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Welfare effects of reductions in the price of leased line equivalents in the U.S.

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Executive Summary

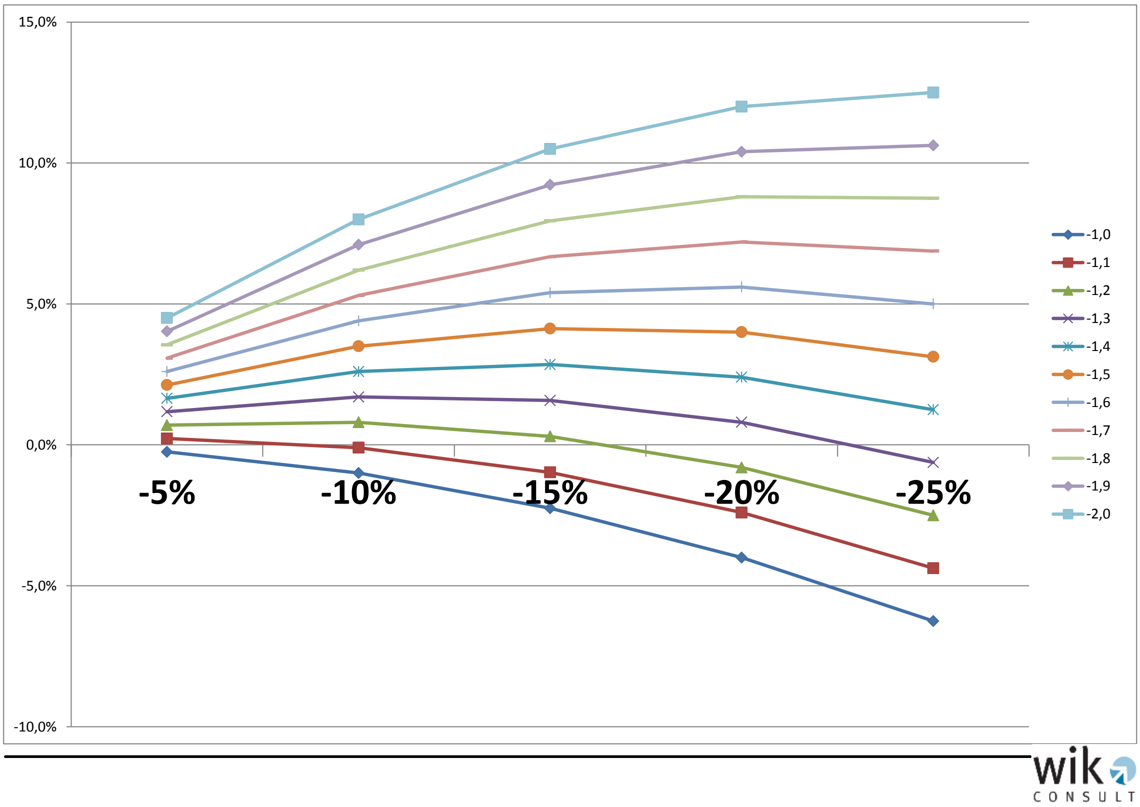
Leased line or business data services are fixed line connections used to interconnect the premises of business or government customers to one another and to the points of presence (POPs) of network operators. They are also employed to interconnect the locations of fixed and mobile network operators, including network operators that compete with the largest network operators. Established network operators are seeking to migrate customers off of legacy TDM leased line services and onto equivalent Ethernet-based services. In light of this transition, the FCC is reassessing regulatory policy going forward as regards TDM and Ethernet-based leased line equivalent services.[1]

Many have contended that the prices of Ethernet-based leased line equivalents are in excess of cost, and in excess of the levels that could be expected in a competitive market. The argument has also been made that prices of TDM-based leased line equivalents are also well in excess of cost and competitive levels.

There is a natural tendency to assume that a reduction in price translates into a reduction in revenue for the provider of the service; however, this is not necessarily the case. Depending on the level of the *price elasticity of demand* (or *PED*, which is a measure of how consumption changes in response to a change in price), a reduction in price is likely to have very little impact on revenues; in fact, if the PED is great enough in magnitude, *a reduction in price can lead to an increase in revenues* for providers of the service. For price reductions of between 5% and 25%, and with a PED of between -1.0 and -2.0 (the most likely values, in our judgment), any decrease in revenue tends to be small (as shown in the following figure). Only where the reduction reaches 25%, and where the PED is a mere -1.0, does the reduction in revenue exceed 5%. For more realistic values, a decrease in price generally results in an increase in gross revenue.

[1] On 2 May 2016, the FCC released a Tariff Investigation Order and Further Notice Of Proposed Rulemaking (2016), “In the Matter of Business Data Services in an Internet Protocol Environment; Investigation of Certain Price Cap Local Exchange Carrier Business Data Services Tariff Pricing Plans; Special Access for Price Cap Local Exchange Carriers; AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services,” FCC 16-54.

Percent change in gross revenue with price reductions of 5% to 25%, at a PED of -1.0 to -2.0.

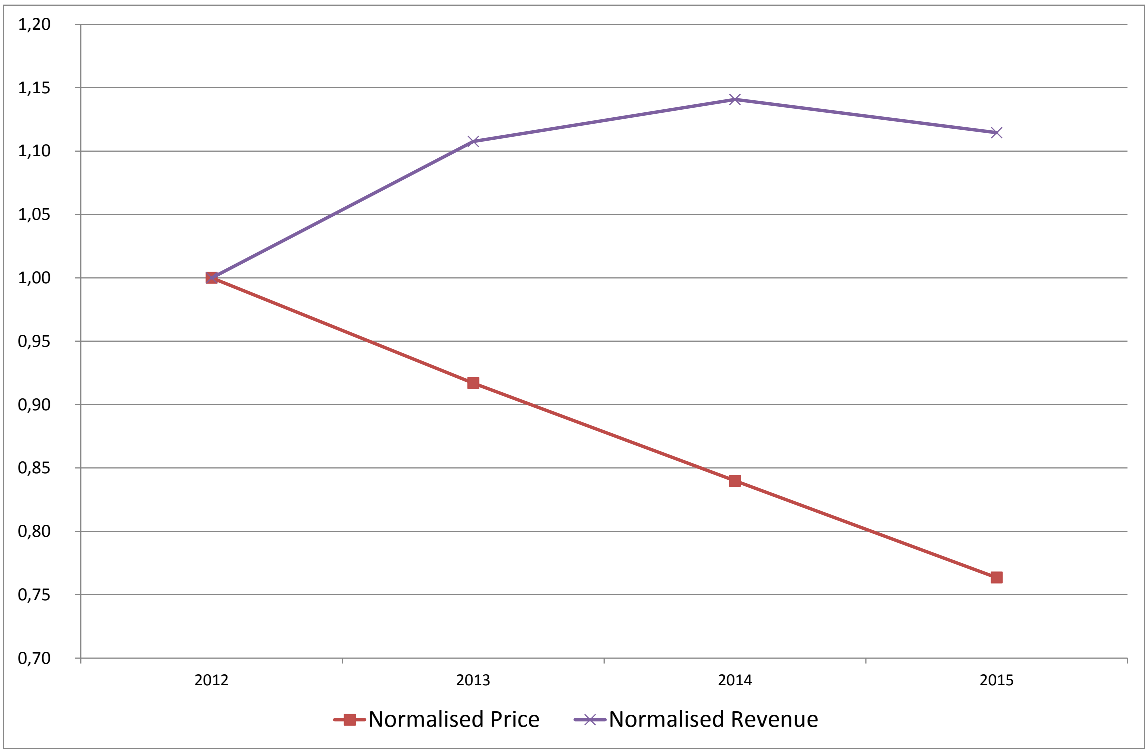


Source: WIK (Marcus)

This is consistent with the experience of INCOMPAS member British Telecom (BT). The prices that BT charges for Ethernet-based leased line equivalent services are subject to regulation by the UK national regulatory authority Ofcom under a so-called RPI-X price basket arrangement. Over the period 2012-2015, this has resulted in decreases in permitted unit prices of 25% for the services; however, gross revenue has increased by 11% (as shown in the following figure). This is in principle suggestive of a PED in the range of -1.9; for a variety of reasons, however, this rough estimate probably overstates the true PED.[2] Suffice it to say that the balance of evidence suggests that the PED is significantly greater in magnitude than -1.0.

2 First, this is a measure of BT's firm specific elasticity, which may be greater than the overall market elasticity. Second, the quantity consumed might have increased even in the absence of price reductions. Without detailed econometric analysis, it is not possible to exclude that other factors may have contributed to the observed result.

Trend in permitted unit prices and in revenues for Ethernet-based services for BT in the UK (2012-2015).

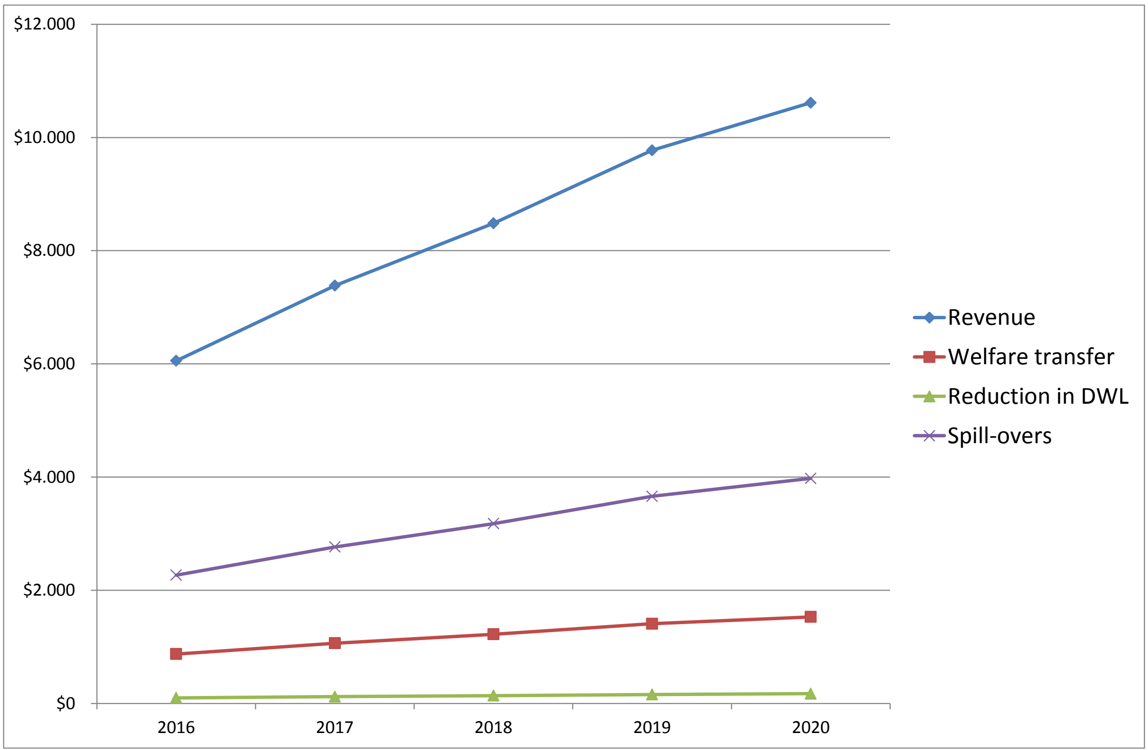


Source: WIK (Marcus)

We have estimated societal benefits using the standard Harberger Triangle methodology, subject to the assumption that the FCC would in no case call for price reductions below the true marginal cost. We have estimated how an FCC-imposed price reduction on these services might change (1) revenue for the providers of these services, (2) welfare transfer from providers of the services to users of the services, (3) the reduction in deadweight loss that could be expected to eventuate, and (4) the spill-overs into the broader economy that might be expected. For a price reduction of 15% and assuming a PED of -1.5 (both of which are in the mid-range of the most likely values), the results are shown in the following figure.[3]

3 The estimates are based on estimates and forecasts of US consumption (end points) and revenues for Ethernet-based leased line equivalent services developed by Ovum in 2015.

Total revenues, welfare transfer, reduction in deadweight loss (i.e. net gain in societal welfare) (million USD) (2016-2020) had the US FCC implemented price cuts of 15% on Ethernet-based leased line equivalents at the beginning of 2016, assuming a price elasticity of demand of -1.5.



Source: Ovum data (2015), WIK/Marcus calculations

If the FCC were to impose price reductions of from 5% to 25% for TDM and Ethernet-based leased line services, real societal gains would follow in terms of welfare transfers, reduction in deadweight loss, and spill-over effects into the broader society. The price elasticity of demand for these services is substantial; consequently, price reductions would tend to be offset by increased volumes. The price elasticity of demand (PED) for these services is somewhere between -1.0 and -2.0, with the balance of evidence suggesting that it is significantly in excess of -1.0. At a relatively unlikely PED of -1.0, reductions in price of up to 25% reduce revenues by at most slightly over 6%; under much more realistic assumptions, these reductions in price actually increase gross revenue.[4]

4 These statements are subjects to caveats and assumptions that (1) the price even after reductions of up to 25% is still in excess of the true short run marginal cost of providing the service; and (2) that the impact on net revenue (profits) may be different.

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1 Introduction: The potential impact on societal welfare of lower prices for business data services (leased lines) in the US

The FCC is currently in the process of reviewing the market for the supply of leased lines access services in the US (also known as “special access” services or “business data services”).[5] Leased line or business data services are fixed line connections used to connect the premises of customers (business or government) to the telecommunications network POPs of interexchange and global providers of telecommunications services. These services are also used to provide connectivity between cell towers and the core networks of wireless telecommunications providers, to backhaul traffic to Internet backbones, to connect data centers and ATMs, and to enable cloud-based offerings. At present, the majority of these connections in the US are provisioned using TDM technology, though incumbent operators are seeking to migrate customers off legacy TDM access services and onto Ethernet-based services. In light of the transition, the FCC is specifically considering whether, and if so how, TDM and Ethernet-based leased line access services should be regulated.

Many have contended that the prices of Ethernet leased line equivalents are in excess of cost, and in excess of the levels that could be expected in a competitive market. Likewise, they contend that prices of TDM-based leased line equivalents are also well in excess of cost and competitive levels.

The FCC’s Further Notice of Proposed Rulemaking (FNRPM) proposes to take steps that potentially have the effect of reducing these prices in areas that are not subject to effective competition, however defined. This raises a range of questions for policymakers, for carriers who provide these TDM and Ethernet-based leased line equivalents, and also for carriers and enterprises that use the services.

- How would a mandated reduction in the price of TDM and Ethernet-based leased line equivalents change the demand (i.e. consumption) for those services?
- How would the changed price, in combination with the changed consumption, change the revenues of the firms that provide TDM and Ethernet-based leased line equivalents in the United States?
- What would the broader societal impacts of these changes be?

In this brief study, our goals are modest. We are seeking only to provide clarity as to the likely effects of any price reductions, especially insofar as they affect the degree to which these services are used.

[5] On 2 May 2016, the FCC released a Tariff Investigation Order and Further Notice Of Proposed Rulemaking (2016), “In the Matter of Business Data Services in an Internet Protocol Environment; Investigation of Certain Price Cap Local Exchange Carrier Business Data Services Tariff Pricing Plans; Special Access for Price Cap Local Exchange Carriers; AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services,” FCC 16-54.

In estimating societal impacts, as we explain in Section 2, the commonly used methodology distinguishes between (1) *welfare transfers* from suppliers of a service to those who consume it,[6] versus (2) *reduction in deadweight loss*, where increased consumption in response to reducing inflated prices generates societal benefits.

In estimating the reduction in deadweight loss, the *price elasticity of demand (PED)* of the service in question plays a crucial role. The PED is a measure of the degree to which demand responds to a reduction in price. If the price of a service were to decline 10%, would people buy 5%, 10%, or 20% more of the service?

There is a natural tendency to assume that a reduction in price translates into a reduction in revenue for the provider of the service; however, this is not necessarily the case. Depending on the level of the PED, a reduction in price is likely to have very little impact on revenues; in fact, if the PED is high enough, *a reduction in price can lead to an increase in revenues* for providers of the service. There is good reason to believe that the price elasticity of demand for these services is high, so there is likely to be little if any adverse revenue impact from reasonable declines in price (see Section 4).[7]

In some cases, it is possible to identify spill-over effects that multiply the benefits to the broader society. We have provided a rough estimate here, based in part on previous analysis in Rappoport, Taylor et al. (2003) (see Section 2).[8]

In this analysis, we do not attempt to quantify what the “right” reduction in price should be; rather, we attempt to show how different levels of price reduction, together with different estimates of the PED for TDM and Ethernet-based leased line services, impact service provider revenues, welfare transfer, reduction in deadweight loss, and spill-over effects into the broader society.

In Section 2, we describe the general methodology used to estimate welfare effects. Section 3 describes the sources of the estimates that we use for past, current and future effective prices in the absence of a regulatory change, and for the price elasticity of demand for these services; we note, however, that these estimates serve mainly to set the ranges over which we will estimate the effects of a change in price. Section 4 then explains the overall relationship between price reductions, increases in quantity due to the PED, and the combined impact on the revenues of firms that provide a service. Section 5 applies this analysis to estimate aggregate effects in the US, based on estimates of revenue and prices of Ethernet-based leased line equivalent services in the US by Ovum, a consultancy. Similar aggregate effects could be expected with respect to TDM business data services. Section 6 summarizes key findings.

6 These welfare transfers benefit those who use the service, but do not necessarily increase the sum total of societal [something seems to be missing here] in and of themselves.

7 The impact on *profits* can not readily be estimated in this way.

8 Paul N. Rappoport, Lester D. Taylor, Arthur S. Menko, Thomas L. Brand (2003), Macroeconomic Benefits from a Reduction in Special Access Prices.

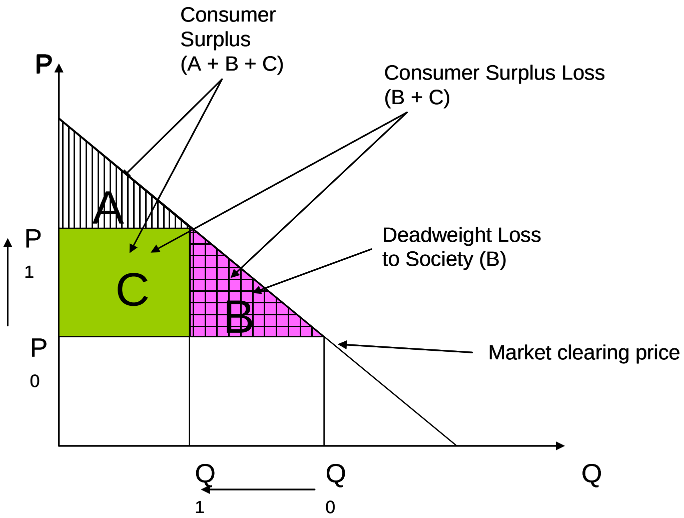
2 Methodology for the analysis

In understanding societal benefits, it is helpful to review the basic economics, beginning with the Harberger Triangle (see Figure 1). In an ideal competitive market, prices would be set at the exact level where the supply and demand curves cross. In Figure 1, the line that slopes downward to the right is the consumer demand curve, while the supply curve (the horizontal line at P_0) is usually not critical to the discussion. The point identified as the 'market clearing price' is the expected and optimal pricing point in an ideal competitive market.

If prices are distorted, social welfare is reduced. Market power is such a distortion, which leads not only to higher prices, but also to lower consumption as a result. This is due to the *price elasticity of demand (PED)*, the tendency of buyers to increase (or reduce) consumption in response to a reduction (or increase) in price.

In a competitive market, the price tends to be set at the market-clearing point (P_0). In this case, the surplus for purchasers (who in this case are businesses rather than consumers) corresponds to the areas labelled A, B, and C in Figure 1. It is the entire area above the price charged, but below the demand curve. It can be thought of as the degree to which buyers would have been willing to pay more than they were required to pay (i.e. the surplus accruing to purchasers at the market-clearing price).

Figure 1: The Harberger triangle



Source: WIK

If a market distortion (for instance, last mile market power) artificially inflates the price charged, the price moves up from P_0 to P_1, while the quantity correspondingly contracts from Q_0 to Q_1. This reduces the consumer surplus (previously A+B+C) by the sum of the areas B+C. All that remains as consumer surplus is A.

This change entails two distinct effects. Area C represents a transfer of surplus (or welfare) from buyers (often consumers, but in this case businesses) to producers. To an economist, who tends to look at societal welfare in terms of the sum of consumer surplus and producer surplus, there is a tendency to think of this transfer as an allocative effect that neither adds to nor detracts from the overall welfare of society. In this case, however, it is highly relevant, because it represents an involuntary transfer from enterprises to U.S.-based (mostly incumbent) network operators.

The area in triangle B is clearly problematic. It represents consumption that should have taken place, but did not. It is referred to as a *deadweight loss*.

This methodology enables an estimate of the direct impact of an increase in price due to market power, but there can be *spill-over effects* into the broader economy that can be even greater. Rappoport, Taylor et al. (2003)[9] simulated the impact of reducing the incumbents' business data services prices by 42% (which amounted to an estimated $5.6 billion on 2002 revenues) in order to produce an 11.25% rate of return (an FCC estimate of the WACC, the permitted return). The downstream effect of this price reduction on all industry sectors was quantified by means of a macroeconomic model.

If this price reduction had gone into effect at the start of 2003, they estimate that it would have had the effect of adding 132,000 jobs and $14.5 billion in real Gross Domestic Product (GDP) to the U.S. economy. This large predicted response is an important and perhaps surprising finding. The annual increase in real GDP of $14.5 billion is *2.6 times as great* as the direct reduction in prices of $5.6 billion, which is to say that the spill-over effects into the broader economy are substantial. In other words, the importance of these services extends beyond the telecommunications industry proper, and is moreover subject to significant *multiplier effects*.

9 Paul N. Rappoport, Lester D. Taylor, Arthur S. Menko, Thomas L. Brand (2003), Macroeconomic Benefits from a Reduction in Special Access Prices.

3 Parameters for the analysis

In the analysis in this brief study, we will for the most part be presenting general results, without making hard assumptions about the past, current, or for that matter future level of prices for Ethernet-based leased line services, nor for that matter for the PED for the services. It is nonetheless perhaps helpful to motivate the discussion by explaining the source of the data that we use to provide a rough framing for the discussion.

3.1 Unit prices for Ethernet-based leased line equivalents in the US

In quantifying the impact of high prices on societal welfare, it is necessary to have estimates of prices or revenues. We emphasize however that the *relative impact* of lowering prices for business data services is largely independent of the absolute level of prices or of total revenues.

There are many ways in which one could attempt to estimate prices of business data services. The FCC has just completed a major data collection of these prices. The data that they have made publicly available is, however, not well suited to further analysis; consequently, we use other publicly available data to estimate these prices for Ethernet-based leased line equivalents.

In recent years, market research firms have attempted to estimate the volume of communications services that were purchased in the past, or were likely to be purchased in the future, in each developed economy, and the total revenues associated with those purchases. One such source is a dataset developed by Ovum for this purpose.[10] In the Ovum data, the number of *end points* is taken as the measure of the volume of Ethernet-based leased line equivalents consumed, since some services are point-to-point (with two end points) while other are multi-point (with more). In this study, we use the most recent version of the Ovum data.

The use of such a data source offers numerous advantages:

- It was created professionally by an independent third party for use for multiple purposes by multiple market players;
- Its value to prospective users is greatest if it is objective and unbiased;
- It is specific to Ethernet leased line equivalents;

10 Ian Redpath (2015), "Ethernet Services Forecast Report: 2015–20: Ethernet underpins the shift to cloud services and facilitates data center access", 28 September 2015. The Ovum data is produced (per the documentation embedded in the dataset) using a sensible process beginning with collecting information about "service endpoints, revenues, [Average Selling Prices (ASPs)], and key segmentation breakdowns from the incumbent and competitive CSPs [network operators]." They also "probe the [network operators] for key trends that will steer future directions in overall growth and shifts in segmentation." They incorporate data about the size of enterprises in the countries under study, and factor in a number of other possible drivers including macroeconomic considerations.

- Since it estimates *revenues*, we do not need to speculate on the level of discounting – they are already fully reflected in the estimates; and
- It was not created to make or refute any particular public policy point.

The Ovum data source was released in September 2015. It contains estimated actual data for 2013, 2014, and part of 2015, together with forecast data for subsequent years through 2020. It thus provides a full time series for analysis. Revenues are estimated in US dollars.

Dividing the Ovum estimates of total revenues for metro Ethernet by their corresponding estimate of total shipments (end points) provides a good, unbiased estimate of the discounted effective unit price.

3.2 The price elasticity of demand: What effect would lower prices have had on demand for leased lines?

A key question for the welfare analysis addresses the relationship between the price of these services and the demand (i.e., the level that would tend to be consumed). As explained in Section 2, this is generally expressed by means of the price elasticity of demand – a number that represents the ratio between a change in *price* and the corresponding change in consumption (*demand*). The price elasticity of demand is generally negative, because lower price implies higher consumption. Where the price elasticity is greater (i.e. more negative) than -1.0, demand is said to be *highly elastic*.

In recent years, many studies have assessed the price elasticity of demand of consumer broadband services. These studies generally find the so-called own-price subscription elasticity to be greater in magnitude than -1.0, which is to say that demand for the service is highly elastic;[11] however, it cannot be guaranteed that leased line equivalents are subject to the same elasticity as residential broadband.

The previously referenced Rappoport, Taylor et al. (2003)[12] study includes an assessment of the demand elasticity for business data services on the part of US businesses. Lester Taylor, who is a first tier expert on the subject of estimating demand elasticity, led the work.

Rappoport, Taylor et al. (2003)[13] derived an own-price demand elasticity of -1.31 for DS-1 circuits (1.5 Mbit/s), and an own-price demand elasticity of -1.91 for DS-3 and faster circuits (45 Mbit/s and above). This is larger than demand elasticities that have

11 See, for instance, Cardona et al. (2009), “Demand estimation and market definition for broadband Internet services”, *Journal of Regulatory Economics* 35:70–95, 2009; Ida and Kuroda (2006), “Discrete Choice Analysis of Demand for Broadband in Japan”, *Journal of Regulatory Economics* 29:1 5–22, 2006; and Hauge and Prieger (2010), “Demand-Side Programs to Stimulate Adoption of Broadband: What Works?” *Review of Network Economics*, Issue 3 2010, Article 4.

12 Paul N. Rappoport, Lester D. Taylor, Arthur S. Menko, Thomas L. Brand (2003), Macroeconomic Benefits from a Reduction in Special Access Prices.

13 Ibid.

typically been found for voice calls, for instance, but it is consistent with the subsequent findings of Ford and Spiwak (2003).[14] Based on these results, Rappoport, Taylor et al. (2003) used a demand elasticity of -1.0 for their subsequent macroeconomic modelling, considering it to be a conservative estimate.

These values reflect analysis of prices for TDM leased lines, not for Ethernet-based leased line equivalents. To a first order, and to the extent that the services are near-perfect functional substitutes for one another, one would expect the PEDs to be in the same range. The PED reflects the end user's willingness to pay for the service, and could be expected to be independent of the technology used to deliver the service.[15]

As we explain in Section 4, BT's own experience with price reductions for Ethernet-based leased line equivalents suggests that the true value is likely to be well in excess of -1.0, and thus in roughly the same range as that which appears in the earlier study Rappoport, Taylor et al. (2003).

In light of these estimates, it seems likely that the true price elasticity of demand is somewhere between -1.0 and -2.0. The exact value is not critical to the analysis that follows, since we treat the PED as an independent (i.e. exogenous) variable, and perform the analysis for different values of PED in the expected range.

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14 George S. Ford and Lawrence J. Spiwak (2003), Set It and Forget It? Market Power and the Consequences of Premature Deregulation in Telecommunications Markets.

15 In practice, there might be somewhat greater willingness to pay for the Ethernet-based equivalent, since it offers advantages such as multi-point service, and lower port cost on the router. Also, the PED is a point estimate, and is not independent of the price paid.

4 The relationship between price reductions, the price elasticity of demand, and total revenues

Revenue is the product of price times quantity (P times Q). A mandatory reduction in P reduces the first multiplier; at the same time, however, the second multiplier (Q) does not remain constant. Reducing the price of Ethernet-based lease line equivalents tends to increase Q thanks to the price elasticity of demand; indeed, this is a primary motivation for making a regulatory intervention in the first place. Further, the demand of businesses for business data services appears to be highly responsive to price (see Section 3.2), which is to say that it is highly elastic. How do these two opposing factors play out in practice?

As Rappoport and Taylor (2003)[16] note, “price reductions are offset by the increase in demand stimulated by the reduced prices, such that the [incumbents’] total revenues remain about the same.” This statement reflects an assumed price elasticity of demand of -1.0 (which is possibly too low), subject to which it is approximately (but not exactly) correct for small differences in price.

The price elasticity of demand (PED) is defined as the ratio between a change in the volume of a good or service consumed and the associated change in price (presumably the cause). It is a ratio between two ratios. Using the notation of Section 2, it can be defined as:

$$PED = ((Q_1 - Q_0) / Q_0) / ((P_1 - P_0) / P_0)$$

Where P_0 and Q_0 are the price and quantity, respectively, before a change is introduced, and P_1 and Q_1 are the price and quantity after a change is introduced.[17] The expression $((P_1 - P_0) / P_0$ can be thought of as representing the percentage change in price.

Total revenue before a change is introduced is $P_0 * Q_0$; total revenue after the change is $P_1 * Q_1$. What is the ratio between the two, taking into account (1) the relative scale of the change, and (2) the price elasticity of demand?

It is straightforward to demonstrate that the ratio of total revenues after a change to those before (i.e. $(P_1 * Q_1) / (P_0 * Q_0)$) is

$$(1 + ((P_1 - P_0) / P_0)) * (1 + (PED * ((P_1 - P_0) / P_0)))$$

Assuming a PED equal to -1.0, this can be simplified to:

[16] Paul N. Rappoport, Lester D. Taylor, Arthur S. Menko, Thomas L. Brand (2003), Macroeconomic Benefits from a Reduction in Special Access Prices. There would, however, likely have been negative impact of *profits.*

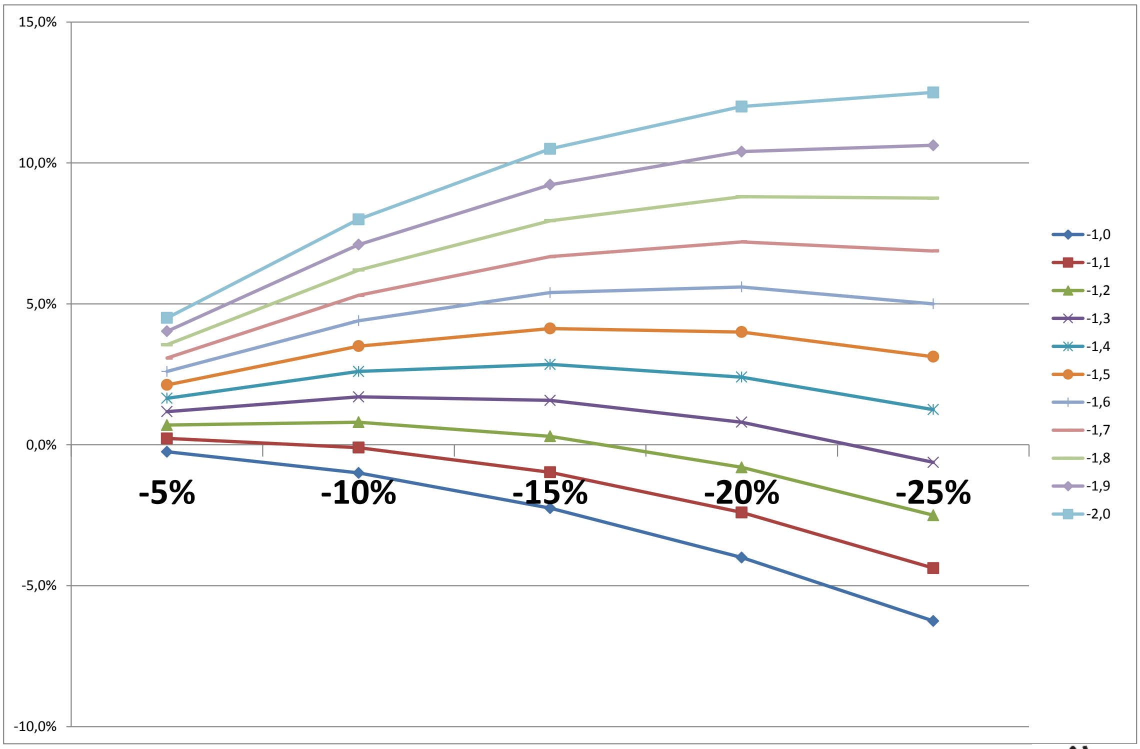
[17] For ease of exposition, we treat price elasticity here as a constant (as is often done). There is however no guarantee that the PED will be the same at price P_0 as it is at price P_1.

$$1 - ((P_1 - P_0) / P_0)^2$$

Where the percentage change in price is fairly small, and at a PED of -1.0 (is at the very bottom of the plausible range), the overall change in gross revenue is minimal. For example, a reduction of 10% in price leads to a reduction of only 1% in total revenue. A reduction of 20% in price leads to a reduction of only 4% in total revenue.

If the elasticity is even greater (i.e. more strongly negative) than -1.0, as seems likely in this case, a reduction in price will often produce an *increase* in revenue, as shown in Figure 2. Based on previous work, the price elasticity of demand for Ethernet-based leased line equivalents in the US is probably somewhere between -1.0 and -2.0. The PEDs determined in earlier work[18] ranged from -1.31 to -1.91 for various copper-based DS-1 and DS-3 leased line services (see Section 3.2). As we explain shortly, the experience of INCOMPAS member British Telecom (BT) with pricing of Ethernet-based leased line equivalents over the period 2012-2015 suggests a PED that is even greater in magnitude.

Figure 2. Percent change in gross revenue with price reductions of 5% to 25%, at a PED of -1.0 to -2.0.



Source: WIK (Marcus)

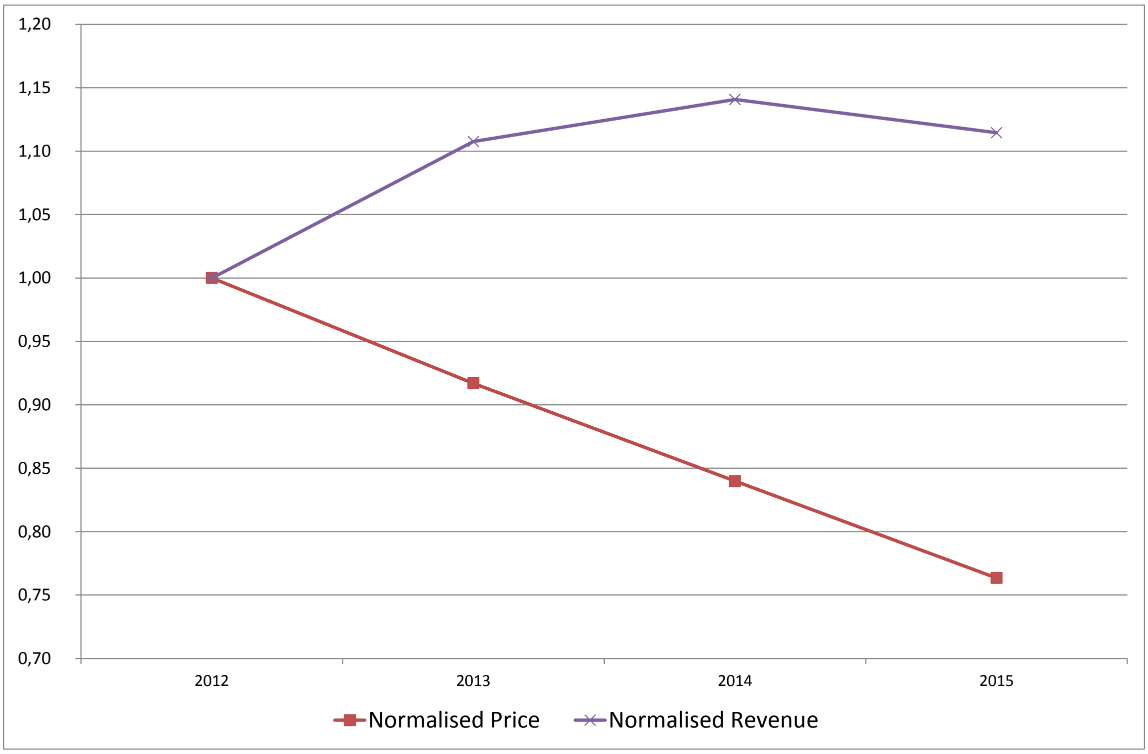
The change in revenue thus depends both on the percent reduction in price and in the PED; however, any decrease in revenue tends to be small. Only where the reduction

18 Paul N. Rappoport, Lester D. Taylor, Arthur S. Menko, Thomas L. Brand (2003), Macroeconomic Benefits from a Reduction in Special Access Prices.

reaches 25%, and where the PED is a mere -1.0, does the reduction in revenue exceed 5%. For more realistic values, any reduction is tiny. For larger PEDs, a decrease in price generally results in an increase in gross revenue.

This is consistent with the experience of INCOMPAS member British Telecom (BT). The prices that BT charges for Ethernet-based leased line equivalent services are subject to regulation by Ofcom under a so-called RPI-X price basket arrangement. Over the period 2012-2015, this has resulted in decreases in permitted unit prices of 25% for the services; however, gross revenue has increased by 11% (see Figure 3). This is in principle suggestive of a PED in the range of -1.9; for a variety of reasons, however, this rough estimate probably overstates the true PED.[19] Suffice it to say that the balance of evidence suggests that the PED is significantly greater in magnitude than -1.0.

Figure 3. Trend in permitted unit prices and in revenues for Ethernet-based services for BT in the UK (2012-2015).



Source: WIK (Marcus)

19 First, this is a measure of BT's firm specific elasticity, which may be greater than the overall market elasticity. Second, the quantity consumed might have increased even in the absence of price reductions. Without detailed econometric analysis, it is not possible to exclude that other factors may have contributed to the observed result.

If the PED were indeed -1.9, then price reductions of 5%, 10%, 15%, 20%, or 25% could be expected to increase gross revenue by 4.0%, 7.1%, 9.2%, 10.4%, or 10.6%, respectively, based on the analysis reflected in Figure 2.

Similar findings should be expected as regards the impact of price reductions of TDM-based business data services on TDM revenues. Carriers' TDM revenues likely are shrinking year-on-year as their customers migrate from TDM to Ethernet-based business data services; consequently, the change in gross revenues needs to be understood relative to the decline in gross revenues that would have occurred even in the absence of a (further) change in price. Based on the analyses of Rappaport and Taylor (2003) and Ford and Spiwak (2003), the PED for TDM-based business data services is somewhere between -1.0 and -2.0. Therefore, the rate of decrease of carriers' TDM revenues that exists should not be significantly affected by reductions in TDM prices. Indeed, as stated previously, only where the reduction reaches 25%, and where the PED is a mere -1.0 would the reduction in revenue even reach 5%.

5 Estimates of the overall impact

With the foregoing estimates and analysis in hand, it is straightforward to make an overall estimate of the impact that price reductions of from 5% to 25% would have on total revenue of the network operators, and on welfare transfer, reduction in deadweight loss, and spill-over gains in connection with Ethernet-based business data services in the US.[20]

In all cases, we use the Ovum 2015 data as the best available estimate of the likely evolution of effective prices (i.e. total revenue divided by total volume) and quantities for metro Ethernet-based leased line services[21] in the absence of a reduction in price required by regulation. If one were to start with a different estimate of quantities and prices, the absolute numbers would change, but the relative values should be largely unaffected.

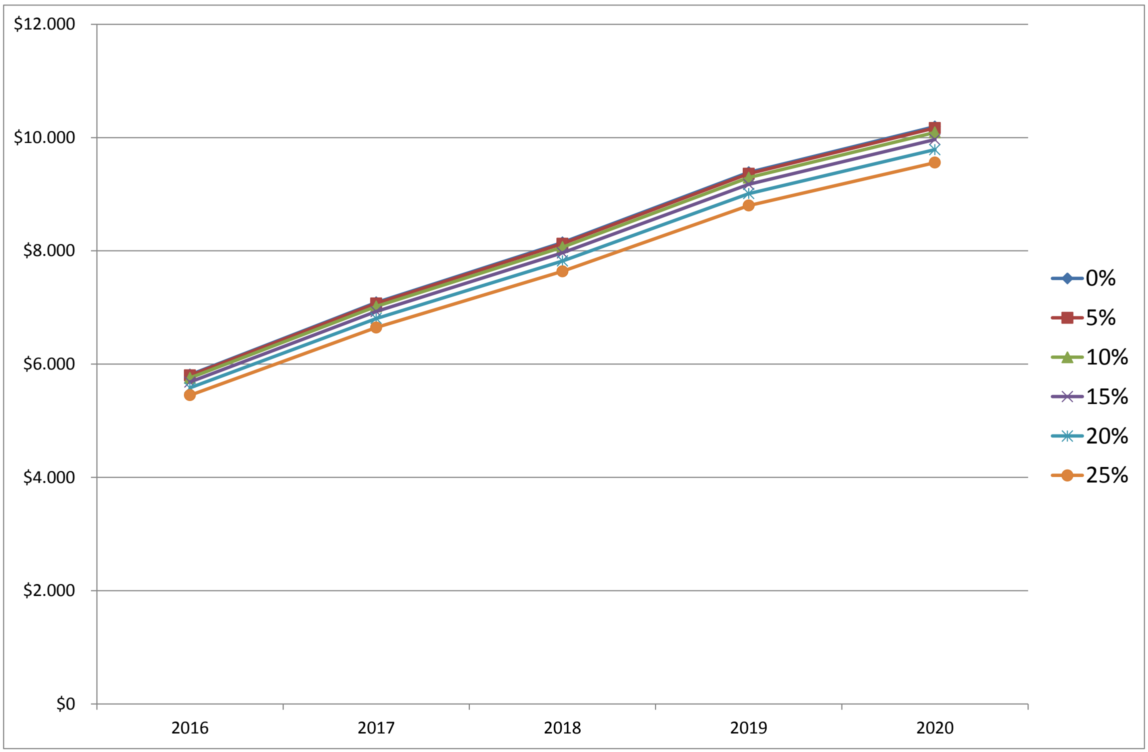
We begin by considering the impact of price reductions on total revenue. We assume that the realistic range for price reductions is between 5% and 25%, and that the realistic range for the price elasticity of demand is between -1.0 and -2.0 with the most likely value being around -1.9. A reduction of 0% corresponds to the "business as usual" scenario where no price reduction is imposed, which is the case assumed in the Ovum data. We consider the period 2016 through 2020, as if price cuts had been in effect from the beginning of 2016.

First and foremost, it is clear that mandatory price reductions have rather little impact on total revenue. The price reduction drives an increase in consumption that nearly compensates for the lower unit price, even at a price elasticity of demand of just -1.0 (the lowest plausible PED). At this PED, even a price reduction of 25% produces a reduction in revenue of only 6.25% (see Figure 4). At a more likely PED of -1.5 or -2.0, price reductions generally lead to an increase in overall revenue for Ethernet-based leased line equivalent services (see Figure 5 and Figure 6).

20 Our tacit assumption throughout is that price reductions to end-users of Ethernet-based leased line services of up to 25% would in no case drive prices below the actual cost of providing the service.

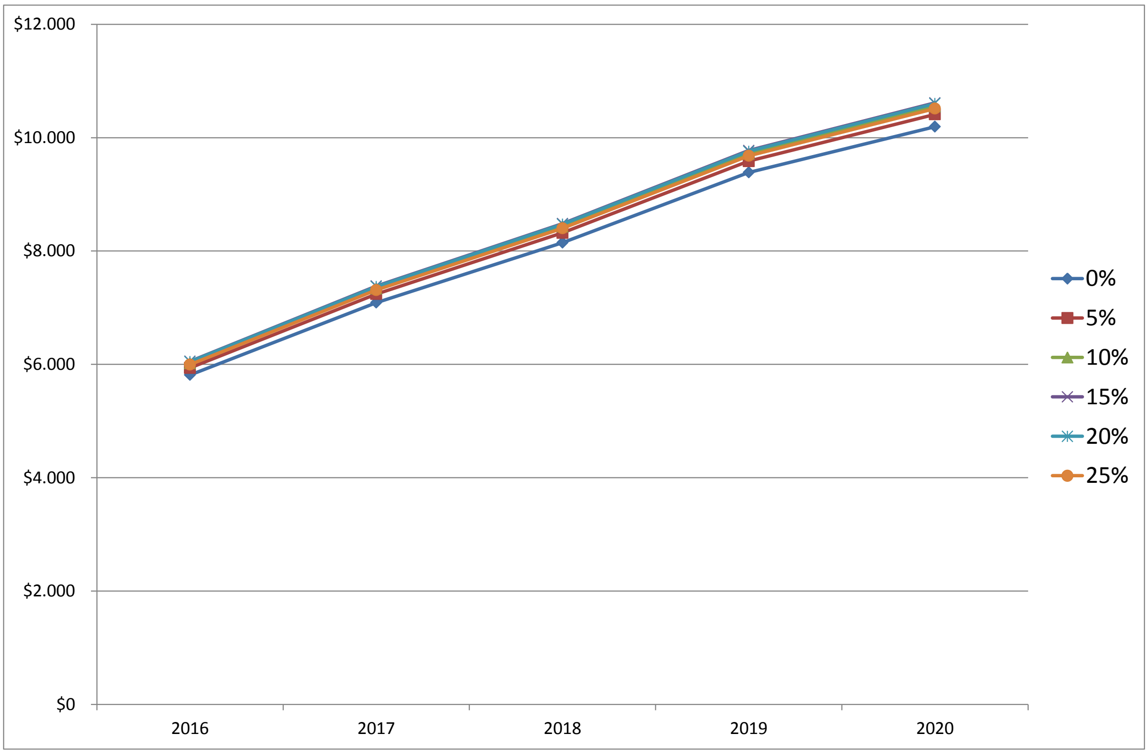
21 In the Ovum analysis, "Metro services apply to an area within a city. Metro services and pricing can be extended to greater metro areas that include the core city and satellite suburbs and adjacent cities." We consider these services to be the most relevant benchmark, since they do not include an inter-city component; however, "national" Ethernet-based services are arguably also relevant.

Figure 4: Total US revenue for metro Ethernet services (million USD) (2016-2020) had the US FCC implemented price cuts of 5% to 25%, assuming a price elasticity of demand of -1.0.



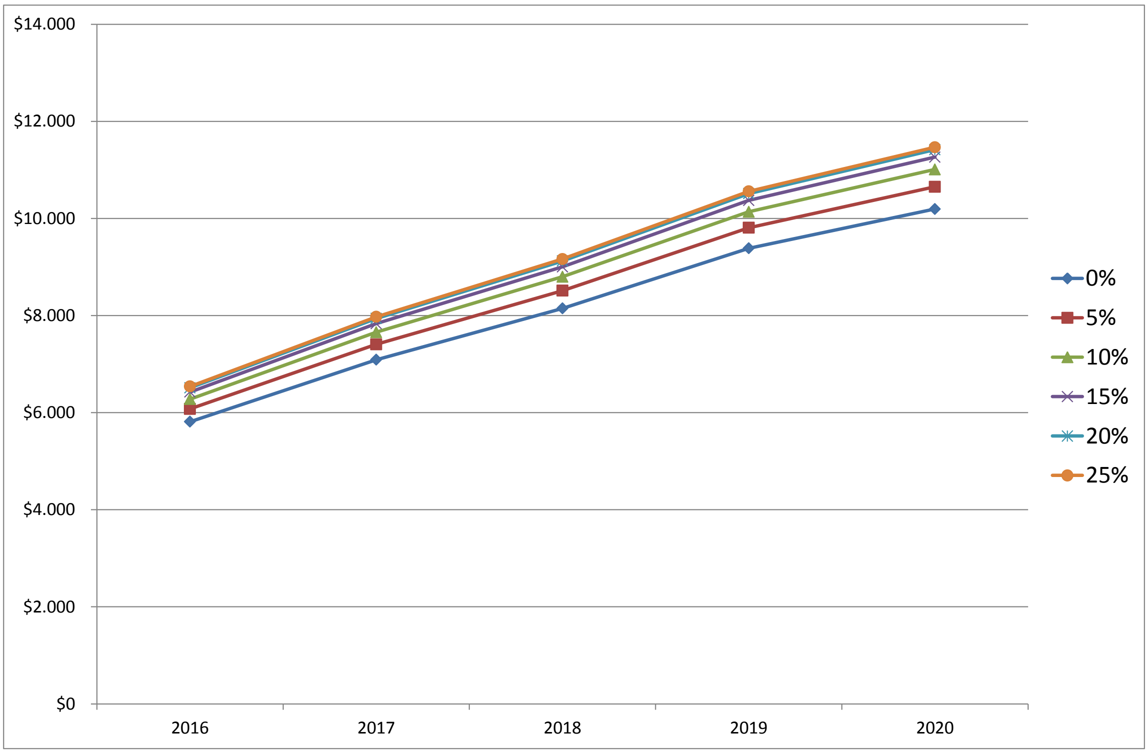
Source: Ovum data (2015), WIK/Marcus calculations

Figure 5. Total US revenue for metro Ethernet services (million USD) (2016-2020) had the US FCC implemented price cuts of 5% to 25%, assuming a price elasticity of demand of -1.5.



Source: Ovum data (2015), WIK/Marcus calculations

Figure 6. Total US revenue for metro Ethernet services (million USD) (2016-2020) had the US FCC implemented price cuts of 5% to 25%, assuming a price elasticity of demand of -2.0.

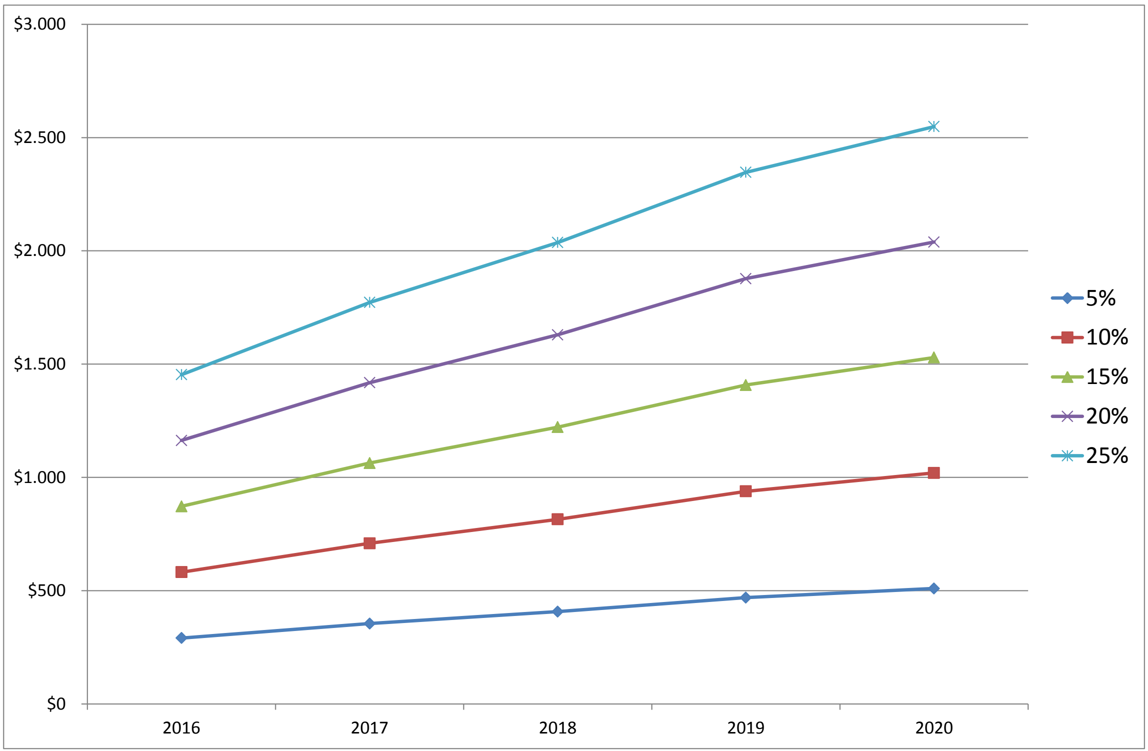


Source: Ovum data (2015), WIK/Marcus calculations

Figure 7 depicts the transfer in societal welfare that could be expected from the beginning of 2016 under a hypothetical scenario where prices were regulated down by from 5% to 25% relative to current levels and to the “business as usual” case reflected in the Ovum (2015) data.[22] This welfare transfer can be viewed as having harmed enterprises and network operators that use metro Ethernet services, while benefitting those that provide them (generally incumbents).

22 The routine calculation of welfare transfer is based on the volume consumed at the original price P_0, and is thus independent of the PED.

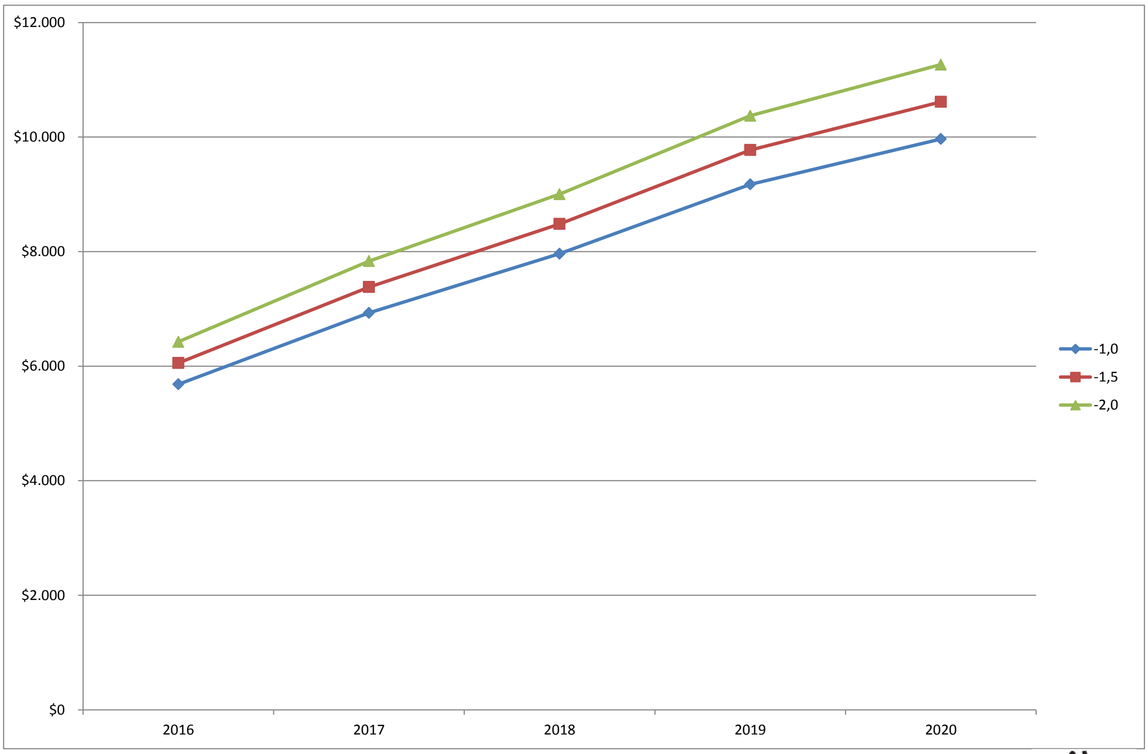
Figure 7. Total welfare transfer from providers of metro Ethernet services to users of the services (million USD) (2016-2020) had the US FCC implemented price cuts of 5% to 25%.



Source: Ovum data (2015), WIK/Marcus calculations

Figure 8 depicts the reduction in deadweight loss that would have resulted had price reductions of 15% (the mid-range of the most likely reductions) been implemented from the beginning of 2016. The cases depicted correspond to a price elasticity of demand of -1.0, -1.5, and -2.0. This reduction in deadweight loss represents an unambiguous societal gain under the assumptions that we make throughout.

Figure 8: Total reduction in deadweight loss (i.e. net gain in societal welfare) (million USD) (2016-2020) had the US FCC implemented price cuts of 15% on Ethernet-based leased line equivalents, assuming a price elasticity of demand of -1.5.



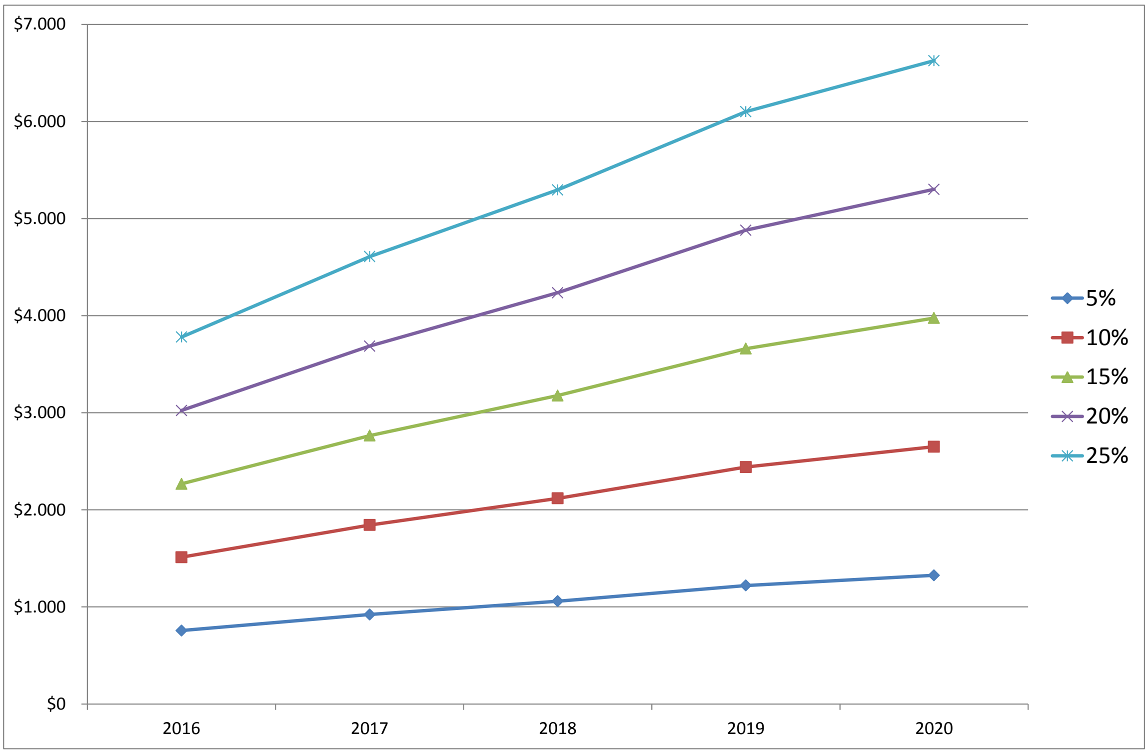
Source: Ovum data (2015), WIK/Marcus calculations

These lower prices flow into the broader economy in many ways. Businesses that are better able to coordinate their geographically dispersed operations are able to operate more efficiently. Competing fixed and mobile telecommunication services that depend on leased lines but have only limited ability to self-supply (for instance Sprint and T-Mobile) have lower operating costs, and are thus better able to compete on price producing further consumer benefits in a virtuous cycle.

The previously cited Rappoport et al. (2003) study invoked a sophisticated macroeconomic model to estimate the spill-over effects into the broader economy. Assuming that companies would re-invest 27% of the money saved, Rappoport et al. estimated that spill-over effects into the broader economy for 2003 would have been 2.6 times as great as the direct reduction in expenditures (i.e. the welfare transfer). This represents an important *multiplier effect* – again, the over-pricing of these services not only impacts competitive network operators, but also flows into the broader economy.

We follow the example of Rappoport et al. in taking a factor of 2.6 as an estimate of spill-overs for purposes of this exercise (see Figure 9).[23]

Figure 9: Potential spill-over effects (million USD) (2016-2020) had the US FCC implemented price cuts of 5% to 25% on Ethernet-based leased line equivalents.

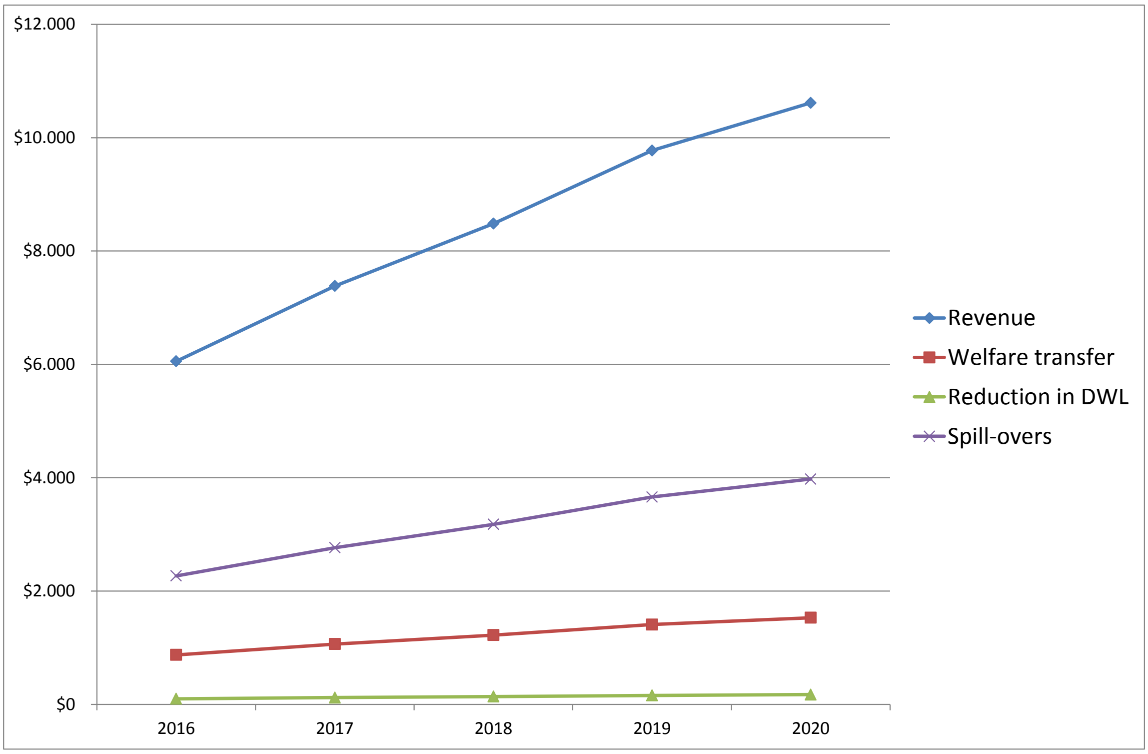


Source: Ovum data (2015), WIK/Marcus calculations

Integrating these results for a case that is in the middle of the ranges that we consider likely, a reduction of 15% as of the beginning of 2016 results in growth of revenues, in welfare transfers, in reduction of deadweight loss, and in spill-over benefits as shown in Figure 10.

23 Since this rough estimate is based only on the welfare transfer, which is based on price reductions on the quantity that would have been consumed in the absence of price cuts, it is independent of the PED. This also implies that these gains are in addition to any reduction in deadweight loss.

Figure 10. Total revenues, welfare transfer, reduction in deadweight loss (i.e. net gain in societal welfare) (million USD) (2016-2020) had the US FCC implemented price cuts of 15% on Ethernet-based leased line equivalents at the beginning of 2016, assuming a price elasticity of demand of -1.5.



Source: Ovum data (2015), WIK/Marcus calculations

6 Conclusions

If the FCC were to impose price reductions of from 5% to 25% for Ethernet-based leased line services, real societal gains would follow in terms of welfare transfers, reduction in deadweight loss, and spill-over effects into the broader society. These conclusions should be equally true for TDM-based business data services.

The price elasticity of demand for business data services is substantial; consequently, any price reductions would tend to be offset by increased volumes. The price elasticity of demand (PED) for these services is somewhere between -1.0 and -2.0, with the balance of evidence suggesting that it is significantly in excess of -1.0. At a relatively unlikely PED of -1.0, reductions in price of up to 25% reduce revenues by at most slightly over 6%; under much more realistic assumptions, these reductions in price actually increase gross revenue.[24]

[24] These statements are subjects to caveats and assumptions that (1) the price even after reductions of up to 25% is still in excess of the true short run marginal cost of providing the service; and (2) that the impact on net revenue (profits) may be different.