dot·econ

Glide paths for fixed termination rates

A note prepared for BT

20 December 2012

1   Background

1. In its recent call for inputs on the fixed narrowband market and the expected network charge control (to come into effect from 1 October 2013), Ofcom has set out its initial thinking in respect of the glide path it considers should apply on fixed termination rates (FTRs) to bring them to pure long-run incremental cost (pLRIC) in line with the 2009 EC Recommendation.[1]

2. In particular, Ofcom notes that there are a number of factors potentially pointing to a short glide path to pLRIC for FTRs. These include:

    a) the fact that one of the main arguments for longer glide paths, dynamic efficiency, is weakened in the case of FTRs;[2]

    b) a desire to achieve consistency with mobile termination rate (MTR) regulation, for which the CC and the CAT determined in favour of a reduction in the period by which MTRs should be reduced to pLRIC given no "compelling reason" to do otherwise;[3] and

    c) a desire to align FTRs to pLRIC with minimal delay.

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[1] See Section 6 of "Fixed Narrowband Market Review and Network Charge Control: Call for Inputs", Ofcom, 17 May 2012.

[2] In a footnote, Ofcom notes that "*For one-way access markets, dynamic efficiency is one of the main arguments supporting a longer glide path, but its relevance appears limited in the case of fixed call termination because (i) a fixed network operator already faces incentives to invest and innovate as call termination largely shares assets with call origination, which we envisage will either be found to be competitive or will be regulated if not, and (ii) the profitability issue arising from the termination rate reduction is mitigated by the two-sided nature of the call termination market (i.e. via the waterbed effect the loss resulting from the call termination rate reduction can be compensated for via price increases on the other side of the market, i.e. for subscription and/or usage).*" See footnote 58 of "Fixed Narrowband Market Review and Network Charge Control: Call for Inputs"; Ofcom, 17 May 2012.

[3] See paragraph 6.33 of "Fixed Narrowband Market Review and Network Charge Control: Call for Inputs"; Ofcom, 17 May 2012.

3.   BT has asked DotEcon to consider these arguments and their suitability for the glide path to be applied in respect of FTRs, and to consider any other issues that may be relevant in establishing a suitable glide path.

4.   In its call for inputs, Ofcom states that it intends to adopt a pLRIC cost basis for FTRs.[4] In this note, we do not consider the issue of the desirability of pLRIC as such, but only the more limited question of the appropriate glide path to pLRIC from current FTRs. Therefore, we simply adopt the assumption that FTRs will eventually fall to pLRIC and ask what principles should inform how that adjustment is best made.

2   Dynamic efficiency and glide paths

5.   Ofcom's first argument is that the case for longer glide paths based on dynamic efficiency effects is weakened for fixed termination rates. Incentives to invest should not be materially affected by changes in termination rates, not least as waterbed effects may serve to limit profitability impacts.

6.   What Ofcom appears to have in mind here is the traditional argument that a glide path acts as a commitment device for an SMP operator subject to price regulation. In order for the operator to have the incentive to cut costs by investing and innovating, it is important that the regulator cannot capture cost reductions too quickly by reducing regulated prices as soon as the cost reductions are made. The operator must be allowed some benefit before reductions are clawed back by the regulator.

7.   This is, in part, the logic behind periodic regulatory reviews, where the regulated company is allowed to retain the entire benefit of out-performing a price cap until the next review is conducted, at which point benefits are identified and passed back to customers through a revised price cap and lower prices for the duration of that control. Essentially, what matters for maintaining investment incentives is not the rate at which prices are reduced during the period of the glide path, but rather that regulated prices are pre-determined until some specified future date, before being reviewed again. This serves to remove the risk of regulatory hold-up if cost reductions are achieved during the period that the glide path is in operation. It also serves to give customer some level of certainty over the prices that they are expected to face over the course of the control.

8.   Ofcom suggests that this logic is not particularly relevant to the case of call termination both because termination is just one component of revenues earned from a customer and because of possible partial mitigation of profitability impacts through waterbed effects. However, at best waterbed effects are likely to be partial (the magnitude of these are under considerable

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[4] See paragraph 6.17 of "Fixed Narrowband Market Review and Network Charge Control: Call for Inputs"; Ofcom, 17 May 2012.

debate)[5] and termination revenues can be entirely dismissed as immaterial to profitability.

9. Also, whilst this argument might apply to some degree to mobile operators – where the waterbed effect might mitigate the profitability impact of lower termination rates – it is far from clear to what degree this applies to BT as a wholesaler, as there may be no direct consumer relationship linking termination and origination (or access) charges. For example, if BT Wholesale receives termination payments in regard of a customer of a CPS operator, it cannot mitigate a reduction in the termination rate by raising other charges paid by that retail customer. Increasing origination charges is a very blunt instrument in this context; there is no equivalent to the complex tariff re-balancing that an MNO might be able to make, adjusting tariffs targeted at different customer groups according to the specific impact of a change in termination rates (which will vary according to the volume of incoming calls to each customer group).

10. Therefore, it would seem that BT could well have much more limited opportunity to mitigate profit impacts through "waterbedding" than the MNOs can. If that is so, Ofcom may be too readily dismissing the dynamic efficiency issue.

11. Furthermore, we understand that Ofcom's is potentially entertaining the possibility that the FTR might not just fall to the pure LRIC of BT's current voice network, but fall further to the pure LRIC of a hypothetical NGN.[6] This does not have a parallel with regulation of MTRs and would be more onerous that might have arguably been expected on the basis of the previous Ofcom regulatory practice[7] and the 2009 EC Recommendation alone. This raises the question of whether the further fall to a hypothetical NGN's pLRIC might be considered to be 'hold-up' in respect of BT's existing network assets. We do not consider this question as it would take us far from our central concerns, but again suggests that Ofcom may be in danger of too rapidly dismissing dynamic efficiency issues.

12. Therefore, whilst dynamic efficiency issues (associated with the length of the price cap) may not be of predominant importance for the case of voice call termination, it is not at all clear these issues can be dismissed out of hand. However, even if Ofcom is correct that traditional dynamic efficiency arguments are less relevant, it is still the case that reducing termination rates may affect the profitability of different services and customer groups, in turn requiring some adjustments to other tariffs and even underlying business

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[5] See recent cases in respect of MTRs, premium numbers and non-geographic call services in regard to the partial nature of the waterbed effect.

[6] See Question 25 and paragraphs 6.18-6.21 in "Fixed Narrowband Market Review and Network Charge Control: Call for Inputs", Ofcom, 17 May 2012.

[7] See "Fixed Narrowband Retail Services Markets - Identification of markets and determination of market power", Ofcom, 15 September 2009.

models or processes in response. This issue still needs to be considered regardless of dynamic efficiency effects.

Adjustment costs

13.   A change in termination rates might require responses from CPs in terms of other prices they set and any changes to their associated business models. Having optimised choices for one pricing regime, changes to that regime may require different choices to be made, which may take time to implement. This need for adjustments in response to changed regulation of termination rates is relevant for both fixed and mobile providers. Indeed, mobile network operators (MNOs) discussed just such adjustments during the recent MTRs review.[8]

14.   These knock-on changes required in response to changes in termination rates may involve a mixture of physical costs (e.g. advertising needs to be changed to show different prices, what is sometimes called "menu costs") and opportunity costs. The latter arise where there are lags and delays in being able to re-optimise variables (which include other prices, but also other business variables, such as how much resource is used in attracting and retaining customers) in response to changes in termination rates. Until these internal adjustments have worked through in response to an external stimulus, profits will be lower than their long-run optimised levels and so there is an opportunity cost.   Such lags and delays may be simply unavoidable due to the nature of management processes within a large organisation and the need for authorisation and implementation within existing frameworks.

Trading off between welfare gains and adjustment costs

15.   The most relevant factor in considering glide paths for voice termination is the trade-off between achieving benefits sooner through faster reductions to pLRIC and the greater adjustment costs that this would cause. Faster reductions achieve benefits earlier. However, more rapid adjustment will typically increase the total costs of adjustment.

16.   Whilst we agree with Ofcom that the issues of regulatory commitment and incentives for cost reduction – what Ofcom calls dynamic efficiency – might be less relevant for determining glide paths for termination rates than for other forms of regulation, it is certainly not correct to leap to the conclusion that glide paths should necessarily be short. This would be an erroneous conclusion, as the particular characteristics of termination would then make the question of balancing welfare gains with adjustment costs all the more important due to the knock-on effects of changing termination rates across CPs' businesses. The correct inference is that Ofcom must look at the balance of welfare gains and adjustment costs when informing its choice of glide path.

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[8] See Section 7 of "Wholesale mobile voice call termination: Statement"; Ofcom, non-confidential version 15 March 2011.

Modelling these trade-offs

17.   In Annex A, we present a simple mathematical model of the trade-off between the welfare benefits of hitting a target with the adjustment costs incurred in doing so.   This model demonstrates the three key factors influencing the optimal rate of adjustment of a regulated price to some target:

   a)   The magnitude of the welfare benefits available from moving to the target price (which depend on how far we are from the target);

   b)   The magnitude of adjustment costs (which depend on the rate of adjustment); and

   c)   The (social) rate of time preference, which determines the trade-off between delaying the benefits of bringing prices in line with the target price and the reduction in adjustment costs achieved in the short-run.

18.   The trade-off between speed of adjustment to a target and adjustment costs necessarily has some structure by virtue of the fact that:

   a)   The target regulated termination rate has presumably been set on the basis of a static analysis of costs and benefits to maximise net benefits. Therefore, there is a welfare loss associated being away from this target;

   b)   Adjustment costs arise from lags and delays in being able to re-optimise other prices (and variables) in response to changing termination rates.

19.   Because adjustment costs tend to increase disproportionately with the adjustment being made (as we show in Annex A), a rapid 'big bang' adjustment will always be more expensive than spreading the adjustment over time. Therefore, smoothed adjustment reduces the total adjustment cost incurred, though obviously at the cost of delaying achievement of the target.

20.   The model shows that we can expect that:

   a)   There should always be some smooth, progressive adjustment to the target prices once there are any adjustment costs;

   b)   There is no compelling reason that the proportionate rate of adjustment should be faster if the initial deviation from the target price is smaller;

   c)   Greater welfare costs where price deviates from the target favour faster adjustment;

   d)   Greater adjustment costs favour slower adjustment; and

   e)   A greater social discount rate (i.e. more impatience) favours slower adjustment (as adjustment costs are incurred in the short-run for long-run benefits from price being closer to target).

21.   We show in Annex A that we can expect both welfare losses and adjustment costs to increase rapidly as we move away from the target price, but qualitatively for these to change in similar ways. Equally, as we move closer to the target termination rate, *both* the loss in being away from the target rate *and* the adjustment costs get smaller. Even if there was only a small way yet to

travel to the target both the marginal benefit from a further step towards the target and the adjustment cost in making that small step *both* decline. Therefore, benefits do not dominate costs or costs dominate benefits and there is still a trade-off.

22. Under the assumptions laid out in <u>Annex A</u> (which necessarily hold as an increasingly good approximation as prices converge towards the target), this trade-off remains fundamentally unchanged as we approach the target, with costs and benefits declining together in lock step. This means that it is fundamentally wrong to assume that a smaller required adjustment should necessarily be made faster.

3 Consistency with MTR regulation

23. This framework immediately suggests that arguments suggesting a short glide path for FTRs, in order to align them with the treatment of MTRs and to ensure that pLRICs are reached without delay, are at best unsubstantiated:

   a) First, although the treatment of MTRs is a clear precedent, one cannot simply carry over the approach from MTRs uncritically to FTRs. Rather, Ofcom must ask whether the balance between welfare effects and adjustment costs is different in the fixed and mobile sectors; and

   b) Second, the fact that current FTRs do not have far to fall to pLRIC (at least in comparison to MTRs) is not in itself a valid reason not to use a glide path or to use a particularly rapid reduction and to bring FTRs in line with pLRIC with 'minimal delay'.

Adjustment costs for FTRs

24. Although there has been much debate about the nature and magnitude of waterbed effects in the mobile sector, similar issues also apply to the fixed sector. Changing FTRs should have some impact on pricing of connections and origination, though obviously this effect is likely to be much smaller in absolute terms than in the mobile sector due to the smaller adjustment needed.

25. These affected prices cannot be altered immediately. Wholesale prices require notice to be given. Retail prices will be subject to contractual obligations. As noted above, MNOs discussed such issues over the course of the MTR review.[9]

26. In terms of a neutral regulatory approach, there is no reason to suppose that different types of network should be treated differently in terms of the opportunity provided to adjust other prices (and business choices) in response to the stimulus of lower termination rates. Whilst the absolute distance of travel to pLRIC may vary for different types of network, a neutral approach would be to allow adjustment paths where the gap between termination rates

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[9] See Section 7 of "Wholesale mobile voice call termination: Statement"; Ofcom, non-confidential version 15 March 2011.

and pLRIC declines at a similar proportionate rate across those different types of networks. This would be a coherent and defensible approach, with the underlying rationale being that different networks were being treated similarly in terms of optimally trading off adjustment costs with benefits of achieving the target sooner.

Welfare effects for fixed and mobile

27. The other key factor determining speed of optimal adjustment is the magnitude of welfare benefits obtained from faster reductions to the target price. We do not wish to revisit the extensive debate about the merits and demerits of regulating termination to pLRIC, but nevertheless there are some significant differences between fixed and mobile sectors with regard to the likely scale of these benefits.

28. A key concern in the mobile sector is that higher termination rates have led to a variety of allocative inefficiencies and potentially adverse competition impacts:

    a) Excessive handset subsidies, leading to wasteful replacement of handsets;

    b) Additional features and functionality being provided to attract and retain mobile customers that are at least in part supported (and incentivised) by margins earned on termination, where these bells and whistles do not benefit voice callers to mobiles; and

    c) Higher termination rates providing greater ability to set differentiated on-net prices, potentially advantaging larger operators in winning and retaining mobile customers due to the non-replicable advantage of a greater proportion of a customer's calls being on-net.

29. None of these factors are relevant in fixed networks. There is no significant subsidisation of terminal equipment incentivised by termination margins and no parallel to the handset replacement cycle in mobile.

30. On-net discounting has not been used by BT and is seldom used by other fixed line operators. Annex B provides a snapshot from BT's website and shows that retail prices do not differentiate between ringing a BT number and another fixed network. Even prior to the widespread introduction of call packages with inclusive minutes, the popular Friends and Family discount scheme (in place until 2010) allowed any numbers to be chosen – including mobile numbers – to enjoy a discount. Therefore, there is little reason to consider that there has been significant distorting impact on retail competition in the fixed sector due to FTRs being above pLRIC. This contrasts strongly with the mobile sector, where H3G – as the smallest operator – has been a vigorous proponent of

lower MTRs, considering that this would provide a relative advantage in competing with other MNOs.[10]

31.   Competition between MNOs creates clear incentives to use termination as a soft source of revenue, which can then be used to fund lower prices and additional features that are attractive to mobile customers. This is the fundamental rationale for regulation of termination. However, we must recognise that this problem is much less acute in the fixed sector because of the much greater role of regulation (originally of BT retail prices directly, but now indirectly through regulation of BT Wholesale's wholesale charges).

32.   Therefore, there is good reason to expect that the scale of welfare effects arising from termination rates being above pLRIC may well be much larger for the mobile sector than for the fixed sector. Of course, this may in part be due to larger absolute difference between pLRIC and current termination rates for the mobile sector than for the fixed sector. However, the role of MTRs in affecting competition between MNOs does strongly suggest that the welfare impact of higher termination rates would – for similar levels of difference – be greater for the mobile sector.

33.   Returning to our framework, trading-off welfare benefits of achieving a target price with adjustment costs, if the welfare benefits are larger for the mobile sector than for the fixed sector, then this would imply (ceteris paribus) that optimal adjustment for the mobile sector should be faster than for the fixed sector.

Scale and speed of FTR adjustment required

34.   FTRs are already much closer to pLRIC in absolute terms than MTRs are. In the case of MTRs, Ofcom has noted that:

> "Prior to April 2011, MTRs were capped at 4.18p per minute (4.48p per minute for Three). From 1 April 2011 until 31 October 2011, MTRs were set at a maximum of 2.66p per minute for all mobile network operators. From 31 October 2011 until 31 March 2012 these rates were set to 2.69p per minute."[11]

MTRs are also expected to fall to 0.67p per minute by 2015, following the recent ruling in respect of reducing MTRs to pLRIC.[12]

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[10] See "Three response to Ofcom Wholesale mobile voice call termination Market Review Consultation."; Non-confidential version, Three, 23 June 2010. For example, at Paragraph 355 H3G says that: "...lower retail profitability due to high off-net flows translate into lower overall profitability due to limited "recycling" of other operators' off-net calls into Three termination revenues. Overall the result is a constraint on Three's ability to compete."

[11] See "Communications market report 2012"; Ofcom, 2012.

[12] See Table 2 in http://stakeholders.ofcom.org.uk/binaries/consultations/mtr/statement/smp_conditions.pdf The figure of 0.67ppm announced by Ofcom was in 2008/9 prices and does not take account of inflation. We understand that BT expects the nominal rate by 2015 to be around 0.85ppm.

35. In contrast, by 2013, FTRs are already expected to be at around 0.23p per minute.[13] This follows an RPI+3.75% charge control established by Ofcom running from 2009 through to 2013.[14]

36. Importantly, however, the fact that a much smaller adjustment is required for FTRs (both in absolute and relative terms) cannot *by itself* be taken as a sound reason to reduce FTRs to pLRIC quickly, and in particular faster than MTRs. As Annex A shows, under natural assumptions about the welfare benefits of approaching a target and the adjustment costs incurred in doing so, there should be progressive adjustment to the target, with the distance from the target price delaying at a constant rate. There is no obvious or natural reason why the adjustment should be made at a faster rate for FTRs just because the starting point is closer to the target of pLRIC than for MTRs.

4 Conclusions

37. Overall, we do not consider that the three arguments presented by Ofcom for the case of a short glide path of FTRs to pLRIC are well-substantiated:

   a) First, Ofcom notes that dynamic efficiency effects supporting longer glide paths are not applicable here. Whilst the reasons for dynamic efficiency effects may be somewhat weaker here (due to the more limited impact of termination rate regulation on overall profitability), they are not absent. Also, this observation does not imply anything by itself for the appropriate length of glide paths. To the extent that the profitability impact of lower termination rates is mitigated, this is because of adjustments made to other prices (and possibly business practices more generally). We consider that Ofcom has not given due consideration to the costs and lags associated with these adjustments when shifting FTRs from current prices to the target of pLRIC, nor has it considered the necessary trade-offs with welfare effects that the glide paths might involve;

   b) Second, Ofcom considers there to be merit in ensuring consistency with MTR regulation. We consider that there are differences between fixed and mobile which need to be considered before drawing such a conclusion. In particular, it is not clear that the welfare effects are similar between fixed and mobile; if anything it may well be that welfare costs of higher termination rates are more severe in the mobile sector; and

   c) Third, Ofcom considers that there is merit in a rapid reduction in FTRs in order to minimise the delay in reaching pLRIC. In this regard, we consider that arguments for rapid reductions are not obvious. The natural framework for considering this issue – the dynamic trade-off between adjustment costs and reaching a target of pLRIC sooner –

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[13] See BT glide path discussion paper, as submitted to Ofcom following its meeting on 11 October 2012.

[14] See http://stakeholders.ofcom.org.uk/consultations/review_bt_ncc/statement/

does not imply that small required price adjustments necessarily warrant faster reductions.

Annex A   A simple model of optimal glide paths

A dynamic trade-off framework

38. Consider the following very general setup. A price p is subject to regulation. Absent any considerations of dynamic adjustment, this price is chosen to maximise economic welfare $W(p)$, with $p^\star$ being the optimal price that (statically) maximises W. We will call $p^\star$ the statically optimal price (i.e. target price).

39. Suppose that the price is initially at some level $p_0 > p^\star$ and that a regulated path p_t needs to be set to bring the price down over time to $p^\star$.

40. Changing the price over time is costly due to the need for adjustments to be made in response. There are welfare losses that are increasing in the rate of adjustment of p. This is represented by an adjustment function $C(\dot{p}_t, p_t)$ where $\dot{p}_t$ is the rate of change of p. Notice that this formulation allows for losses associated with the absolute rate of change of p, or the relative rate of change of p (i.e. $\dot{p}/p$).

41. C is a convex function of $\dot{p}$, which implies that there is benefit in having a smoothed adjustment path. We return to this property of adjustment costs below.

42. Suppose that the social discount rate is δ. The socially optimal glide path should maximises welfare over time net of adjustment costs, i.e.

$$\int e^{-\delta t}[W(p_t) - C(\dot{p}_t, p_t)]\, dt$$

43. This is a calculus of variations problem and the optimal solution satisfies the Euler-Lagrange condition

$$e^{-\delta t}[W - C_p] + \frac{\partial}{\partial t}[e^{-\delta t} C_{\dot{p}}] = 0$$

which can be simplified to

$$W - C_p - \delta C_{\dot{p}} + \frac{\partial}{\partial t} C_{\dot{p}} = 0.$$

This is the first order condition that characterises the optimal glide path.

44. In the case that prices are close to the optimal price $p^\star$, it follows that expressing economic welfare as a series approximation

$$W(p) \cong -\alpha(p - p^\star)^2$$

because $W'(p^\star) = 0$ on account of $p^\star$ being the statically optimal price. Therefore, the welfare costs of deviations from the optimal price <u>must</u> be approximately quadratic in the size of the deviation; this is a logical consequence of $p^\star$ being the statically optimal price.

45. Take a simple example of quadratic adjustment costs, where

$$C(\dot{p}, p) = \tfrac{1}{2}\beta \dot{p}^2$$

which is a convex function of the adjustment rate of price change. This formulation arises naturally in the case that there are other control variables

(e.g. other prices or business decisions) that are affected by the regulated price p but which cannot be instantaneously adjusted to their new optimal values when p changes.

46.   From the Euler-Lagrange condition, the optimal adjustment path satisfies the differential equation

$$\ddot{p} - \delta p - \frac{\alpha}{\beta}(p - p^{\star})^2 = 0$$

which has a solution

$$p_t - p^{\star} = [p_0 - p^{\star}]e^{gt} \quad \text{where} \quad g = \frac{\delta}{2} - \sqrt{\delta^2 + \frac{\alpha}{\beta}} < 0$$

47.   Therefore, the optimal glide path has the following characteristics:

   a)   the gap between the current price and the optimal price decays at a constant rate g;

   b)   the optimal rate of decay g is independent of the initial difference between the starting price and the optimal price (with this formulation of adjustment costs);

   c)   the optimal rate of decay g is greater if the welfare cost of deviating from statically optimal price is larger (i.e. α is larger);

   d)   the optimal rate of decay g is smaller if the adjustment cost is larger (i.e. β is larger);

   e)   the greater the social discount factor (i.e. δ), the slower the optimal rate of decay (as adjustment costs are incurred now for later benefits).

48.   Notice in particular, that even where the initial difference from the optimal price is small, it is still optimal for prices to decline smoothly at just the same rate as if the initial difference were large.

Approximately quadratic adjustment costs

49.   Approximately quadratic adjustment costs arise natural in situations where a firm needs to respond to some stimulus (i.e. lower termination rates) by adjusting other variables, but there are lags in being able to make those adjustments. The underlying idea is illustrated in the figure below.
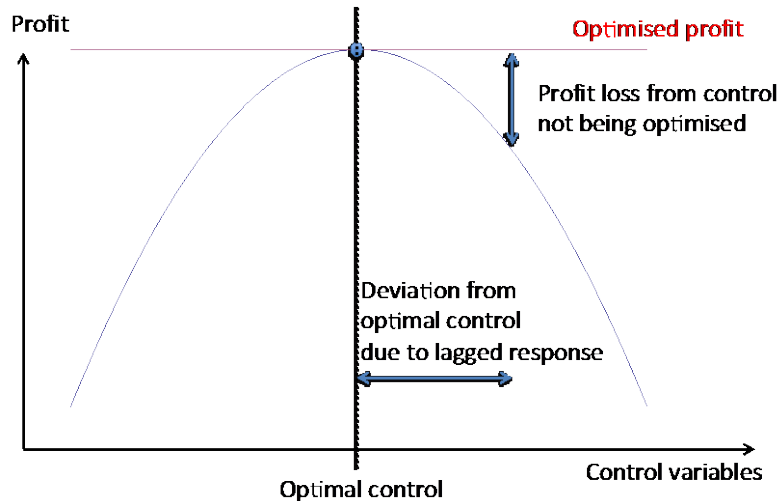
50.   The figure shows how profits are maximised if control variables are optimally set (the dotted line). Because profits are maximised at this point, the profit curve must be locally flat and, as a result, the profit loss from the control variable not being optimally chosen increases rapidly as the distance from their optimal values increases (in fact in proportion to the square of this distance for small changes).

51.   This fundamental principle means that it is natural to suppose that adjustment costs are a *convex* function of the adjustment made. This means that if the magnitude of the required adjustment doubles, the cost of that adjustment more than doubles (in fact it might reasonably increase four-fold for sufficiently small adjustments).[15]

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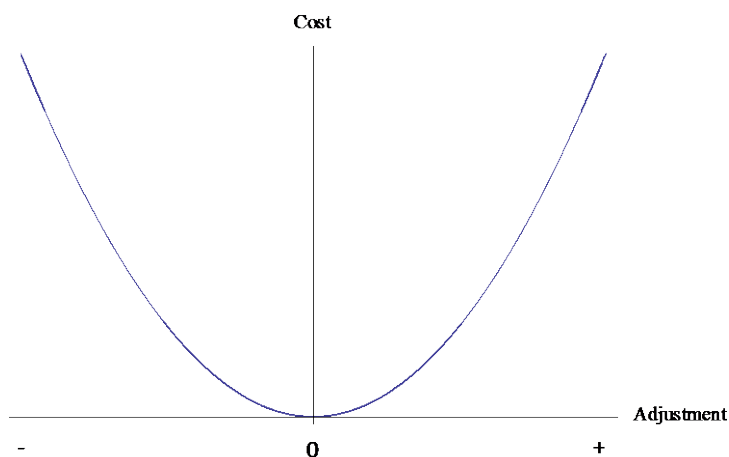
[15] This follows from the fact that in the region of the optimal choice of controls $x^\star$, profits can be expanded in a series as $\pi(x) \cong \pi(x^\star) + \frac{1}{2}\pi''(x^\star)[x - x^\star]^2$

Annex B   BT Calling plans

Source: BT website, snapshot taken on 5 December 2012
(http://www.productsandservices.bt.com/products/landline/packages?packid=uapplus)