July 22, 2011

VIA ECFS

Marlene H. Dortch, Esq.
Secretary
Federal Communications Commission
Office of the Secretary
445 Twelfth Street, S.W.
Washington, DC 20554

Re: *Applications of AT&T Inc. & Deutsche Telekom AG for Consent to Assign or Transfer Control of Licenses & Authorizations*, WT Docket No. 11-65

Dear Ms. Dortch:

AT&T Inc. and Deutsche Telekom AG (the "Applicants") are jointly filing herewith a paper by Professor Robert Willig that describes certain extensions of the "Upward Pricing Pressure" ("UPP") analysis of the potential pricing effects of mergers that was discussed at the recent economists' workshop in this docket and in the Reply Declaration of Dennis W. Carlton, Allan L. Shampine and Hal S. Sider filed with the Applicants' Joint Opposition. Professor Willig's paper describes a methodology for taking account of quality improvements resulting from a merger, as well as the effects of eliminating or relieving capacity constraints faced by the merged firms, and shows how those effects offset potential upward pricing pressure that might be suggested by an application of a simplified UPP framework.

More specifically, Professor Willig explains that a simple application of the basic UPP tool overlooks important effects of mergers on product and service quality, as well as on technology, capacity and infrastructure services that affect quality, marginal costs and the level of output, and on changes to the elasticity of demand for a product. Effects of a merger that lead to improvements in product quality and reductions in marginal costs (including the marginal costs associated with increased capacity) can create downward pressure on quality-adjusted price. Professor Willig shows how such sources of downward pricing pressure are additive in nature. This provides a useful theoretical framework for applying the UPP analysis in a way that takes account of the increases in capacity and quality, and the reduction in marginal costs, that will result from the proposed acquisition of T-Mobile USA by AT&T and, even without considering other offsetting factors, leads to the conclusion that there will be no net upward pricing pressure resulting from the transaction.

If you have any questions or require further information, please contact us at 202-942-5499 or Richard.Rosen@aporter.com, or (202) 719-7344 or nvictory@wileyrein.com. Thank you for your assistance.

Sincerely,

/s/

Richard Rosen
Counsel for AT&T Inc.

/s/

Nancy Victory
Counsel for Deutsche Telekom AG

Enclosure

cc (via email): Best Copy and Printing, Inc.
Kathy Harris, Esq.
Ms. Kate Matraves
Jim Bird, Esq.

UPP Methodology Extensions to Product Quality and Capacity Issues

Robert Willig

July 22, 1011

- The UPP formulation in the 2010 Horizontal Merger Guidelines is based on a theoretical methodology applied to a basic model of firms with exogenously differentiated products setting their prices unilaterally before and after the analyzed merger.

- While the Guidelines themselves do not explicitly cover efficiencies in their UPP framework, Werden in 1996 and Farrell and Shapiro in recent papers and speeches have integrated in elegant and practically useful fashion the basic UPP formulation with the offsetting impacts of savings in marginal costs caused by the analyzed merger.

- Until just lately, the UPP formulation in the Guidelines had not been extended to cover other practically important features of the merging parties, and these extensions have not yet been widely disseminated. However, they show the importance of allowing the basic formulation to be modified to apply the same fundamental methodology to other fact patterns – because the resulting consumer welfare impacts of mergers can be significantly different than those predicted by the UPP formulation in the Guidelines. Where these mainstream fact patterns are prevalent, rote adherence to the Guidelines' formulation of UPP will likely lead to erroneous conclusions about the impact of mergers on consumer welfare.

- After reprising the analytics underlying the basic formulation of UPP that appears in the Guidelines, augmented by the possibility of savings in marginal costs from the merger, this presentation will focus on four sets of conditions not covered by the Guidelines' formulation:[1]

    - In Section/Extension II, the merger would improve the quality of one or more of the parties' products. It is shown that the value of the quality improvement of each unit of the good is a counterforce to UPP that is additive to the marginal cost savings from the merger.

    - In Section/Extension III, the merger would eliminate a capacity constraint that confines the level of output of one of the parties' products. Pre-merger, the constraint was a force for higher prices to limit output, and by eliminating the

[1] This paper focuses only on savings in non-capacity marginal costs, increased product quality, and the reduction or elimination of the effective marginal costs of capacity as potential countervailing forces offsetting the calculation of UPP. In evaluating a merger, it is also appropriate to consider other offsetting forces, such as the ability of existing competitors to reposition, but these additional considerations are beyond the scope of this paper.

constraint, the merger can create substantial downward pricing pressure.

- In Section/Extension IV, the merger would eliminate a previously adjustable capacity constraint that creates congestion that diminishes the quality and confines the outputs of one of the party's products. Here, price, quality of service and investment are modeled as pre-merger decision variables of the pre-merger profit-maximizing firm. UPP is offset or overcome by the additive effects of boosted product quality, diminished non-capacity marginal costs of production, and the elimination of the marginal cost of the binding capacity constraint. In this model, even the latter component of the downward pricing forces can be measured, due to the firm investing until it is equated to the marginal cost of constructing capacity.

- Finally, in Section/Extension V, the merger enhances available infrastructure services to the parties, which drops the total marginal cost of production, eases congestion thus improving product quality, and in effect also raises the price elasticity of demand for the good, thereby creating an additional additive source of downward pricing pressure. In this model, product quality is not a decision variable of the firm, but it is endogenously determined by the interplay of output and infrastructure services. Also, investment by the firm is not assumed to be optimal pre-merger, and the merger only eases rather than eliminating constraints. In these respects, this Extension works through a model that was constructed in response to suggestions of the DOJ economists.

I: The Guidelines' Basic Formulation – UPP Without Capacity and Product Quality Effects From the Merger

To set the notation and methodology, let us concisely derive the Guideline's formulation of the UPP test.

Pre-merger:

$$\Pi^i = (P_i - c_i^0) D^i(P_1, P_2).$$

Post- merger, the marginal cost of firm 1 may be different and the firms' profit functions are combined:

$$\Pi^m = (P_1 - c_1) D^1(P_1, P_2) + (P_2 - c_2) D^2(P_1, P_2).$$

$$\frac{\partial \Pi^m}{\partial P_1} = (P_1 - c_1) D_1^1(P_1, P_2) + D^1(P_1, P_2) + (P_2 - c_2^0) D_1^2(P_1, P_2)$$

The key to the entire UPP methodology is the next step of evaluating this expression at the pre-merger levels of prices, where $P_i = P_i^0$. If the derivative of the merged firm's profit function with respect to one of its product's prices is positive when evaluated at the pre-merger levels of prices,

then it would be profitable for the merged firm to raise that price above where it was pre-merger. This is the economic meaning of the phrase "upward pricing pressure."

$$\frac{\partial \Pi^m}{\partial P_1}\Big|_{pre-merger} = (P_1^0 - c_1)D_1^1(P_1^0, P_2^0) + D^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0) =$$

$$[(P_1^0 - c_1^0)D_1^1(P_1^0, P_2^0) + D^1(P_1^0, P_2^0)] + (c_1^0 - c_1)D_1^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0) =$$

$$\frac{\partial \Pi^1}{\partial P_1}\Big|_{pre-merger} + (c_1^0 - c_1)D_1^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0) =$$

$(c_1^0 - c_1)D_1^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0)$ since

$$\frac{\partial \Pi^1}{\partial P_1}\Big|_{pre-merger} = 0$$

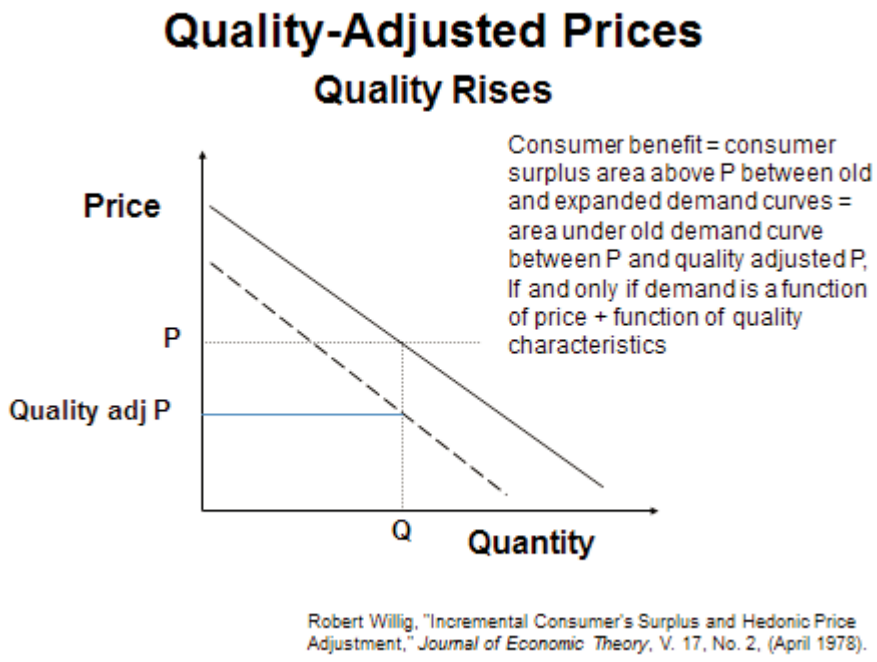
Then, there is UPP, i.e. the derivative of the merged firm's profits with respect to P_1 at the pre-merger prices is positive if

$$\frac{(P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0)}{-P_1^0 D_1^1(P_1^0, P_2^0)} > \frac{c_1^0 - c_1}{P_1^0}.$$

II: UPP Extension To Where The Merger Improves the Quality of the Parties' Products

<drawn from Willig, R. "Unilateral Competitive Effects of Mergers: Upward Pricing Pressure, Product Quality, and Other Extensions." *Review of Industrial Organization*.>

Here, the demands for good 1 and 2 are
$D^1(P_1 - v_1, P_2 - v_2) \equiv D^1(H_1, H_2)$ and $D^2(P_1 - v_1, P_2 - v_2) \equiv D^2(H_1, H_2)$.
$H_i = P_i - v_i$ are the "hedonic," or quality-adjusted prices for the products after the merger, where v_i is the value of the improvement in the quality of product i, per unit, for each consumer, brought about by the merger. An increase in product quality shifts up individuals' demand curves because they are each experiencing a greater value per unit for the same quantity. The welfare gain from the quality increase is the same as that from a nominal price decrease equal to the unit value to consumers of the quality increase – i.e. the consumers' surplus gain from that equivalent shift in price.



This is the same representation of product quality that DOJ and Compass-Lexecon economists employed in assessing the impacts of recent airline mergers. It enables practical strategies for estimating impacts on the quality of goods or services in terms of the price changes that would induce the same change in demand that the quality shift causes.
Here, post- merger:

$$\Pi^m = (P_1 - c_1)D^1(P_1 - v_1, P_2 - v_2) + (P_2 - c_2)D^2(P_1 - v_1, P_2 - v_2) \ ;$$

or, since $H_i \equiv P_i - v_i$, so that $P_i = H_i + v_i$,

$$\Pi^m = (H_1 + v_1 - c_1)D^1(H_1, H_2) + (H_2 + v_2 - c_2)D^2(H_1, H_2)$$

Assuming for focus on good 1 that $v_2 = 0$ and $c_2 = c_2^0$, and applying the same methodology as in the standard UPP formulation, it is found that the derivative of the merged firm's profit function with respect to the hedonic price of good 1, evaluated at pre-merger prices, is positive and indicative of UPP if $\dfrac{(P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0)}{-P_1^0 D_1^1(P_1^0, P_2^0)} > \dfrac{v_1 + c_1^0 - c_1}{P_1^0}$.

Using the diversion ratio notation, this is equivalent to

$$\frac{(P_2^0 - c_2^0)\delta_{12}}{P_1^0} > \frac{v_1 + c_1^0 - c_1}{P_1^0}.$$

Thus there is UPP on the quality adjusted price only if the usual (Guidelines') GUPPI exceeds the unit value of the quality improvement of the product, plus the savings in the marginal cost of the product due to the merger.

III: UPP Extension To Where The Merger Eliminates a Capacity Constraint That Binds Output

Here, the model is the simple original one of the Guidelines except that pre-merger firm 1 faces a binding capacity cap on its output, while post-merger that constraint is no longer binding due to an infusion of capacity from firm 2 through the deal.

Pre-merger, reflecting the constraint that the output of firm 1 cannot exceed capacity K, the Lagrangian for the profit of firm 1 is:

$$\Pi^1 = (P_1 - c_1^0)D^1(P_1, P_2) + \mu\left[K - D^1(P_1, P_2)\right]$$

Differentiating yields the first order condition for the profit maximizing choice of the firm's pre-merger price:

$$(P_1^0 - c_1^0)D_1^1(P_1^0, P_2^0) + D^1(P_1^0, P_2^0) - \mu D_1^1(P_1^0, P_2^0) = 0$$

Assuming that the merger increases the capacity available for product 1 so as to relax the previously binding constraint, post-merger μ=0. Thus, evaluating the derivative of the merged firm's profit function with respect to P_1 at the pre-merger prices yields:

$$\frac{\partial \Pi^1}{\partial P_1}\Big|_{pre-merger} + (c_1^0 + \mu - c_1)D_1^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0) =$$

$$(c_1^0 + \mu - c_1)D_1^1(P_1^0, P_2^0) + (P_2^0 - c_2^0)D_1^2(P_1^0, P_2^0)$$

Hence, there is UPP here if

$$\frac{(P_2^0 - c_2^0)\delta_{12}}{P_1^0} > \frac{\mu + c_1^0 - c_1}{P_1^0}.$$

There is net upward pricing pressure due to the GUPPI if and only if it exceeds the sum of the savings in marginal cost from the merger and the pre-merger positive value of the Lagrange multiplier μ on the capacity constraint. While it is not easy to measure μ in this model, the economic intuition of the situation is straightforward.

The capacity constraint pre-merger led the firm to price higher than it otherwise would have found most profitable in order to suppress demands that it could not fulfill. While the merger might create a partial incentive due to diversion to raise price, the concomitant relief of the earlier binding capacity constraint creates incentive to lower price that is of a strength that could easily outweigh that indicated by the GUPPI.

IV: UPP Extension To Where The Merger Would Eliminate an Adjustable Capacity Constraint That Creates Congestion Diminishing Quality and Confining Output

I now turn to a new extension that includes both endogenous quality effects and capacity limitations on output levels, along with the ability of the firm pre-merger to invest sunk costs in capacity to maximize profit. The results of the merger's alleviation of the capacity constraints on output and quality will be possibly powerful forces to lower prices, and these will be far more amenable to empirical estimation than the Lagrange multiplier of the last model above.

For firm 1 premerger, there is limited capacity to produce output that is equal to $K(v_1, I)$, where I is investment in capacity and v_1 is the quality level of the product. The higher the quality level of the product, the less output of it can be produced for a given level of investment in capacity. More investment makes possible more output of a given quality level, or higher quality for given amounts of output, or combinations of the two governed by the K function. The periodic cost of the capacity investment is rI. Under these circumstances, the Lagrangian for the maximization of firm 1's profits pre-merger is:

$$\Pi^1 = (P_1 - c_1^0)D^1(P_1 - v_1, P_2 - v_2) - rI + \mu\left[K(v_1, I) - D^1(P_1 - v_1, P_2 - v_2)\right].$$

The corresponding first order conditions are:

$$\frac{\partial \pi^1}{\partial P_1} = (P_1^0 - c_1^0)D_1^1(P_1^0, P_2^0) + D^1(P_1^0, P_2^0) - \mu D_1^1(P_1^0, P_2^0) = 0$$

$$\frac{\partial \pi^1}{\partial v_1} = -(P_1^0 - c_1^0)D_1^1(P_1^0, P_2^0) + \mu K_v + \mu D_1^1(P_1^0, P_2^0) = 0$$

$$\frac{\partial \pi^1}{\partial I} = \mu K_I - r = 0$$

From these it follows that the pre-merger marginal capacity cost, i.e. the additional recurrent cost of the incremental capacity needed to handle incremental output at constant quality, is

$$\frac{d(rI)}{dK} = \frac{r}{K_I} = \mu$$

It also follows that

$$D^1(P_1^0, P_2^0) + \mu K_v = 0.$$

Consequently, $\mu = \dfrac{-D^1(P_1^0, P_2^0)}{K_v}$, the number of units supplied times the diminution in product quality that results from adding a unit of output, without bolstering investment in capacity. An effective way to construe this is to recognize that a nominal price decline equal to that diminution in product quality would be necessary to maintain demand. Multiplying that decline in nominal price by the number of units supplied gives the total hit to revenue due to the loss in product quality coupled with the maintenance of demand. It makes good economic sense that at

the firm's optimum that loss would be equated to the firm's marginal capacity cost. Adding capacity and dropping revenue from nominal prices are the two ways to react to a loss of product quality due to congested capacity, and at the firm's optimum these alternatives should have the same incremental cost.

In the post-merger scenario, it is assumed here for relative simplicity that the combined firm has enough capacity to render the pre-merger capacity constraint non-binding. As a result, post-merger, product 1's quality rises by ν_1, and μ becomes 0. Evaluation of the derivative of the merged firm's profit function with respect to H_1 at pre-merger prices shows that there is UPP if $\frac{(P_2^0 - c_2^0)\delta_{12}}{P_1^0} > \frac{\mu + \nu_1 + c_1^0 - c_1}{P_1^0}$.

Thus, here, any partial upward price pressure resulting from diversion has three sources of counterweight. First, the added capacity brought to bear on the supply of good 1 from the merger alleviates congestion and increases its quality by ν_1. Second, there may be merger efficiencies that reduce non-capacity marginal costs from c_1^0 to c_1. And third, there is the reduction in the effective marginal cost of capacity from μ pre-merger to 0 post-merger due to the relaxation of the capacity constraint caused by the merger. This marginal cost of capacity elevated price pre-merger to alleviate the impact of the capacity constraint on quality. Thus the elimination of the binding capacity constraint creates incentives to move nominal prices down, regardless of the partial UPP caused by the diversion effect. How these forces balance in any application is of course an empirical matter.

To this end, it is particularly significant that the model identifies two routes to the estimation of the crucial variable μ. One route is the identification of μ as the marginal cost of capacity needed to maintain quality in the face of an expansion of supply. The second route, logically equivalent in this model, is the number of units supplied times the diminution in product quality that results from adding a unit of output, without any change in the level of investment in capacity.

Qualitatively, where the merger eliminates congestion of capacity that impacts product quality, the GUPPI is offset or reversed by three additive effects – savings in non-capacity marginal costs, the increase in product quality and the elimination of the effective marginal cost of capacity that drove higher prices pre-merger.

V: UPP Extension To Where The Merger Would Enhance Available Infrastructure Services Thereby Lowering Costs and Improving Quality by Easing (But Not Eliminating) Congestion

I now present another extension of the basic UPP model to a scenario where the extent of the available infrastructure underlies the relationship between output and all other costs, and also the relationship between output and network congestion that influences the quality of service. The infrastructure assets in question can include both established plant facilities and spectrum. The impact of the merger is represented by an increase in the services of the infrastructure that are available for the supply of the product that is the subject of the UPP analysis. This might occur from economies of scale and/or economies of scope in the services of the infrastructure -- *i.e.*, heightened productivity from the commingling and more effective coordinated deployment of the infrastructure assets held by the parties pre-merger.

In this model, quality of service is endogenous in that it is affected by the level of output of the product under analysis, as well as by the extent of available infrastructure services, but it is not a decision variable of the firm as it was in the model developed in the previous section. Also, unlike in the previous model, there is no presumption in this model that the parties invested optimally pre-merger (that is, the infrastructure assets of the parties are taken as exogenously given at the time of the merger). Perhaps most important, in this model the merger does not necessarily entirely eliminate a binding capacity constraint, as was the case in the model of the previous section. Instead, the enhanced infrastructure services made available by the merger create somewhat lower marginal costs of production and eased congestion that somewhat raises the quality of the product.

Despite these differences in the details of the modeling, the end conclusions of this model for the interpretation of UPP measures are quite similar in principle to those of the model of the previous section. Here, too, the GUPPI must be compared to the value of the increase in product quality that results from the merger, as well as the decrease in the total marginal cost of the product's supply.

An additional offset to the GUPPI arises here because the merger in effect raises the price elasticity of demand for the product, which in turn creates downward pricing pressure. In this model, since the quality of service automatically adjusts to changes in output for a given level of effective infrastructure, a price increase lowers demand and alleviates congestion to some extent, thus increasing product quality and in turn somewhat increasing demand. Due to the feedback effect on product quality, a price increase has, on net, less of an impact on the level of demand than it would at constant product quality. With effectively augmented infrastructure due to the merger, the impact of output on product quality is apt to be attenuated. Thus, post-merger, there is less of a feedback on quality from a price increase, and consequently a price increase has a more depressing net impact on demand. Obversely, post-merger, a decrease in price has a greater stimulating impact on demand. This merger-driven increase in the product's price elasticity of demand is a force that alters the firm's incentives post-merger towards a lower price, offsetting, along with higher product quality and lower marginal costs, any other sources of UPP.

Turning now to the analytics of the model, the pre-merger profit function of firm 1, the supplier of the product 1 under investigation for UPP, is:

$\Pi^1 = P_1 D^1(P_1 - v_1, P_2 - v_2) - C^1(Q_1, K^0)$.

Here, $C^1(Q_1, K)$ is the firm's cost function of output, for a given level of infrastructure K, without consideration of the expenditures that created the infrastructure K, since K is taken to be exogenous. It is the natural assumption that an increased K will lower the cost function, and also lower the marginal cost of output, $\partial C^1(Q_1, K) \big/ \partial Q_1 \equiv C^1_Q(Q_1, K)$. The firm's output of product 1 is Q_1, which will be set equal to demand $D^1(P_1 - v_1, P_2 - v_2)$. As before, $H_i = P_i - v_i$ are the "hedonic," or quality-adjusted prices for the products. To keep focus on the simplified issue of UPP for product 1 alone, I hold $H_2 = P_2 - v_2$ constant throughout this analysis and drop it from the notation where I can. (Where the changes due to the merger affect both products, interaction effects arise that complicate the UPP analysis and perhaps necessitate a full merger simulation.)

The quality of product 1 is a decreasing function of its output level and an increasing function of the extent of available infrastructure: $v_1 = v(Q_1, K)$. An increase in *K* both raises *v* for a given level of output, and diminishes the negativity of the marginal effect on *v* of added output: $\partial v(Q_1, K) \big/ \partial Q_1 \equiv v_Q(Q_1, K) \le 0$.

Since quality is not a decision variable in this model, but it rather adjusts to the level of output, the impact of price on demand is affected by this feedback. Taking the feedback into account, the total derivative of demand with respect to price, holding H_2 but not v_1 constant, is: $dD^1(P_1 - v(Q_1, K)) \big/ dP_1 = (D^1_1)(1 - v_Q(dD^1 \big/ dP_1))$. Here, D^1_1 is the derivative of D^1 with respect to H_1, the hedonic quality-adjusted price of product 1. Solving this equation algebraically, $\frac{dD^1}{dP_1} = \frac{D^1_1}{1 + D^1_1 v_Q}$. This is negative, but less so than D^1_1 since the denominator is greater than 1.

Similarly, $\frac{dD^2}{dP_1} = \frac{D^2_1}{1 + D^1_1 v_Q}$. For given levels of the quality-adjusted prices, but for an augmented value of *K* due to the merger, $\bar{K} > K^0$, the negative pre-merger value of $\frac{dD^1}{dP_1}$ becomes more negative, label it $\frac{d\bar{D}^1}{dP_1}$, because v_Q becomes less negative. So $\frac{d\bar{D}^1}{dP_1} < \frac{dD^1}{dP_1} < 0$.

Following through with this notational convention, let $\bar{v}_1 = v(Q^0_1, \bar{K})$ and $v^0_1 = v(Q^0_1, K^0)$, where $Q^0_1 = D^1(H^0_1, H^0_2)$, the pre-merger level of output of product 1. Similarly, let $C^1_Q \equiv C^1_Q(Q^0_1, K^0)$ and $\bar{C}^1_Q \equiv C^1_Q(Q^0_1, \bar{K})$, the latter being the smaller due to the enhanced infrastructure.

We are finally ready for the extended UPP analysis. The first order condition for the profit maximizing choice of P_1 is: $D^1(H_1^0, H_2^0) + (H_1^0 + v_1^0 - C_Q^1)\frac{dD^1}{dP_1} = 0.$

The post-merger profit function of the firm, holding constant H_2, is

$$\Pi^m = P_1 D^1(P_1 - v_1, H_2^0) + P_2 D^2(P_1 - v_1, H_2^0) - C^1(Q, K) - C^2(Q^2).$$

Differentiating with respect to P_1 and evaluating at pre-merger levels of output and quality-adjusted prices yields:

$$\frac{\partial \Pi^m}{\partial P_1}|_{pre-merger} = D^1(H_1^0, H_2^0) + (H_1^0 + \hat{v}_1 - C_Q^1)\frac{dD^1}{dP_1} + (P_2^0 - C_Q^2)\frac{dD^2}{dP_1} =$$

$$\frac{\partial \Pi^1}{\partial P_1}|_{pre-merger} + (\hat{v}_1 - v_1^0 + C_Q^1 - C_Q^1)\frac{dD^1}{dP_1} + (P_1^0 - C_Q^1)(\frac{dD^1}{dP_1} - \frac{dD^1}{dP_1}) + (P_2^0 - C_Q^2)\frac{dD^2}{dP_1}$$

Recognize that $\frac{\partial \Pi^1}{\partial P_1}|_{pre-merger} = 0$, divide through by $-\frac{dD^1}{dP_1}$ and note that

$$\frac{\frac{dD^2}{dP_1}}{-\frac{dD^1}{dP_1}} = \frac{D_1^2}{-D_1^1} = \delta_{12}.$$ This yields the result that $\frac{\partial \Pi^m}{\partial P_1}|_{pre-merger} > 0$ -- there is net UPP-- if and only if $\frac{(P_2^0 - C_Q^2)\delta_{12}}{P_1^0} > \frac{(\hat{v}_1 - v_1^0) + (C_Q^1 - C_Q^1)}{P_1^0} + \frac{(P_1^0 - C_Q^1)}{P_1^0}\frac{(\frac{dD^1}{dP_1} - \frac{dD^1}{dP_1})}{\frac{dD^1}{dP_1}}$.

Here, the traditional GUPPI is on the left hand side, and the first term of the right hand side is the now familiar sum of the merger's impacts on the quality of the product and on the marginal cost of its production. It is significant to note that the improvement in the quality of the product, $(\hat{v}_1 - v_1^0)$, is simply the direct gain in quality resulting from the infrastructure enhancement from the merger, and does not reflect additional changes that may result from subsequent alterations in output, prices or investment. Similarly, the decline in marginal cost, $(C_Q^1 - C_Q^1)$, is that resulting from the merger's enhancement of infrastructure services, at the pre-merger level of output, and does not reflect the changes in output that may also result. These are as expected for a UPP style analysis, since the traditional GUPPI is also focused on the forces resulting from demand diversion caused by the merger at the levels of output and prices that prevailed pre-merger.

The new term on the right hand side, also offsetting the GUPPI, is the pre-merger margin multiplied by the percentage difference between the post-merger and pre-merger levels of the

own price elasticity of demand for the product at issue. In this model, it is expected that the pre-merger own price elasticity of demand is smaller in absolute value than its counterpart post-merger, due to the larger pre-merger feedback effect of nominal price on product quality. This feedback effect dampens the repression of demand from a higher price, since the reduced demand mitigates congestion and raises demand-stimulating product quality. Of course, the consequence of a relatively low own-price elasticity of demand is a relatively high price-marginal cost margin. Thus, inasmuch as the merger's enhancement of the infrastructure mitigates the feedback effects from price changes to quality, it will result in a force towards downward pricing pressure from raising the price elasticity of demand.

There is another insightful perspective that arises from the additional offset to the GUPPI. Substituting from the first-order condition for the profit-maximizing price pre-merger, and using the expressions derived above for the own-price derivatives of demand, we have

$$\frac{(P_1^0 - C_Q^1)}{P_1^0}\frac{(\frac{d\hat{D}^1}{dP_1} - \frac{dD^1}{dP_1})}{\frac{d\hat{D}^1}{dP_1}} = \frac{(\frac{d\hat{D}^1}{dP_1} - \frac{dD^1}{dP_1})}{-\frac{P_1^0}{D^1}\frac{dD^1}{dP_1}\frac{d\hat{D}^1}{dP_1}} = D^1\frac{\left[v_Q(Q_1^0,\hat{K}) - v_Q(Q_1^0,K)\right]}{P_1^0}.$$

Since v_Q is the decrease in the quality of service due to an incremental unit of output, when it is multiplied by the total output the result is a measure of the marginal cost of output borne by the totality of users of the service. Although this is not a pecuniary marginal cost of production, it is a congestion externality to all users, and it is reflected in the ability of the firm to price without losing demand. Then, the numerator of the right hand side of the above equation is the reduction in the marginal cost of network congestion resulting from the infrastructure enhancement of the merger, inasmuch as $v_Q(Q_1^0,\hat{K})$ is less negative than is $v_Q(Q_1^0,K)$.

Consequently, from this perspective on this model, the additive elements of downward pricing pressure that offset or overcome the diversion ratio UPP are the increase in product quality, the decrease in total production marginal cost and the decrease in service-congestion marginal cost that result from the merger's impact on the firm's infrastructure.

Conclusions

The principal lesson of the work presented here is that consumer welfare may be reduced, rather than enhanced, if antitrust agencies analyze mergers with rigid adherence to the basic UPP tool as articulated in the Guidelines. Instead, it must be recognized that the basic UPP tool does not account for, among other things, prevalent impacts of mergers on product and service quality, on technology, capacity and infrastructure services that affect quality, marginal costs and the level of physical output, and on changes to the elasticity of demand for the product at issue. Each of these areas of merger impact is shown here to give rise to significant modifications to the measure of UPP, modifications that may, along with other things (such as repositioning) offset or reverse the indication of a GUPPI that the merger creates upward pricing pressure.

This lesson has been shown here to be robust, since it is derived in consistent ways from five different models with different representations of the impacts of the merger on the firms and on the products involved. In each case, while details of the models differ, they all agree that it is necessary to consider offsets or reversals to the indications of a GUPPI due to improvements in product quality and decreases in all elements of marginal costs (both due to increases in capacity and otherwise). The models all agree that it is not a double-count to consider these sources of downward pressure on quality-adjusted prices as additive. And the full course of the analyses here show that these forces and the necessity of including them in UPP analysis occur regardless of the details surrounding the nature of the capacity concerns, the details of how capital and product quality interact, and the details of how and whether these firm variables are endogenous as elements of explicit decisions or just concomitants of the pricing decisions that drive the UPP methodology.