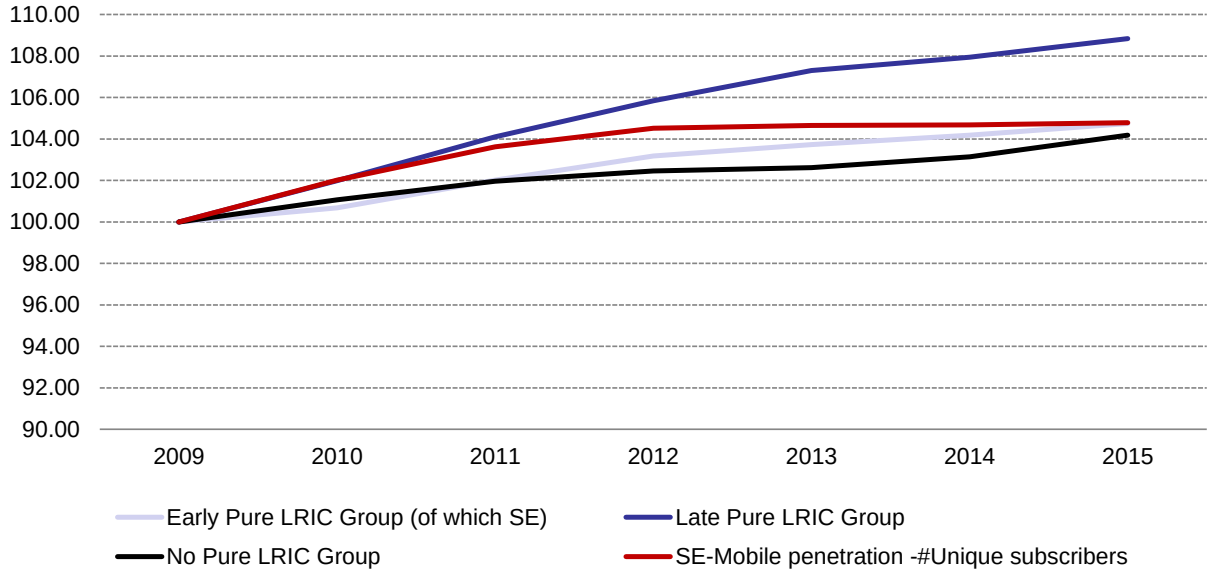
Figure 546 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The market penetration in terms of unique subscribers presented in Figure 547 has shown a steady increase in Sweden between 2009 and 2012. It has then been remaining constant, and has followed from 2009 to 2015 the same growth as the Early and No Pure LRIC Groups. In 2015, the Swedish market penetration is also among the highest in Europe.

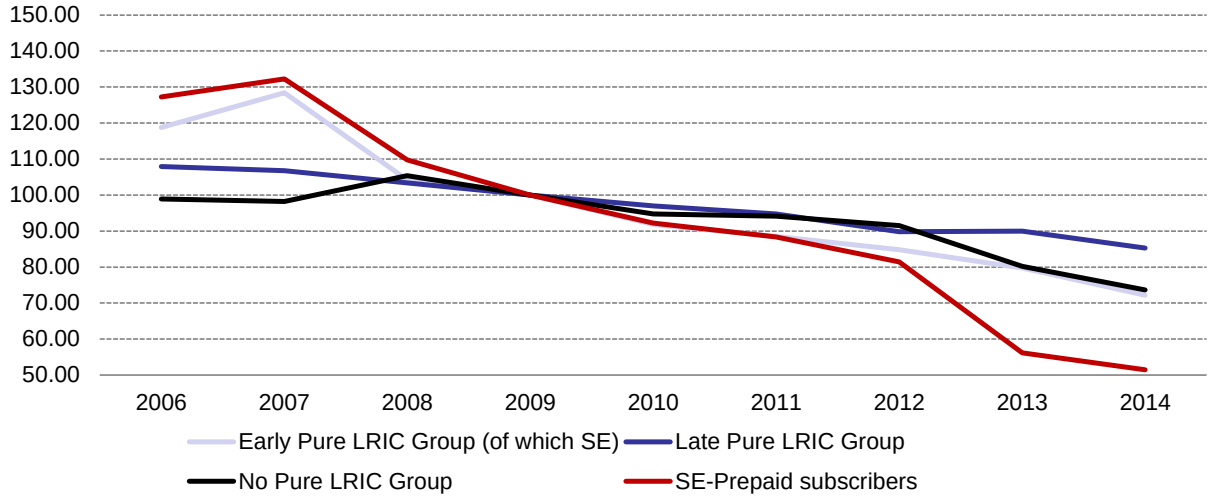
Figure 547 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 548 shows the evolution of the share of prepaid subscribers in Sweden compared to the three groups. It can be observed that it continuously dropped in Sweden between 2007 and 2014, faster than all groups. In 2014, Sweden had a share of prepaid subscribers of 21%, significantly lower that the European average.

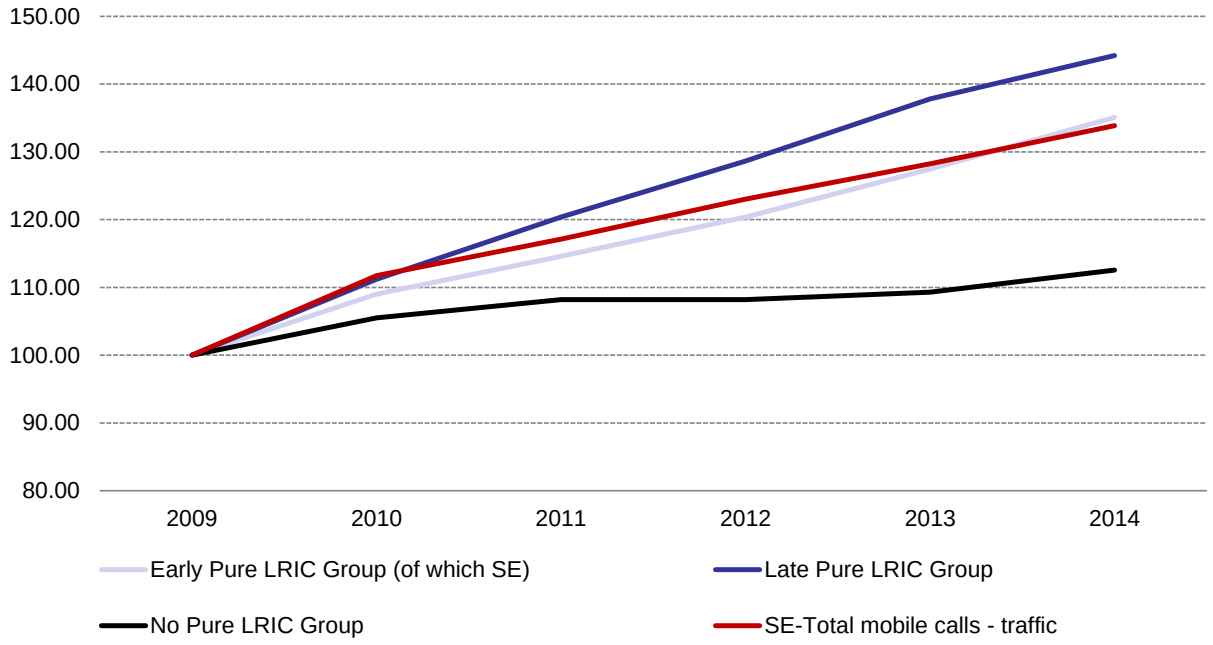
Figure 548 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 549 shows the evolution of the amount of minutes of mobile calls. It can be observed that it has been following a very comparable trend to the Early Pure LRIC Group since 2009, constantly increasing over this period.

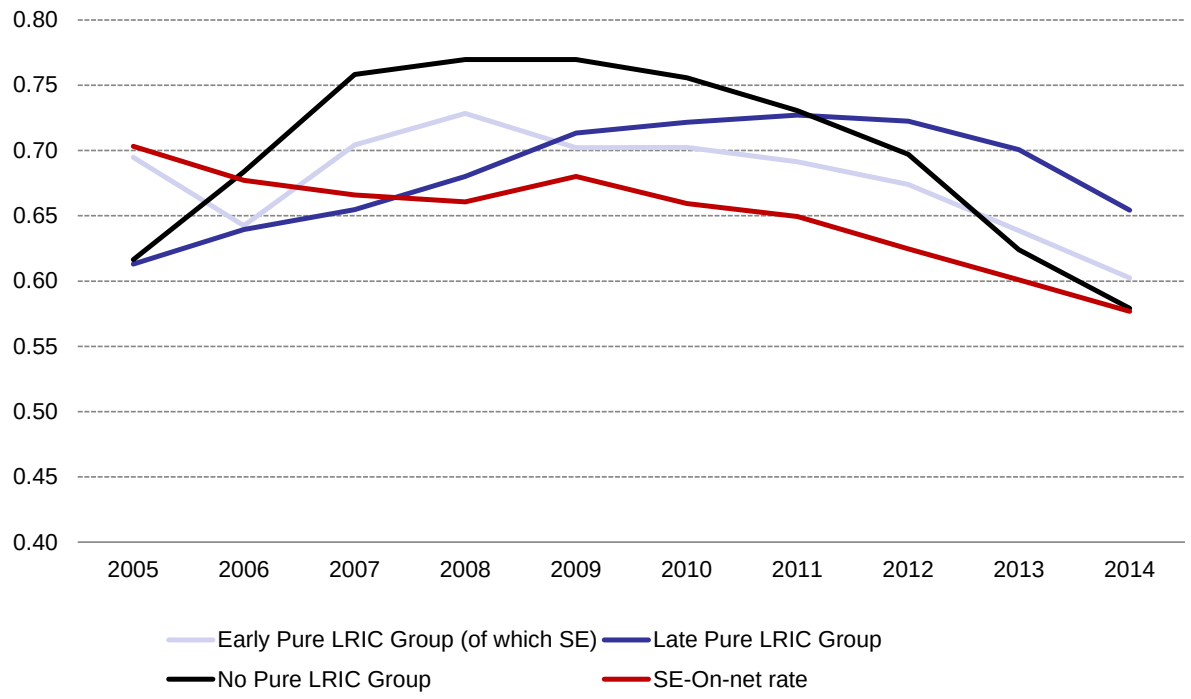
Figure 549 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 550 shows the share of on-net mobile calls in Sweden from 2006 to 2014 compared to the three groups. It can be noticed that it has been constantly below all groups since 2007, and continuously dropped since 2009. In 2014, it is on the same level as the Early and Late Pure LRIC Groups.

Figure 550 - On-net rate of mobile calls (%)



Source: PTS

8.27.1.2 *Evolution of retail mobile offers*

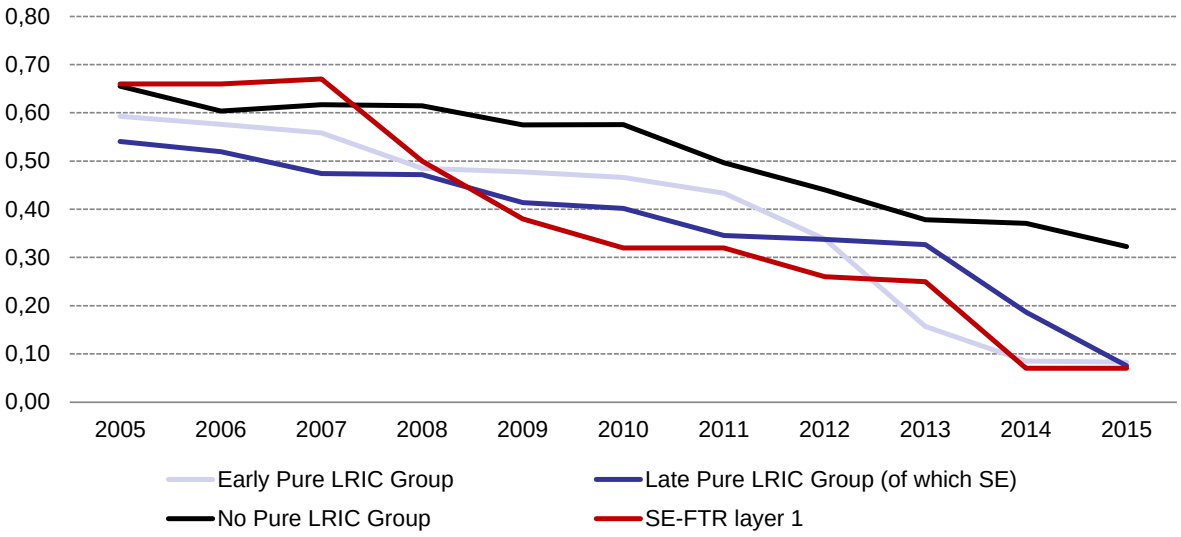
PTS did not answer the question about retail offers.

8.27.2 Fixed market

8.27.2.1 *Quantitative analysis*

Figure 551 compares the level of FTRs in Sweden and the three groups' weighted averages. It can be observed that Swedish FTRs have been continuously dropping since 2007, and are at the same level as the Early Pure LRIC Group since 2014 when it was set at a Pure LRIC level.

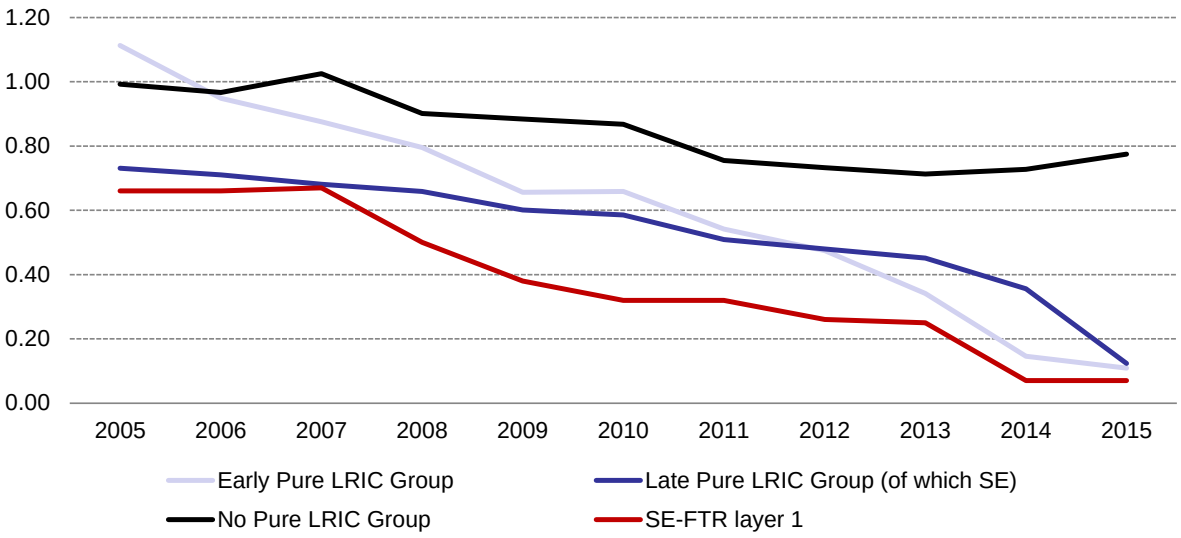
Figure 551 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 552 shows the flat average for the three groups as opposed to the previous figure. It can be observed that Swedish FTRs have been relatively lower than all groups' flat averages since 2005, and are at the same level as the Early Pure LRIC Group since 2014

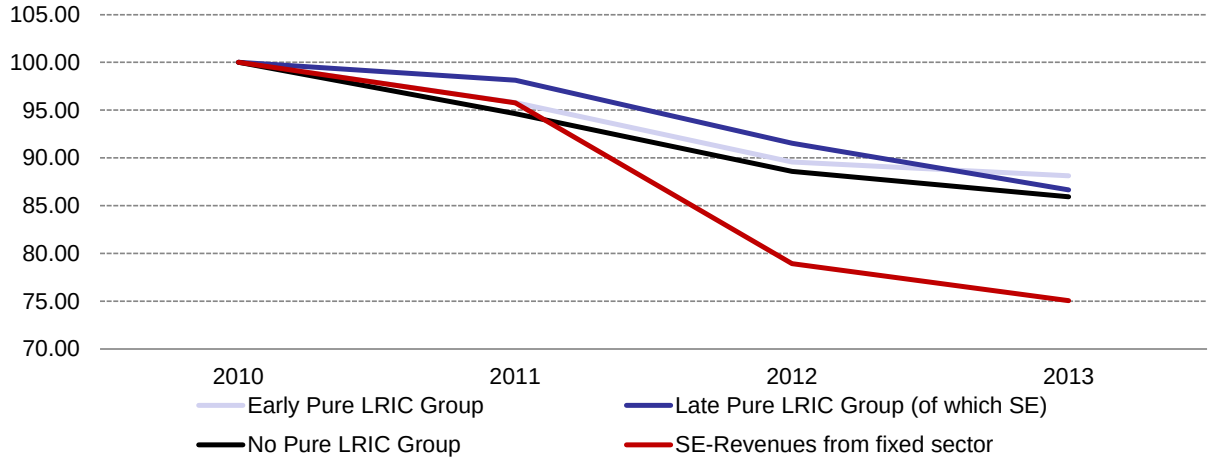
Figure 552 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 553 shows the evolution of revenues from the fixed-line market since 2009 for Sweden. It can be observed that it decreased way more than all groups in 2012. Since 2010, Swedish revenues from fixed-line market have been decreasing more than all groups.

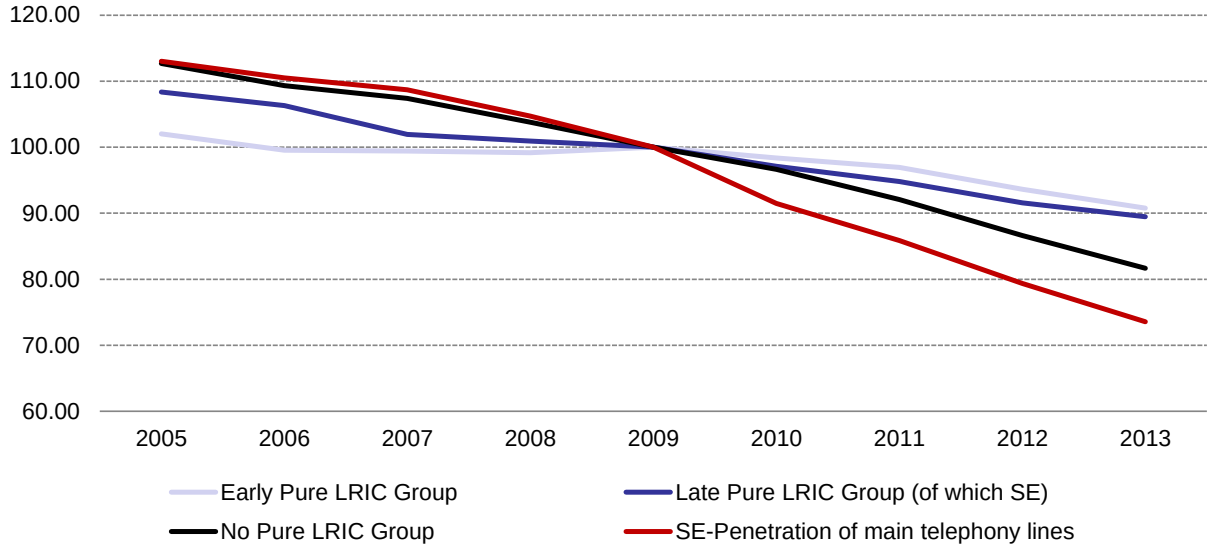
Figure 553 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in Sweden has shown a constant decrease since 2005 with a faster reduction than all groups since 2009. However, since it was on a relatively high level in 2005, the market penetration in 2013 was still higher than the European average.

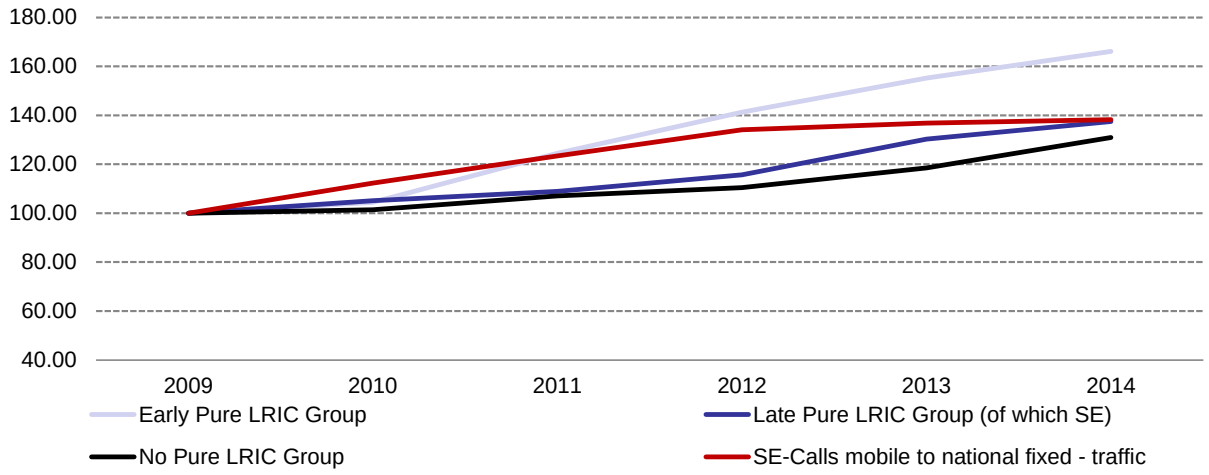
Figure 554 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes of mobile calls to national fixed in Sweden, presented in Figure 555, has shown a steady increase between 2009 and 2014, although it seems to level-off since 2013. Its overall evolution since 2009 is comparable to the Late Pure LRIC Group (+40%)

Figure 555 - Traffic of mobile calls to national fixed (base 100 in 2009)[160]



Source: PTS

8.27.2.2 *Evolution of retail mobile offers*

PTS did not answer the question about retail offers.

8.27.3 Summary

The tables below summarize, for each metric, the difference between Sweden and the average metric for the Early pure LRIC Group in order to highlight how Sweden is positioned against its pair countries.

Figure 556 - Differences between Sweden and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and Sweden
Mobile revenues	Bigger increase than all groups
Mobile investments	Way bigger increase than all groups
Mobile retail prices	
Mobile penetration	Increased more in terms of #SIM cards than Early Pure LRIC Group. Same evolution in terms of Unique Subscribers
Competition in mobile	Close in absolute value to Early Pure LRIC Group. Increased more than its group average
On-net rate	Close to the Early Pure LRIC Group

Source: TERA Consultants

Figure 557 – Differences between the Late Pure LRIC Group and Sweden for the fixed market

Metrics	Differences between the Late Pure LRIC Group and Sweden

[160] From number of minutes

Fixed revenue	Much faster decrease than all groups
Traffic	Close evolution to the Late Pure LRIC Group
Main telephony lines	Faster decrease than all groups

Source: TERA Consultants

8.28 United Kingdom

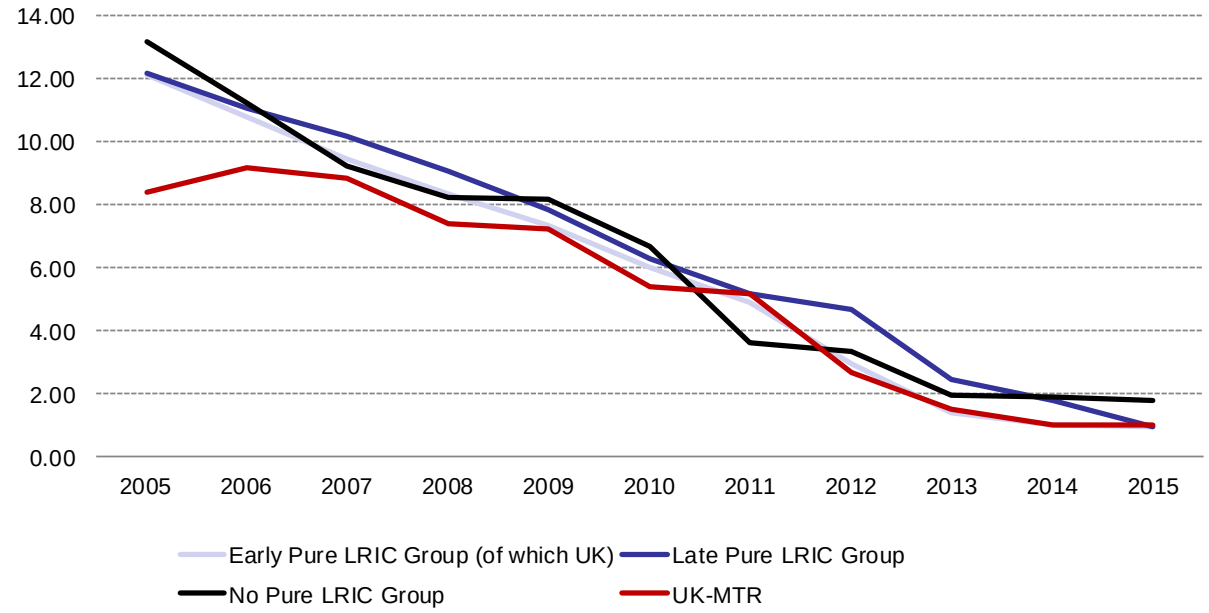
The UK telecommunications market is one of the largest in Europe. It is served by major operators with international presence such as Deutsche Telekom, Orange, Telefonica or Vodafone. Orange and T-Mobile (Deutsche Telekom) recently merged to create EE. The market is also characterised by the growing number of low-cost MVNOs providing effective competition. The UK incumbent is British Telecom and is still leader in the fixed-line market. Since OFCOM decided to implement the pure LRIC approach in 2011 with a three years glide path for the MTR, the country has been allocated to the Early Pure LRIC group for the mobile sector analysis. FTRs however, are set on a Pure LRIC basis since 2014 only. UK has therefore been allocated to the Late Pure LRIC Groups for the fixed sector analysis.

8.28.1 Mobile market

8.28.1.1 *Quantitative analysis*

Figure 556 compares the level of MTRs in the UK since 2005 with the three groups' weighted average MTR. It can be observed that MTRs in the UK have been continuously decreasing since 2007, and have also been in the medium range as compared to other MS. They have been following a very similar trend to the Early pure LRIC Group since 2011 and are at the same level since 2013 and the implementation of the Pure LRIC approach.

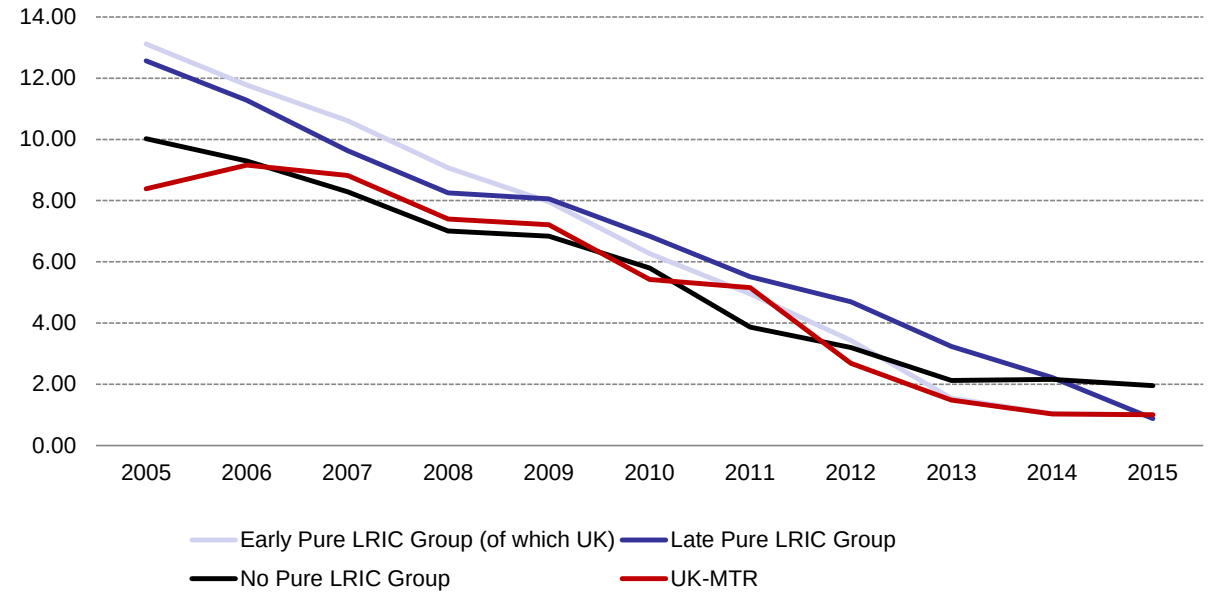
Figure 558 - Mobile termination rates / weighted average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

A flat average MTR has also been calculated for each group (see Figure 557). MTRs in the UK have been in the medium range as compared to the three groups, and have been on the same level as the Early Pure LRIC Group since 2011.

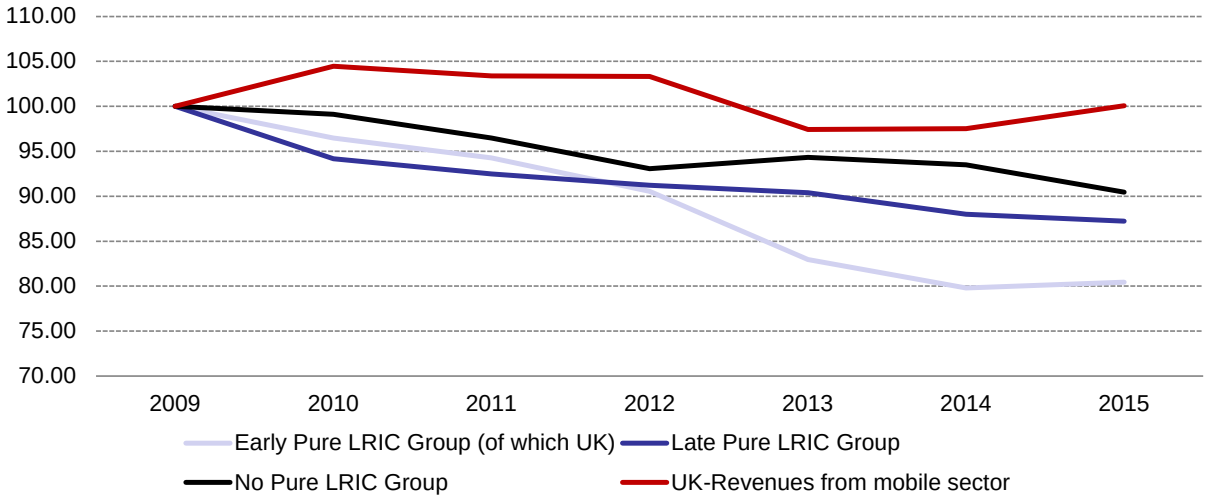
Figure 559 - Mobile termination rates / flat average (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Revenues from the mobile sector presented in Figure 560 have increased in 2010, and have then slowly decreased between 2010 and 2013, and increased in 2015. Between 2009 and 2015, revenues have been overall constant (+0%) whereas they have been decreasing for all groups over the same period (-10% to -20%).

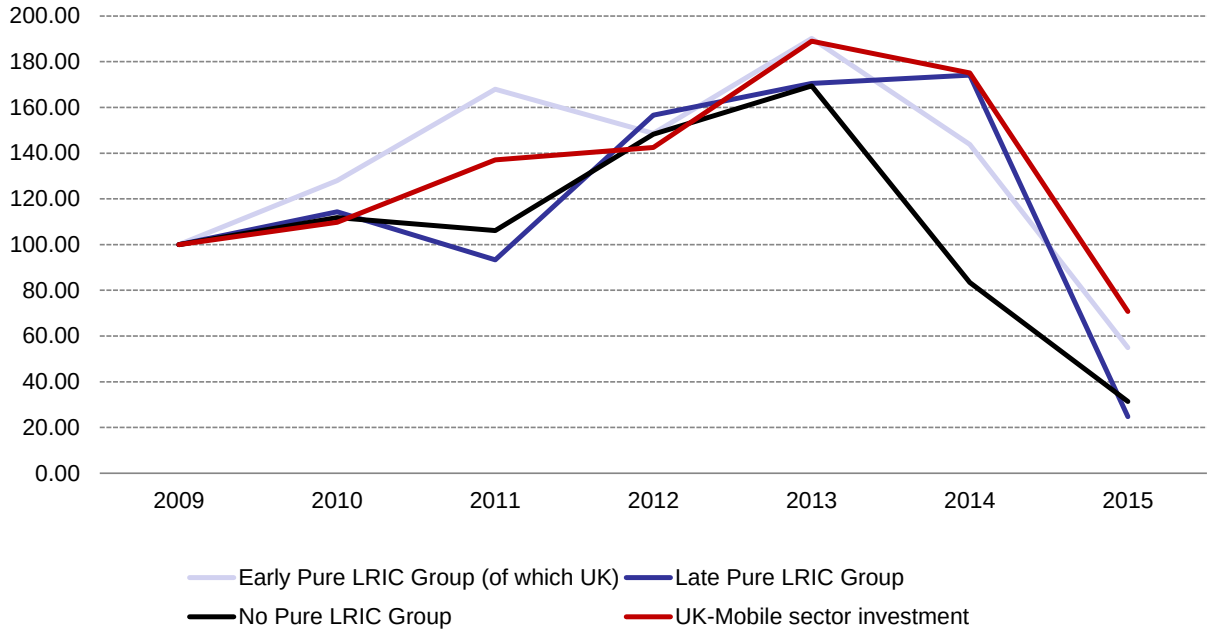
Figure 560 - Mobile revenues (base 100 in 2009)



Source : GSMA

Investments in the UK's mobile sector presented in Figure 561 steadily increased between 2009 and 2013, and have been decreasing ever since, following roughly the Early Pure LRIC Group trend since 2012.

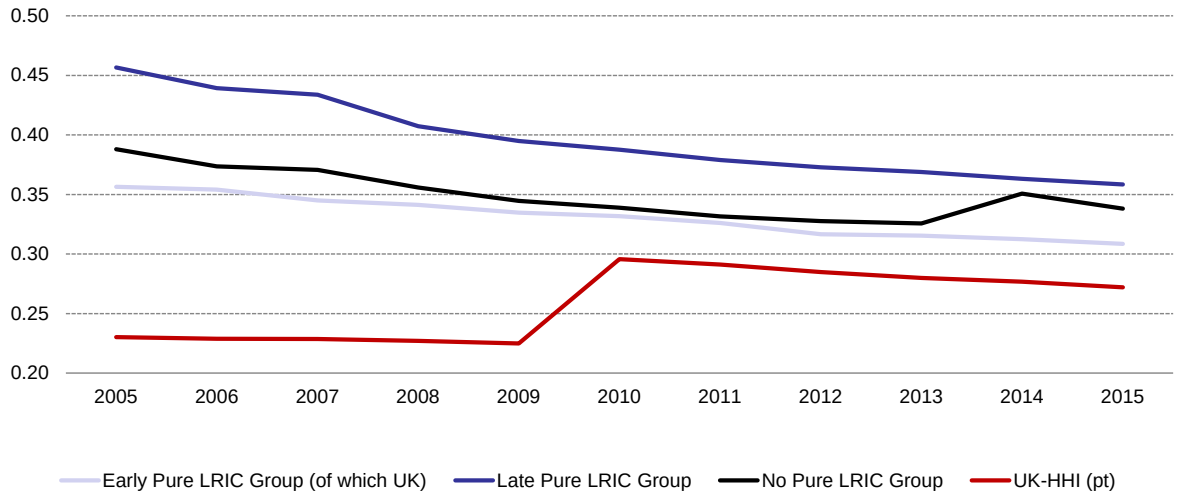
Figure 561 - Mobile investment (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The market concentration measured with the HHI presented in Figure 562 has been way lower than all groups since 2005. It has been continuously decreasing, with an exception in 2010 following the merger between Orange and T-Mobile to create EE.

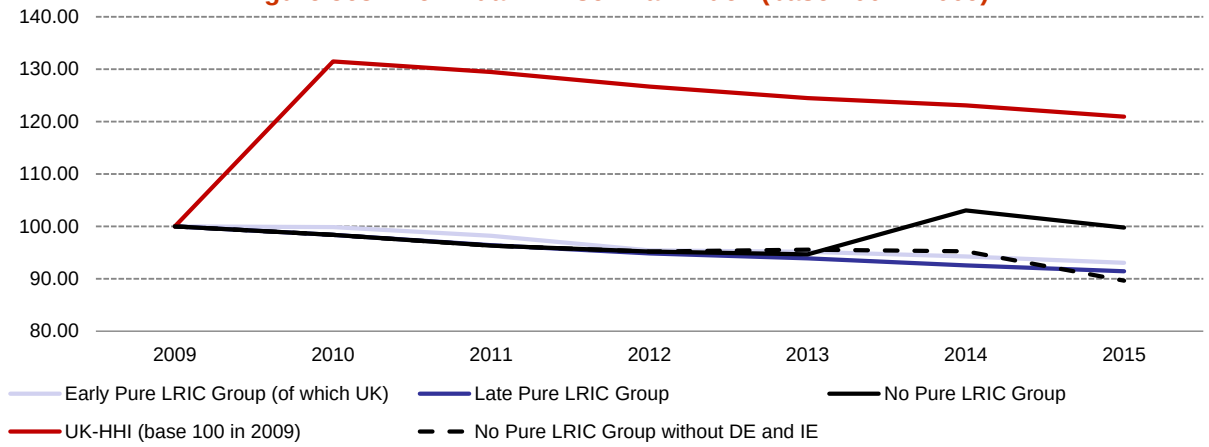
Figure 562 - Herfindahl-Hirschman Index (%)



Source: TERA Consultants from Eurostat & Digital agenda

More specifically, the strong increase in 2010, followed by the reduction of the market concentration can be observed with Figure 563 presenting the HHI as base 100 in 2009.

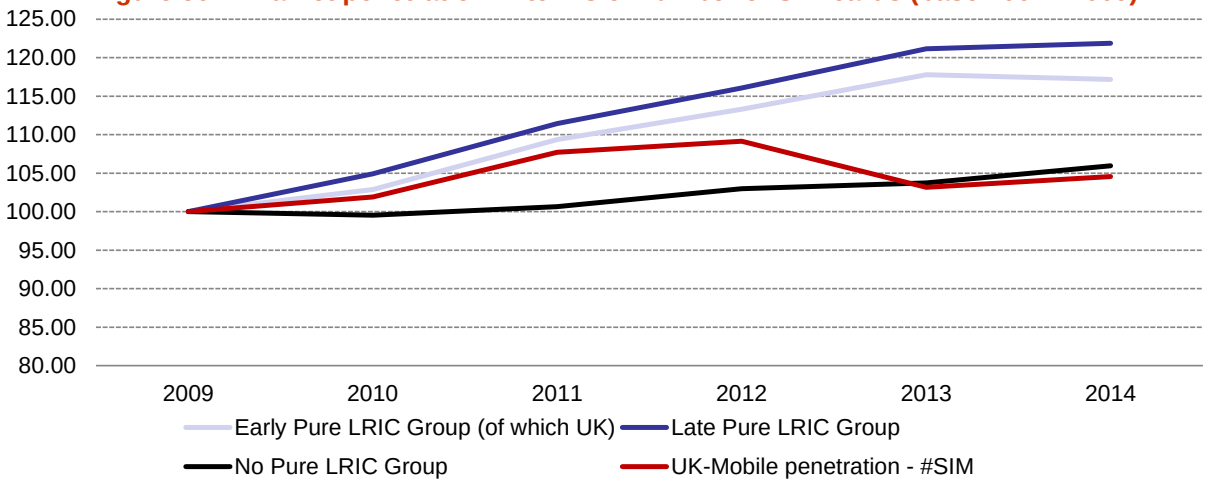
Figure 563 - Herfindahl-Hirschman Index (base 100 in 2009)



Source: TERA Consultants from Eurostat & Digital agenda

The UK's market penetration in terms of number of SIM increased between 2009 and 2012, then decreased in 2013 and slightly grew in 2014. Its overall evolution since 2009 is the same as the No Pure LRIC Group. In 2014, it is a bit lower than the European average.

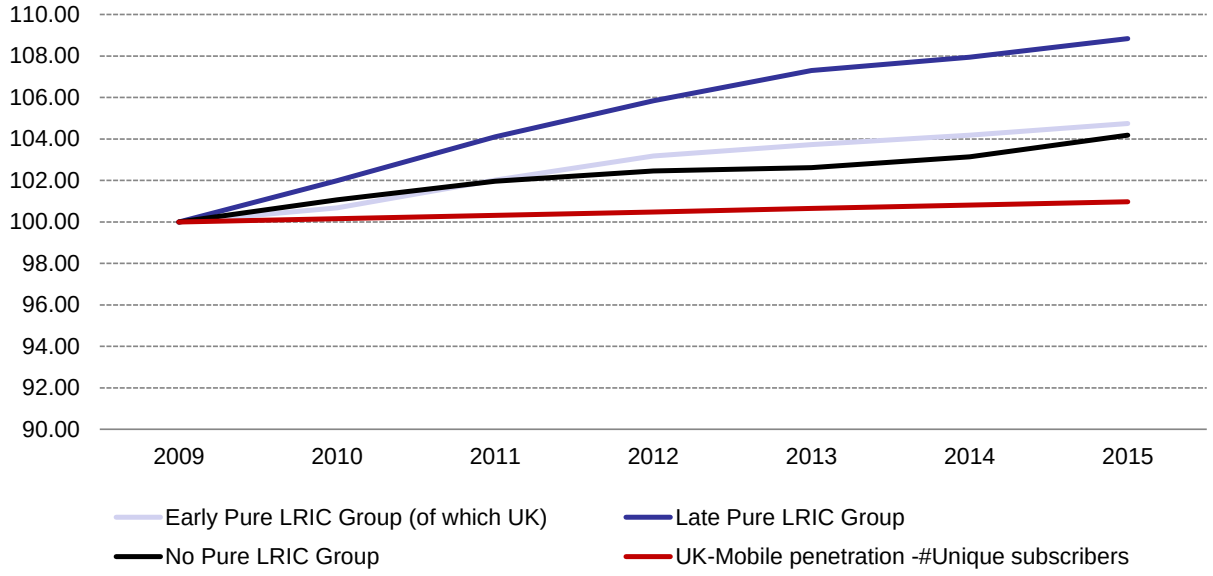
Figure 564 - Market penetration in terms of number of SIM cards (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

The market penetration in terms of unique subscribers presented in Figure 565 has been fairly constant since 2009 in the UK, whereas it has been increasing for all groups. However, since it started from a high level, it is in 2015 higher than most MS.

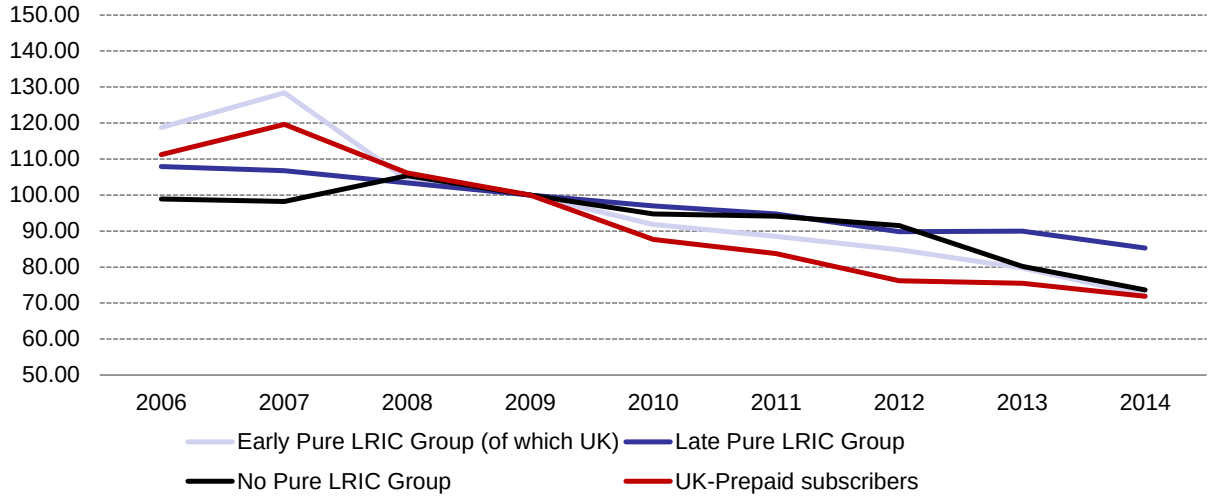
Figure 565 - Market penetration in terms of unique subscribers (base 100 in 2009)



Source: TERA Consultants from GSMA

Figure 566 shows the share of prepaid subscribers in the UK compared to the three groups. It can be observed that it has been continuously dropping since 2007, more than any other group, although the No Pure LRIC Group has been decreasing faster over the past two years. The share of prepaid customers in 2014 in the UK is at 43%.

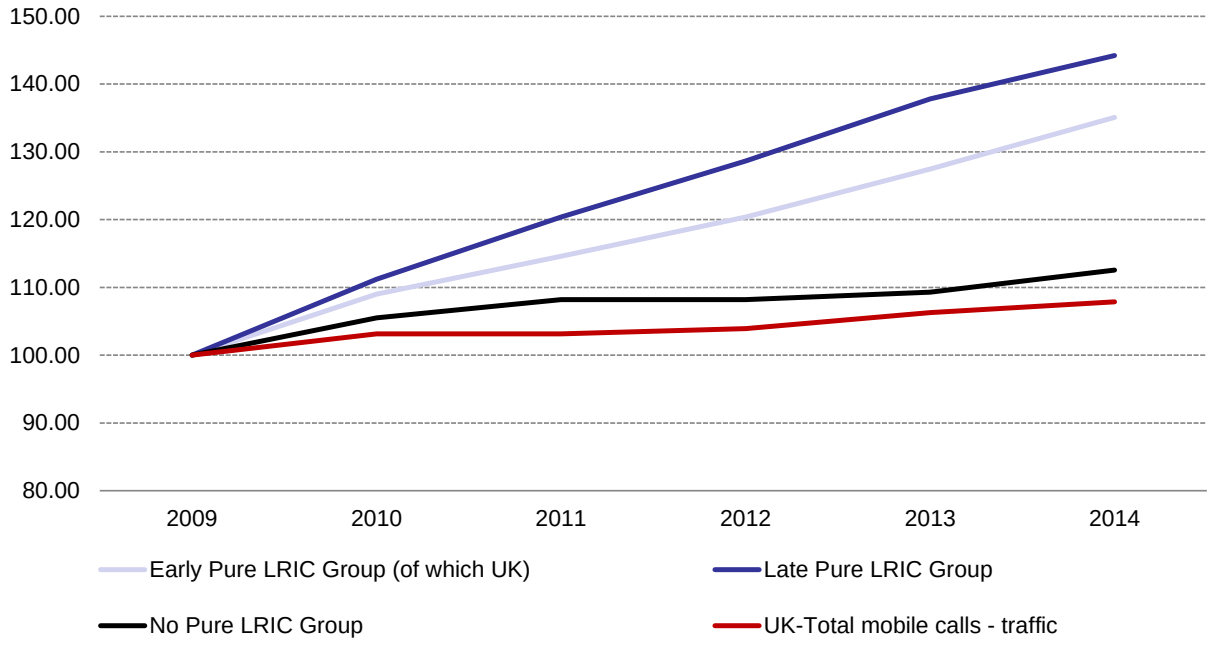
Figure 566 - Share of prepaid subscribers in the mobile market (base 100 in 2009)



Source: TERA Consultants from GSMA, EC reports & Digital agenda

Figure 567 shows the evolution of the amount of minutes of mobile calls. It has only been slightly increasing since 2009, following a more comparable trend to the No Pure LRIC Group than its own group.

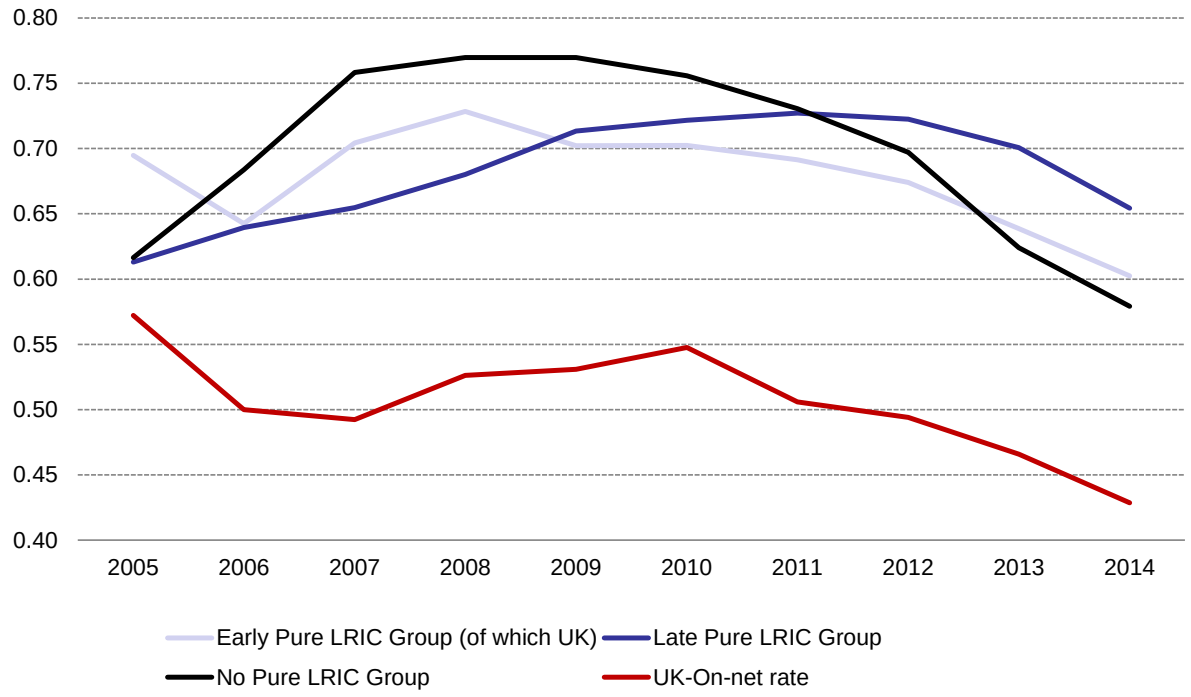
Figure 567 - All mobile calls - traffic (base 100 in 2009)



NRAs Replies to questionnaire

Figure 568 shows the share of on-net mobile calls in the UK compared to the three groups. It can be noticed that it is at a way lower level in the UK than all groups due to the important level of competition in the UK's mobile market. It has also kept on decreasing since 2010, "*following the path of MTRs reduction*" according to OFCOM.

Figure 568 - On-net rate of mobile calls (%)



Source: OFCOM

8.28.1.2 *Evolution of retail mobile offers*

In its "Mobile call termination market review 2015-18" OFCOM has made several statements about the evolution of retail mobile offers, and prices in general. OFCOM first noticed that

overall, there does not appear to have been a significant increase in average mobile retail prices as a result of the move to LRIC based MTRs.

Concerning post-pay consumers, OFCOM stated that there seems to be a "*benefit from lower prices now than in 2011 in accordance with the CC's expectations in 2012 about the impact on customers with a ratio of outbound to inbound MTR-affected traffic higher than one*." OFCOM noticed in particular that:

- 3G post-pay bundles which existed in 2011 and before still exist today and their subscription prices appear to be much lower today;
- Whilst 4G offers have appeared since 2012, and are generally more expensive than the 3G contracts available today, these are offered alongside rather than in place of the latter. Recently, some operators have even started to upgrade customers on 3G contracts to 4G at no extra charge to the customer

Concerning high-usage pre-pay customers, they also seem to benefit more from lower prices now than in 2011 according to OFCOM, which makes sense since these customers are potentially net makers of MTR-affected calls.

Concerning low-usage pre-pay customers, OFCOM noticed that:

- Two of the largest operators (EE and Vodafone) have increased their entry-level pre-pay call charges. However, O2 has maintained its charges constant since 2011 and Telefonica (which owns O2) offers lower prices through its associated brands and H3G has reduced all its call charges substantially;
- Overall, there is still a wide range of operators, covering half of the pre-pay market, offering tariffs for basic pre-pay plans at the same or similar prices as in 2011.

OFCOM stated that compared to 2011, prices for post-pay customers and high-usage pre-pay customers appear lower. The basic pre-pay prices also appear to be lower than in 2011 or at least at the same level, while low usage pre-pay tariffs appear to be more expensive.

About the concerns from several operators that Pure LRIC would result in significantly higher prices overall, OFCOM stated that the choice of cost standard did not have this effect, and furthermore, these trends could be affected by factors such as falling costs and broader trends in the provision of mobile services generally.

OFCOM "*would expect that, going forward, segments that are net makers of MTR affected calls would be better off under LRIC than under LRIC+*."

And for segments that are net-receivers of MTR-affected calls, OFCOM noticed that prices may be slightly higher under Pure LRIC, "*although this may be counteracted by an increase in competition, or more generally falling costs of provision."*

Concerning on-net/off-net differentiation, OFCOM observed that it is very likely to be affected by MTR changes, and noticed that the differentials have fallen following the path of MTRs' decline. However these differentials could have been affected by other factors and OFCOM thought that the choice of the cost standard may have more limited effects than was the case in the past.

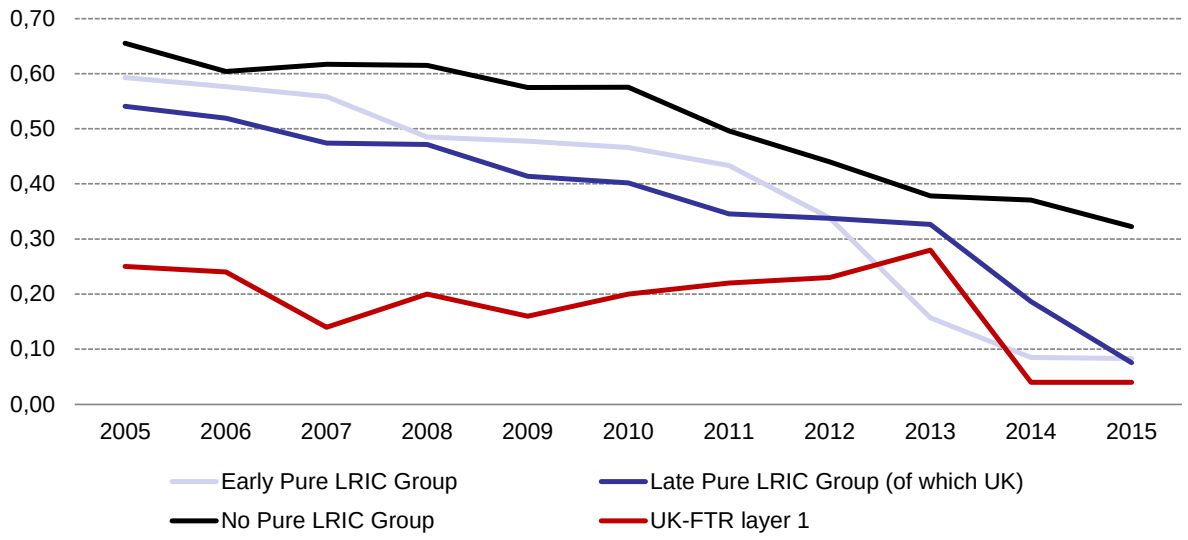
OFCOM lowered the influence of the implementation of Pure LRIC since the difference between the projected LRIC+ and projected LRIC was extremely thin.

8.28.2 Fixed market

8.28.2.1 *Quantitative analysis*

Figure 569 compares the level of FTRs in the UK to the weighted averages of the three groups. It can be observed that UK's FTRs have been way lower than all groups from 2005 to 2012. In 2014, it strongly decreased to a Pure LRIC level, and is since 2014 at an even lower level than the Early Pure LRIC Group.

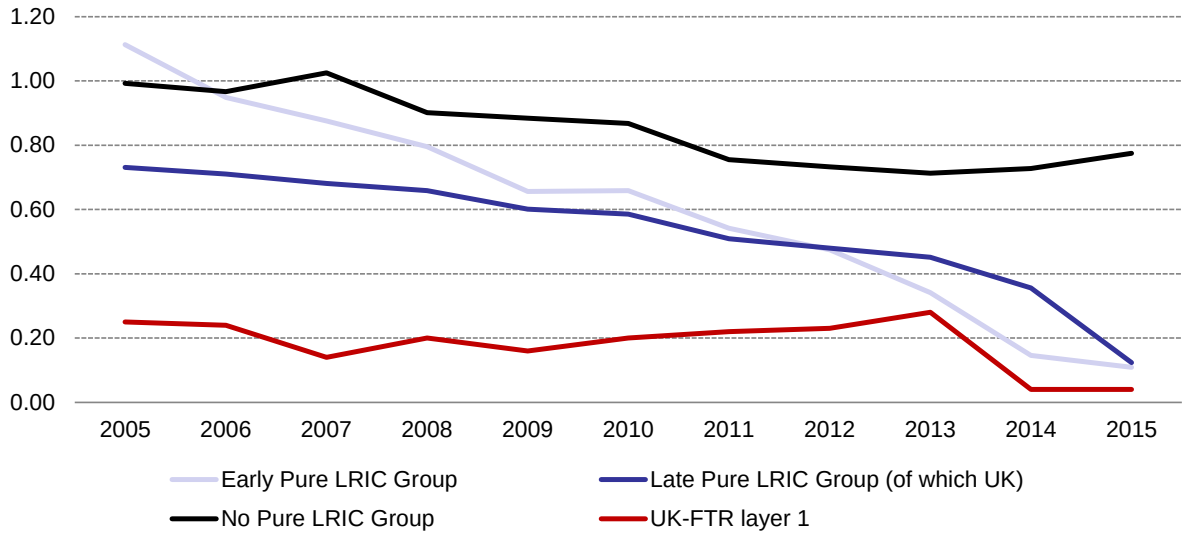
Figure 569 - Fixed termination rates weighted average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 570 shows the flat average for the three groups as opposed to the previous figure. When considering flat averages, it can be observed that UK's FTRs have been constantly below all groups.

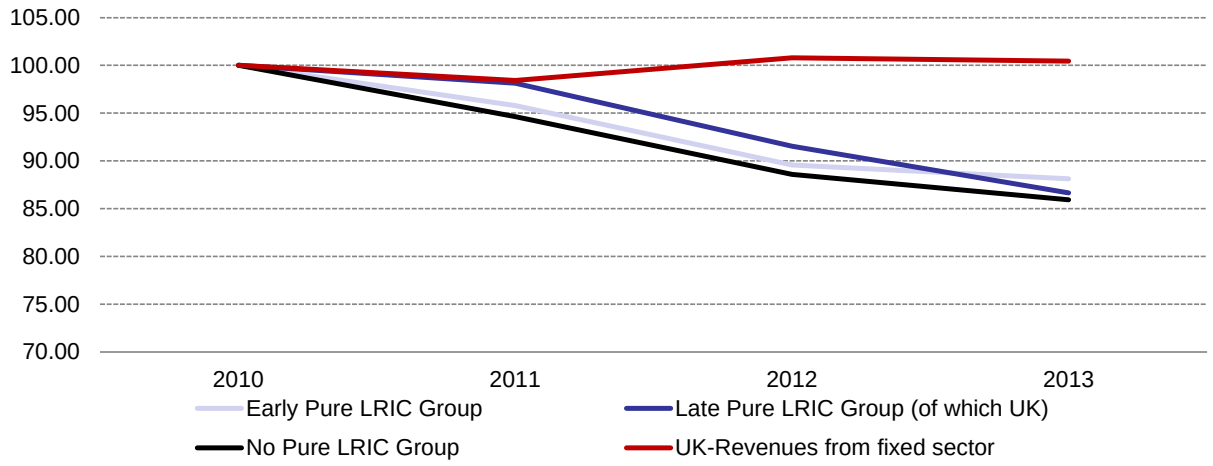
Figure 570 - Fixed termination rates flat average - layer 1 (EURcts/min)



Source: TERA Consultants from BEREC & EC reports

Figure 571 shows the evolution of revenues from the fixed-line market since 2010 in the UK. It can be observed that it has been constant since 2010 whereas revenues have been falling for all groups over the same period.

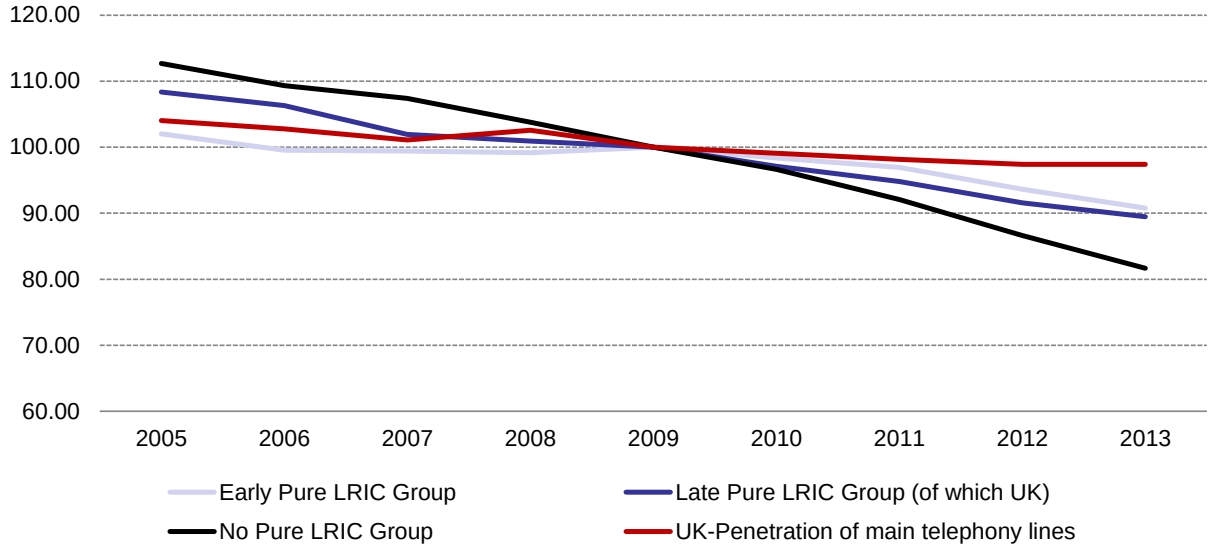
Figure 571 - Fixed revenues (base 100 in 2009)



Source : GSMA, Digital Agenda & Eurostat turnover

The number of main telephony lines in UK has shown a constant and slow decrease since 2005, with a slower reduction than all groups since 2009, as observed with Figure 572. The market penetration in the UK was therefore in 2013 higher than in most European countries.

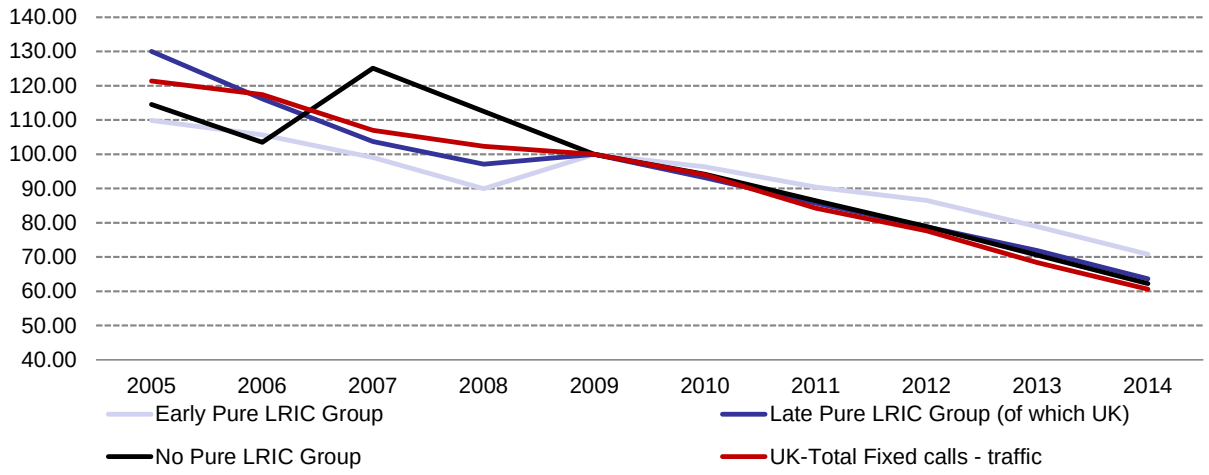
Figure 572 - Evolution of the market penetration of main telephony lines (base 100 in 2009)



Source: TERA Consultants from Eurostat

The amount of minutes from fixed calls in UK presented in Figure 573 has shown a constant decrease since 2009. It has been following a comparable trend to the Late and No Pure LRIC Groups, whereas the Early Pure LRIC Group has been declining way slower.

Figure 573 - Traffic of fixed calls (base 100 in 2009)



Source: OFCOM

8.28.2.2 *Evolution of retail fixed offers*

Concerning the evolution of retail fixed offers, OFCOM stated that they had no evidence about the influence of lower FTRs.

Furthermore, OFCOM noticed that although F2M calls are not usually included in basic bundles, a number of fixed operators now offer add-ons that include calls to mobiles, and provided few examples of bundles offered by different operators. In 2011:

- Talk Talk: 100 F2M minutes add-on for £2.99, and 200 F2M minutes add-on for £4.99.
- Post Office: Unlimited week-end F2M calls for £12.25

And in 2015:

- Talk Talk: unlimited calls to UK landline and mobile, and calls to 58 international destinations for £5
- Post Office: the same offer but as an add-on for £1.25
- EE/Orange: 1000 F2M minutes add-on for £5
- Plusnet: 100 F2M minutes add-on for £3

OFCOM stated that prices for fixed-line consumers would be expected to be lower when MTRs are at LRIC rather than LRIC+.

8.28.3 Summary

The tables below summarize, for each metric, the difference between the United Kingdom and the average metric for the Early pure LRIC Group in order to highlight how United Kingdom is positioned against its pair countries.

Figure 574 - Differences between United Kingdom and its group for the mobile market

Metrics	Differences between the Early Pure LRIC Group and United Kingdom
Mobile revenues	Bigger increase since 2011 for UK than Early Pure LRIC Group
Mobile investments	Close to the Early Pure LRIC group

Mobile retail prices	Not available
Mobile penetration	Same trend followed in terms of #SIM cards than No Pure LRIC Group. Lower penetration for UK in terms of Unique Subscribers than all groups
Competition in mobile	Followed the same trend since 2011, starting from a higher level in 2009
On-net rate	Way lower than all groups

Source: TERA Consultants

Figure 575 – Differences between the Late Pure LRIC Group and United Kingdom for the fixed market

Metrics	Differences between the Late Pure LRIC Group and United Kingdom
Fixed revenue	Constant whereas all groups decreased
Traffic	Very close to the Late Pure LRIC Group
Main telephony lines	Slower decrease than all groups

Source: TERA Consultants

8.29 Conclusion of the country by country analysis

In this part, the study assesses whether all the metrics reviewed in section 4 and in the country by country analysis are homogeneous or heterogeneous inside each group. This section constitutes a review for each country in the country by country analysis provided in section 5. This is conducted for the Early, Late and No Pure LRIC Groups. The study also summarizes all NRAs statements about the impact of the TRR.

Figure 576 - Review of the 2009 IA for the Early Pure LRIC Group

Metrics	Countries consistent with the average of their group	Heterogeneous or homogeneous
Mobile Revenues	Belgium, Denmark, France, Slovakia (4 out of 14)	Heterogeneous
Mobile investments	Belgium, United Kingdom (2 out of 14)	Heterogeneous
Mobile retail prices	Czech Republic, Italy, Spain (3 out of 4 available)	Homogeneous
Mobile penetration	Austria, Belgium, Denmark, Estonia, France, Slovakia, Sweden, United Kingdom (8 out of 14)	Homogeneous
Competition in mobile sector	Austria, Estonia, Italy, Spain, Sweden, United Kingdom (6 out of 14)	Heterogeneous
On-net rate	Belgium, Lithuania, Spain, Slovakia, Sweden (5 out of 9)	Homogeneous
Fixed revenues	Bulgaria, Slovakia (2 out of 7)	Heterogeneous
Fixed traffic	France, Portugal, Slovakia (3 out of 7)	Heterogeneous
Main telephony lines	France, Malta (2 out of 7)	Heterogeneous

Source: TERA Consultants

Figure 577 - Review of the 2009 IA for the Late Pure LRIC Group

Metrics	Number of country consistent with the average of its group	Heterogeneous or homogeneous
Mobile Revenues	Slovenia (1 out of 9)	Heterogeneous
Mobile investments	Bulgaria, Greece, Slovenia (3 out of 9)	Heterogeneous
Mobile penetration	Bulgaria, Croatia, Greece, Latvia, Slovenia (5 out of 9)	Homogeneous

Competition in mobile sector	Bulgaria, Croatia, Greece (3 out of 9)	Heterogeneous
On-net rate	Bulgaria, Hungary	Homogeneous
Fixed revenues	Italy (1 out of 10)	Heterogeneous
Fixed traffic	Sweden, United Kingdom	Heterogeneous
Main telephony lines	Croatia, Italy, Ireland, Latvia and Spain (5 out of 10)	Homogeneous

Source: TERA Consultants

Figure 578 - Review of the 2009 IA for the No Pure LRIC Group

Metrics	Number of country consistent with the average of its group	Heterogeneous or homogeneous
Mobile Revenues	Germany (1 out of 5)	Heterogeneous
Mobile investments	Netherlands (1 out of 5)	Heterogeneous
Mobile penetration	Cyprus, Finland, Ireland, Netherlands (4 out of 5)	Homogeneous
Competition in mobile sector	Germany, Finland, Ireland, Netherlands (4 out of 5)	Homogeneous
On-net rate	Only German data was available	Not available
Fixed revenues	Germany, Latvia and Poland (3 out of 9)	Heterogeneous
Fixed traffic	Belgium, Poland	Heterogeneous
Main telephony lines	Cyprus	Heterogeneous

Source: TERA Consultants

Figure 579 – Summary of NRAs statements about the influence of the TRR on fixed and mobile sectors' evolutions

Country	Mobile sector	Fixed sector
Austria	One of the drivers	Limited influence
Belgium	One of the drivers	Implemted too recently to observe any change yet
Bulgaria	One of the drivers	One of the drivers
Croatia	No influence yet	No influence yet
Cyprus	Not implemented	Not implemented
Czech Republic	Limited influence	Limited influence

Denmark	One of the drivers	Not available
Estonia	One of the drivers	Not implemented
Germany	Not implemented	Not implemented
Greece	One of the drivers	One of the drivers
Finland	Not implemented	Not implemented
France	Main driver	Main driver
Hungary	One of the drivers	One of the drivers
Ireland	Not implemented yet	Not available
Italy	One of the drivers	Main driver
Lithuania	Limited influence	Not implemented
Luxembourg	Limited influence	Limited influence
Latvia	One of the drivers	Limited influence
Malta	One of the drivers	Main driver
Netherlands	Not implemented	Not implemented
Poland	Main driver	Not implemented
Portugal	Main driver	Not available
Romania	One of the drivers	One of the drivers
Spain	One of the drivers	Limited influence
Slovakia	Not available	Not available
Slovenia	Not available	Not available
Sweden	Not available	Not available
United Kingdom	Limited influence	Limited influence

Source: TERA Consultants

It can be concluded that:

- Termination rates in general have been on a downward trend in Europe, and are all converging towards comparable levels, around 1 EURct/min, although countries of the No Pure LRIC Group seem to bottom-out slightly higher than the two other groups, around 1.7 EURct/min.
- The decrease of retail prices for both mobile and fixed calls has also been pretty homogeneous for all groups.
- The On-net rate has been, despite some rare exceptions, decreasing for all groups. This has been noticed by most NRAs in their answer to the EC, with a decreasing number of plans offering on-net/off-net differentiation.

The main goal of the TRR was to limit the asymmetries among the Member States in Europe. Considering the overall decrease of the termination rates, as well as the decline of the on-net

rate and of the number of on-net/off-net differentials in retail offers, it can be concluded that the TRR has been successful on these points.

Regarding the remaining metrics, such as investments, revenues and competition, the overall impact of the TRR is harder to observe since it only has a limited impact compared to the financial crisis for investments and revenues, or the different mergers described in the study for the level of competition.

9 Appendix 4 – List of acronyms

Figure 580 – List of acronyms

Acronyms	Description
CAGR	Compound Annual Growth Rate
MTRs	Mobile Termination Rates
FTRs	Fixed Termination Rates
MS	Member States
LRIC	Long Run Incremental Cost
LRAIC	Long Run Average Incremental Cost
TRR	Termination Rates Recommendation
EC	European Commission
EU	European Union
NRA	National Regulation Authorities
IA	Impact Assessment
EBIT/EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
HHI	Herfindahl-Hirschmann Index
US	United States
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland

IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom

Source: TERA Consultants

10 Appendix 5 – Figures and tables

European Commission

Assessment of the 2009 Termination Rates Recommendation and costing methodologies for estimating termination rates – Final report

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