

Second Supplemental Declaration

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1. INTRODUCTION

The Fact Sheet issued recently by Chairman Wheeler addresses the key elements of the FCC's proposed price cap regulation of BDS services.¹ In this declaration, we focus on three key provisions in that proposal: 1) initial reductions to prices for ILEC DS1 and DS3 services by 11%, spread over three years ("reset"); 2) further reductions to DS1 and DS3 prices going forward by an annual "X-factor" of 3%, offset by inflation; and 3) application of these reductions through price cap regulation of DS1 and DS3 services in **all** geographic markets, including those in which there is extensive provision of Ethernet services by non-ILEC providers. In this declaration, we show that these elements of Chairman Wheeler's proposal lie completely outside the range of policies that can credibly claim to be "evidence-based."

The Fact Sheet does not identify the evidence or methodology used to justify this proposal. It appears, however, that the DS_n rate reductions proposed in the Fact Sheet rely (at least as a starting point) on the BLS-KLEMS data for TFP and input price measurement, as we had originally proposed. But the draft order, as we understand it, would then apply an "adjustment factor" based on a comparison of the BLS-KLEMS data to X-factors computed by the FCC for particular points of time **as far back as the 1990s**.

Such an adjustment factor is unnecessary. While it is true that the BLS-KLEMS data includes broadcasting and wireless telecommunications, we showed in our supplemental declaration that the aggregation of broadcasting, wireless telecommunications, and wired telecommunications is not a concern. In fact, the BLS-KLEMS data provide a very conservative estimate of TFP growth for the DS_n services at issue here.

The proposed adjustment factor also is deeply problematic and unjustified, for at least three reasons. *First*, this proposal has a fundamental methodological problem, as the draft order apparently would not make any adjustment to the input price series used to construct the BLS-KLEMS productivity numbers, and thus would create a mismatch between the productivity and input price series used for the reset and X-factor. *Second*, the X-factors the FCC generated in the 1990s were based on ARMIS data. These data, as explained below, reflect fundamentally arbitrary allocations of joint costs that have no justification from an economic perspective. Despite this concern, the draft order uses the difference between the ARMIS-based estimates of productivity and the BLS-KLEMS productivity numbers, for those earlier points in time to compute an "adjustment factor." The draft order then applies this adjustment (fudge) factor to *recent BLS-KLEMS estimates of TFP* and uses that as the basis to compute the reset and the X-factor going forward. *Third*, the draft order apparently assumes, not only that this adjustment factor is meaningful (which we strongly dispute below) but also that it has remained the same over two decades which have seen dramatic changes in the structure of the telecommunications industry, and especially the growth of wireless and relative decline of wired services. In this Second Supplemental Declaration we will explain why these problems render the reset and X-factor proposed in the Fact Sheet invalid and indefensible.

¹ *Chairman Wheeler's Proposal to Promote Fairness, Competition, and Investment in the Business Data Services Market*, Fact Sheet, <https://www.fcc.gov/document/chmn-wheelers-update-business-data-services-rules> (Oct. 7, 2016).

We also explain below that the reset and X-factor levels in the draft order are indefensible, based on further analysis of the BLS-KLEMS data. For example, even with extreme (and unrealistic) assumptions, the BLS-KLEMS data would yield a reset of no higher than 6.7% – far lower than the 11% reset proposed in the Fact Sheet. We also show that the Frentrup and Sappington submissions suffer from key methodological errors, and that the productivity and X-factors they propose are not based on credible evidence.

Finally, we address the draft order's proposal to extend price cap regulation and the rate reductions noted above to DSn services in all geographic markets, including those in which many customers have migrated from DSn service to non-ILEC Ethernet services.

2. THE PROPOSED ADJUSTMENT FACTOR IS UNNECESSARY.

In our initial report and supplemental declaration, we strongly recommended adopting the official Bureau of Labor Statistics indexes of input price and TFP growth, which are based on the KLEMS data and state-of-the-art methodology.² Other experts in this docket, including Christensen Associates and Sappington (in his second declaration with Frentrup) have agreed. However, Frentrup-Sappington claim it is necessary to adjust this data to focus on input price and TFP growth for DS1/DS3 services. The concern is that the KLEMS sectoral data include both telecommunications and broadcasting (SIC codes 515 + 517). If TFP grew faster in telecommunications (and DS1/DS3 services, specifically) than in broadcasting over the last decade (the time span for computing the X-factor that we recommended in our initial report), the KLEMS sectoral estimate would understate the true TFP growth in telecommunications. On the other hand, if TFP grew faster in broadcasting, then the KLEMS estimate would be an overestimate, not an underestimate.

In our supplemental declaration we showed that both wireless telecommunications and broadcasting exhibited much higher labor productivity growth than *wired* telecommunications (which includes DS1/DS3 services) during the relevant period. This evidence contradicts the assumption (which may well be the basis for the proposed adjustment factor) that the inclusion of broadcasting and/or wireless in the BLS-KLEMS data leads to an underestimate of the relevant productivity growth. In fact, there is strong evidence that the BLS-KLEMS data *overestimates* the productivity growth for DS1/DS3 services. As a result, there is no need to apply an adjustment factor to the BLS-KLEMS data.

² Mark Schankerman and Pierre Regibeau, "Response to the FCC Further Notice: Regulation of DS1 and DS3 Services," Section 4.3.1, at 18-21 (Aug. 9, 2016) (Schankerman-Regibeau Initial Report); Mark Schankerman and Pierre Regibeau, Supplemental Declaration, Comments on the Frentrup-Sappington Report, Section 5, at 11 (Oct. 6, 2016) (Schankerman-Regibeau Supplemental Declaration).

3. THE PROPOSED ADJUSTMENT FACTOR IS DEEPLY FLAWED AND UNJUSTIFIED.

3.1. The Computation of TFP Must Be Consistent with the Input Price Index. Otherwise It Is Methodologically Incorrect.

It only makes economic sense to use TFP and input price measures together to compute reset and X-factors if the two are obtained in a *unified framework*. One simply cannot meaningfully use a TFP estimate with an index of factor prices other than the index that was used in order to obtain the TFP estimates in the first place. This issue of consistency between the TFP and input price data is not academic: it can bias the results of the analysis quite considerably. Indeed, using TFP and input price numbers that are not consistent with each other invalidates the analysis completely. Combining a TFP estimate from one source with an index of input prices from a different source (i.e., an index different from the one used to compute the TFP estimates) would be like computing a hitter's batting average by dividing the number of the batter's hits by the number of times another batter had come to the plate. One can construct such a measure, but it would be meaningless. This is true irrespective of the qualities and drawbacks of the input price index used. For example, even the best index of input prices from the BLS should not be used in conjunction with a TFP estimates obtained with another index, and vice versa.

Even though one would prefer to have data that are more specific to BDS services – or at least wired telecommunications – than what the BLS provides, moving to such a smaller data set only is methodologically defensible if one can get data on both TFP and factor prices at that level. As long as one relies on the BLS measure of TFP, using any measure of input prices other than the BLS – be it the CACM or any index based on arbitrary allocations of costs, such as ARMIS data – is simply incorrect.

This also applies to what we understand now to be the draft order's proposed approach. It apparently computes an "adjustment factor" by comparing an ARMIS-based productivity measure with the BLS estimate from particular prior years back to the 1990s and then, without justification, applies this factor to the current BLS-based TFP. However, the Commission apparently would **not** also apply any corresponding adjustment to the input price series to generate the reset and X-factor values proposed in the Fact Sheet. This again creates a mismatch between the final TFP measure proposed and the input price series that underlie it. As we explained at length in our initial report and supplemental declaration, this is a serious methodological error.³

3.2. Any TFP Estimation that Relies on Allocating Shared Fixed (Accounting) Costs Is Completely Arbitrary. This is Especially Problematic in the Current Context Where Some Services Are Regulated and Others Are Not.

The Frentrup-Sappington analysis is just one example of an approach that relies on accounting data (in that case associated with an FCC cost model) to estimate the actual cost of producing a particular product or service. Even if we ignore all issues stemming from the use of accounting data to capture the appropriate *economic* costs, such exercises always involve an arbitrary allocation of joint costs between particular products

³ Schankerman-Regibeau Initial Report, Section 4.3.1, at 21; Schankerman-Regibeau Supplemental Declaration, Section 1, at 3-5.

and services.⁴ This applies to any allocation of these costs – there is simply no economically meaningful way to allocate joint and common costs.⁵ How much of a drawback such arbitrary allocation of costs represents depends on the regulatory context. This is a particular problem in this context because the Commission is assessing productivity growth for a subset of the services provided over shared facilities.

A good example of what not to use is the ARMIS data that the FCC collected from telecommunications companies in the 1990's, and even further back. These data embody the *arbitrary allocation of joint (accounting) costs* under the FCC's 'separation' rules covering cost allocation both across regulated jurisdictions (intra- and interstate) and across services within a regulatory jurisdiction. It is no justification to say that these separation rules had been adopted by the Commission – this does nothing to remove their complete arbitrariness from an economic perspective. The ARMIS regime was designed at a time when essentially all of the ILECs' activities were regulated and prices were set to guarantee an appropriate "rate of return" at the company level (not at the individual service level). This is a critical point. In that context of comprehensive and uniform regulation, while an arbitrary allocation of costs between activities would, of course, affect the structure of prices for individual products and services and thus have an impact on consumers, the allocation would have little if any impact on ILECs, at least in the absence of competition, since a lower allocation of joint costs to one product – and hence a lower regulated price – would automatically imply a higher cost allocation – and hence a higher regulated price – for another product. As long as the allowed rate of return was ensured by the regulators, the arbitrary cost allocation embodied in ARMIS was relatively innocuous from the ILEC's perspective.⁶

However, the current situation is completely different since BDS services share joint costs with services that are not subject to interstate price cap regulation, such as local telephone services and DSL services. (We later explain that BDS services should not be regulated in all geographic markets, but instead only those where effective competitive discipline from Ethernet or other substitutable services is absent). This means that any arbitrary allocation of joint costs – e.g. based on the FCC's separation rules used in the 1990s and earlier -- now has a strong effect on the ILEC's revenues since any increase (decrease) in the costs allocated to BDS services leads to a lower (higher) X-factor, without any compensatory effect on other services.

In other words, by choosing a particular allocation of joint costs, the regulator necessarily, if unwittingly, interferes with the process of competition in the *unregulated* markets.

⁴ The difference between accounting and economic costs is likely to be particularly important when the economic prospects of the sector are changing. As is well-known, the (rental) cost of capital depends on the rate of depreciation in the value of the capital (not just the decay in its physical productivity). In a declining sector like TDM-based services, the true economic cost of capital is likely to be higher because the profitability of deployed capital will be falling, and this increases the depreciation (decline) in capital value. The cost of capital is a primary determinant of the capital share in total cost, and this is the weight that is attached to the growth of capital input in computing TFP growth. Thus, in a declining sector like TDM-based services, the accounting measure will underestimate the growth in capital input (since it underestimates the true depreciation rate). By understating the growth in capital input, it leads to an overestimation of true TFP growth.

⁵ The only economically meaningful allocation is the one derived from welfare maximization subject to the constraint that the necessary funds cover the joint costs. This is known as Ramsey pricing in the economics literature. No "fully distributed cost" method for allocating such costs can be justified on the basis of sound economic principles.

⁶ One qualification to this statement is that the allocation between intrastate and interstate jurisdictions might matter since the regulatory authority in each was different, and thus the same rate of return was necessarily not guaranteed. But the basic point we are making still holds.

Loading joint costs on services ILECs provide in unregulated markets puts them at an artificial cost disadvantage (arising solely from the arbitrary allocation of joint costs). This is damaging to the ILECs in those markets, and hence to their ability and incentive to invest in new technology there, as well as damaging to economic welfare because it undermines competition where it could otherwise be effective. To reiterate, the use of the old ARMIS data or any other accounting cost data that allocates joint costs across services, is indefensible from an economic perspective. Yet the Commission's proposal constructs an "adjustment factor" based in part on such data.

3.3. The Proposal Erroneously Assumes that the Difference Between BLS-Based and ARMIS-Based X-Factors Has Remained the Same Over the Past Two Decades.

It is our understanding that the proposed adjustment factor is based on a comparison of ARMIS-based and BLS-based productivity factors from earlier periods, including the 1990s. Without question, the telecommunications industry has undergone dramatic changes over the past two decades. In the 1990s, ILEC switched access minutes were growing rapidly and accounted for a much higher percentage of price cap revenues than today, migration from DS1/DS3 services to Ethernet had not yet begun, and the use of wireless phones was very limited. Given these changes, there is no reason to expect that the relationship between the ARMIS-based and BLS-based productivity factors in 1997, for example, would be the same or even relevant to the relationship of those factors today. In light of the utterly unjustified assumption that the "adjustment factor" that the Commission computes for the 1990s has been stable over twenty years of transformative change in the sector, or has any independent validity despite the arbitrary cost allocations embedded in it, we believe that it would be unreasonable (as well as unnecessary) to apply the proposed adjustment factor to the BLS-KLEMS data.

4. OBSERVATIONS ON FRENTRUP AND SAPPINGTON PROPOSALS

4.1. Combining the KLEMS Index of TFP with the CACM Input Price Index Violates Economic Principles. Frentrup's Defense of This Flawed Approach is Incorrect.

We also cannot help but notice that the specific reset and X-factor proposal made in the Fact Sheet is very similar to the "conservative" scenario included in the most recent declaration made by Frentrup and Sappington. While the approach used by the Commission to defend the proposal is different, it shares some of the key methodological errors with the Frentrup-Sappington report. Therefore, we begin by summarizing the reasons why the Frentrup-Sappington report is completely unreliable and then explain that Frentrup's subsequent submissions are equally flawed and provide no basis for the FCC to establish a defensible reset or X-factor.

Like the earlier Sappington-Zarakas Declaration,⁷ the central argument in the Frentrup-Sappington Declaration is simply wrong. To review, the Frentrup-Sappington Declaration proposed to use CACM data to construct input prices for the TFP.⁸ The main reason why they get a greater initial reduction for the price reset for BDS services, and a larger X-factor, than those obtained by other experts is not a difference in assumptions or a legitimate disagreement on methodology. They simply make a grievous mistake in economic reasoning. Taking the “most conservative” estimate from such a faulty analysis, as they do, does not make such an estimate any more reliable. The October 5, 2016 submission by Frentrup (alone) tries to argue that there was no basic error,⁹ but, as we will explain below, his defense is simply wrong on economic principles.

The Frentrup-Sappington Declaration completely ignores the prior submission by Sappington and Zarakas – understandably, since the Sappington-Zarakas Declaration was shown in our original report and that of Christensen Associates to have fundamental, fatal methodological errors. Interestingly, while Sappington and Zarakas did not recommend using the CACM to construct input prices, this was later reversed in the Frentrup-Sappington Declaration. They provide no explanation for this radical change of position. They argue only that using the CACM provides a measure of input prices which is allegedly more specific to BDS services. This new approach is also fundamentally wrong, as we explain next.

As noted, it is a basic and well-established principle in productivity measurement that the index of TFP and the index of input prices -- which are the key elements to determine reset and X-factor – must be derived from a unified framework. Again, it is important to realize that a failure to use productivity and input prices data that are consistent with each other is not just an *approximation* that could be then taken into account by interpreting the results of the analysis cautiously. It is not an approximation; it is a *methodological mistake*. We explained this in our Supplemental Declaration, as did Christensen Associates.

Briefly, if one wanted to use, for some reason, an input price index obtained from the CACM, the correct procedure would require one to recalculate the quantities of inputs (from the observed expenditures on those inputs) by deflating with the CACM-based input price index, and then re-calculate TFP using those new input quantities. As we showed in the Supplemental Declaration, this correct procedure yields *the same TFP growth as one obtains when uses the BLS data for both TFP and input prices*. In other words, Frentrup and Sappington only get estimates that differ significantly from ours, or from those of Christensen Associates, *because they make a mistake*.

⁷ Declaration of David E. M. Sappington and William P. Zarakas, Exhibit E to the Comments of Sprint Corporation, WC Docket Nos. 16-143, *et al.* (filed June 28, 2016). Rather than rely on the US KLEMS data used by the FCC and most other economic experts, the Sappington-Zarakas report proposed to use the European Union (EU) version of KLEMS because the EU version purportedly has a narrower definition of the telecommunications sector (which turned out not to be true). As we showed in our initial report, the TFP data in the EU-KLEMS data set has two critical pitfalls, including its reliance on value added, rather than gross output, which overestimated the true TFP gains in the sector by a factor of almost two. See Schankerman-Regibeau Initial Report, Section 2.3, at 7-8.

⁸ Declaration of Chris Frentrup and David E.M. Sappington, Attachment to Letter from Jennifer Bagg, Counsel to Sprint Corporation, to Marlene H. Dortch, FCC, WC Docket Nos. 16-143 *et al.* (filed Aug. 31, 2016) (Frentrup-Sappington Declaration).

⁹ Letter from Chris Frentrup, Sprint, to Marlene H. Dortch, FCC, WC Docket Nos. 16-143 *et al.* (filed Oct. 5, 2016 (Frentrup October 5th Letter)).

In his October 5, 2016 submission, Frentrup claims that one does not (necessarily) need to make this re-calculation.¹⁰ His reasoning is incorrect. He claims that when one changes the input price index, the input quantities chosen by a rational (profit-maximizing) firm will also change, so it is not *a priori* clear how TFP will change. Of course, it is true that a company would respond to changes in input prices, but this is *not* the relevant question. Frentrup's *claim confuses two very different questions: The relevant question is how one should measure TFP in a given context (or "equilibrium" in economists' terminology) when one adopts a different measure of input prices. The other question, which is what Frentrup focuses on, is how the equilibrium position (input choices of the firm) would change if the company had faced different input prices from the ones that it actually did face. The key point here is that it is not the actual input prices the company faced that are changing – they were what they were – it is only our proxy measure for them that is being changed here.*

To put the matter simply, the key point – as we explained in our Supplemental Declaration – is this: The companies in question faced a given set of input prices and made their decision about the quantities of each input to use. However, we do not observe directly the input quantities, but we do observe the expenditures on each input (i.e., the input price times the input quantity). These expenditures are actual expenditures by the companies, a given piece of data for the analyst. To measure TFP, we need to back out the *implied input quantities* and that requires that we deflate expenditures by an input price index. If a different input price index is selected for the X-factor (e.g., a CACM-based measure were to be used), one cannot continue to use the original input price index for the purposes of measuring the input quantities. Consistency requires that the same input price index be used to back out input quantities (from observed input expenditures), and thus to compute TFP, as it is used directly in the computation of the X-factor.

In addition, we note that the only possible reason for departing from the KLEMS-based input price index that corresponds to the BLS measure of TFP is the claim that a CACM-based index might offer a closer approximation to the cost conditions at the level of individual providers of BDS services. However, the CACM is a highly stylized, static model of a hypothetical network constructed *de novo*, not a model of the actual costs of extending an existing network that has been developing for years. These are very different settings, and the composition of costs for the two purposes is likely to differ significantly. On top of that, the CACM generates forecasted input costs, which may bear little or no relationship to the actual costs recently incurred for network expansion, which by contrast *would* be reflected in the actual TFP performance of the sector. The notion, put forward by Frentrup and Sappington, that the CACM generates more precise, reliable input price data suitable for the actual expansion (or contraction) of BDS services is fanciful. It is specious precision.

Moreover, it makes little sense to try to account for an input mix on the grounds that it might be a closer approximation of the manner in which producers actually combine factors of production, and not also consider other important aspects of the technology of BSD service producers -- notably, economies of scale and the secular erosion of the demand for these TDM-based services -- which are factors that the Frentrup-Sappington report ignores completely.

¹⁰ Frentrup October 5th Letter at 2.

4.2. Frentrup Proposes Using TFP/X-Factors from the 1999 FCC Review to Adjust KLEMS-Based Estimates from the BLS. This is Unjustified and Fails a Basic Sanity Check.

In his October 20, 2016 submission, Frentrup proposes yet another faulty approach to try to justify large reset and X-factor reductions to ILEC DS_n rates.¹¹ Specifically, Frentrup presents computations of TFP growth, and the associated X-factor, during the late 1980s and 1990s using two sources: 1) KLEMS- based TFP and input price indexes constructed by the BLS for the telecommunications and broadcasting sector; 2) TFP and X-factors adopted by the Commission in its *1999 Price Cap Performance Review FNPRM* based on information from the ILECs (i.e., excluding broadcasting). He argues that those dated estimates are preferable for BDS price cap regulation because they focused on ILEC services. Frentrup finds that the productivity growth embedded in in the Commission's 1980s and 1990s X-factors was much higher than those constructed by the U.S. Bureau of Labor Statistics, and claims that this difference should be used to adjust BLS estimates for the current reset and X-factor, more than twenty or even thirty years later.

We will show here that Frentrup's findings and conclusions are unwarranted, misleading, and do not pass a basic sanity check. First, the industry has undergone transformative change in the intervening decades, with wireless services largely replacing wireline telecommunications, switched access minutes declining with access lines, special access transitioning from TDM to IP packet-based services, and increased competitive entry from CLECs and cable companies. Even if the adjustments Frentrup computes were accurate at that time – and they are not meaningful, as we will explain – there is no basis at all for assuming this fudge factor would be relevant in the new telecommunications landscape.

Second, as we explained in more detail in Sections 3.2 and 3.3, the productivity measures used by the Commission, which underlie the X-factors adopted by the Commission in the 1980s and 1990s, were based on ARMIS data. These embed (mandatory) allocation of joint costs that are entirely arbitrary from an economic perspective, and this makes any productivity computations based on them of limited, if any, economic use. The fact that ARMIS-based productivity differs from the BLS numbers, which are based on widely-accepted data sources and methodology, has no probative value. Also, these X-factors were applied to all ILEC price cap services, which were primarily comprised of switched access at that time and thus are a poor proxy for productivity growth for BDS services.

Moreover, a simple comparison of the annual rate of TFP growth for the ILECs from the 1999 FCC Price Cap Performance Review with the TFP growth from the BLS shows that the FCC performance review estimates do not pass a basic sanity check. Frentrup asserts that an X-factor computed from the BLS KLEMS data may not be reflective of the productivity of wireline telecommunications or BDS, because it includes data for other industries, such as wireless telecommunications and broadcasting.¹² The true productivity growth for the BLS sector that includes telecommunications and broadcasting/cable is a weighted average of the productivity growth in telecommunications (which we treat here as synonymous with the ILECs for the 1990s, when wireless telecommunications was just emerging) and the other subsectors which

¹¹ Letter from Chris Frentrup, Sprint, to Marlene H. Dortch, FCC, WC Docket Nos. 16-143 *et al.* (filed Oct. 20, 2016 (Frentrup October 20th Letter).

¹² Frentrup October 20th Letter at 1.

include broadcasting and cable.¹³ Just for argument's sake, suppose that the FCC estimates of TFP for the ILECs were correct. Using that estimate and the BLS-KLEMS based estimate of TFP for the sector as a whole, we can back out the implied growth rate in TFP for the "non-ILEC" part of the BLS Broadcasting and Telecommunications sector (e.g., wireless services, broadcasting and cable).¹⁴ Table 1 below summarizes the calculations for four different periods presented by Frentrup.

Table 1: Average Annual TFP Growth from BLS and 1999 FCC Review, and the Implied TFP Change for Non-ILEC Broadcasting and Telecommunications

	BLS, TFP Growth: Entire Sector	FCC Review, TFP Growth: ILECs	Implied TFP Growth: Non-ILEC Broadcasting and Telecommunications
1986-98	0.43%*	4.51%	-9.09%
1988-98	0.43%	4.44%	-8.93%
1991-95	0.72%	3.69%	-6.21%
1986-95	1.48%*	3.46%	-3.14%

Source: First two columns are taken from the Frentrup October 20th Letter, at 3. Column 3 is computed as follows (footnote 7): $\text{Implied TFP} = (\text{BLS-TFP}_{\text{Sector}} - 0.7 \text{ FCC-TFP}_{\text{ILECs}}) / 0.3$. The asterisk denotes the fact that BLS estimates begin in 1987, so the periods in the first and fourth row correspond to 1987-98 and 1987-95, respectively.

The last column shows the implied *average annual rate of change* in TFP for the non-ILEC subsectors if we were to take seriously the TFP growth for ILECs reported in the 1999 FCC Review. The implication is that TFP in the non-ILEC part of the broadcasting and telecommunications sector declined by an average rate of 9.09% per year over the 1986-98 period, or a cumulative decline in TFP of 100% over this period. Even if we take the shorter period 1986-95, the FCC numbers imply a decline in TFP in non-ILEC broadcasting and telecommunications of 3.14% per year, equivalent to a cumulative decline of 25% in TFP for that sector over the shorter period. This conclusion strains credulity, to say the least, and shows just how problematic the comparison Frentrup makes is. To use such numbers to adjust BLS-KLEMS productivity estimates during the 2005-14 period, as Frentrup proposes, would be indefensible.

¹³ We can express this in the following equation: $\alpha \text{ TFP}_{\text{ILEC}} + (1-\alpha) \text{ TFP}_{\text{BC}} = \text{TFP}_{\text{Sector}}$ where α denotes the share of employment in the sector accounted for by telecommunications (ILECs) and BC denotes broadcasting, cable and other non-ILEC telecommunications in this sector.

¹⁴ We use the fact that broadcasting/cable accounted for 30% of total employment in the BLS "telecommunications" sector in 1999 (wireless was a relatively small component in that period). See U.S. Bureau of Labor Statistics, "Productivity and Costs: Service- Producing and Mining Industries, 1990-99." http://www.bls.gov/news.release/History/prin_06062001.txt.

5. FURTHER ANALYSIS OF THE BLS-KLEMS DATA SHOWS THAT THE RESET AND X-FACTOR LEVELS PROPOSED IN THE FACT SHEET ARE INDEFENSIBLE AND CONTRARY TO THE EVIDENCE.

In our initial report, we used the consistent estimates of TFP and factor prices provided by the BLS and state-of-the-art methodology to provide estimates of the range for the initial “reset” of BDS service prices and the X-factor that were consistent with the evidence. We proceeded in two steps, starting with a straightforward “baseline case” and then discussing a number of additional factors – such as capacity utilization and economies of scale – which should be taken into account.

Based on these two steps, we concluded that our best strictly evidence-based estimate of the necessary reset of BDS price was an *increase* of 4.4%. Without any of the adjustments involved in our “second step,” our baseline results suggested that a *decrease* of 0.4% might be in order. For the going-forward X-factor, we found that, without any of the additional adjustments that we believe are needed, the X-factor should be 1.42%. With all evidence-based adjustments made, this figure falls to between 0.73% and 0.96%.¹⁵

In this section we further analyze the BLS data to show that the Commission cannot justify the reset and X-factor levels proposed in the draft order. Even with extremely conservative and unrealistic assumptions, the BLS data would not support these proposed reductions. We emphasize that we are not recommending that the Commission adopt any of the reset and X-factors numbers presented here. But they illustrate the unreasonableness of the draft order’s proposed reset and X-factor.

We consider two aspects. The first is the period over which the analysis is performed (sample period). The second aspect is to make an unwarranted assumption that the broadcasting sub-sector experienced lower productivity gains than the (wireless and wired) telecommunications sector. For this illustration, we start from our previous benchmark without any of the adjustments discussed in our initial report.

5.1. Sample Period.

5.1.1. Reset Sample Period.

The proper period of analysis to determine how much BDS services prices should be reset before moving to a new GDPPI – X regime depends on what “error” one thinks the reset is designed to redress. One view is that the reset should correct for the possible mistakes made under the previous regulatory regimes where prices were essentially frozen in real (inflation-adjusted) terms. In this case, the period of analysis to determine the reset starts when this regulatory regime started, i.e., in 2005. Alternatively, one could argue that earlier regimes which set X-factors without any reference to credible evidence on TFP and input prices were equally arbitrary and should also be corrected for as well. In

¹⁵ Schankerman-Regibeau Initial Report, Section 4.5, at 45-46.

this view, the proper period of analysis to determine the initial reset of BDS services prices should start well before 2005, perhaps as far back as 1997.¹⁶

The baseline results in our initial report were based on the period from 2005-2014. However, we also checked how robust our estimates of the reset were by comparing the results for a longer period, such as 2000-2014 and intervening sub-periods. We found that longer periods unambiguously lead to the conclusion that initial prices should be reset at a higher level than the level suggested using the shorter period. In other words, a longer period would result in higher rate levels. We conclude that, for the reset at least, changing the period of analysis could not help justify larger evidence-based rate reductions.

5.1.2. X-Factor Sample Period.

Choosing the appropriate period of time to estimate an X-factor for ongoing regulation requires balancing two considerations. On the one side, we need to rely on a period that is long enough to “smooth out” business cycle fluctuations and any anomalous changes in TFP or input prices. On the other side, the period should not be too long if it is to ensure that the X-factor reflects sufficiently recent productivity and cost trends to be relevant. In particular, it would be extremely difficult to justify using productivity and input price data that are much more than a decade old in any way to compute the relevant productivity factor, especially in view of the dramatic technological innovation that has been experienced in the telecommunications sector. The sector in the 1990s and earlier was dominated by wireline services (and switched access services were more prevalent than special access, while only the latter is relevant to price cap regulation of DS_n services). In the later period the sector’s growth, and the innovation that has driven it, have come predominantly in wireless telecommunications.

The estimates of the X-factor provided in our initial report were based on the years 2011-2014. In the table below, we show how our baseline estimate of the X-factor changes as we change the period used for our computations. The X-factors reported are computed from the direct method – equal to the rate of change in input prices in the sector minus the rate of change in TFP. As explained in our original report, this method is the most direct in that it requires the fewest assumptions (in particular, it does not require any assumption about how GDPPI relates to aggregate input prices or productivity).

Table 2: X-Factor for Different Periods

Period	2011-14	2010-14	2009-14	2008-14	2007-14	2006-14
X-Factor	1.47%	1.74%	1.6%	1.81%	1.73%	1.70%

Our recommended sample period for the X-factor going forward, in our original report, was 2011-14, as it is likely to be most reflective of recent technological trends in the

¹⁶ Schankerman-Regibeau Initial Report, Section 4.3.2, at 27-30. As we noted in our initial report, any methodology that begins at any date after 1997 will not fully correct for methodological errors during the 1997-2003 period, when the FCC generally applied a 6.5% X-factor that a court invalidated as empirically ungrounded and that we now know, from currently available data, was indeed excessive.

sector.¹⁷ Table 2 shows that, while going back further in time raises the computed X-factor, the maximum X-factor that we get is equal to 1.81%.¹⁸

5.2. Productivity in Broadcasting versus Telecommunications

As we mentioned earlier, a common theme of the two Sappington reports is that the TFP numbers provided by the BLS might *underestimate* the true increase of productivity growth in BDS services because it combines the broadcasting and telecommunications sector (the latter is made of wired and wireless telecommunication sub-sectors). For this to be true, it must be the case that productivity growth in broadcasting has been slower than in telecommunications as a whole. We showed in our Supplemental Declaration that this is almost certainly false.¹⁹ Using labor productivity (since TFP is unavailable for the sub-sectors), we found that broadcasting productivity was far greater than for wired telecommunications (which is the sector relevant for the BDS price cap), even though it was less than productivity for wireless. On top of that, the sharp erosion of demand for TDM-based services and heavy migration of customers toward Ethernet which has been occurring over the recent past almost surely has made TFP growth for BDS services even slower than for other wired services because economies of scale are being lost. We concluded on the basis of the available evidence that the inclusion of broadcasting does not create any downward bias in the estimate of the X-factor.

Nevertheless, to demonstrate the unsupportable nature of the Fact Sheet's proposed reset and X-factor, we want to show what would happen if the Commission were to adopt two extreme assumptions, which we emphasize are *unsupported* by the best available evidence: 1) that productivity for TDM-based services has grown in line with the rest of the telecommunications sector, and 2) that TFP growth was actually slower in broadcasting than in telecommunications.

In the following table, we report what the initial reset of BDS prices would be under these two extreme assumptions. Specifically, we assume for purposes of this illustration that broadcasting TFP growth is only a fraction of the productivity gains seen in telecommunications. We then vary this fraction, which is denoted in the table by α , from zero (this corresponding to no TFP gain at all in broadcasting over the period 2005-14) all the way up to one (this corresponds to the baseline case where we assume that TFP growth is the same for broadcasting and telecommunications).

¹⁷ If there were concerns about using a period too short to smooth out business cycle fluctuations, one could simply make a direct adjustment for capacity utilization, using official government statistics (e.g., from the Federal Reserve data base). In our original report, we proposed and used this approach.

¹⁸ In our view, it becomes difficult to justify going back much further in time because the late 1990s and early 2000s was the period of particularly rapid innovation in wireless telecommunications. Given that the focus in this proceeding is wireline telecommunications – and in fact, the subsector within wireline that has experienced the sharpest secular erosion of output growth – the earlier period is less relevant and surely would overstate the relevant prospects for TFP growth for TDM-based services.

¹⁹ Schankerman-Regibeau Supplemental Declaration, Section 5, at 11-13.

Table 3: Reset for BDS Service Prices as a Function of the Differential in TFP Growth between Broadcasting and Telecommunications (2005-14)

Broadcasting TFP as % of telecoms TFP growth	$\alpha = 0$	$\alpha = 0.25$	$\alpha = 0.5$	$\alpha = 0.75$	$\alpha = 1$
Reset	-6.7%	-4.9%	-3.1%	-1.3%	-0.4%

This table shows that, if the Commission were to assume that there had been *zero growth in TFP for broadcasting over the period 2005-14*, that would imply that the reset for telecommunications should be a reduction of 6.7% in BDS prices. Of course this estimate is utterly unreasonable, since it is virtually certain that broadcasting experienced some gains in TFP over that period (as we showed in our Supplemental Declaration, labor productivity the broadcasting sector grew by about 6% per year over that period). If the Commission were to assume that TFP growth in broadcasting was only 25% as large as in telecommunications, the implied reset for BDS would be a reduction of 4.9%. If the Commission assumed that TFP in broadcasting grew half as fast in telecommunications, the reset would be a reduction of 3.1%. Even these extreme assumptions, which we do not think are well grounded in the evidence, produce resets that are far lower than the 11% reset proposed in the Fact Sheet. This shows just how extreme that proposal is.

We now turn back to the X-factor to be used for on-going regulation. In Table 4 below, we present the X-factors corresponding to various (but reasonably short) periods of reference and values of α between 0.25 and 1.

Table 4: X-Factor for Different Reference Periods and Different Productivity Gaps between Broadcasting and Telecommunications

	$\alpha = 0.25$	$\alpha = 0.5$	$\alpha = 0.75$	$\alpha = 1$
2011-14	1.97%	1.77%	1.57%	1.47%
2010-14	2.24%	2.04%	1.84%	1.74%
2009-14	2.1%	1.9%	1.7%	1.6%
2008-14	2.31%	2.11%	1.91%	1.81%
2007-14	2.23%	2.03%	1.83%	1.73%

Keep in mind that the assumptions built into this table are extreme in two dimensions – first, by allowing for estimation periods for TFP that are, in our professional view, too long, and second and most importantly, allowing for a productivity gap between broadcasting and wired telecommunications services which does not seem to exist based on the available (labor productivity) evidence. Yet even if the Commission were to adopt any of these extreme assumptions, the implied X-factor *would still be at most around 2%*. Again, *this shows just how far out of bounds and unjustified the Fact Sheet's proposal for an X-factor of 3% actually is.*

6. THE EXTENSION OF DSN PRICE CAP REGULATION TO GEOGRAPHIC AREAS WITH COMPETITION FROM ETHERNET SERVICES IS INDEFENSIBLE.

Finally, we want to comment on the third part of the proposal in the Fact Sheet – the recommendation by the Commission to apply the reset and price cap X-factor to all TDM-based services both in areas currently subject to price cap regulation and those that are not. This would constitute a dramatic, and utterly indefensible, extension of regulation. In many, if not most, geographic markets, ILECs providing DS1 and DS3 services face competition from other suppliers, notably CLECs and cable companies. In fact, this is the case in essentially all dense (urban) markets and many more outlying areas. The whole point of the FCC-commissioned study by Mark Rysman was to develop empirically-based criteria of how many suppliers were needed to generate effective competitive discipline on these services.²⁰ While that study has been severely, and correctly, criticized for various reasons, its basic premise is that markets differ in the degree of competitive discipline, and where sufficient competition is present, there is no justification for direct price regulation in those markets.

The only conceivable justification would be if there was conclusive evidence that consumers treat TDM-based services as completely non-substitutable with other competing services, notably Ethernet. But the obvious fact that there has been severe erosion of demand for TDM-based through migration of customers to Ethernet during the recent past belies this argument (the fact that most of that migration has been one way does not change this as evidence of substitution, at least for many customers). It is important to stress that migration of customers, including one-way migration, has been widely accepted among competition policy authorities in telecommunications.²¹

7. CONCLUSION

For the reasons discussed above, we believe that the reset and X-factor proposed in the Fact Sheet are indefensible and inconsistent with the available evidence. We also believe that the Commission should recognize the fact that ILECs supplying DS1 and DS3 services face competition from CLECs and cable companies that provide Ethernet in dense (urban) markets, and as well as other local geographic areas, and that the widespread and continuing migration of customers from DS_n services to Ethernet over the past decade is *de facto* evidence that these services are effective substitutes for consumers, and thus that the presence of non-ILEC providers of Ethernet imposes meaningful competition on the TDM-based services. This makes the Commission proposal in the Fact Sheet to extend price cap regulation to all DS_n services, even in geographic markets with effective competition, unjustified and unreasonable.

²⁰ Marc Rysman, “Empirics of Business Data Services: White Paper,” (Apr. 2016), attached as Appendix B to Tariff Investigation Order and Further Notice of Proposed Rulemaking, WC Docket Nos. 16-143, 15-247, 05-25, RM-10593 (2016).

²¹ For an excellent discussion of this issue, see the OECD report (2014), “Defining the Relevant Market in Telecommunications: Review of Selected OECD Countries and Columbia”, especially Chapter 2. Available at: https://www.oecd.org/daf/competition/Defining_Relevant_Market_in_Telecommunications_web.pdf.