Report for ComReg

Pricing principles and methodologies for future regulation of wholesale voice call termination services

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Contents

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1 Executive summary

ComReg has commenced analysis of the communications markets for wholesale fixed voice call termination (FVCT) and wholesale mobile voice call termination (MVCT). These correspond to Market 1 and Market 2 respectively, as set out in the European Commission (EC) Recommendation 2014/710/EU. The current decisions in place for these markets are based on ComReg's existing finding of significant market power (SMP) and both use cost models calculating a pure long-run incremental cost (LRIC) of termination. Since July 2015, the fixed termination rate (FTR) has been EUR0.072 cents per minute. The mobile termination rate (MTR) fell to EUR0.84 cents in September 2016, to EUR0.82 cents in 2017 and to EUR0.79 cents in 2018.

For regulation of FVCT and MVCT, ComReg must rely on analysis which considers its statutory objectives set out in Ireland's 2002 Communications Act (as amended) and the Access Regulations, whilst also taking utmost account of the European Commission (EC) Recommendation on the regulatory treatment of fixed and mobile termination rates published in May 2009 ('2009 EC Recommendation').[1] ComReg must assess whether ex ante regulation is appropriate in the relevant markets, having defined these markets in the Irish context.

Our report considers the pricing principles for ComReg to apply in its future decision instrument (i.e. the legal regulation) and the development of pricing models, taking into account the findings of ComReg's draft Market Review.[2] This includes the competition problems that may exist and the proposed regulatory obligations to be imposed by ComReg to address such problems. We have also reviewed market information on the fixed and mobile voice communications markets in Ireland, recognising that this already reflects the market conditions in the presence of regulation.

Our considerations are:

- the pricing control employed, covering both the type of control and the costing increment
- the model structure to be used for costing purposes
- aspects of the costing approach
- the degree of consistency in the approach taken for FVCT and MVCT.

We outline our recommendations below.

[1] See European Commission Recommendation: "The Regulatory Treatment of Fixed and Mobile Termination Rates in the EU" (2009/396/EC), dated 7 May 2009. Available at, for example, http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2009/c_2009_3359_en.pdf.

[2] The draft was published for consultation in October 2017. See https://www.comreg.ie/media/dlm_uploads/2017/10/ComReg1790r.pdf

1.1 Price control

Although there are alternative price controls for voice termination such as bill and keep, or receiving party pays, ComReg's existing approach (and the preference of the 2009 EC Recommendation) is to use cost-oriented pricing. We see no need to deviate from that approach. Cost-oriented pricing is justified as a proportionate and suitable method of regulation, given the risk of excessive pricing for MVCT and FVCT.

Regarding the type of costing increment to use for the price control, ComReg can use either fully allocated costing, average increments, service ('pure') increments or a marginal increment. Figure 1.1 sets out the findings of our overall assessment according to ComReg's objectives.

Figure 1.1: Assessment of choice of increment against ComReg's objectives [Source: Analysys Mason, 2018]

Source	Objective	Outcome that best achieves objective	Reasoning
Regulation 13(1) to 13(3)	Promotion of efficiency	Pure LRIC	Allocative efficiency is best achieved through marginal costs, which can be approximated through pure LRIC
	Maximising of consumer benefits	Pure LRIC	Applying a lower rate reflects the economic efficiencies of call externalities (network externalities are negligible in Ireland)
	Comparisons with comparable markets	Pure LRIC	Would be consistent with ComReg's previous voice call termination decision and with the approach in almost all other EU Member States
	Development of a publishable cost accounting methodology	No preference	Equally achievable for either LRAIC+ or pure LRIC, as both now have a long history of transparent development
2002 Communications Act (as amended)	Promotion of competition through choice, price and quality	Low interconnection rates	Operators will pay less for off-net calls and will therefore be more inclined to offer larger bundles of usage, and including cross-network calling Small operators can overcome tariff-mediated network externalities more easily
	Promotion of competition through innovation and efficient investment	Pure LRIC or low rates	Recovery of a greater proportion of costs in the competitive market encourages operators to be efficient, and operators have a wide range of options for accruing revenues and recovering costs Net financial impact of termination rate changes will now be small
	Contribution to the development of the internal market	Pure LRIC	The EC recommends the pure LRIC methodology and almost all other EU Member States have now implemented pure LRIC for voice call termination markets. ComReg must take utmost account of the EC's Recommendations.

Source	Objective	Outcome that best achieves objective	Reasoning
	Promotes interests of end-users	Low rates	Supports larger bundles of usage Fixed-only subscribers and other 'disadvantaged' groups benefit from lower MTRs when calling mobile networks

Having considered economic, efficiency and competitive aspects of both voice call termination markets, as well as considering the view of the EC, we recommend that ComReg continue to apply 'pure' incremental costing for FVCT and MVCT services. This choice is consistent with ComReg's statutory objectives, as set out in Paragraph 13 of the Access Regulations.

1.2 Model structure

The Irish High Court has previously rejected a calculation of call termination rates based on a benchmark of termination rates in other EU Members States, indicating that it did not reflect Irish-specific costs and was not as transparent as using a model.[3]

Hence, for a modelling approach, two structures are used in the costing of networks, referred to as 'top-down models' and 'bottom-up models'. There have been many examples of regulators making use of both structures in a "hybridised" approach, in which the outputs of the bottom-up model can be adjusted to reflect aspects of outputs from top-down operator information. Such adjustments can be referred to as *top-down validation*. Recitals 2 and 3 of the 2009 EC Recommendation specifically state the use of a bottom-up model, with the possibility of comparison to top-down data. We recommend this approach to ComReg as it is consistent with best practice for assessing the reasonably efficient costs of supplying wholesale termination services and also takes into account the requirements of the 2009 EC Recommendation.

Given ComReg's current planned timetable for undertaking both the Market Review and the pricing decisions, ComReg could apply new decisions relating to pricing using the costs of MVCT from 2019 onwards and the costs of FVCT at any time. Therefore, we recommend that the cost models calculate costs per minute for at least the years 2017-2022 in nominal currency.

[3] See paragraph 88 at http://www.bailii.org/ie/cases/IEHC/2013/H382.html.

1.3 Costing approach

Although several aspects of the modelling are specific to the modelling workstreams commissioned by ComReg, there are several overarching principles to consider, including the type of operator modelled, depreciation method, assumed scale, demand forecasting and how the modelled technologies are chosen.

We believe that hypothetical efficient existing operators should be modelled, since actual operator costs are likely to capture past inefficiencies. This is also consistent with the 2009 EC Recommendation. However, operator-specific information, including cost information, should be considered. The development of the cost models should use inputs based on the analysis of information from the actual operators, and should consider an analysis of their actual cost levels, to ensure that the modelled operators do not underestimate a reasonable level of efficient investment and rate of return. The models should also be shared with the relevant operators in a consultation procedure, so that operators have an opportunity to raise comments where they believe specific costs or other inputs should be applied in the models. This would be a transparent approach that adheres to ComReg's statutory objectives.

We consider that the use of economic depreciation should be the starting point for cost recovery over time. However, an alternative method can be used provided it can be justified as being a good approximation to the economic cost recovery over the lifetime of the network assets. This consideration also takes into account the 2009 EC Recommendation.

The modelled hypothetical existing operators should be assumed to have productively-efficient scale during the next regulatory period, which we believe can be approximated by the average scale of the actual number of large network operators having near-100% population coverage in Ireland. Since the telecoms voice markets are contestable, we believe it is reasonable to assume immediate scale, with reasonable demand forecasts assumed across all modelled services carried by the networks.

Modern technologies for the future regulatory period should be chosen to ensure future dynamic efficiency benefits are captured, as described below.

1.4 Degree of consistency in the approach for FVCT/MVCT

This section considers the aspects of ComReg's approach to the costing of FVCT and MVCT where, in our view, consistency will be beneficial to consumers and the market, or useful for interpreting the results from separate FVCT and MVCT cost models.

Consumers require the ability to make any-to-any calls, reaching other subscribers on all other networks. FVCT and MVCT perform a very similar function insofar as they facilitate the completion of calls to all other subscribers served by different service providers[4]. Therefore, ComReg's approach to regulating FVCT and MVCT should not distort consumer choices for consuming, and operator incentives for supplying, the various necessary call termination possibilities. Both markets are also subject to similar bottlenecks. Therefore, consistency of treatment will be needed for both MVCT and FVCT. We highlight that applying consistent costing *principles* for FVCT and MVCT is not the same as deriving similar cost *results* due to the inherent structural differences in fixed and mobile network costs.

The key areas of consistency are for both approaches to apply symmetric pricing for the regulated service providers. This includes new fixed service providers (FSPs) and mobile service providers (MSPs) such as MVNOs. In addition, both approaches should recognise dynamic efficiency in the modelling, and have an internally consistent forecast of the Irish voice market. With regards to dynamic efficiency in particular, this means that the model should not just assume by default that current static technology efficiencies still apply into the future without any dynamic benefits (e.g. from successive generations or improvements in technology).

The models should also calculate the costs not recovered if a pure LRIC approach is applied to voice termination, in case this needs to be considered by ComReg in the context of other relevant markets (e.g. related to wholesale fixed origination).

Regarding the pricing of call termination, we recommend using the models to derive costs for individual twelve-month periods. We do not believe that ComReg should need to update the model within the pricing period of the decision unless evidence of significant divergence of forecasts or other model inputs from reality, leading to material changes in the models' results, is brought to ComReg's attention.

4 Excluding calls international, 1800, 1850 or 1890 numbers

2 Introduction

ComReg has commenced analysis of the communications markets for wholesale fixed voice call termination (FVCT) and wholesale mobile voice call termination (MVCT). These correspond to Market 1 and Market 2 respectively, as set out in the European Commission (EC) Recommendation 2014/710/EU.[5] ComReg's draft Market Review covers the fixed service providers (FSPs) and mobile service providers (MSPs) operating in these two markets. The current decisions in place for these markets are based on ComReg's existing finding of significant market power (SMP) and both use cost models calculating a pure long-run incremental cost (LRIC) of termination.

In this section, we:

- summarise the existing termination regulation in Section 2.1
- set out ComReg's statutory objectives in Section 2.2
- describe the key aspects of the 2009 EC Recommendation on termination costing in Section 2.3
- outline the structure of the remainder of this report in Section 2.4.

2.1 Existing termination regulation

In Ireland, the current definition of FVCT generally corresponds to a service like the "primary" interconnect in the wholesale fixed voice offering of eircom Limited ('eir'); that is, the nearest point to the end-user at which incoming voice calls can be handed over for termination to certain classes of numbers.

The tandem and double tandem accompanying services are defined by ComReg as transit services and as such are not within Market 1.

In general, the current definition of MVCT corresponds to the provision by a Mobile Service Provider (MSP) of a wholesale MVCT service to other service providers.

ComReg currently regulates prices in both Markets 1 and 2; we describe the current pricing decisions pertaining to these two markets separately below.

2.1.1 Market 1

ComReg published its latest decision D12/12 in November 2012.[6] This required a number of FSPs to use a symmetric fixed termination rate (FTR) calculated using an updated version of the cost model of fixed networks used in the previous decision (D06/07, released in December 2007). The FTR was calculated using a pure LRIC approach and declined to EUR0.098 cents per minute from

5 See http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014H0710, released October 2014.

6 See http://www.comreg.ie/csv/downloads/ComReg12125.pdf.

1 July 2013 to the end of June 2014 and then to EUR0.085 cents until the end of June 2015. Since the start of July 2015, the FTR has been EUR0.072 cents per minute, as shown below in Figure 2.1.

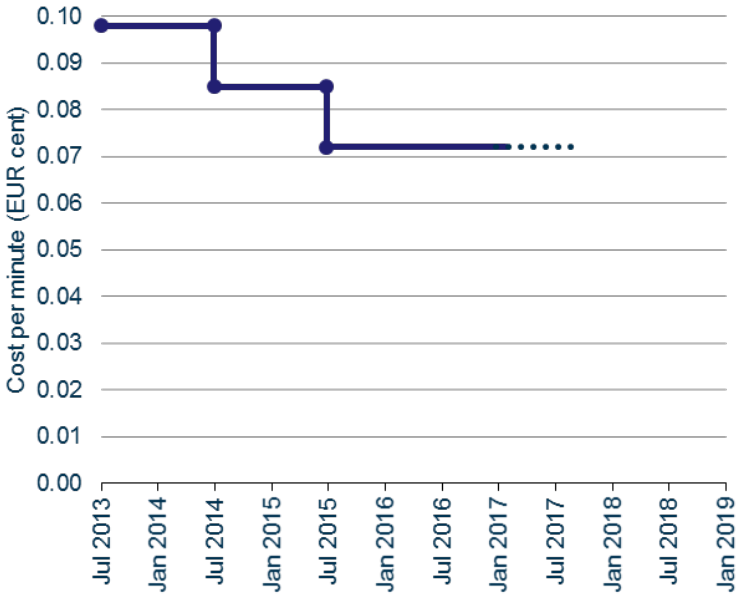


Figure 2.1: Evolution of FTR from mid-2013 onwards [Source: ComReg, 2018]

As no final decision was adopted in respect of Decision D12/12 (due to the appeal of the decision in relation to MTRs), regulation of the relevant FVCT markets continues to be anchored to Decision D06/07.

2.1.2 Market 2

ComReg published its latest decision D02/16 in February 2016.[7] This required six MSPs to use a symmetric mobile termination rate (MTR) calculated using a cost model of mobile networks. The six MSPs were:

- Vodafone Ireland Limited ('Vodafone')
- Three Ireland Hutchison Limited ('3IHL')
- Telefónica O2 Ireland Limited ('O2')
- Meteor Mobile Communications Limited ('Meteor')
- Tesco Mobile Ireland Limited ('TMI')
- Lycamobile Ireland Limited ('Lycamobile').

The specification for the model accompanied the decision D02/16. Prior to this decision, the MTR had been set at EUR2.6 cents since July 2013 following a Court Order. In Decision D02/16, the MTR was calculated using a pure LRIC approach and reduced to EUR0.84 cents per minute in September 2016, with further small reductions by the end of 2018. This is shown below in Figure 2.2.

7 See http://www.comreg.ie/csv/downloads/ComReg1609.pdf.

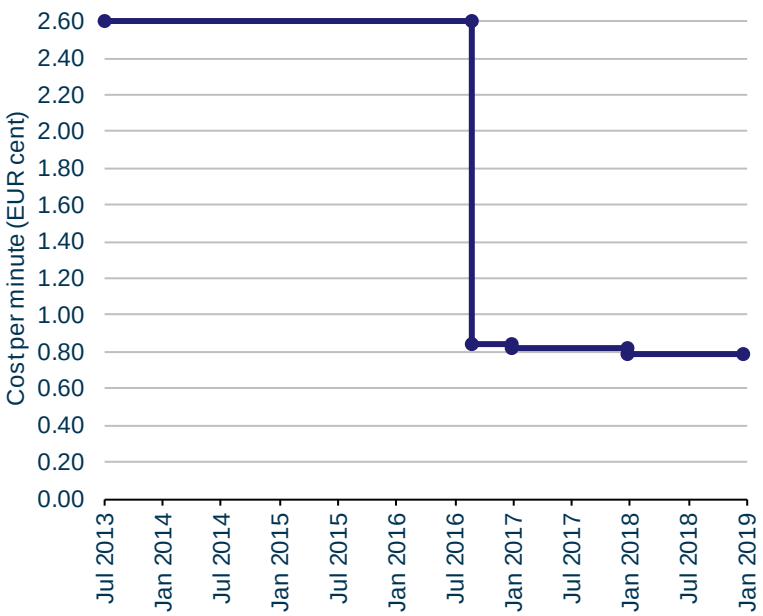


Figure 2.2: Evolution of MTR from mid-2013 to the end of 2018 [Source: ComReg, 2018]

2.1.3 Draft Market Review

ComReg's draft Market Review was published for consultation in October 2017. Key aspects of the market definition that could be relevant to this report are that:

- the market for FVCT include calls terminated to geographic numbers, nomadic numbers and emergency numbers
- the market for MVCT includes calls terminated to mobile numbers[8]
- the markets could potentially include (or exclude) calls originating from countries outside the European Economic Area (EEA): this is one area where views are being sought from industry
- the service provider must be able to set its own termination rate (for example, the FSP is able to set the FTR for terminated traffic to the relevant telephone numbers).[9]

2.2 ComReg's statutory objectives

The European Communities (Electronic Communications Networks and Services) (Access) Regulations 2011 published in Ireland (the 'Access Regulations') require that any remedies are:[10]

- based on the nature of the problem identified
- proportional and justified in the light of ComReg's objectives
- only imposed following consultation.

[8] As defined in the Numbering Conditions of Use, a mobile number means a non-geographic number that is used as part of a mobile service.

[9] For example, as described in the draft Market Review, Lycamobile is hosted on 3IHL's network but determines their own MTR, whereas Postfone are hosted on Vodafone's network but do not determine their own MTR.

[10] See http://www.irishstatutebook.ie/eli/2011/si/334/made/en/pdf and http://www.irishstatutebook.ie/eli/2011/si/333/made/en/pdf, Regulation 8(6).

Regulations 9–13 set out the remedial options. These are listed below in Figure 2.3.

Remedy	Description
Transparency (Regulation 9)	This is common for voice interconnect, where prices are known and technical interconnection reference standards are largely uncontroversial
Non-discrimination (Regulation 10)	This is already generally the case for FVCT/MVCT, notwithstanding the fact that the internal retail organisation is vertically integrated and not a financially separated buyer of wholesale traffic
Accounting separation (Regulation 11)	This is a possible way of demonstrating that prices may be above cost, but requires extensive accounting monitoring and also needs to have in place a subsequent solution if prices are indeed found to be above cost
Access to products, services and facilities (Regulation 12)	Generally effective and uncontroversial in Market 1 and Market 2
Price control and cost accounting (Regulation 13)	This is the method used in other European Union (EU) countries to set FTRs/MTRs, according to a variety of more-or-less similar cost models developed by the national regulatory authorities (NRAs)

Figure 2.3: Options for remedies as set out in the statutes [Source: Irish statutes, Analysys Mason, 2018]

In particular, when an obligation regarding cost orientation is imposed then sections (1), (2) and (3) of Regulation 13 set out what needs to be taken into account. This includes:

- ensuring that the regulation promotes efficiency and maximises consumer benefits
- considering prices of equivalent services in comparable competitive markets
- identifying operator investments and the risks associated with new investment projects
- developing a cost accounting methodology, that can be independent of those used by operators, with a description of that system made publicly available.

In setting regulations, ComReg's objectives, amongst others, are like those of many other European regulators. These arise from the 2002 Communications Act (as amended) and are to: [11]

- promote competition (in terms of choice, price and quality, without market distortion or restrictions; encouraging innovation and efficient investment)
- contribute to the development of the internal market
- promote the interests of end users.

In carrying out these objectives, ComReg must ensure that any measures taken or regulations imposed are objective, transparent, proportionate and non-discriminatory.

11 See http://www.lawreform.ie/_fileupload/RevisedActs/WithAnnotations/HTML/EN_ACT_2002_0020.htm

The regulation of wholesale voice interconnect affects all of these objectives, initially through the promotion of inter-operator competition. If wholesale prices are set above cost, then this creates a barrier to effectively competitive wholesale markets, which in turn can lead to competition issues (a market failure) in related downstream retail markets, particularly the retail markets involving or impacted by cross-network calling.

The impact on innovation and investment is subtler. If operators are regulated on the assumption of reasonable use of modern, efficient and lower-cost technologies, then this could theoretically incentivise operators to invest in new more efficient methods for delivering call termination services that can achieve or even surpass those assumed efficiencies (and thus improve their margins). If operators are regulated on the assumption of a protracted migration from legacy technologies (and therefore implicitly receive a higher termination rate due to the contribution of higher-cost legacy technologies), then the incentive may be to reduce investment in new technologies and use the legacy technology as long as possible[12]. In reality, any reduction in incentives to innovate (as described in the paragraph above) is, likely to be relatively small (and shrinking) given the reducing influence of voice on modern investment decisions compared to data-focused services.

The termination service itself is technology neutral and can be delivered over a variety of fixed and mobile technologies. However, newer technologies such as VoIP/VoLTE may not deliver identical standards of service to their consumers compared to established 2G/3G or PSTN TDM networks. The overall service needs of fixed and mobile networks nonetheless mean that there is a dynamic evolution from older to newer network technologies over time.

ComReg's objectives are to promote consumer interests and to contribute to the development of markets (using objective, transparent, proportionate and non-discriminatory remedies). In particular, this means that:

- the investments of one operator are not given more importance than those of any other operator, unless ComReg has a specific policy to favour specific investments such as fixed NGA.
- the welfare of one operator's end users is no more important than others, especially since operators offer similar services
- the welfare of some 'types' of users may be more important than others, such as vulnerable groups who may be excluded from maximally benefitting from the consumption of telecoms services because of less-than-perfectly-competitive call termination. However, this issue is unlikely to be addressed by specific refinements to the remedies for FVCT/MVCT as the chosen 'types' of users need to be identified and targeted.

ComReg's objectives, as discussed above, are achieved by taking a market-level view of needs and competition, rather than an operator-level view of pros and cons of any particular choice of regulation.

[12] This will not continue in the long-term, as technologies reach each end-of-life and also tend to get relatively more expensive in terms of operating costs as time passes (e.g. relatively higher maintenance and power consumption costs). However, this can be a relevant effect in the short- to-medium-term, hence it is relevant to the principles used to determine rate regulation.

2.3 2009 EC Recommendation

The European Commission (EC) published a Recommendation on the regulatory treatment of fixed and mobile termination rates in May 2009 ('2009 EC Recommendation').[13] In this document, it is recommended that telecoms regulators in EU Member States should apply a strictly defined implementation of a cost-based approach to voice interconnect regulation, and this has been reinforced in numerous cases by subsequent EC documents and comments letters by the EC to NRAs. This implementation covered the aspects summarised in Figure 2.4 below.

Figure 2.4: Aspects of the approach to termination rate costing stipulated in the 2009 EC Recommendation [Source: Analysys Mason, 2018]

Economic principles
Use of incremental costing
Use of economic depreciation for cost recovery
Treatment of voice termination traffic as the last increment in the stack[14]
Exclusion of common costs
Modelling principles
Bottom-up model structure
Verification of outputs to top-down operator data
Use of modern efficient technologies (identifiable in modelling timeframe). Specifically, NGN core technologies and 2G/3G mobile radio technologies are cited.
Assumption of efficient scale operations, applied symmetrically to all players in the market (subject to objectively justifiable cost differences)

The Recommendation allows for exclusions to this strict approach, such as using benchmarking as an interim measure. However, such exclusions require any alternative approach to be substantially and unequivocally justified.

Countries where the regulator elects to not follow the 2009 EC Recommendation frequently leads to comments from the EC in the notification process. For example, in Germany, when BNetzA proposed a LRAIC+ approach in 2015, there was criticism from both BEREC and the EC. In 2016, BNetzA proposed a revised approach using pure LRIC which was notified without comments from the EC[15].

While ComReg currently has a duty to take 'utmost account' of the EC Recommendation, it also has a duty to assess whether there are objective reasons why Ireland should apply a different approach, and if so what route it should follow.

13 See European Commission Recommendation: "The Regulatory Treatment of Fixed and Mobile Termination Rates in the EU" (2009/396/EC), dated 7 May 2009. Available at, for example, http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2009/c_2009_3359_en.pdf.

14 Recital 13 of the 2009 EC Recommendation states that "it is justified to apply a pure LRIC approach whereby the relevant increment is the wholesale call termination service and which includes only avoidable costs."

15 See https://circabc.europa.eu/sd/a/d7fc469c-6869-4b58-ab43-104562de2600/DE-2016-1887%20Adopted_EN.pdf

As described in Section 2.1, ComReg, in its most recent decisions on voice call termination, has followed the 2009 EC Recommendation. This decision was based in part on the reports produced by Analysys Mason for ComReg in 2012 ('final 2012 report') and 2016 ('final 2016 report'), published alongside ComReg's decisions.[16]

The EC's recommended approach to costing termination services means that common costs are not included in the calculated cost per minute – the resulting 'pure' incremental cost does not include a contribution to all of the costs which are needed in the long run to deliver the minute of traffic (i.e. it excludes any contribution to common costs).

In March 2016, the EC launched a public consultation to evaluate the impact of the 2009 EC Recommendation, and to assess whether to maintain or amend it in the light of EC Digital Single Market (DSM) policy.[17] In June 2016, BEREC published its own response to this consultation.[18] In February 2017, the EC published its own synopsis report on the outcomes of this consultation.[19] The EC indicated this would feed into a decision related to termination rates to be adopted on the basis of Article 19 of the Framework Directive. This decision has not yet been published. BEREC's response provides an indication of possible evolutions in the recommendation, such as Member States having to use a completely common model template developed for use in each Member State, or the costing approach of the 2009 EC Recommendation being made mandatory.

The EC's exact conclusions regarding the future regulation of Market 1 and Market 2 remain unknown at this time, but it did highlight several "preliminary trends", namely:

- The 2009 EC Recommendation (as a non-binding instrument) was viewed as less successful in promoting the internal market, mainly due to inconsistency in the implementation of the recommended principles across the EU
- Termination services will continue to be a bottleneck (even in the presence of technological changes and increased presence of VoIP and OTT operators)
- Over 70% of respondents considered further actions should be foreseen at EU level, with a slim majority in favour of some form of binding instrument
- Both operators and national regulatory authorities called for a simplification of termination rate regulation and longer market review periods.

Concerning future EU-level interventions, in 2016, the EC released a proposed version of a new European Electronic Communications Code.[20] Article 73 of this proposal introduced an EU-level process for determining a binding methodology for setting voice termination rates, enabling similar

16 See http://www.comreg.ie/csv/downloads/ComReg12125b.pdf and http://www.comreg.ie/csv/downloads/ComReg1609b.pdf.

17 See https://ec.europa.eu/digital-single-market/en/news/digital-single-market-strategy-europe-com2015-192-final

18 See https://ec.europa.eu/digital-single-market/en/news/public-consultation-termination-rates-recommendation.

19 See https://ec.europa.eu/digital-single-market/en/news/commission-reports-public-consultation-termination-rates-recommendation

20 See European Commission Proposal: "Proposal for establishing the European Electronic Communications Code" (2016/0288/COD), dated 12 October 2016. Available at http://eur-lex.europa.eu/resource.html?uri=cellar:c5ee8d55-7a56-11e6-b076-01aa75ed71a1.0001.02/DOC_3&format=PDF

regulation across most Member States. In addition, it created a mechanism for establishing maximum termination rates at EU-level, with a view to alleviating the administrative burden for regulators. Until these regulations are enacted, ComReg must continue to work within its existing objectives and develop regulatory measures specific to Ireland.

2.4 Structure of this document

The remainder of this document is laid out as follows:

- Section 3 summarises our reasoning on the price control for voice call termination in Ireland
- Section 4 outlines our conclusions regarding the modelling implementation that should be used for the recommended price control method
- Section 5 details our conclusions on the key aspects of the costing approach to be used
- Section 6 sets out our views on where the approach taken for FVCT/MVCT should be consistent.

Note: Where confidential data has been presented in this report, it is indicated using the scissor symbol '✂'. A redacted version of this report has also been prepared, suitable for publication, with the confidential data removed.

3 Price control

ComReg have published a draft Market Review of the Fixed and Mobile Voice Call Termination Markets for consultation (ComReg 17/90r) [21]. That document proposes to impose a price control of cost-orientation on those operators found to have SMP in those markets. This report takes into consideration the findings of the draft Market Review, in particular the competition problems that may exist and the proposed regulatory obligations to be imposed by ComReg to address such problems. For completeness, we have considered other possible price control remedies that could be applied, to put the cost-orientation remedy in context.

We outline the broad price control options in Section 3.1, discuss possible increments to consider in Section 3.2 and set out our recommendation in Section 3.3, having considered the price control options against each of ComReg's objectives, which we summarise in this section as well.

3.1 Type of price control

Figure 3.1 below sets out the main types of price control that ComReg can consider.

Figure 3.1:Types of price control [Source: Analysys Mason, 2018]

Price control method	Description
No price controls	Operators set their own termination rate levels
Fair and reasonable (F&R)	'Light-touch' regulation, where ComReg would only be directly involved in price setting in a dispute
Bill and keep (B&K)	Call-originating operator bills the calling party and does not pay anything to the call-terminating operator
Receiving party pays (RPP)	Call-terminating operator pays the cost of the call, including a payment to the call-originating operator
Cost-orientation (with calling party pays)	Termination rates paid by the call-originating operator to the call-terminating operator are set to reflect the cost to the call-terminating operator of it conveying the call • can be derived through a benchmark of prices of comparable services, or separately using a cost model • several definitions exist for an appropriate "cost".

We assess each option in turn below.

3.1.1 No price controls

It should be noted that this approach would directly contradict both the 2009 EC Recommendation and ComReg's previous remedy (to apply cost-orientation). No price control would also:

[21] The draft was published for consultation in October 2017. See https://www.comreg.ie/media/dlm_uploads/2017/10/ComReg1790r.pdf

- not address the competition problems identified in findings of ComReg's draft Market Review
- potentially lead to disputes between operators
- lead to regulatory uncertainty
- not be appropriate in case of an SMP finding as it would do nothing to address the risk of excessive pricing or any other price issues which could arise from unchecked SMP.

When considered in relation to ComReg's statutory objectives, we do not believe this option to be objective, transparent, proportionate or non-discriminatory. We therefore do not consider this option further.

3.1.2 Fair and reasonable

The term "fair and reasonable" comes from the UK Communications Act 2003[22] and so is not directly applicable in the Irish context. It would have the characteristics of being 'light-touch' regulation, as it reduces the regulator's direct involvement in setting prices, until a dispute arises (at which point the regulator's involvement may become significant). It should be noted that this approach:

- would not be very effective as it could result in case-by-case interventions by ComReg on SMP-type competition problems which would be more adequately and efficiently dealt with through ex-ante remedies applied to all findings of SMP in the relevant market
- would generate regulatory uncertainty, and a variety of possible disputes.

When considered in relation to ComReg's statutory objectives, we do not believe this option to be objective, transparent, proportionate or non-discriminatory. We therefore do not consider this option further.

3.1.3 Bill and keep

One main advantage of 'bill and keep' is that it is simple to implement (and therefore does not involve a disproportionately large amount of regulatory effort to apply) as well as transparent, as operators do not have to pay anything to one another (the caller effectively pays the originating operator for the originating leg only). It is also in accordance with ComReg's other statutory objectives i.e. it is objective and non-discriminatory.

There is a question about whether bill and keep is in accordance with the EC framework, especially Article 13 of the Access Directive (and correspondingly paragraph 13(2) of the Access Regulations) which indicate that an operator should be able to recover its costs when providing the service of

22 Section 74(2)(b)(i), "(2) The conditions that may be set by virtue of section 73(2) also include such conditions imposing obligations on a person providing facilities for the use of application programme interfaces or electronic programme guides as OFCOM consider to be necessary for securing— (b) that the facility for using those interfaces or guides is provided on terms which— (i) are fair and reasonable".

interconnection.[23] Contrary to this however, Recital 20 caveats that the method of cost recovery should be appropriate to the circumstances taking account of the need to promote efficiency and sustainable competition and maximise consumer benefits.

The 2009 EC Recommendation does not necessarily argue against a bill-and-keep approach, as it notes in Recital 20 that "When regulating wholesale termination charges, NRAs should neither preclude nor inhibit operators from moving to alternative arrangements for the exchange of terminating traffic in the future to the extent that these arrangements are consistent with a competitive market." Section 6.1.2 of the accompanying Explanatory Note to the 2009 EC Recommendation also notes that bill and keep could have potential merits, but also describes several drawbacks.[24]

In our view, a zero termination-rate bill-and-keep regime would only be economically efficient if there were high positive externalities on receiving calls such that the caller pays nothing towards the terminating leg of the call and the recipient and its network are prepared to bear all the costs of the terminating leg. This is hard to justify, and applying bill-and-keep could therefore distort both the FVCT and MVCT markets, and the downstream markets relying on FVCT and MVCT as an input.

3.1.4 Receiving party pays

As was the case for bill and keep, both the EC Recommendation and its accompanying Explanatory Note do not preclude the use of the wholesale termination arrangements required for an RPP regime.

In our view, RPP (effectively a negative termination-rate approach) would only be economically efficient if there were very high positive call externalities such that the recipient is prepared to bear all the costs for both the originating and terminating legs of the call. Evidence required to justify a call externality sufficiently large to arrive at a RPP regime is not available in Ireland, and in any case RPP could distort not just both the FVCT and MVCT markets, but also the downstream markets relying on FVCT and MVCT as an input. It would also be unexpected by today's subscribers in Ireland, since they are not used to paying per-minute prices to receive calls. This would cause a transient distraction (leading to some inefficiency) for suppliers and consumers having to adapt to an RPP regime from the current calling-party pays regime which has existed in the EU for over twenty years. It would therefore not be a proportionate mechanism to implement in Ireland and therefore does not comply with ComReg's statutory objectives.

23 DIRECTIVE 2002/19/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive), available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0007:0020:EN:PDF. There are no relevant amendments within 2009/140/EC (available from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0140&from=EN).

24 See http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2009/sec_2009_0600_en.pdf.

3.1.5 Cost-orientation

Telecoms markets are characterised by both their interdependencies and their externalities, since services offered using telecoms network are not consumed by end users in isolation on one network, but can require multiple networks for the service to be provided to multiple consumers.[25] There is a theoretical price level of termination which maximises economic efficiency (i.e. where, all other factors being equal, resources are optimally allocated such that each end user benefits and waste is minimised). It should be noted that this level will likely change based on the number of operators in the market.

The traditional economic finding is that cost-oriented termination rate pricing maximises efficiency. This is based on the use of a generalised model of network competition, in which network operators maximise their surplus by charging call prices equal to the perceived marginal cost and use the subscription fee to compete for customers.[26] Departures from cost-orientation may be justified by the presence of network externalities and call externalities, which recommend over-charging and under-charging respectively.[27] Externalities are discussed further in Section 3.2.2.

Equivalently, from the end-user perspective, consumers should make (ideally, efficient) decisions regarding their consumption when faced with a cost signal (e.g. different per-minute rates).

Telecoms voice termination markets are also prone to becoming competitive bottlenecks. Specifically, when an end user joins a network, the said network is more than likely the only one that is technically able to deliver calls to the end user. Moreover, due to the nature of the telecoms voice markets (as described in Section 3.2.1), the excess profits generated by termination rates that are not cost oriented may be used to subsidise competitive activity in retail markets, which may distort consumer choices and hence reduce the effectiveness of long-term competition.

This effect is a strong justification for regulatory intervention through cost-orientation, as call termination in an unregulated market would be charged excessively resulting in welfare losses. High charges to call the network will be privately desirable (to the network operator) but socially costly, as usage is dampened.[28] This means that high termination rates can result in consumers, as a group, paying more, even if subsidisation of other services occurs concurrently using the excessive profits from termination. If the regulator acts to control the market power of the terminating operators, this can (depending on the impact on retail prices) lead to a transfer of wealth to originating operators and hence have implications for competition.

25 More than two networks can occur in the case of voice transit, which can include the originating network, terminating network and also a transiting network.

26 This is referred to as the workhorse model in the original paper where it is described, entitled *Network competition with income effects* (Tangerås, 2011).

27 *Nonlinear Pricing of Telecommunications with Call and Network Externalities* (Hahn, 2001).

28 *The theory of access pricing and interconnection* (Armstrong, 2002).

Recital 7 of the 2009 EC Recommendation is unequivocal in that "in the light of the ability and incentives of terminating operators to raise prices substantially above cost, cost-orientation is considered the most appropriate intervention to address this concern over the medium term."

Finally, cost-orientation is ComReg's current approach, and regulatory certainty would, given the situation across Europe, anticipate this imposition. This provides Irish operators with the necessary regulatory stability to make investment decisions on the basis of an expected cost-based regulatory approach.

We therefore recommend that a cost-oriented price control is applied by ComReg. This takes the utmost account of the 2009 EC Recommendation: our assessment of this conclusion is set out further in Section 3.3.

3.2 Type of increment

Several choices of increment can be used for calculating the costs of termination. First of all, we do not consider fully allocated or short-run incremental costing to be relevant options for setting prices, since they do not present adequate long-term incentives for economic efficiency and efficient operations[29].

We also reject fully allocated costing on the basis that it is not best practice for voice interconnection services, and relies upon the unspecified (and debateable) choices of separate cost allocation rules for all of an operator's top-down activities. Incremental costing is therefore the robust and best-practice way to identify costs associated with voice call termination, and to do so in a transparent and justifiable way.

Therefore, we only consider long-run incremental costing (LRIC) methodologies, the most common types of which are described below in Figure 3.2.

Figure 3.2: Options for long-run incremental costing [Source: Analysys Mason, 2018]

Method	Description
LRAIC ('A' is for 'average')	This considers a large increment (e.g. all traffic services provided by the network) and allocates the incremental cost of traffic between the volumes of these services, using 'average traffic routeing factors'. Each service, including voice termination, therefore receives a share of intra-traffic network common costs.
LRAIC+	This is calculated in the same way as LRAIC, except that one or more mark-ups are applied to the network costs to capture other costs (e.g. business overheads). We refer to this approach in our report as "average cost".
(Pure) LRIC	This considers a small increment (e.g. each individual service). The pure incremental cost of a service is considered to be the costs avoided by not providing that service on the network, treating it as the last service in the service stack.

29 For example, fully-allocated costing rules may not fully reflect the timing of cost recovery between different voice and data services over the lifetime of the network assets; short-run costs may be unusually high or unusually low, depending on network evolution during a capacity expansion phase.

Method	Description
	This is the approach specified in the 2009 EC Recommendation, with the relevant costs being the traffic-sensitive costs of a network providing all services, less the traffic-sensitive costs of a network providing all services except wholesale voice termination.
LRIC+	As calculated for the (pure) LRIC, except that one or more mark-ups are applied to the pure LRIC to capture common costs. However, In Annex A of the 2009 EC Recommendation, business overhead costs are specifically excluded from the mobile case (along with retail and coverage costs). Results using this approach are likely to be similar to LRAIC+ since this is a total cost approach, although differences may arise from the exact formulation of the mark-ups.
Marginal cost (MC)	This can consider even smaller increments than pure LRIC (e.g. part of the volume of an individual service, perhaps only one unit e.g. one voice minute). The marginal cost is considered to be the additional network costs of serving that additional volume with the network.

We consider the consequences of the choice of increment in the rest of this section. This needs to be considered in the context of both the key aspects specific to wholesale voice termination markets and ComReg's objectives. We believe the five key aspects of wholesale voice termination are its:

- two-sided market structure
- associated externalities
- relationship to market competitiveness and efficiency
- impact on relevant (downstream) retail voice markets
- regulatory best-practice.

Figure 3.3 sets out ComReg's objectives and where in the remainder of this section, these objectives are assessed in the context of the different price control options.

Figure 3.3: Assessment of choice of increment against objectives [Source: Analysys Mason, 2018]

Source	Objective	Aspect	Section
Regulation 13(1) to 13(3)	Promotion of efficiency	Relationship to market competitiveness and efficiency	3.2.3
	Maximising of consumer benefits	Associated externalities	3.2.2
		Impact of relevant markets	3.2.4
	Comparisons with comparable markets	Regulatory best-practice	3.2.5
	Development of a publishable cost accounting methodology	Regulatory best-practice	3.2.5
2002 Communications Act (as amended)	Promotion of competition through choice, price and quality	Impact on relevant retail voice markets	3.2.4
		Associated externalities	3.2.2
	Promotion of competition through innovation and efficient investment	two-sided market structure	3.2.1
	Contribution to the development of the internal market	Regulatory best-practice	3.2.5
	Promotes interests of end-users	Impact on relevant retail voice markets	3.2.4

3.2.1 Two-sided market structure

Voice termination forms a two-sided market, in that the subscriber of any operator can seek to call a subscriber of any other operator and vice-versa. The calling subscriber gains a benefit from making the call (and pays a retail price in return for that benefit) and in the two-sided market, the called subscriber gains a benefit from answering the call (otherwise they would not answer the call). All subscribers can and do make and receive calls; although some make or receive more than others (perhaps depending on relative wealth or perceived desire to initiate communication). In aggregate, incoming and outgoing traffic flows are reasonably balanced. Therefore, any operator would be required to buy termination for off-net calls originating from its own subscribers and sell termination for off-net calls terminating with its own subscribers. Therefore, operators both receive termination fees as revenues and pay them as outpayments (costs).

ComReg may find that operators have a de-facto monopoly on providing termination on their own network. This can directly lead to a risk of excessive pricing by operators in the absence of regulation, since they could seek to discourage off-net calls to reduce their outpayments, and could seek to encourage on-net calls to increase their own asset utilisation and incur only incremental own-network costs.

There is insufficient countervailing power for buyers in the two-sided markets for call termination, so that the monopolies in place cannot be compelled by other operators to price at the socially optimal (allocatively efficient) level. In particular, although smaller operators and consumers in general may benefit overall from lower interconnection prices in the small operator's bilateral arrangements, the smaller operators cannot force the larger operators to agree to lower termination prices.

This differences in scale in MSPs in Ireland can be seen in Figure 3.4, with two larger in scale, one medium in scale, two smaller in scale and several very small MSPs (not shown below) making up the rest of the mobile market.[30]

[30] In ComReg's published quarterly reports, MSPs with a market share of less than 2% are not separated out. In Q3 2016, they make up approximately 1% of the market in terms of subscribers.

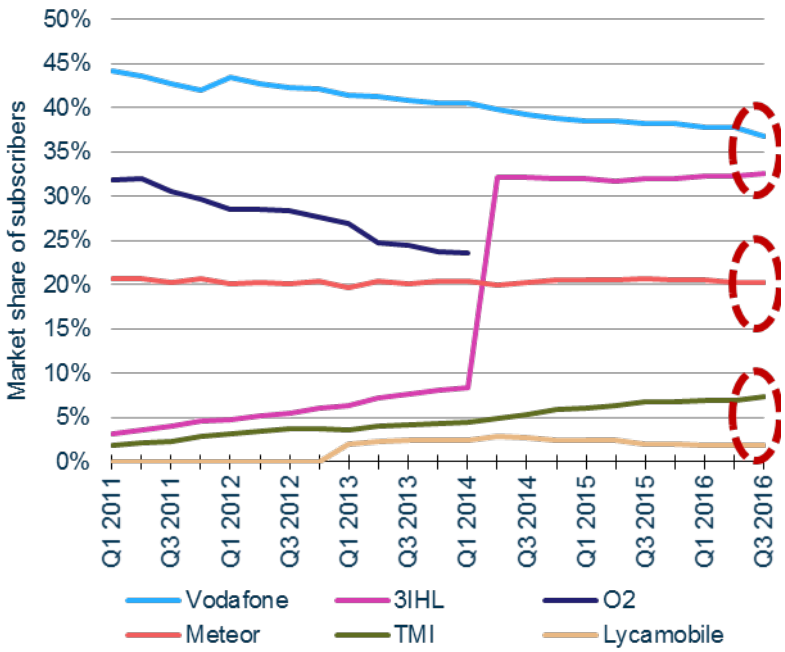


Figure 3.4: Market share[31] of mobile subscriptions by MSP, excluding mobile broadband and M2M [Source: ComReg published quarterly reports, 2018]

The red line is data for Meteor, which as of Q3 2017 has rebranded as eir Mobile

This is also true for FSPs in Ireland, with the market being largely dominated by eir, with numerous smaller operators.

The financial implications of the two-sided nature of the market, namely that operators are both buyers and sellers of traffic, are threefold:

- first, in a situation of balanced traffic between two operators in a two-sided market, the rate for that market could be set at any level (e.g. very high or very low) and the *net* financial position of both operators arising from that wholesale termination market would be zero. This applies individually to FVCT markets on their own, and MVCT markets on their own
- second, the proportion of an operator's total revenue (respectively total operating costs) that is derived from selling (respectively buying) termination is now very small in Ireland, as modern networks are dominated by origination service traffic (voice and non-voice) and its associated revenues. Therefore, in a situation of imbalanced termination traffic, the *net impact* arising from anything other than a significant increase in termination rates will also be small
- third, the common costs incurred in supporting incoming and outgoing traffic can be recovered from either an operator's own subscribers, or from its competitors' subscribers (via call termination), but that same operator would also bear the opposing situation for the recovery of others' common costs (via call termination).

The implication of all these points is that the two-sided market structure of voice termination, coupled with termination now being a small part of the overall business, means that the impact of choice of increment (e.g. pure LRIC rather than LRAIC+) from Figure 3.2 should be small.

[31] The step-change in the line for 3IHL is due to their acquisition of O2.

3.2.2 Associated externalities

There are also externalities present, contributing to the market failure and lack of effective competition, and which may have an influence on the socially optimal pricing of wholesale call termination markets. There are three types of relevant externality, described below.

Network externality

This is where existing users benefit from maintaining additional (marginal) subscribers on the network, as those later subscribers do not take into account the externality benefits to existing subscribers. Marginal subscribers can be optimally encouraged to join the network, to the benefit of the network community, with a subsidy.

Arguments for this subsidy to be applied through termination rates are now exceedingly weak, as:

- owning one of a fixed or mobile subscription (or having access to one paid by parents) is practically seen as a necessity for anyone over age of around twelve[32] (hence the inducement subsidy required is minimal)
- in many cases the externality is internalised by the parties paying for the subscription (e.g. family members)
- the cost of being a telecoms subscriber and being able to receive calls in Ireland is very low (for example, under the current termination regulation regime, a SIM-only package from Lycamobile is available for a monthly top-up of EUR9[33])
- the application of the subsidy through termination rates is a poorly targeted solution to internalise any positive network externality.

Furthermore, such a subsidy is rarely applied in other countries. An externality subsidy to termination rates was rejected in the price control for mobile termination in the UK in 2009 (and has not been included since).[34]

Hence, we recommend not including a network externality surcharge for the charges of FVCT and MVCT.

Call externality

This is where the recipient of the call (usually) receives a benefit from answering an incoming call that is free to receive. The Pigouvian subsidy[35] to adjust for this externality is to charge the recipient

32 The approximate age at which children typically want to be connected with other communications network users.

33 National "S" bundle, advertised in October 2017, https://www.lycamobile.ie/en/bundle.

34 See http://www.catribunal.org.uk/files/CC_Determination_1083_H3G_1085_BT_220109.pdf, paragraph 4.168.

35 A Pigouvian subsidy (tax) is one which is directly applied to the activity that generates the external benefits (harm). Source: https://market.subwiki.org/wiki/Pigouvian_subsidy. This can be seen as different to a subsidy or tax which is applied to a different product or service which has the indirect effect of boosting (suppressing) the externality-causing activity. A good example of a non-Pigouvian tax was UK Vehicle Excise Duty (road "tax") whereby all car owners (until recently) paid according to the amount of CO2 their vehicles can produce, not the amount of CO2 pollution which they actually produce. This tax reduces the number of high emissions cars purchased, which in turn should reduce the amount of CO2 pollution.

for answering a call (i.e. a receiving-party-also-pays regime) and to reduce the amount which the caller pays. However, this recipient charge would be a challenge for ComReg to impose in a wholesale calling-party-network-pays regime as it imposes an incoming call retail tariff on the recipient subscribers; see also Section 3.1.4. An alternative is to simulate the call externality by reducing the proportion of the cost of the call paid by the calling party, and to allow the recipient network flexibility on how to recover the remainder of the cost of the call, related to the call externality, using other indirect methods unrelated to specifically answering the call.

In relation to the call externality, we do not recommend a receiving-party-also-pays regime. However, applying a pure LRIC increment does reduce the proportion of the total cost of the call paid by the calling party. Therefore, pure LRIC can emulate this economic efficiency.

Tariff-mediated externality

This externality is price-related and is created from voice tariffs that include free/discounted on-net minutes. As a result, subscribers benefit from being a customer of a larger-scale operator, as they are able to call a larger pool of on-net subscribers at lower rates. Conversely, there is a disadvantage to subscribers outside this pool (i.e. customers of other smaller-scale operators), as their calls to the other network subscribers are subject at a wholesale level to termination charges which do not benefit from the free/discounted advantages gained by subscribers to the large network. It can be argued (by large operators) that the benefits to closed user groups outweigh the disadvantages to unrelated individuals. However, the disadvantages to unrelated individuals must take into account the impediments to any-to-any connectivity which arise from higher priced cross-network calling compared to lower priced on-network calling.

We observe, as can be seen in Figure 3.5 below, that off-net voice per subscriber has been rising since 2011. This will have been supported to some extent by lower and symmetric termination rates. On-net voice traffic per mobile subscriber has been falling. This implies that the strength of any tariff-mediated externalities is also diminishing. Now that connectivity penetration is largely saturated in Ireland, there are competition and consumer benefits from maximising the usage consumption opportunities for subscribers to call other subscribers on any network.

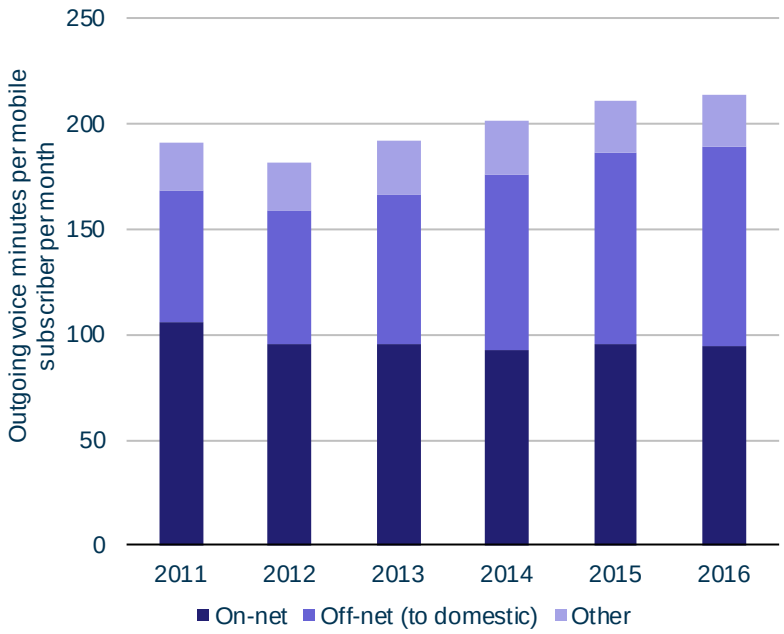


Figure 3.5: Annual mobile voice traffic per mobile subscriber in Ireland [Source: ComReg quarterly reports, 2018]

Total voice minutes per fixed voice subscriber have been falling with a compound annual rate of change of 10% since 2010 and therefore any fixed-market TMNEs will also have reduced in relevance over that period.

This means that narrowly focused operator-specific TMNEs (and setting higher FTRs/MTRs to support overall cost recovery as a result) are distortive to overall market effectiveness since they encourage closed user group calling to the detriment of market-wide communication. On this basis, in our view TMNEs are not economically justified for setting regulated FVCT and MVCT rates.

3.2.3 Relationship to market competitiveness and efficiency

In a perfectly competitive market, there are no dominant firms, with a homogeneous product bought/sold that is a substitutable commodity. There are also no barriers to entry/exit, no sunk costs, and end users can switch suppliers.

All firms should then earn a "normal" profit, which includes a reasonable rate of return on their investments. This can be referred to as a break-even "economic profit". As shown below in Figure 3.6, economic profit is maximised at the point of allocative efficiency, i.e. when resources are efficiently allocated such that the maximum possible welfare can be achieved from their use. In this context, beyond this level of volume, the marginal costs of additional volume increase faster than the marginal revenue, meaning that the economic profit becomes negative. This optimum point is where the marginal revenue of the product is equal to the marginal cost.

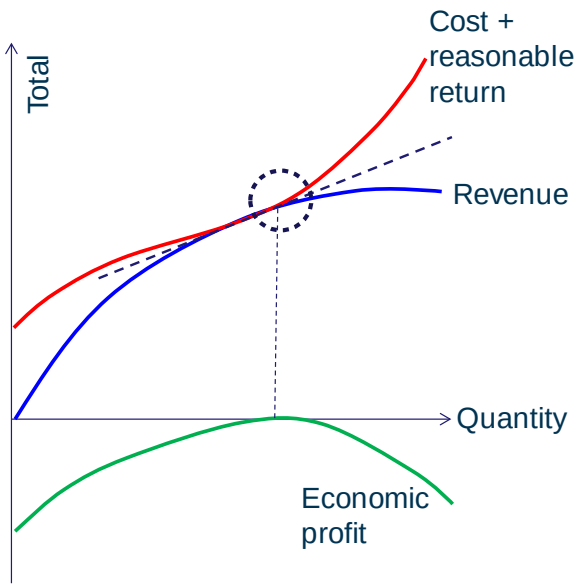


Figure 3.6: Illustration of economic profit [Source: Analysys Mason, 2018]

This is known as "first-best pricing" and indicates that if the market were fully competitive, the optimal allocatively efficient prices would be at marginal cost, which can be approximated as the pure LRIC of wholesale voice termination (i.e. pure LRIC).

However, the termination markets are not perfectly competitive in all aspects, as:

- there are some differences in the termination product (e.g. call quality, network coverage)
- termination is not a substitutable product
- economies of scope and scale exist in offering the termination service
- both call and network externalities exist
- some obligations or restrictions on capital and regulation are in place.

Furthermore, key features of the infrastructure needed to deliver fixed and mobile voice interconnection are economies of scale, economies of scope and large fixed costs. This means that first-best pricing applied to the quantity of all services produced would not fully recover costs. However, "second-best pricing" (prices are set to include the full recovery of all costs) could be applied to some or all quantities produced.

We illustrate this in Figure 3.7 below. First of all, it can be seen that the average cost of the service decreases as volume increases due to the economies of scale. Moreover, due to the large fixed costs, the marginal cost is less than the average cost.

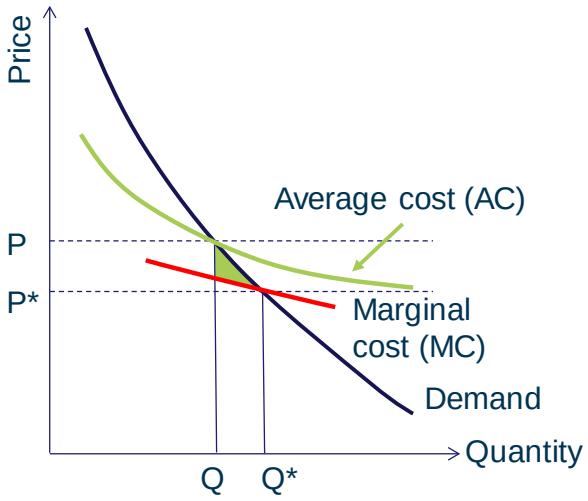


Figure 3.7: Illustration of average cost versus marginal cost [Source: Analysys Mason, 2018]

If the service was priced using marginal cost (or, alternatively, LRAIC or pure LRIC), then fixed costs would not be recovered. If the services were priced using LRAIC+ or LRIC+, then there is full cost recovery, but there is also some welfare lost due to the lower volume consumed from higher pricing.

Historically in Europe, the focus was on full cost recovery and therefore use of average cost (i.e. LRAIC+).

It is important to note however that voice interconnect is not only a two-sided market, but voice traffic in the Irish market is largely balanced (as we describe in more detail below and can be seen in Figure 3.9). Therefore, most of an operator's common costs that are notionally "recovered" through LRIC+/LRAIC+-based termination rates are counterbalanced by outpayments to other operators for the recovery of their common costs (especially if rates are symmetric, as is the case in Ireland).

It is less appropriate here to consider a *revenue* imbalance in the context of termination rates as this would lead to a circular argument and there are differences in the rates charged for MVCT and FVCT: we therefore consider the *traffic* imbalance, which is relatively small.

As a result of the largely balanced traffic and the fact that call termination is now a minor service in the operators' portfolios, termination traffic can be priced at pure LRIC (a proxy for marginal cost) without any significant impact on the *net financial position* of the operators (i.e. both outpayments and revenues for termination decline by a similar amount with pure LRIC compared with a total cost recovery approach such as LRAIC+/LRIC+).

Based on ComReg's market data, Figure 3.8 below shows that total mobile-to-mobile off-net interconnect is more than half of total voice interconnect in Ireland. Moreover, in Figure 3.9, it can be seen that there is a net voice interconnect traffic flow from fixed subscribers to mobile subscribers, but has been less than 2% of all voice interconnect (as shown by the dotted red line in Figure 3.9) for several quarters. It is only this very small net flow that potentially leads to a principled issue in terms of cost recovery.

Figure 3.8: Mobile-only interconnect as a proportion of total interconnect traffic [Source: ComReg market data, 2018]

✂

Figure 3.9: Net fixed-to-mobile voice interconnect as a proportion of total [Source: ComReg market data, 2018]

✂

This balance of traffic can also be considered at the operator level. Individual operators may not have the same traffic balance as the market average, due to greater/lesser market share, different retail pricing strategy or customer preferences for calling. Even with symmetric MVCT rates and FVCT rates, some operators will be net better/worse off as rates are changed.

However, as can be seen below in Figure 3.10, based on data for Q1 2016, three of the four largest MSPs each have only a very small *net flow* of incoming offnet mobile-to-mobile voice as a proportion of outgoing mobile-to-mobile offnet voice (based on retail minutes).

For example, when looking at off-net mobile-to-mobile minutes in Q1 2016, ✂ had slightly more incoming minutes than outgoing minutes, but the net flow was only 3% of its total outgoing minutes. In contrast, ✂ had slightly fewer incoming minutes than outgoing minutes, but the net flow was only 3% of its total outgoing minutes.

Therefore, the net impact of any termination rate change for both these operators is only equivalent to 3% of its outgoing off-net minute volumes.

✂

Figure 3.10: Net incoming offnet mobile-to-mobile voice as a proportion of outgoing offnet mobile-to-mobile voice (at the retail level) [Source: ComReg market data, 2018]

Total FTR revenues are approximately 0.1% of total fixed revenues. Whilst total MTR revenues are approximately 7% of total mobile revenues in Q1 2016, this has fallen to approximately 2% by Q4 2016 with the reduction of the MTR from EUR2.6 cents to EUR0.84 cents from September 2016.

Although there are some small imbalances in the traffic flows, the materiality of the cost recovery concern arising from this imbalance is small in comparison to overall costs and revenues of each operator.

The traffic balance figures presented here indicate that LRIC+/LRAIC+ would be preferred by some (but not all) FSPs/MSPs, while at the same time use of pure LRIC (or LRAIC) does not in our opinion lead to a material cost recovery concern for any MSP or FSP.

3.2.4 Impact on relevant retail markets

Price-regulation of FTRs and MTRs can have an impact on in both fixed and mobile markets. We consider the main impacts in terms of fixed/mobile retail pricing and competition below.

Retail pricing in the fixed market

The fixed market is characterised by one main FSP (eir) and a number of other segment-focused competitors such as BT Ireland and Vodafone. FSPs typically offer packages that can include a bundle of calls. Retail prices for calls to mobile should fall as MTRs fall, although the full MTR reduction may not necessarily pass through in all cases, depending on the extent of competition across bundles and individual call types, and contractual terms between operators.

FSPs charge the same retail prices for calls to fixed (local or national) numbers, regardless of which FSP is the terminating party. This means there are no material fixed-network tariff-mediated network externalities generated by groups of customers choosing one fixed network over another. However, eir still charge lower prices to their customers for calling eir Mobile numbers,[36] which means that customers with both fixed and mobile subscriptions may benefit from joining the eircom group.

Retail pricing in the mobile market

All mobile operators offer a variety of prepaid and postpaid ("bill pay") subscription packages. Most now offer free on-net calls and unlimited SMS for a certain monetary commitment in their prepaid plans. Of course, in order to benefit from discounted or free on-net calls, these receiving parties must be on the same mobile network (a tariff-mediated network externality). Regarding off-net calls, typical mobile price plans that are currently available from all of the MSPs do not normally differentiate between the price per minute to call off-net mobile numbers and the price for calling off-net fixed numbers. Given that the FTR is currently much lower than the MTR, it can be seen that MSPs are not passing the lower FTR through to a lower retail tariff to call fixed networks.

The postpaid retail packages offered by MSPs typically include a bundle of usage (minutes and/or megabytes of data) per month. These bundles are continuing to increase in size, particularly the data allowance. Unlimited voice packages are offered by all the major MSPs and are now being priced as more standard packages (rather than just top-end). For example, of the four postpaid plans offered by eir Mobile, the most expensive two include unlimited voice, whilst for Vodafone's three RED packages, the most expensive two include unlimited voice[37] We consider this an indication that MTRs are no longer a significant barrier to MSPs offering competitive packages with unlimited off-net voice bundles. This includes smaller MSPs. For example, iD mobile offers a bespoke "plan-

36 See https://www.eir.ie/opencms/export/sites/default/.content/pdf/pricing/Part2.1.pdf

37 See https://www.eir.ie/mobile/bill-pay/ and https://n.vodafone.ie/shop/bill-pay-plans.html

builder" to prospective subscribers where they can pay a customised monthly fee based on their own defined usage limits. This can include the option for unlimited voice.[38]

Competition

Figure 3.11 assesses the impact that FTR/MTR regulation can have on competition.

38 See https://www.idmobile.ie/shop/phones-plans/bill-pay-plan

Figure 3.11: Impact assessment of FTR/MTR regulation on competition [Source: Analysys Mason, 2018]

Competition	Impact of MTR regulation	Impact of FTR regulation
Mobile	The nature of mobile competition is oligopolistic, as noted by Genakos and Valletti[39], particularly given the significant fixed costs in providing mobile services. A common profit-maximising approach used by MSPs is to set termination charges and retail off-net charges above cost and to discriminate between retail prices for on-net and off-net calls. This leads to "tariff-mediated externalities", resulting in restricted demand for off-net calls, a competitive advantage for larger MSPs and a potential reduction in competition. Such behaviour could also act as a barrier to entry and have a negative effect on dynamic efficiency. A new entrant could find itself at a disadvantage in offering retail access and outgoing call services. This suggests that low and symmetric MTRs are beneficial for mobile competition.	MSPs often do not offer lower prices for calls to fixed networks, even when this ought to be substantially cheaper than on-net calls. This incomplete mobile-to-fixed passthrough implies any impact of a change in FTRs must be very low. This difference between the impact of FTRs on MSPs and the impact of MTRs on FSPs can be attributed to the relative importance of the rates within their cost bases. For MSPs, the FTR is small compared to their retail costs, while for FSPs, the MTR makes up a much larger part of the whole.
Fixed	MTRs have no direct impact on fixed competition (as all fixed operators pay the same MTR to a given MSP, unless the operator is integrated and indirectly cross-subsidises between fixed and mobile services). Another indirect impact arises from the way MTRs constrain what FSPs can do on the retail side. For example, a lower MTR allows the use of larger and more competitive bundles of minutes including fixed-to-mobile calls.	A FSP is incentivised to set its FTR at high levels in the same way as a MSP. Regulators therefore set FTRs for at least the incumbent in order to facilitate competition in the market. Applying a pure LRIC FTR could impact the incumbent if they also face ex-ante regulation on wholesale origination, as they would have no opportunity to recover some common costs from carrier pre-select subscribers (leading to possible arbitrage situations).
Fixed-mobile	Mobile and fixed networks compete in some respects since their voice services may be partially substitutable (homes can have access to one or both of these services, although aspects like the service characteristics would require deeper comparison). MTRs are higher than FTRs, leading to a net transfer of resources from the fixed to the mobile sector. In the past, it has been claimed that high MTRs have adversely affected fixed customers and operators and damaged competition between fixed and mobile operators.	The history of FTR and MTR regulation has been radically different, with cost-based pricing used for FTRs for much longer. This historical asymmetry has given MSPs a competitive advantage over FSPs, in that they benefited from cost-based FTRs while receiving unregulated MTRs. It is arguable that the regulation of FTRs removes or lessens the degree to which FSPs can use their buyer power to negotiate lower interconnect rates with MSPs (and vice versa, albeit that FTR regulation came first in most cases).

39 *Testing the "Waterbed" Effect in Mobile Telephony* (Genakos and Valletti, 2008).

3.2.5 Regulatory best-practice

As of July 2017, according to BEREC,[40] of the 27 EU Member States excluding Ireland, almost all of them apply a pure BULRIC costing/benchmarking approach for termination rate regulation (except in Finland for FTRs/MTRs and for FTRs in Poland and Belgium[41]). Moreover, ComReg's existing pricing decisions for FVCT/MVCT both comply with the 2009 EC Recommendation. Continued consistency with both the 2009 EC Recommendation and ComReg's existing decisions is beneficial to the market on the basis of regulatory certainty and would also be taking account of the 2009 EC Recommendation.

ComReg must assess to what extent their approach could contribute to the development of the internal market (i.e. supporting the free flow of capital, goods and labour in the EU). In the context of wholesale voice termination pricing, this is best achieved by Ireland having a similar pricing regime as most other EU Member States, so as to not distort the market for wholesale services in Ireland versus other Member States, nor to (dis)advantage consumers in Ireland and other Member States. Again, this would mean a clear preference for cost-orientation using pure LRIC.

There is now little difference in the difficulty or transparency of implementation of a model of LRAIC+ versus pure LRIC for the specific purpose of termination costing. Both approaches have been developed in numerous jurisdictions for ten years or more, with numerous cases of the documentation of the model (or the model itself) being in the public domain.

3.3 Recommendations on price control

In Section 2.2, we observed that ComReg must ensure that any measures it takes are objective, transparent, proportionate and non-discriminatory in accordance with its statutory objectives (in particular, Regulation 13 of the Access Regulations, sections (1) to (3)). Figure 3.12 summarises each proposed approach with respect to whether we consider they achieve these four aspects.

[40] See BEREC Termination Rate Snapshot, Annexes 2 and 6, published December 2017, http://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/7524-termination-rates-at-european-level-july_0.pdf

[41] BIPT's decision to use pure LRIC for FTRs was annulled by the courts in March 2017 for procedural reasons and the former tariff regulation was restored. See http://www.bipt.be/public/pressrelease/fr/134/FTR_FR.pdf.

Approach	Objective	Transparent	Proportionate [42]	Non-discriminatory
No price control	✗	✗	✗	✗
Fair and reasonable	✗	✗	✗	✗
Bill and keep	✓	✓	✓	✓
Receiving party pays	✓	✓	✗	✓
Cost-orientation in general	✓	✓	✓	✓
Cost-orientation using FAC or SRIC	✗	✗	✓	✗
Cost-orientation using LRAIC	✓	✓	✓	✓
Cost-orientation using LRAIC+	✓	✓	✓	✓
Cost-orientation using pure LRIC	✓	✓	✓	✓
Cost-orientation using LRIC+	✓	✓	✗	✓
Cost-orientation using marginal costing	✓	✗	✗	✓

Figure 3.12: Assessment of the approaches in terms of the requirements indicated by ComReg's statutory objectives [Source: Analysys Mason, 2018]

As can be seen above, several options satisfy all four aspects in our view, in particular options using a combination of cost-orientation and a long-run cost approach. A summary of our further assessment of the pricing methodologies to ComReg, in relation to their regulatory objectives and the practicality of the methodology is provided below.

Figure 3.13: Summary of pricing methodologies [Source: Analysys Mason, 2018]

Approach	Ensuring no distortion or restriction of competition/innovation/ investment	Promotes interests of end-users	Practicality of approach
No price control		Does nothing to address risks of excessive pricing or other price issues	Could lead to disputes between operators and regulatory uncertainty
Fair and reasonable	Would require case-by-case interventions on SMP-type problems		Could lead to disputes between operators and regulatory uncertainty
Bill and keep	Could distort markets for voice termination (and markets downstream of them)		Simple and transparent
Receiving party pays	Could distort markets for voice termination (and markets downstream of them)	Subscribers in Ireland are not used to paying to receive domestic calls	Would require a step-change from the calling party pays regime of the last twenty years or so
Cost-orientation in general	Reduces ability of operators to subsidise retail activities, distort consumer choice and	Reduces excessive pricing of off-net calls by terminating operators	Gives regulatory certainty

42 Proportionate: meaning, the effort required for the industry and stakeholders to adopt the remedy is not excessive given the size of the problem being addressed.

Approach	Ensuring no distortion or restriction of competition/innovation/ investment	Promotes interests of end-users	Practicality of approach
	improves effectiveness of long-term competitions		
Cost-orientation using FAC or SRIC	Does not present adequate long-term incentives for economically efficient operations		Relies upon the (debateable) choice of cost allocation rules for each operator's activity. Values could fluctuate over time
Cost-orientation using LRAIC	Does not allow recovery of any fixed costs		Can be calculated using the functionality from LRAIC+/pure LRIC modelling approaches
Cost-orientation using LRAIC+	Allows full cost recovery	Some welfare lost due to the lower volume consumed (compared to marginal cost-based price)	Widely adopted historically by EU regulators for termination pricing
Cost-orientation using pure LRIC	The materiality of any cost recovery concern arising from imbalanced voice traffic flows is small in comparison to the overall costs and revenues of each operator	Based on first-best marginal cost-based price	Consistent with the EC Recommendation and widely adopted currently by EU regulators for termination pricing
Cost-orientation using LRIC+	Allows recovery of fixed costs	Some welfare lost due to the lower volume consumed (compared to marginal cost-based price)	Requires a more complex method of cost calculation to identify the relevant common costs, based on a termination increment and other increments.
Cost-orientation using marginal costing	Does not allow recovery of any fixed costs		Difficult to calculate in principle, although it can be approximated using pure LRIC

Voice termination is a two-sided market: this means that the application of pure LRIC reduces both costs and revenues for buyers and sellers of termination services (albeit to a varying extent, depending on calling patterns). On the other hand, some other markets regulated by ComReg are one-sided, such as local loop unbundling (LLU), and the regulation of these markets is justifiably based on total costs (LRIC+, LRAIC+, FAC), to ensure full recovery of (efficiently incurred) costs.

LRAIC+ and pure LRIC largely define the 'normal' bounds of cost-orientation for wholesale termination services. Call externalities, which would tend to reduce the efficient price, are real but unknown. At the same time, we do not think that network externalities (the benefit of greater penetration, and an associated subsidy applied to call termination) is a valid argument for a wholesale termination rate subsidy in Ireland, with more than 100% penetration and low network-related costs for maintaining a subscription to a telecoms network.

Using LRAIC+ does avoid creating a knock-on issue for the costing of fixed voice origination, as it is a total-cost methodology and does not require common costs left unallocated to termination to be considered in the context of other price-regulated services.

However, pure LRIC is fully compliant with the EC Recommendation and may have better allocative efficiency because it is a proxy for marginal costs, depending on the size of call externalities. Pure LRIC would also have a positive impact on mobile–mobile and fixed–mobile competition in Ireland because it would help to remove tariff-mediated network externalities and reduce payments from fixed-to-mobile markets. Pure LRIC-based termination rates also support (higher) usage bundles, including off-net mobile calling. These competition benefits should improve dynamic efficiency.

Based on all these considerations, we therefore conclude that:

ComReg should apply cost-orientation. The method of calculating costs of termination that achieves ComReg's objectives should be pure LRIC, which is also consistent with the 2009 EC Recommendation.

4 Model structure

In Section 4.1, we set out the options for the modelling structure. In Section 4.2, we recommend the model structure that should be applied by ComReg.

4.1 Options for model structure

Before we consider this further, we observe that values of the costs of termination can also be obtained through benchmarking the results from other countries. The 2009 EC Recommendation does allow for this in Recital 22 and it has been used by a number of Member States rather than developing a model. This was also considered in our final 2012 report for ComReg. However, when ComReg proposed an interim benchmark for setting the MTR, it was rejected after legal challenge, on the basis that it did not meet transparency requirements and could not reflect (by definition) Irish-specific costs and conditions.[43] Therefore, we recommend against using benchmarking of the termination rates of other Member States for price setting in Ireland.

There are two structures used in the cost modelling of networks, referred to as 'top-down models' and 'bottom-up models'.

Top-down models start from an existing 'top-down' network cost base and determine 'incremental' costs. There may also be top-down efficiency adjustments and potential cost adjustments to reflect the costs of modern assets. This method can be useful for an operator to determine its own cost base, but is not necessarily the best modelling approach to determining the costs of an efficient operator for transparent regulatory purposes.

Bottom-up models provide the most commonly used approach to determining the costs of a hypothetical efficient operator. The network asset base is dimensioned starting with the traffic/subscribers of the operator modelled, as well as reflecting an assumed network footprint. Therefore, only the assets required to handle this demand (in a forward-looking situation) are taken into account, and so inefficiencies are excluded. The level of efficiency can, however, be 'selected' through the choice of technologies modelled and assets used (for example: only modern equivalent assets such as Ethernet backhaul) and various other parameters such as maximum utilisation factors.

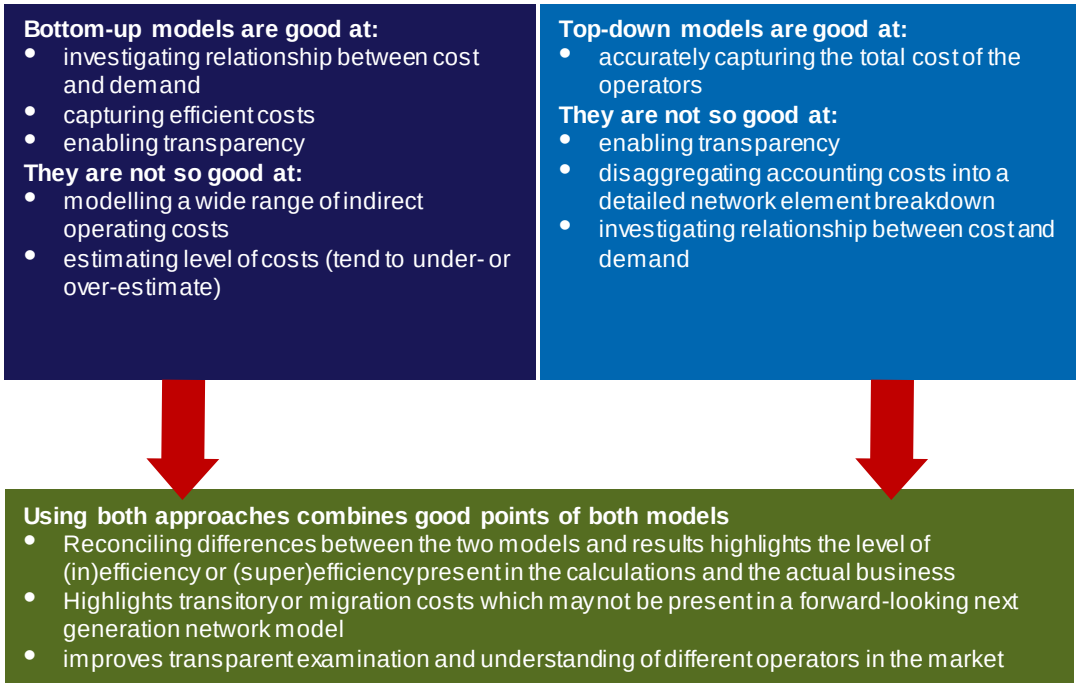
A comparison of the merits of the two approaches are shown below in Figure 4.1. As described in the last box, the two structures are often both used in a "hybridised" approach, whereby the outputs of the bottom-up model can be adjusted to better reflect aspects of outputs from top-down information. Such an alignment of particular asset count outputs is referred to as asset *calibration*, whilst corresponding comparison of particular cost outputs is referred to as cost *reconciliation*. The process of this comparison taken together is *top-down validation*.

43 The transparency of cost modelling comes from a model being sharable and that can be understood by operators with reference to their own costs.

Whilst these comparisons can be made, adjustments of the bottom-up may not be deemed necessary as there may be explainable reasons for such divergences. For example, the difference may be due to inefficiencies in the actual operators' networks or hypothetical bottom-up assumptions that differ from the specific operator. However, adjustments are justified if the bottom-up model is producing outputs that are not reasonable: therefore, top-down validation can serve as a "reality check".

A top-down model is not necessarily required for hybridisation. Instead, the outputs of the bottom-up model can be simply compared to top-down asset counts and cost data from operators, rather than building a top-down model to allocate the costs all the way to services.

Figure 4.1: Comparison of top-down and bottom-up models [Source: Analysys Mason, 2018]



We note that it is extremely difficult to use a top-down model to calculate a "pure LRIC" of any service (a small, final increment cost), since the cost-volume relationships of all cost categories would require a detailed definition. Also, top-down models do not exist for hypothetical operators and may not reflect efficient deployment, scale or choice of modern technologies.

Recitals 2 and 3 of the 2009 EC Recommendation specifically state the use of a bottom-up model, with the possibility of comparison to top-down data.

Consistent with the 2009 EC Recommendation, we therefore recommend the use of a bottom-up model, with top-down validation of the bottom-up model outputs where appropriate.

Cost models can either calculate costs of termination for one year or several years. In particular, the model developed can either be:

- a single-year model that can only calculate output unit costs of services of one selected year

- a single-year model that can calculate output unit costs of services for one year at a time chosen from a selection of years
- a multi-year model that can simultaneously derive outputs for each year in a time series.

Given ComReg's current planned timetable for undertaking both the Market Reviews and the pricing decisions, ComReg could apply new decisions using costs of MVCT from 2019 onwards and costs of FVCT at any time. Therefore, we recommend that the cost models can calculate cost results in nominal currency for at least the years 2017-2022. Modelling until 2022 should cover the period of time where ComReg's future decision instrument will apply.

4.2 Recommendations on model structure

Develop bottom-up models of the appropriate networks for costing purposes, capable of costing each year in the period 2017–2022 in nominal currency.

5 Costing approach

In this section, we set out what we consider to be the relevant principles for the costing approach to be used by ComReg. This covers:

- type of operator in Section 5.1
- depreciation method in Section 5.2
- scale in Section 5.3
- choosing the modelled technologies in Section 5.4.

We finally summarise the recommendations made in Section 5.5.

5.1 Type of operator

There are four choices of modelled operator, as summarised below in Figure 5.1.

Figure 5.1: Types of operator that can be modelled [Source: Analysys Mason, 2018]

Type	Description
Actual	The costs of actual market players are calculated. In particular, the model is capable of modelling the actual network and costs of a real operator (or operators). As a starting point, the technologies and assets currently used by the operator would be captured (i.e. legacy networks that have been shut down would not be included, since these costs would have been assumed to already be recovered).
Average	The players in each individual market (i.e. the fixed market and the mobile market) are averaged or standardised to define a 'typical' operator for each individual market. Whilst the market share, date of entry and coverage can be calculated, a choice of the technologies used by such an operator would need to be made, based on the technologies used by the actual operators (an "average" technology is impossible).
Hypothetical existing operator	An operator is defined with characteristics similar to, or derived from, the actual operators in the market, except for specific hypothetical aspects that are adjusted (e.g. date of entry, technology used).
Hypothetical new entrant	An operator enters on a specified date in the present or future (e.g. 2016 or 2017) with today's modern network architecture, and acquires a share of the market from the existing operators. This can be modelled even if there is no prospect of a new entrant appearing in the market.

The 2009 EC Recommendation (for example, in Recital 1) envisages an efficient operator rather than actual operators. Paragraph 13(4) of the Access Regulations also indicates that the efficient cost of service provision should be considered. Therefore, we do not consider actual operators further, since this would likely lead to the capture of past inefficiencies. On a similar basis, since average operators are defined based on the actual operators, this could similarly lead to the capture of past inefficiencies and therefore we do not consider the average option further.

A comparison of the two remaining (hypothetical) options is shown below in Figure 5.2.

Figure 5.2: Summary of operator choices [Source: Analysys Mason, 2018]

Option	Hypothetical existing operator	Hypothetical new entrant
Advantages	• Transparent for industry • Can reflect reality to some extent, by capturing technology(ies) used and volume effects of migration • Can use scale similar to actual scale • Can use actual nodes (for 'scorched-node' approaches[44]) • Avoids inefficient deployments	• Transparent for industry: models only the future technology of a 'greenfield' entrant[45] • Easy to implement • No need to model legacy assets • Operator can be defined to be efficient wherever appropriate
Disadvantages	• Reconciliation of expenditure only possible where 'current cost' top-down data exists • Effort is needed to justify parameters	• No direct reconciliation of assets and expenditure possible • Harder to gain industry acceptance of inputs (e.g. subscriber evolution, network roll-out) • Harder to justify use of any existing nodes in the fixed network (scorched-node approaches)

We recommend modelling a hypothetical existing operator, since this can flexibly allow for past constraints to be reasonably captured and if relevant reflected (e.g. different levels of spectrum scarcity, different numbers of network operators, use of existing network node locations).

5.2 Depreciation method

There are four main types of depreciation method for defining recovery of capital investments, as described in Figure 5.3 below.

Figure 5.3: Types of depreciation [Source: Analysys Mason, 2018]

Type of depreciation	Subtype	Description
Historical cost accounting (HCA)	–	The capex recorded in the fixed asset register (the gross book value, GBV) is depreciated over the defined financial lifetime of the asset, usually with a constant depreciation charge per annum
Current cost accounting (CCA)	Operating capital maintenance (OCM)	Seeks to maintain the operating or output capacity of the asset
	Financial capital maintenance (FCM)	Seeks to maintain the value of the original capital investment

44 A scorched-node approach is based on the existing locations of an operator, but the choice of technology and/or capacity at the node can be modified as if the equipment was removed ('scorched') and replaced with a different choice.

45 A greenfield entrant is one which has no existing infrastructure or activities, and can therefore deploy its network without any influence from existing or past network choices.

Type of depreciation	Subtype	Description
Annuities	Standard annuity	An annualised cost is derived to allow for full recovery of both the investment and the capital employed, at a constant level per year.
	Tilted annuity	An annualised cost is derived to allow for full recovery of both the investment and the capital employed, with the recovery tilted according to the forecast price trend of the asset
	Modified tilted annuity	An annualised cost is derived to allow for full recovery of both the investment and the capital employed, with the recovery tilted according to the forecast price trend of the asset, with an adjustment to reflect constant changes in economic output over time
Economic depreciation	–	Takes into account all the underlying factors that influence economic value, i.e.: • projected trends in the opex of the asset • projected trends in replacing the asset with its modern equivalent asset (MEA) unit cost • the output generated by the asset (i.e. demand)

Figure 5.4 shows that only economic depreciation considers all potentially relevant factors.

Figure 5.4: Factors considered by each depreciation method [Source: Analysys Mason, 2018]

Aspect	HCA	CCA	Standard annuity	Tilted annuity	Modified tilted annuity	Economic depreciation
MEA cost today		✓	✓	✓	✓	✓
Forecast MEA cost				✓	✓	✓
Output of network over time					✓[46]	✓
Financial asset lifetime	✓	✓	✓	✓	✓	✓[47]
Economic asset lifetime			✓	✓	✓	✓

Although some methods do not reflect all aspects of economic depreciation, they do recover the original investment incurred in NPV terms[48]. Figure 5.5 illustrates the capital charge for a EUR1 million investment over a 10-year lifetime, assuming a positive year-on-year cost trend and a constant positive year-on-year increase in demand. All of these methods recover exactly EUR1 million in NPV terms over the period, but the profile of year-by-year charges varies considerably.

46 An approximation for output changes over time (with a compound annual growth rate of x%) can be applied in a tilted annuity by assuming an additional output tilt factor of x% per annum.

47 Economic depreciation can use financial asset lifetimes, although strictly it should use economic lifetimes (which may be shorter, longer or equal to financial lifetimes).

48 The net-present value is obtained using a discount factor based on the percentage weighted average cost of capital (WACC), which reflects a reasonable rate of return for an operator in (in this case) Ireland.

With a constant year-on-year change in output (in this context, traffic and subscriber volumes) and forecast MEA cost, modified tilted annuity and economic depreciation lead to the same cost recovery profile. However, economic depreciation can consider more complex cases (that might occur in reality) where the year-on-year change in output/forecast MEA cost is not constant and/or varying between different services.

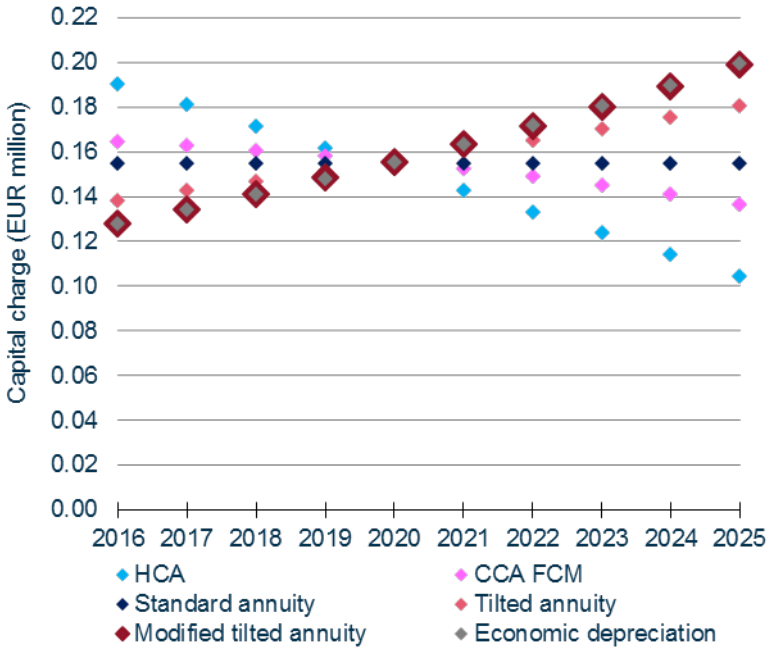


Figure 5.5: Illustration of the annual cost recovery of a EUR1 million investment over 10 years using different depreciation methods [Source: Analysys Mason, 2018]

Although Recital 18 of the 2009 EC Recommendation does state a preference for economic depreciation, it does not prohibit the use of the other methods, provided that the depreciation profile of each major asset is examined separately in these cases. The approach generating a depreciation profile similar to that of economic depreciation should then be chosen. We recommend that the models apply depreciation consistent with this recital, with justification provided where any proxy of economic depreciation is applied. Where multi-year economic depreciation is modelled, this can reflect the dynamically efficient build-up of assets over successive technology generations. This will require a start date for the dynamically efficient hypothetical existing operator to be defined.

5.3 Scale

One of the main parameters that defines the cost (per unit) of the modelled operator is its market share: it is therefore important to determine the market share of the operator and the period over which any market share evolution/growth takes place. The parameters chosen for defining the operator's market share over time influence the overall level of economic costs calculated. The quicker the operator grows, the lower the eventual unit (total) cost of traffic should be.

These assumptions on scale are concerned with the concept of productive (static) efficiency, where the output produced is maximised using a given set of resources with an assumed level of product quality.

Another relevant parameter could be whether the efficient operator is assumed to be part of a larger business operating in multiple countries, which can potentially enjoy lower unit costs on its equipment purchases from vendors due to higher multinational procurement volumes (provided it has centralised procurement).[49] Of the three main MNOs in Ireland, only eir Mobile lacks this multi-national scale, although it can enjoy other synergies with its fixed business that Vodafone and Three Ireland (3IHL) cannot. With regards to eir in the fixed market, it only has the corresponding synergies from its mobile business. Such economies of scale can be captured through validating the cost base of the modelled equipment against the typical prices paid for equipment by Irish operators, as indicated in the data they have provided.

Regarding the scale of the modelled operator, a neutral approach to both fixed and mobile markets is to use the average scale of the actual number of large network operators having near-100% national population coverage. This is therefore 33.3% for a national mobile network operator (as there are three such operators for mobile serving 100% of the mobile market) and eir's scale for the modelled fixed network operator (as the only such operator for fixed).

Where modelling is undertaken over several years (particularly regarding past years), this average scale may vary over time if the number of such network operators varies over time.

We recommend that the hypothetical efficient operator used to calculate costs is modelled at this productively efficient scale over the period 2017-2022.

In terms of the assumptions required on the time to achieve scale, we recommend assuming a contestable market i.e. that firms can immediately join the market and contest to supply all of the existing players' demand, meaning that operators should be assumed to achieve immediate scale.

In the context of future scale, this should be driven by reasonable demand forecasts of all the services assumed to be carried by that network (both from the retail and wholesale subscriber bases). These forecasts should allow reasonable economies of scope and scale to be captured, whilst also assuming a reasonably efficient utilisation of the network technologies over their lifetimes.

5.4 Choosing modelled technologies

Article 12 of the 2009 EC Recommendation states that "the cost model should be based on the efficient technological choices available in the timeframe considered by the model, to the extent that they can be identified."

Although Article 12 specifically refers to 2G/3G mobile technologies and NGN core technologies, we believe that current and near-future efficient technological options should also be considered (e.g. single-RAN, Long-Term Evolution (LTE) technology, LTE-Advanced and voice-over-LTE for

[49] Such economies of scale are possible, such as through the pan-national agreement agreed between Vodafone and Telefonica in 2009, as described in http://www.vodafone.com/content/index/media/vodafone-group-releases/2009/telefonica_and_vodafone.html.

mobile; voice-over-IP platforms for fixed), since these are now the modern equivalent assets (MEA) of the technologies identifiable when the 2009 EC Recommendation was published.

Successive generations (or upgrades[50]) of technology typically support increasing output at lower (long-run) unit costs of capacity, and hence lower costs compared to a single technology situation. Therefore, migrating to new technology generations allows for dynamic efficiencies to be reflected in calculated costs, as described in more detail in Section 6.2.

The modelled termination services should also assume an efficient number of points of interconnect and layer of interconnection.

5.5 Recommendations on costing approach

Consistent with the 2009 EC Recommendation, a generic hypothetical existing operator should be modelled. Economic depreciation of modelled expenditures should be the starting point for obtaining annualised costs including a return on capital employed. However, an alternative depreciation method can be used for one or more asset types provided it can be properly justified as being a good approximation to the economic cost recovery over the lifetime of these assets.

The modelled operators should be assumed to have reasonably productively efficient scale during the next regulatory period, assumed to be the average scale of the actual number of large network operators having near-100% population coverage in Ireland.

A contestable market and therefore immediate scale should be assumed.

Reasonable demand forecasts should be developed across all modelled services, balancing economies of scope and scale with the efficient utilisation levels of each technology generations.

The modelled termination services should assume an efficient number of points of interconnect and layer of interconnection.

Modern technologies for the future regulatory period should be considered.

[50] We observe, for example, that LTE-Advanced could be a software upgrade of the LTE hardware already deployed.

6 The degree of consistency in the approaches for FVCT and MVCT

This section describes the aspects of ComReg's approach to the costing of FVCT and MVCT where consistency will be, in our view, beneficial or required in principle. FVCT and MVCT perform a very similar function in that they facilitate the completion of calls between subscribers of different service providers. Therefore, a consistency of treatment will ensure that one market will not be distorted unfairly compared to the other. Both markets are also subject to similar bottlenecks, as outlined in Section 3.1.5.

We highlight that applying consistent costing *principles* for FVCT and MVCT is not the same as deriving similar cost *results*, as this is unlikely due to the inherent structural differences in fixed and mobile network costs. We consider consistency in the context of:

- symmetry in Section 6.1
- dynamic efficiency in Section 6.2
- voice market forecasting in Section 6.3
- treatment of unrecovered costs in Section 6.4
- price path in Section 6.5
- model updating in Section 6.6.

We finally summarise the recommendations made in Section 6.7.

6.1 Symmetry

The 2009 EC Recommendation is strongly in favour of symmetry in voice termination charges among operators of a given type (i.e. fixed operators, mobile operators) in a given country.

Article 1 of the 2009 EC Recommendation states that "when imposing price control and cost-accounting obligations […], NRAs should set termination rates based on the costs incurred by an efficient operator. This implies that they would also be symmetric". Article 11 also states on the next page that "NRAs should ensure that termination rates are implemented at a cost-efficient, symmetric level."

Articles 9 and 10 offer some limited flexibility for new mobile entrants to benefit from a higher termination charge during a transitional period, but with the caveats that:

- any such period should not exceed four years after market entry
- the NRA determines there are impediments in the retail market to market entry and expansion

- exogenous factors are identified giving rise to objective cost differences.[51]

We therefore recommend ComReg applies symmetric pricing in Market 1 for all FSPs designated with SMP and requiring a price control. We similarly recommend symmetric pricing in Market 2 for all MSPs designated with SMP and requiring a price control. This is also consistent with ComReg's current pricing decisions for Markets 1 and 2.

6.2 Dynamic efficiency

Dynamic efficiency is important for setting costs for the next regulatory period (for example, from 2019 onwards given the current MVCT decision). Its objective is to identify an optimal long-run path of technological innovation and investments; such that productive efficiency improves over time.

In both fixed and mobile networks, major technological improvements could be expected in the next few years. For mobile networks, this includes LTE, voice-over-LTE, sharing of active RAN equipment (in addition to sharing of passive equipment such as sites) and single-RAN technology. For fixed technologies, this includes next-generation access networks and voice-over-IP platforms. In the case of both fixed and mobile networks, this could also mean use of transmission links, line cards and other equipment with larger capacities.

These innovations should be reflected in the models to the extent that they can be quantified, meaning that the models should be dynamically efficient and reflect the network costs anticipated for the next regulatory period, rather than just applying current productive efficiency expectations to current technology without any future dynamic benefits. This is particularly important given that the next regulatory period is still some years in the future, during which time significant additional dynamic efficiencies are expected to be achieved.

This must however be balanced against not assuming too aggressive a technology mix that would require voice callers to change their behaviour. This is particularly true in the case of MVCT, where applying short-term 100% migration to LTE would need to assume that the entire subscriber base purchases a LTE-capable handset. Such an assumption would be implicitly:

- imposing some distortion on the mobile market through the requirement to transform the retail handset base, contrary to ComReg's statutory objectives
- detrimental to equitable consumer welfare (for example, older users struggle to use smartphones and want a simple phone; users on lower incomes benefit from being able to freely acquire second-hand 2G/3G phones).

[51] Commission Recommendation of 7 May 2009 on the *Regulatory Treatment of Fixed and Mobile Termination Rates in the EU* (2009/396/EC), Article 9.

6.3 Voice market forecasting

To ensure that the voice forecasts for the fixed network and mobile network modelling are consistent, we recommend that a single voice market forecast[52] feeds into both models to dimension the network assets required. This can ensure, for example, that the volumes of fixed voice origination to mobile users assumed in the fixed model are consistent with the volumes of mobile voice termination from fixed users assumed in the mobile model, given the market shares of the selected hypothetical operators.

6.4 Treatment of costs not recovered if applying pure LRIC

When using pure LRIC for termination pricing, certain costs are not recovered from terminating traffic. The modelled operator would not recover its average costs (i.e. average incremental costs plus share of common costs) for terminating traffic, but could for example recover the unrecovered costs from the price it charges for originating services (either retail or wholesale).

As a result of pure LRIC for wholesale termination, the prices of other regulated voice origination services (such as on eir's fixed network) could be adjusted to accommodate the recovery of efficiently incurred common costs not recovered from the pure LRIC of termination. The 2009 EC Recommendation does not discuss this issue. Other countries have reallocated these costs to services other than just voice (e.g. wholesale line rental in France).

To assess the materiality of these unrecovered costs, we recommend that the models should also explicitly calculate the LRAIC+ of services. ComReg can use this information for other purposes, such as pricing other services and the possible treatment of recovering these costs from services defined as within other relevant markets.

6.5 Price path

As described in Section 4, we recommend that the models produce nominal costs per minute of FVCT (respectively MVCT) for each of the calendar years 2017–2022. There are several options for setting FTRs (respectively MTRs) for all or part of a future regulatory period using these costs per minute. We describe the main options below in Figure 6.1.

52 Developed independently by ComReg's cost modelling team and its advisors

Option	Description
Glide path	Set the price per minute for the last year of the regulatory period to be the cost per minute for that year from the model. Define a glide path over time from the current price to that target price per minute
Unaveraged	Set the price per minute for a given year in the regulatory period to be equal to the cost per minute for that year from the model
Unweighted average	Set a single price per minute over the regulatory period equal to the arithmetic average of the costs per minute of all the years in that period
Weighted average	Set a single price per minute over the regulatory period equal to the terminating minute-weighted-average of the costs per minute of all the years in that period (or alternatively using another weighting)
Levelised	Set a single price per minute over the regulatory period so that the net present value of the termination revenues is equal to the net present value of the costs recovered from the model

Figure 6.1: Choices for price setting [Source: Analysys Mason, 2018]

We recommend using the simplest method specified above i.e. to use unaveraged costs for individual years as the starting points for prices for FVCT/MVCT in those years.[53] This is consistent with the approach taken in numerous other Member States (e.g. the UK, France, Sweden and Denmark) and is consistent with ComReg's existing pricing decisions.

The pure LRIC per minute calculated by the models will comprise cost contributions from various network assets. Some of these cost components will be caused by the number of calls within the increment, and some by the duration of calls in the increment. Currently in Ireland, MVCT is priced per minute, and FVCT is priced using a combination of per call and per minute components. We do not recommend pricing MVCT using the same structure as with FVCT, as this is likely to increase operators' costs in their wholesale billing systems, and most mobile network costs are minute-driven rather than call-driven. We recommend that a per call price component is set only if the per call cost is a material proportion of the overall blended average cost per minute of termination.

6.6 Model updating

There are several options for procedurally updating the models. ComReg could choose to lock the models for the duration of the future regulatory period. This would provide regulatory certainty for the market. Some Member State regulators, such as the Danish Business Authority, undertake annual updates of key inputs of their models (the demand volumes and the weighted-average cost of capital). This allows the regulated prices to respond to key market developments.

However, regular updates generate a significant overhead for both the regulator and industry stakeholders, who must participate in this update process. We therefore recommend an intermediate

53 All of the options specified could equally be further post-processed into periods other than calendar years e.g. financial years, July to July.

approach to ComReg, whereby an update of the price-setting model is only undertaken if evidence of significant divergence of forecasts or other model inputs from reality, leading to material changes in the models' results, is brought to ComReg's attention.[54]

6.7 Recommendations on consistency between FVCT and MVCT

Apply the same MTR to all MSPs.

Apply the same FTR to all FSPs.

The models should recognise the effects of dynamic efficiency through the assumed technologies and assumed migration between them.

Develop a single, internally consistent forecast of the voice market in Ireland.

The models should also calculate the costs not recovered if a pure LRIC approach is applied to voice termination.

Price according to twelve-month periods, with the prices for those periods derived from the cost model results.

ComReg should not update the model within the pricing period unless there is evidence of significant divergence of forecasts or other model inputs from reality which causes a material change in the cost per minute.

54 This is similar to ComReg's decision D03/16 regarding wholesale current generation access services. eir is required to review the inputs and assumptions of the access model annually. However, the modelling underpinning the pricing will only be reopened where significant and sustained changes to key inputs are observed. See https://www.comreg.ie/publication-download/pricing-of-eiras-wholesale-fixed-access-services-response-to-consultation-document-1567-and-final-decision, paragraphs 12.17–12.23.