Anchor product regulation – retrospective and prospective

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Abstract: Communications networks are undergoing a transition from copper to fibre, from 2G and 3G to LTE and from switched to IP. Where *ex ante* regulation applies transition involves particular challenges and trade-offs that differ from those applying to relatively stable pre-existing infrastructure. The rationale and approach to *ex ante* regulation should therefore be re-assessed to take account of network transition - indeed the desire for transition - as a policy goal. Anchor product regulation, an approach whereby an *ex ante* price control is applied to the legacy network service or to a sub-set of services over a new network, was first proposed in 2007 as an intermediate approach between a full cost orientated price control and no price control; and with network transition in mind. In relation to copper-fibre transition anchor product regulation, alongside non-discrimination requirements for network access, has been adopted by Ofcom in 2010 and in the recommendation on non-discrimination and costing adopted in September 2013 by the European Commission. This paper explores the motivation for anchor product regulation, its origins and its prospects.

The investment challenge

Globally networks are in transition from copper to fibre, from 2G and 3G to LTE and from switched to IP networks. Broadcast networks may also undergo a transition with greater convergence between mobile networks and broadcasting. Where regulation applies transition presents particular challenges applying cost oriented pricing to new networks may deter investment and take-up, bias the choice of network technology, and involve information challenges in estimating a cost reflective price and disruption of existing access and universal service requirements.

Nevertheless where market power is present regulation aims to protect consumers and access seekers against potential abuse of market power. The challenge is to devise a means of offering sufficient protection whilst recognising information constraints and the requirements for efficient investment.

One measure of protection is that anchor product regulation, by maintaining a status quo option for consumers, ensures that consumers are made no worse off by transition. If consumers do not value the attributes of fibre sufficiently they are able to remain on the existing product, or a virtual equivalent on fibre. Any investment therefore involves a Pareto welfare improvement, a strong measure of protection not necessarily afforded to consumers in competitive markets.

It is important also that investment proceeds when it is worthwhile, not simply satisfying a condition that it makes no consumer worse off (which would be met by no investment). For efficiency investment should meet a simple value test, namely Δ WTP > Δ Cost (where WTP is willingness to pay). Price controls undermine this outcome by limiting the scope to set prices reflective of willingness to pay. However, there is an additional criterion for efficiency, namely that there is an incentive to select from a portfolio of choices (including technology and timing choices) the investment option that maximises social surplus.

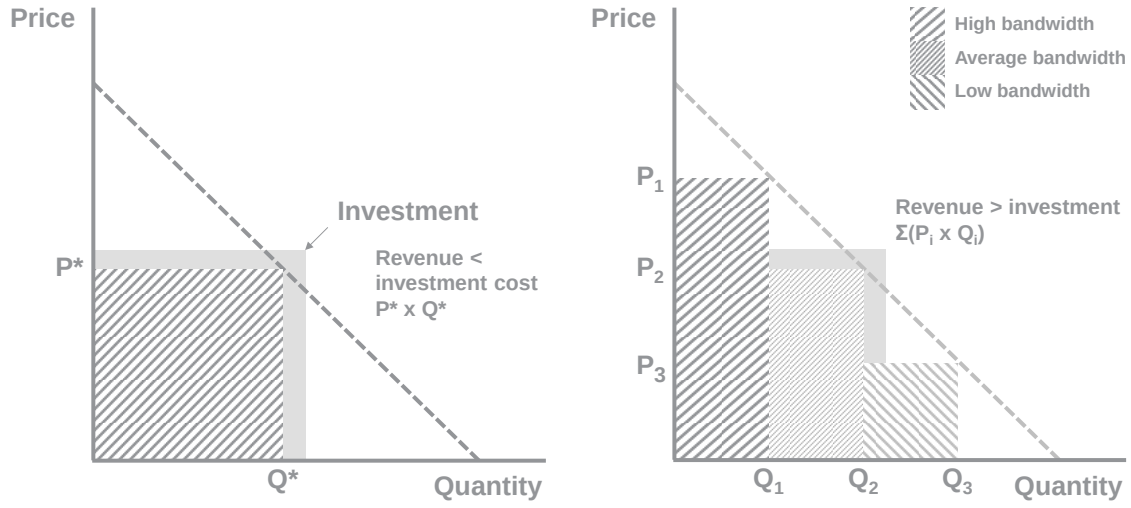
[1] The contribution of Sam Wood in providing research support for this paper is acknowledged.

The anchor product approach therefore sought to meet two meet two criteria, whilst also providing a degree of protection for consumers and access seekers, namely:

- To preserve scope for price differentiation at access level to align expected revenue, and therefore investment decisions, with end user willingness to pay.
- To allows investors to earn “information rents” to motivate appropriate choice from portfolio of options in terms of investment location, timing and technology etc.

Figure 1 illustrates how service-price differentiation helps align investor and consumer interests in network transition, when compared with a single cost orientated price.

Figure 1: Service-price differentiation helps align investment with consumer preferences



Pricing flexibility will also allow strategies such as penetration pricing to be pursued and for the pricing strategy to develop as investors learn from market responses. The value of these additional considerations is likely to be important in practice, but is not reflected in Figure 1.

In relation to the second criterion, namely choice of the most socially valuable investment from a portfolio of options, Williamson (2009) showed that no given fixed price or price cap can offer efficient investment across a portfolio of investment options with uncertainty and asymmetric information. We note that all investments involve a portfolio of options, since the choice of timing alone expands the set beyond a yes/no decision. Figures 2 and 3 illustrate the problem, where situations A and B are different states of the world.

Figure 2

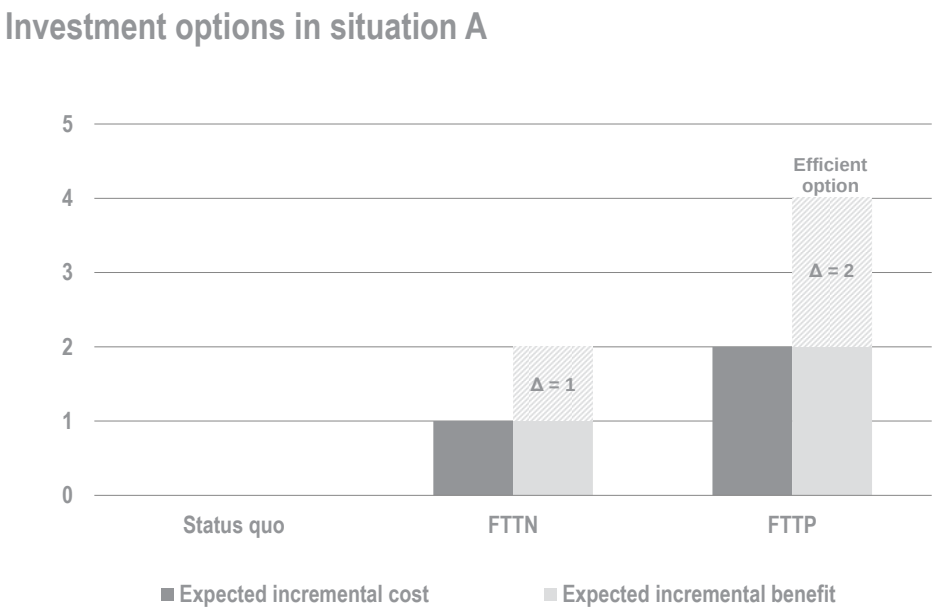
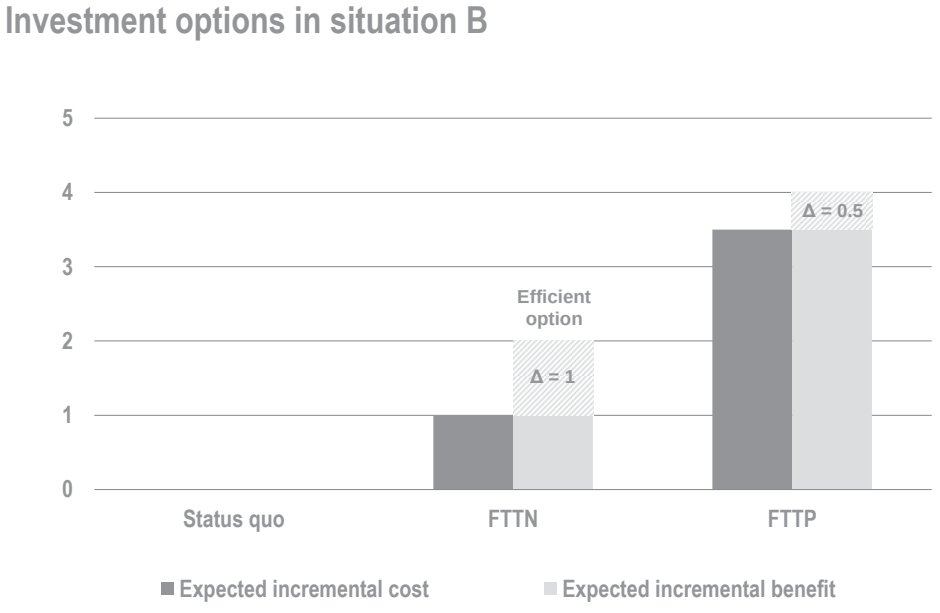


Figure 3



The status quo is shown with zero incremental cost and zero incremental benefit – all investment choices are against this counterfactual and the focus is on incremental costs and revenues. In terms of value (incremental benefit less incremental cost), fibre to the premise (FTTP) is preferred in situation A (a surplus of 2) and fibre to the node (FTTN) is preferred in situation B (a surplus of 1).

With regulation inefficiency can arise as follows. Under utility style regulation, if the return on capital is too low, the status quo (no investment) would be chosen in both situations, whilst if the return on capital were too high, FTTP would be chosen in both situations, and this would involve inefficient "gold

plating" in situation B. With a price cap, the investor would prefer FTTN in both situations if the price cap were in the range 1 to 3. If the price cap exceeds 3, the investor can generate a greater surplus by making the efficient investments in both situations i.e. information rents are necessary to motivate the efficient choice (assuming there is information asymmetry).

If the information required to assess efficient investment in each location were common knowledge, the regulatory problem would be trivial - the regulator could simply offer returns conditional on making the efficient investment in each location. In practice, a judgement is required over which investment to make in each location given uncertainty over the value (and therefore customer willingness to pay) for alternatives. In these circumstances, it is essential that investors face incentives to make the right decision *ex ante*, in other words, to bear some of the potential risk and reward and to be able to earn information rents.

Finally we note that the condition Δ WTP > Δ Cost appears independent of the existing cost (and price) of the legacy network - what matters is that the difference in WTP exceeds the difference in cost. However, stability of existing access regulation and pricing is important when investor expectations are considered, as investor will be reluctant to commit to new infrastructure if the regulator has a demonstrated willingness to lower prices *ex post* once investment is sunk.

Indeed it may be optimal for a rationale regulator to lower prices ex post, unless they can commit not to do so, an example of the time inconsistency problem demonstrated by Kydland and Prescott (1977):

> *"Even if there is an agreed-upon, fixed social objective function and policymakers know the timing and magnitude of the effects of their actions, discretionary policy, namely, the selection of that decision which is best, given the current situation and correct evaluation of the end-of-period position, does not result in the social objective function being maximized."*

Ofcom's Chief Economist Peter Culham (2012) introduced the concept of *"'Dynamically efficient value'"* which *"depends on what is required to avoid expropriation of assets"* in relation to access pricing – a concept that recognises the central importance of commitment.

Developments at a European level in 2013, consider further below, may also assist national regulators to commit credibly to copper price stability and fibre pricing freedom subject to non-discrimination and anchor product constraints), thereby maximising social welfare over time.

Development of anchor product regulation in the UK

Anchor product regulation, an approach whereby an *ex ante* price control is applied to the legacy network service only or to a sub-set of services over a new network, was proposed by Williamson (March, 2007) as an intermediate approach between a full cost orientated price control and no price control; and with network transition in mind. The objective was to provide protection against abuse of market power, whilst also leaving a substantial degree of price flexibility with investors and reducing the information burden on regulators given uncertainty and information asymmetries.

The anchor product concept was suggested by the UK regulator Ofcom (September, 2007) in a policy document which stated (Paragraph 1.10) that:

> *"We are proposing to achieve the conditions for this investment by adapting the existing principles of contestability, innovation and equivalence that we have used for the regulation of current generation broadband. In addition we think that two further principles will be necessary as we move to next generation access, to reflect the commercial risks and different*

characteristics of these investments compared to existing access networks, which are largely sunk cost investments…

- *reflecting risk in returns: we recognise that anyone who makes investments in next generation access is likely to face significant commercial risks. Regulation should reflect these risks in order to provide appropriate incentives for investment in the first place. We are consulting on a range of approaches to reflect such risk such as anchor product regulation, and risk-adjusted returns; and*
- *regulatory certainty: It is also important that the regulatory regime we adopt is clear and in place for a reasonable period of time, to allow investors the clarity that they need to invest with confidence. We are publishing this consultation and establishing a program of seminars and meetings supporting it to provide this clarity."*

The importance of price flexibility to efficient investment was emphasised in paragraph A7.18 of the Ofcom consultation:

> *"Anchor products provide a high degree of flexibility for investors in new access networks, allowing the option to secure higher returns for new or higher performance services. This flexibility also provides operators with an ability to experiment with service offerings and tailor them to end customer needs. Such price differentiation is also welfare enhancing. Price differentiation…could in turn allow investments to take place that would, with a single price, not be possible. This is unlikely to be possible under a flat rate pricing system (such as cost based pricing)."*

Ofcom continued to explore anchor product regulation during 2008. Ofcom noted the protection against potential market abuse afforded by a strong non-discrimination requirement ("equivalence") following the establishment of Openreach in 2006 coupled with competition from cable and from copper ADSL with fibre. The regulatory costs and risks involved in imposing a price control, and the resulting disincentive for investment, were also key considerations.

In effect Ofcom was weighing up alternative regulatory options not in terms of a simple yes/no decision dependent on whether market power existed, but in terms of a broader set of regulatory options on the basis of the costs, benefits and risks of both market and regulatory failure.

BT (July 2008) responded to these developments by announcing its intention to invest £1.5 billion bringing fibre (a mix of FTTH and FTTC) to 40% of UK households or 10 million homes by 2012, but conditional on Ofcom nurturing a "supportive and enduring regulatory environment".[2]

Ofcom (September 2008) first set Ofcom's clear preference for the anchor product approach (Paragraph 71.8):

> *"Anchor product pricing has the advantage of creating incentives for efficient investment (by allowing higher prices on higher bandwidth products) while ensuring that consumers of products currently available today are not adversely affected."*
>
> *"We consider that of the options outlined, the anchor product pricing approach has significant advantages. Where feasible, is likely to be the most efficient pricing approach for risky next generation access products. Its main advantages are:*
>
> - *it provides incentives to invest by allowing higher returns on new products (likely to be higher speed broadband);*

[2] http://news.bbc.co.uk/1/hi/business/7506742.stm

- *it minimises the risk of detriment by ensuring that products equivalent to those available today are offered at equivalent prices;*
- *the ability to charge excessive prices is limited because the anchor product's price constrains the prices of all other products offered;*
- *it allows flexibility in pricing, enabling investors to trial different price points and change price to maximise take-up; and*
- *it carries less regulatory cost and risk compared with the option where the regulator sets the absolute prices."*

Ofcom (2009) issued a statement signalling their intent to create a regulatory framework favourable for investment. The CEO of BT Ian Livingston (2009) responded that *"Today's announcement gives us the green light to push ahead with our £1.5bn superfast broadband investment plans to reach at least 40 per cent of UK households by 2012."*[3]

As it became increasingly clear that investment would predominantly be in fibre to the cabinet and VDSL rather than fibre to the premise, it also became clear that existing regulated ADSL could serve as the anchor product. In the medium term, provided current and next generation networks continued to run in parallel, Ofcom would not therefore need to define a "virtual" anchor product over fibre. Ofcom (2010) issued a statement in September 2010 which formally endorsed fibre pricing freedom and the anchor product approach:

> *"We have decided not to regulate the prices of the product(s) that BT provides under its VULA obligation. We consider that this approach will give BT the flexibility to price its VULA services according to emerging information on the demand for, and supply costs of, NGA services. At the same time, the prices of these services will be constrained by the availability of current generation broadband services and by competition from services provided over cable TV network infrastructure." (Paragraph 1.27)*

Other competitive benefits of the combination of pricing freedom and next generation access investment have also been noted by Ofcom – in particular that investment by BT provides an open access platform in competition with cable, and that wholesale pricing freedom may reduce incentives to discriminate. Ofcom (2012) note that: *"With cost orientation at wholesale level, incentive to leverage is greater than if wholesale prices are unregulated".* This is consistent with the finding by Weisman and Kang (2001) that "*the incentive to discriminate is decreasing in the level of the access charge…"*

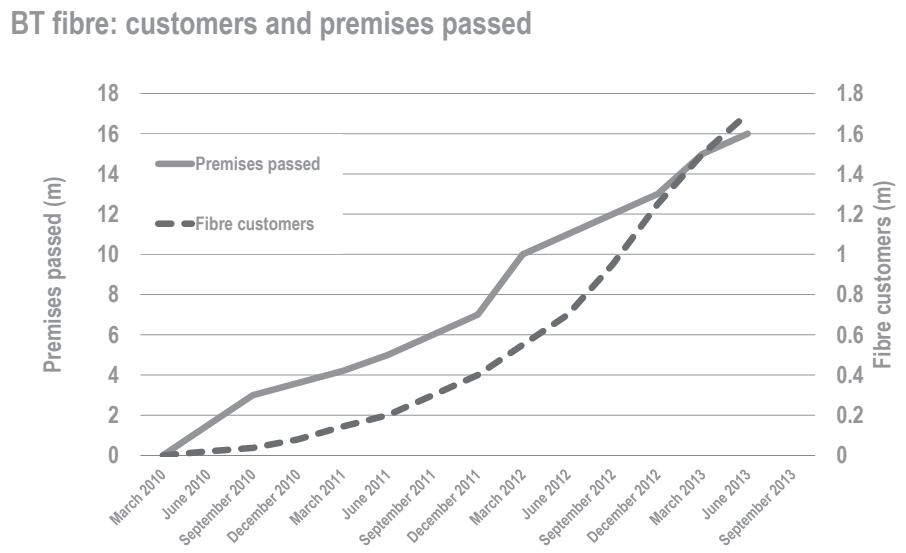
Investment outcomes in the UK

Following these developments BT announced the commercial launch of its "Infinity" fibre product (largely based on FTTC architecture) on 25 January 2010. BT (2011) announced that rollout would be accelerated to reach two-thirds of households by the end of 2014, one year ahead of the original target.[4] Network roll-out has been rapid, reaching 5 million premises by July 2011, 10 million premises by March 2012 and 15 million by March 2013 (see Figure 4). A competitive retail market in fibre products is also emerging.

[3] http://news.bbc.co.uk/1/hi/technology/7919904.stm

[4] BT. October 2011. http://www.btplc.com/News/Articles/ShowArticle.cfm?ArticleID=D228F2B4-25FC-4095-8EC4-BD17B903CC3B

Figure 4



Source: Plum Consulting, BT quarterly reports

Investment and innovation in the access market is also on-going with Openreach (2012) doubling the speed of fibre to the cabinet to up to 80 Mbps,[5] and Openreach (2013) starting to make 330 Mbps FTTP available "on demand" in FTTC enabled areas. These developments point to the on-going need for pricing flexibility to provide incentives for innovation and efficient upgrades.

Development of anchor product regulation in Europe

The European Commission (July, 2012) engaged in extensive analysis and consultation, concluding that pricing flexibility subject to an anchor product and non-discrimination should be allowed for fibre:

> *"When the right conditions are imposed by regulators (equivalence of input obligation, replicability test), and where there is a significant competitive constraint (from operators with cost-oriented access to the copper network in accordance with Commission guidance; or from other infrastructure-based competitors such as cable or LTE."*

Subsequently, after further discussion of the proposals with stakeholders, the Commission published a recommendation on costing and non-discrimination on 11 September 2013. This recommendation provided for fibre pricing freedom subject to non-discrimination requirements and anchor product and/or platform competition. The need for real price stability for regulated copper local loops was also recognised.

The European Commission (2013) also foresaw the possibility that a virtual anchor product might be required on fibre in future, either because copper is retired or because the constraint from copper weakens over time:

> *"If the product offered by the SMP operator on the legacy access network is no longer able to exercise a demonstrable retail price constraint on the NGA product (for example in the event of*

[5] http://www.news-openreach.co.uk/news.aspx?newsid=47

a copper switch-off), it could in principle be replaced by an NGA-based product that is tailored to have the same product features. However, it is not envisaged that such an NGA-based anchor will be required in the immediate future or before 2020."

This leads into the question of how the market might develop in future and whether a progressive weakening of market constraints on fibre is inevitable (leaving cable, which is not universal in Europe, to one side).

Future market development and the sustainability of the anchor product approach

The key market development which is currently underway is arguably the shift towards smart mobile devices, wireless connectivity and apps. Whilst the potential direct substitution of wireless for fixed is widely acknowledged, an indirect channel via the impact on applications and consumer behaviour on demand for next generation versus current generation broadband is also plausible.

Demand side developments

We first assess this indirect channel before returning to the question of whether mobile broadband might in future substitute for fixed. An important driver of bandwidth-economising innovations is the global shift to mobile broadband relative to fixed, with Ericsson (2013) forecasting 7 billion mobile broadband connections by 2018, but less than 1 billion fixed broadband connections. This shift has seen a wide number of application providers including Google and Facebook adopt "mobile first" development strategies, which puts an emphasis on improvements to compression and smart connectivity management.

It is also seeing intense efforts at developing bandwidth economising techniques. Ericsson (2013) including HEVC (also referred to H.265) compression which involves a once in a decade step change and is expected to halve the bandwidth requirement for a given quality of video (improved compression effectively involves the substitution of raw computing power coupled with more advanced algorithms for the transmission of data). Commercial initiatives – potentially using proprietary technology - are also under development aimed at getting more out of a given level of bandwidth. For example, Verizon (2013) commented to investors that:

"…there is a lot of very interesting compression work going on. I won't say which particular Company -- you may be covering them -- but where today it takes us about 10 megabits to handle video on a per-subscriber basis, I have seen technology that will be commercial in the next six months that will take that down to 2 and more likely 1.5. So you just saw a huge capacity improvement in the network to deliver that sort of video."

Growth in smartphone use may also lessen demand for bandwidth and high speed fixed broadband as users increasingly access services through smartphones rather than PCs, and therefore via small screens and apps optimised for lower quality connectivity. Software innovation including context awareness and intelligent management of connectivity and downloads by the device can also reduce the importance of connection speed, and capacity at a given location. For example, Apple iOS 7 (released in September 2013) includes features which manage downloads in the background based on a user's past behaviour and the quality of connectivity. By anticipating a user's needs software can reduce the relevance of available bandwidth.

Other developments demand higher speed and higher capacity access, but the rapid shift underway via smartphones and tablets has introduced a number of offsetting considerations. Table 1 summarises a number of developments and their impact on capacity and speed requirements.

Table 1: Impact of developments on speed & capacity demand

		Speed	Capacity
Increase	Growth in video on demand & content sharing	↑	↑
	Growth of HD video	↑	↑
	Growth in multiple device use	↑	↑
	3D TV	Limited development anticipated [6]	Limited development anticipated
	Ultra HD (4K)	Limited development anticipated[7]	Limited development anticipated
Decrease	Growth of video & music streaming vs. download	↓ (buffer time only, peak speed matters less)	Neutral
	Smart background downloads e.g. Apple Newsstand & iOS 7	↓	Neutral
	HEVC (H.265) compression	↓	↓
	Shift to small screen consumption i.e. tablets[8]	↓	↓
	Device-to-device wireless file transfer e.g. Apple Airdrop	Zero: no network required	Zero: no network required

A shift to not only ownership of smartphones but increased reliance on them for daily tasks is shown by a Pew Internet (2013) survey in the US that found that 63% of adult cell owners now use their phones to go online, a figure that has doubled since 2009. In addition the Pew survey found that 34% of these cell internet users say that they mostly go online using their cell phone and not some other device such as a desktop or laptop computer.

Supply side developments

On the supply side it is useful to distinguish the speed of access technologies from their capacity, i.e. their ability to carry a given level of data at an affordable cost. In particular whilst speed differences between fixed and wireless access have historically been considered a barrier to substitution this difference may reduce with LTE which offers speeds that can support most if not all applications.

[6] 3D has not gained traction in the TV market with the BBC putting 3D 'on hold' indefinitely in July 2013. http://www.bbc.co.uk/news/entertainment-arts-23195479

[7] 4K unlikely to be feasible over terrestrial broadcasting before 2020 due to spectrum constraints and requirement for user equipment change to shift to HEVC compression (which is likely to involve a separate transition from a shift to DVB-T2 with MPEG-4). This will limit the market development of 4K in the UK. In addition, ultra HD (4K) would offer limited benefit in many settings (depending on screen size and distance from screen): http://arstechnica.com/gadgets/2012/06/4k-tvs-are-coming-but-they-face-an-uphill-battle-in-the-home/

[8] Tablet ownership in the UK more than doubled to 24% by Q1 2013, with one-third of tablet owners saying a tablet is their main means of connecting to the internet. http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr13/2013_UK_CMR.pdf

The material economic difference may then relate more to capacity than speed, given that wireless access networks involve shared capacity and therefore incremental traffic costs whereas fixed access networks do not (in both cases there are incremental traffic costs in the core, though these are low and falling). Figure 5 reflects this distinction with capacity on the horizontal axis and speed on the vertical axis. Within this space different wireless and fixed technologies are mapped out – approximately reflecting their capabilities.

Figure 5

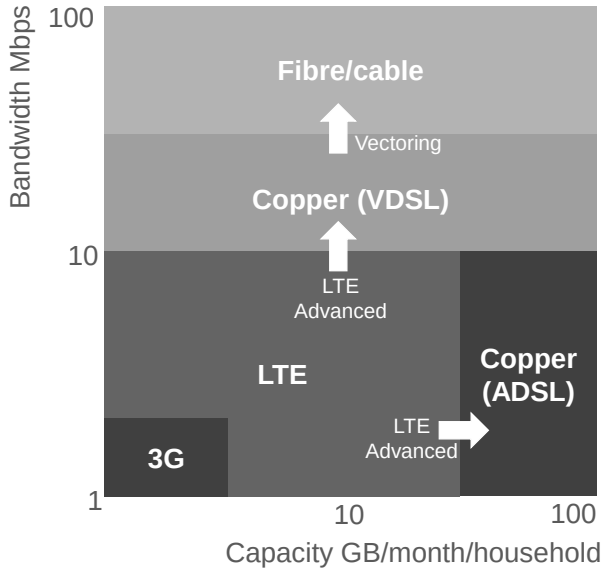


Figure 5 illustrates the fact that for practical purposes copper ADSL is indistinguishable from copper VDSL or fibre from a capacity perspective – the difference relates to speed (and other quality metrics such as up-load speed and latency which is not shown). Cable technology will also evolve with a new standard - DOCSIS 3.1 – offering significantly higher speeds (particularly the upload speed).[9]

Wireless technology differs in that the shift from 3G to LTE (alongside greater spectrum availability for LTE) improves both affordable capacity and speed. The increase in speed with LTE shifts mobile from a technology that struggled to support video to one that can. The reduction in unit costs (and therefore the increase in affordable data cap) is also pronounced.

Verizon (February 2013) in the US have noted that *"…the 4G network is a less costly network to operate, at least 5 times less costly than the 3G network."* Modelling also indicates that the combined impact of more spectrally efficient LTE technology, additional spectrum for mobile and increased utilisation across networks will contribute to a substantial reduction in unit costs for mobile over time. Williamson (January, 2012) and Ericsson (2011) and projections by NSN (2013) all point to incremental costs below €1/GB.

When falling mobile data costs are coupled with demand side shifts to small screen devices, improved compression and other developments mentioned earlier it appears plausible that mobile will offer sufficient capacity to meet the needs of a significant number of consumers. As consumers adopt smartphones – to which other devices can be tethered via Wi-Fi – mobile will become the counterfactual against which fixed access is assessed. Whilst fixed may offer higher speeds – though not necessarily in the case of ADSL – the relevant question is consumer willingness to pay for

[9] http://blogs.cisco.com/sp/catching-up-with-ciscos-john-chapman-at-cable-congress-2013-this-week/#more-104374

incremental gains in speed – not whether fixed remains faster than mobile. As the speed of both fixed and mobile increase, and if speed increases are subject to diminishing returns in terms of willingness to pay, then remaining speed differences will become less important.

It therefore appears plausible that over time mobile will itself become an important anchor product constraining the price of fixed, and may in some circumstances supplant copper ADSL in terms of the constraint on fibre pricing. In the US Pew Internet (August, 2013) found that 10% of smartphone owners do not have broadband at home. The proportion was also significantly higher amongst certain groups. We note that this difference is material even though smartphone adoption at the time was around 56% and LTE adoption was less than one-third.[10]

Conclusion

Anchor product regulation is an intermediate option between a full *ex ante* price control and no price control whereby either an existing price controlled technology acts as a constraint on a new technology or a sub-set of services on the new technology is price controlled. Short of full deregulation, the approach improves incentives for efficient investment.

The path from its origins in 2007 to adoption by Ofcom in 2010 and the European Commission in a recommendation on non-discrimination and costing in 2013 has been comparatively rapid. The concept may also find application elsewhere as policy makers face the challenge of how to create incentives for commercial investment in new networks whilst also seeking to project access based competition and consumers during transition. An emerging question is whether the approach is sustainable, as the anchor product could weaken as a discipline on abuse of market power:

- First, this question should be framed and answered via an assessment of the costs and benefits of alternative approaches to regulation, not as a yes/no decision based on an assessment of market power. There are risks of market and regulatory failure to weigh up, and the challenge and consequences of applying a cost oriented price control should not be underestimated.
- Second, the rapid shift to smart mobile devices, applications and connectivity may disrupt the seemingly inevitable rise in demand for higher speed and higher capacity fixed network access. A weakening chain of substitution between copper and fibre should not be assumed to be inevitable. Mobile broadband may also come to supplant copper as a constraint on fibre pricing, at least in some locations and for some market segments.
- Third, if the chain of substitution from copper ADSL to fibre has weakened to the point where additional protection is considered to offer net benefits, then rather than moving to cost orientation a virtual anchor product on fibre could be considered. This would also decouple the anchor product approach from continued parallel running of legacy and next generation networks.

In assessing the on-going role of anchor product regulation the value of commitment and stability should also be factored in. Whilst it may be difficult for an individual regulator to credibly commit over time, interplay between different institutions may offer the prospect of greater commitment and stability. The European Commission recommendation on non-discrimination and costing, coupled with national regulation and a process of checks and balances, may contribute to achieving more credible commitment.

[10] One-third of Verizon contract customers have adopted LTE. This overstates the market total given that Verizon have led in LTE deployment.

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