A more recent version of this article has been accepted for publication in:
CPI Antitrust Chronicle, 2011

Upward Price Pressure, Merger Simulation, and Merger Simulation Light

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March 2, 2011

Introduction

Every year, the Federal Trade Commission and the Antitrust Division of the Department of Justice are notified of thousands of mergers. Investigating which mergers are likely to have anti-competitive effects is a difficult, data-intensive, and resource-consuming task. Screens are necessary to target the truly problematic mergers and economize on scarce agency resources.

The agencies have historically relied upon a screen for unilateral effects based on the market shares of the merging firms. The 1997 merger guidelines state that, in concentrated industries, if the new merged firm would attain a market share of at least 35% the merger would be presumptively anti-competitive. The specific figure has since been dropped in the 2010 guidelines.

As has long been noted by economists, market share screens rely on the inherently difficult and artificial exercise of defining a relevant market from which to construct market shares. Market definition exercises must make a discrete "in or out" decision for each product from what is generally a continuum of substitute products, and market shares are sensitive to where this cutoff is drawn.

Recently, Farrell and Shapiro (hereafter FS) introduced a new screen known as Upward Price Pressure (UPP) to flag potential unilateral effects.[1] The screen requires as inputs estimates of diversion ratios, markups, and post-merger cost efficiency expectations.

On theoretic grounds, UPP has many advantages over traditional market share based screens and represents a potentially important step forward for merger enforcement policy. UPP is rooted in the economic theory of profit maximization (for Bertrand competition), and attempts to directly gauge the post-merger pricing incentives of merging firm. In general it does not require defining a relevant antitrust market.

UPP has several limitations, though. Like market share based screens, it only seeks to predict whether prices will rise, but not by how much, when it is actually the latter we actually care about. Also, the data requirements are more stringent for UPP than for market based screens which may limit its use. Finally, UPP is yet to be fully tested and optimized empirically.

[1] Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition* (Working Paper 2010).

In this article, I consider the advantages and limitations of implementing UPP in practice, discuss the relationship between UPP and merger simulation, and ultimately argue in favor of a "merger simulation light" style screen, based on UPP, that I think holds most promise for effective merger screening practice.

The Basic and Advanced UPP Screens

The UPP formula derives from the theory of profit maximization.[2] Assume there are two firms: Firm 1 produces Product 1 and Firm 2 produces Product 2. The firms intend to merge. Assuming constant average and marginal costs and no fixed costs, the pre-merger profit of Firm 1 is given by

(1) $$\pi_1 = (p_1 - c)q_1(\vec{p})$$

and similar for Firm 2. To maximize own profits, Firm 1 sets

(2) $$(p_1 - c)\frac{\partial q_1(\vec{p})}{\partial p_1} + q_1(\vec{p}) = 0$$

the point at which its incremental revenue is just about to fall below its incremental cost.

When the two firms merge, the merged firm now considers the impact its price on each good has on sales of the other. The incremental profit to the merged firm from increasing the price of product 1 above its pre-merger level is equal to

(3) $$\frac{\partial \pi}{\partial p_1} = (p_1 - c_1)\frac{\partial q_1(\vec{p})}{\partial p_1} + q_1 + (p_2 - c_2)\frac{\partial q_2(\vec{p})}{\partial p_1} + E_1 c_1 \frac{\partial q_1(\vec{p})}{\partial p_1}$$

where E_1c_1 is the reduction in the cost of producing Product 1 from merger generated efficiencies. Equation 3 reduces to

(4) $$\frac{\partial \pi}{\partial p_1} = (p_2 - c_2)\frac{\partial q_2(\vec{p})}{\partial p_1} + E_1 c_1 \frac{\partial q_1(\vec{p})}{\partial p_1}$$

at pre-merger prices since then the first two terms are zero. Dividing equation 4 by $\left|\frac{\partial q_1(\vec{p})}{\partial p_1}\right|$ yields the Basic UPP Screen promoted by FS

(5) $$UPP_1 = (p_2 - c_2)D_{12} - E_1 c_1$$

[2] This derivation follows the exposition of Elizabeth M. Bailey, Gregory K. Leonard, G. Steven Olley, and Lawrence Wu, *Merger Screens: Market Share-Based Approaches Versus Upward Pricing Pressure*, THE ANTITRUST SOURCE, February 2010.

where $D_{12} = \frac{\partial q_2(\vec{p})}{\partial q_1(\vec{p})}$ is the diversion ratio from Product 1 to Product 2. That is, D_{12} measures the fraction of sales lost by Product 1 after a price increase that are recaptured by Product 2. The equation for UPP_2 is similar.

If incremental efficiencies E_1C_1 are large enough to overcome the incentive to raise prices by the merged firm, then UPP is negative and, in expectation, prices are likely to fall post-merger. If efficiencies are not large enough, UPP is positive, prices are likely to rise. With symmetric firms, UPP is positive when

(6) $$D\frac{M}{1-M} > E$$

There are two major simplifications in the Basic UPP Screen. First, it awkwardly assumes no efficiencies to Product 2 from a merger when UPP_1 is calculated and no efficiencies to Product 1 when UPP_2 is calculated. Second, it is a "first stage" UPP, in that it does not allow for feedback effects as the merged firm re-optimizes as prices adjust to new equilibrium levels. The Advanced UPP Screen that includes these effects is given by

(7) $$UPP_1^* = (p_2 - c_2)D_{12} + (p_1 - c_1)D_{12}D_{21} - (1 - D_{12}D_{21})E_1c_1$$

with a similar equation for UPP_2^*.[3] With symmetric firms, UPP is positive when

(8) $$\frac{D}{1-D}\frac{M}{1-M} > E$$

The screens are effectively a measure of whether "costs" will rise or fall, where costs include not only the usual incremental costs but also the "cannibalization tax" of FS - the tax that, if imposed on the pre-merger firms - would get them to replicate the joint profit maximizing prices of the merged firm. Higher net costs leads to higher prices, lower net costs leads to lower prices.

FS suggest using the Basic UPP Screen rather than the Advanced UPP Screen, noting the better transparency of the former. While transparency has much value, so does accuracy, and I would favor the Advanced UPP Screen which has the advantage of greater accuracy with little loss in transparency.

There are two kinds of transparency here - functional and conceptual. Functional transparency means the screen must be simple even for non-specialists to use. Conceptual transparency means the economic logic should be straightforward enough for non-specialists to understand.

With respect to the functional transparency, the Advanced UPP Screen is still simple arithmetic. Any calculator or spreadsheet can handle it and it is difficult to imagine, given the size of mergers involved, that a few extra calculations will be problematic. The advanced formula requires no additional data collection. If the agencies were to use the screen, it would be easy to enough for them to supply a spreadsheet containing the formulas for easy accessibility.

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[3] See Gregory Werden, *A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of Differentiated Products*, J. Industrial Economics, 44, pp. 409-413 and FS.

With respect to the conceptual transparency, the Advanced UPP Screen is clearly a bit less intuitive. But it is straightforward to refer back to the logic of the Basic UPP Screen, and simply note the more complicated version allows efficiencies on both products and feedback effects while the firm adjusts to the new pricing equilibrium, for a more accurate calculation.

UPP, Merger Simulation, and Merger Simulation Light

UPP is attractive in large part because it is simple to implement (assuming available data inputs) while capturing important pricing incentives. UPP avoids the difficult task of estimating a demand system and calculating expected post-merger price changes, as is standard with full merger simulations. As Froeb et al. and others have found, different demand systems may give rise to substantially different estimates of post-merger price increases.[4] Even in full merger simulations, demand systems are often assumed rather than estimated.

Avoiding demand estimation is not without cost. UPP tells us only if prices are likely to rise, not by how much, even though it is the latter we really care about. To estimate price effects, dealing with demand systems is unavoidable.

The relationship between UPP and merger simulation is a close one but sometimes can be overstated. In a recent paper, Epstein & Rubinfeld compare the Basic UPP Screen (Equation 5) to the Advanced UPP Screen (Equation 7), referring to the latter as merger simulation, and conclude that the Basic UPP Screen is just a special case of merger simulation when D_{12}=0. While clearly the Basic UPP Screen is a special case of Advanced UPP Screen when D_{12}=0, the Advanced UPP Screen and merger simulation are far from equivalent. While merger simulations can and have been used to identify the critical level of efficiencies needed for retail prices to remain unchanged (which is what Equation 7 does), merger simulations are more powerful. They are designed to estimate actual price effects and whether prices are likely to rise by a small but significant and non-transitory amount (a SSNIP), rather than just whether they will rise. Merger simulations also allow for equilibrium price responses of *all* firms, rather than assume prices of non-merging firms remain unchanged, can estimate the set of own and cross price elasticities, and can be used to study other responses like entry and exit, product repositioning, quality changes, innovation changes, and so on.

One of the touted benefits of UPP is its independence from demand systems, but a less appreciated point is that even UPP imposes a demand assumption. The diversion ratio is assumed independent of the size of the price increase that generated the switching behavior in the first place. If the diversion ratio is estimated, for example, with a survey that asks consumers if they would switch and what they would switch to in response to a 1% price increase, it may yield different answers than if the price increase were 5% or 10%. The former may be more relevant when efficiencies are low and a small cannibalization tax would be sufficient to overcome efficiencies, and the latter more relevant when

[4] See Luke Froeb, Steven Tschantz, & Gregory Werden, *Pass-Through Rates and the Price Effects of Mergers*, INTERNATIONAL J. OF INDUSTRIAL ORGANIZATION, 23, pp. 703-715, December 2005.

efficiencies are high. The calculation assumes a constant ratio. To what extent this effect matters, given that estimates of diversion ratios are often quite rough to begin with, remains to be seen.

While UPP is still a marked improvement over market share screens *a priori*, it is important to know not only if prices will increase but by how much. I agree with Schmalensee that, even at the screening level, a superior approach is to convert the UPP measure, which is not a metric of anything we directly care about, into a measure of predicted price increases, which is exactly what we care about.[5] To do this, demand assumptions are unavoidable. The demand system determines the passthrough rate of "cost" changes into prices, and pass-through rates connect UPP measures to predicted price change magnitudes.

We do not and generally cannot know the true demand structure at the screening stage, so an assumption is necessary. With linear demand, Schmalensee calculates the expected price change resulting from a merger between two symmetric firms as

(9) $$\frac{\Delta p}{p} = \frac{DM - E(1-D)(1-M)}{2(1-D)}$$

While Equation 9 is more complicated and less transparent to be sure, it is based on the same logic as UPP, uses the same inputs, and is still a spreadsheet calculation suitable for the screening stage. It would be easy enough for agencies to provide spreadsheet algorithms for any of the screens they use to enable non-specialists to easily run the screen with their own preliminary estimates of diversion ratios, markups, and efficiencies. The calculation is much more complicated for other demand functions, but a template is still feasible if agencies use the screen. If significant price effects are suggested under reasonable demand assumptions, further investigation would be warranted.

The Schmalensee method produces rough price effects estimates and can be considered "merger simulation light" (MSL). It is still short of full merger simulation for a variety of reasons, including that prices of non-merging firms are assumed the same. It also assumes, like UPP, we have good data on diversion ratios and markups already. But overall the MSL method, built on UPP but producing a more transparent outcome metric, seems a worthy improvement over either the Basic or Advanced UPP Screen alone.

Can UPP or MSL Predict Anticompetitive Mergers?

The value of a screen, be it UPP, MSL, or otherwise, is ultimately that it does a good job flagging mergers with a high probability of unilateral effects and not flagging too many with a low probability.

Consider again the Basic and Advanced UPP Screens. If efficiencies are ignored, UPP is always positive, flags all mergers, and is not an effective screen. Efficiencies are notoriously difficult to estimate ex ante

[5] Richard Schmalensee, Should New Merger Guidelines Give UPP Market Definition, CPI ANTITRUST CHRONICLE, December 2009(1).

so FS suggest using a default efficiency credit absent other evidence. The figure FS use in examples is a 10% efficiency credit. Simons & Coate argue this figure is both arbitrary and very high given agency experience.[6] With a reasonable credit, they argue, UPP would flag many more mergers than currently done under the market share screens.

The fact that UPP would flag more mergers is not necessarily a problem if the extra flagged mergers had a truly high risk of unilateral price effects and were missed by existing screens. But there is a obvious problem. Historically it has not been the goal of merger policy to stop all mergers for which prices are likely to rise, but rather mergers for which prices are likely to rise by a significant and non-transitory amount. Therefore a UPP threshold of zero is unlikely to be the right one and, all else equal, would flag too many mergers. One could compensate for this by being very generous with efficiency credits but clearly it is not a good approach to overestimate one thing to compensate for underestimating another.

The best UPP threshold would therefore be something positive. Coate mentions one possibility is to use a UPP threshold of 0.05*P, i.e. a UPP/P threshold of 5%.[7] To get this number, Coate begins with a 5% SSNIP and takes half of that - a 2.5% increase - as a conservative threshold for price increases above which the merger should be flagged. Then assuming a linear demand specification - which has a passthrough rate of UPP into price changes of 0.5 - Coate gets a threshold level for UPP/P of 5%. Higher values of UPP are likely to result in more than a 2.5% price increase and would flag the merger for potential unilateral effects.

Notice that the UPP threshold is really based on a price increase threshold, translated back into UPP terms through a demand assumption. Again, using a screen that tries to abstract from demand is difficult when we want to say something about the potential magnitude of price changes.

If we use UPP (or MSL), the most appropriate threshold is, of course, an empirical question. An early analysis by Coate highlights some of the difficulties in trying to estimate this threshold well at this juncture. Looking at 152 past detailed merger reviews undertaken by the FTC, Coate checks, under different thresholds, how often UPP would have "correctly" flagged a merger that the FTC investigated for unilateral effects concerns and how often UPP would have "incorrectly" flagged a merger the FTC investigated but not for unilateral effects, rather for coordinated effects instead. He shows that at a 2% UPP/P threshold, UPP correctly flags 85% of mergers in unilateral effects investigations and incorrectly flags 55% of mergers in coordinated effects investigations as having unilateral effects. He argues that the optimal UPP/P threshold ranges from 1% at low markups to 5% at high markups.

There are several obvious concerns. First, we do not know from the results which mergers actually would have had significant unilateral effects, only which the FTC investigated it. This FTC decision to investigate was surely based at least in part on various screens, such as the 35% market share screen or

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[6] Joseph J. Simons & Malcolm B. Coate, *Upward Pressure on Price Analysis: Issues and Implications for Merger Policy*, EUROPEAN COMPETITION J., 6(2), August 2010, pp. 377-396.

[7] Malcolm B. Coate, *The Enhanced Upward Pressure on Price Screen: Merging Markets into the Methodology*, Working Paper (October 2010).

the Herfindahl index safe harbor screen. The analysis thus directly compares the decision rule of the UPP screen to that of other screens, and is considered "correct" if it matches, and "incorrect" if it does not.

The problem is that UPP is not intended to replicate other screens, it is designed to improve upon them. "Match" and "Do not Match" are different than "Correct" and "Incorrect". It is the latter we want, it is the former we are actually testing. If the goal were only to replicate market share screens, there would be little point in using UPP because of its stronger data requirements.

It is not surprising, then, that Coate finds the UPP threshold that best replicates the FTC screens varies positively with the markup. Mergers involving higher markups are more likely to be flagged under a UPP screen relative to a, say, straight 35% market share based screen. That is part of the value added of UPP.

Second, in spite of separate historical treatment in the merger guidelines, there is actually considerable overlap in the potential for unilateral effects and coordinated effects. The analysis assumes they are mutually exclusive events, so that mergers flagged by the FTC (primarily) for coordinated effects do not have any unilateral effects concerns. Thus it is assumed that any of coordinated effects mergers flagged by UPP are incorrectly flagged, and this cannot be right. Finally, there is the usual selection issue - only cases flagged by the FTC's screens are included in the data. We do not know which mergers were not investigated but would have been flagged by UPP and ultimately had important unilateral effects. It would be worth comparing UPP for these cases with actual price effects post-merger.

Clearly, continued research is needed to determine the optimal UPP threshold if UPP is to be used, and the optimal price increase threshold if MSL is to be used.

Data Availability to Implement UPP and MSL

Successful implementation of the UPP or MSL Screens require estimates of diversion ratios, markups, and efficiencies. If good estimates for these inputs are difficult to attain, it can limit UPP's or MSL's usefulness as a screen.

Accurately estimating diversion ratios (or equivalently, elasticities) as part of a full merger simulation is a difficult task that requires good data and resources to do. At the screening stage, sufficient data will often be unavailable. Diversion ratios may be estimated roughly from existing data or surveys, or can be proxied with market shares, as FS suggest, though the latter reintroduces the usual problems of appropriate market definition.

Markups are easier to estimate, though the difference between average variable costs (often measured) and incremental costs (which are relevant) can cause biases. The most difficult input to estimate, even in the later stages of a full investigation and even to the parties involved, is the level of incremental efficiencies to be expected from a merger.

This is not to say UPP or MSL is inferior to a market based screen, rather the opposite. UPP and MSL have stronger data requirements because they seek to use better information on pricing incentives.

More relevant inputs makes a better screen. If available, they can and should be used, and UPP and MSL is the blueprint for how to use them. If not available, the usual screens remain available.

It should be noted that even market share based screens implicitly assume the UPP inputs in a loose and generally inferior way. Diversion ratios, for example, determine substitutability patterns, and substitutability patterns determine the relevant antitrust market. Definition of the relevant antitrust market in large part determine market shares. Market shares are aggregated for use in the market share screens. Thus calculated market shares are based often on a loose idea of what the underlying diversion ratios might be. Markups are typically not calculated for the screen but assumed significant by virtue of the fact that the market shares of the merging firms are high. Finally, efficiencies are just assumed to be zero under the market share screening at first, and revisited at a later stage.

Conclusion

Farrell and Shapiro (FS) have introduced a new technique - Upward Pricing Pressure (UPP) - to gauge the incentive for merging firms to increase the price of products it sells. The data requirements are more strict than market share based screens, but if the data are available, the result is more informative. One downside to the UPP screen - like market share based screens - is that it does not estimate the magnitude of post-merger price changes, only whether a price is likely to rise. The Merger Simulation Light (MSL) methodology adds a demand assumption to convert UPP into an outcome metric - predicted post-merger price changes - that we directly care about. UPP and MSL have much to recommend them on theoretical grounds and should be pursued. How effective they are in flagging problematic mergers in practice, and how to fine tune the optimal screening thresholds used, remains an empirical question.