When is Static Analysis a Sufficient Proxy for Dynamic Considerations? Reconsidering Antitrust and Innovation*

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This paper examines the claim that dynamic considerations play a particularly important role in certain industries (in particular, those characterized by high rates of product innovation) and, consequently, render antitrust analysis based on static concepts inappropriate or misleading. By expositing and applying the fully dynamic model of Segal and Whinston (2008), I argue that, in many cases, static analyses are *not* misleading and that dynamic considerations (such as competition *for the market*) are not decisive in these analyses. I argue, however, that dynamic considerations can be important when the predominant mode of commercialization by innovative entrants is via cooperation rather than competition with incumbent firms; examples of cooperation include acquisition and licensing. Therefore, a vigilant approach to antitrust enforcement may be necessary in certain circumstances when dynamic considerations play a major role

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I. Introduction

This paper examines whether static analysis of antitrust policy is sufficient to draw reasonable and robust conclusions regarding industries and markets in which dynamic considerations appear to play an important role The term 'dynamic considerations' is neither well defined nor immune to misuse as a catch-all for factors other than purely static ones. Thus, here I will rely on the notion exposited by Evans and Schmalensee (2002). They argued that in some industries competition takes place not so much *in the market* but rather, *for the market*. That is, rather than being modelled as markets in which competition is largely based on price, and in which static instruments are used to achieve market power, some industries might be more appropriately characterised as a series of winner-take-all contests in which innovation plays a significant role.

The reason this distinction is argued to be important for the analysis of antitrust policy is that, in many cases, policy precedes via a two-step procedure in which a regulatory body first determines whether a particular practice should be limited or deterred. Regulatory bodies begin by examining whether the firm possesses monopoly, or at least a substantial degree, of market power It then examines whether, the practice under examination (say, exclusionary contracts) would have been undertaken in the absence of market power, and whether this practice could potentially damage competition. Evans and Schmalensee (2002) are concerned that firms possessing a substantial degree of market power are, to use software lingo, a feature rather than a bug in some industries. Therefore, prohibiting certain practices (for example, product tying or below cost pricing) by firms who have market power will necessarily inhibit and reduce

the profitability of firms in those industries and, as a result, subvert the means by which dynamic competition operates; it will eradicate the high market prize associated with successful innovative activity, − namely, the ability to displace incumbent monopolists.

The consequence of this line of reasoning is the emergence of a debate focused on the argument that when dynamic considerations (that is, the notion that the incumbency prize is a key driver of innovation) are taken into account, antitrust authorities should be more cautious about interventions, since such interventions might weaken the potential for long-run competition in the industry (Gilbert, 2006, 2007; Manne and Wright, 2009). The argument that authorities should be more permissive of short-run exploitation of market power is based on the idea that it leads to continual and frequent changes in market leadership. This process requires a distribution of rent from the market leader to consumers and puts pressure on incumbents to invest in innovation so as to maintain their market leadership (Gilbert and Newbery, 1982).

Countering this is the concern, voiced most aggressively by antitrust authorities themselves, that great vigilance is needed when the source of innovative pressure in an industry is from new entrants rather than existing incumbents. The argument is that those entrants face significant hurdles and bear considerable risks in attempting to raise the required capital to introduce new products to markets, and that unfair behavior on the part of incumbents should be restricted so as to give entrants the greatest chance of success.

Below cost pricing is a good example of a practice that creates this type of tension. On the one hand, such pricing is, under usual antitrust analyses, indicative of predatory behavior whereby an incumbent sets low prices upon entry in the hope of facilitating the exit of any new potential competitors and deterring any future entry (for

example, by sending the signal that entry is unprofitable). Given the inherent risks associated with entrant innovation, antitrust authorities have long been concerned that aggressive post-entry behavior may exacerbate the already sub-optimal levels of innovation.

On the other hand, it is argued that in some industries, winner-take-all competition does not necessarily award the market to firms with the better product but may instead award it to those firms who build up market share the quickest. This can occur in markets for network goods, where consumer value for products depends not only on the intrinsic utility of the good, but also on how many other consumers are consuming the same or a similar product. Firms in these markets will be willing to 'pay for market share,' even if this involves below cost pricing for a short period of time. Proponents of this view argue that, even a monopolist may choose to set low prices for a short period of time, so as to increase market share, thus boosting the consumers' utility from the product and hence its profitability. Hence, it is argued that low pricing which is observed is not necessarily predicated on competition or the deterrence of it. Thus, to deny firms the ability to build markets will itself further reduce the incentives for new product innovation in such industries.

Notice that both sides of the argument essentially appeal to 'dynamic considerations.' Specifically, that incentives for innovation in industry are likely to be damaged should anti-competitive practices be either permitted or prohibited. Certainly, a similar tension appeals in the purely static environment – that is, below cost pricing may be entry deterring but it is also good for consumers who are able to purchase low cost products. The issue for antitrust policy is to determine what tools are required to analyze

these issues, and to determine whether a violation has taken place. In both cases, the proponents argue for less weight to be placed on static considerations (such as current and prospective monopoly power) and more weight to be placed on dynamic factors (such as the rate and sources of innovation).

In this paper, I put forward the argument that, in fact, when taken seriously dynamic considerations can often be addressed and analyzed using the same tools we would use for static analysis., I base this argument on the application of a formal model of the dynamic impact of antitrust policies on innovation. Somewhat counter intuitively, I apply this model in precisely the same way that advocates of 'dynamic considerations' apply it. One contribution of this paper is to present this model in a form that is accessible to the mainstream antitrust audience and to relate it to the practice of antitrust investigation.

I base my analysis on a model by Segal and Whinston (2008); hereafter, SW. SW argue that in innovative industries, antitrust policies have two major consequences. First, if effective, antitrust policies are likely to prevent rents from flowing from entrants to incumbents and in the process, hopefully allow consumers to capture some of these rents. Second, the potential loss in rents will lower the value of incumbency. In an industry where competition is characterized by sequential monopolists rather than persistent rivalry, innovation is driven by the desire for incumbency profits.

These consequences of antitrust policy mirror both sides of the debate over 'dynamic considerations.' The first, that rents entrants receive immediately upon entry may be lost should a practice be permitted, is what most concerns antitrust authorities. The second, that prohibiting certain practices could devalue the role of incumbency, is

what most concerns those in fear of placing excessive constraints on incumbents. Yet, SW note that *both* consequences drive innovation and, importantly, both interact with each another. After all, the value of being an incumbent is equal to the profits that a firm expects to make as the market leader, less the profit that it expects to make if it is a laggard. Thus, while antitrust policy might reduce the profits of a market leader, it does so by increasing the profits of a laggard making it hard, at first glance, to determine the net effect on the value of incumbency.

The outline of this paper is as follows. In the next section, I will provide a non-technical exposition of SW's model. In section 3, I then state my thesis as to why this framework, in many cases, implies that the conclusions that can be drawn by taking into account dynamic considerations can be achieved using the same tools that we apply for static analysis. Section 4 then considers my own extension to the SW framework to consider an aspect of firm behavior in innovative industries that is neglected by antitrust scholars – namely, that entrants often do not end up competing head to head with incumbents, but instead end up cooperating with them. I argue that this poses special issues for the application of static antitrust analysis and provide suggestions as to how we should evaluate the consequences of static market power. Indeed, this is an area which is likely to require new tools in order for proper antitrust analyses to be conducted. A final section concludes.

II. Modelling Innovation Dynamics

SW consider an environment in which developing product improvements in an industry leads to innovation. Examples include computer processors with increasingly

superior performance, software with improved capabilities, or mobile phones with more features. While these product improvements could result from the R&D activities of incumbents my focus is on improvements that arise from entrant investment in R&D – specifically, R&D conducted in firms with little or no presence in the product market. Indeed, the easiest way to understand the SW framework is to begin by considering a situation in which all new products are the invention of entrants rather than incumbents.

R&D in new products is fundamentally a process of applying resources (in particular, capital and labor) in those activities that are most likely to increase the chances of generating a new product in a short amount of time. Of course, the sooner that a firm hopes to achieve innovation, the more costly it is to achieve. But, the cost associated with bringing forward the innovation date will be worthwhile if the 'prize' from innovating is large enough −delayed innovation will result in a delayed prize.

In what follows I describe the formal model that considers this tension. Let w denote the prize an entrant receives if it successfully innovates. The details of the prize are discussed below, but in the mean time, we can conceptualize a supply function for industry innovative activity, $S(w)$. This function, $S(w)$, is literally the likelihood that a new product generation is developed today, and is increasing in w. The logic behind this idea is that a higher prize will encourage more entrants to expend more resources trying to innovative more quickly, thus increasing the likelihood of an innovation appearing today. Importantly, the innovation supply function is driven purely by the costs associated with R&D. As we will see below, many practices that are of antitrust concern are not dependent on R&D costs, and as such, do not impact upon this supply function. That said, the supply function does not depend only the response of the winning

innovator, but rather, depends on the response of all potential entrants, *w*. Thus, a higher prize could induce more research start-ups into the industry. One antitrust concern is that incumbent practices could deter these start-ups but, as we will see below, this concern has an effect on the level of the prize, *w*, but, ceteris paribus, does not change the nature of the innovation supply function itself.

Determinants of the Innovation Prize

One key question that needs to be addressed is: what determines the size of the innovation prize, *w*? In this model, the prize is simply equal to the profit that the entrant receives if it generates an innovation today. One component of this is the immediate post-entry profits of an entrant in competition with the incumbent. This includes any revenues that the entrant receives net of the costs associated with entry. The second component consists of the *additional* future profits that are associated with being the innovation leader, above and beyond those profits appropriated to the laggard in the industry; that is, the *incumbency advantage* or *IA* for short. I assume that the entrant receives this bonus because its innovation generates a product that is superior to the current incumbent's product; thus allowing the entrant to displace the existing incumbent. Antitrust policy will have an impact on both the immediate profits of the entrant and the *IA*. Generally, we focus our attention on how such policies favour the entrant's immediate profitability, increasing the short term component of the prize; that is, we think of antitrust policy in a static sense. In contrast, the impact on *IA* – which captures the dynamic component –is subtle. Clearly, if antitrust policy were to increase (or weakly increase) the expected profits of the incumbent (rather than the expected profits of the entrant), then the impact of such policies on the prize associated with incumbency would be unambiguous. In

order to determine precisely how antitrust policy effects expected profits, however, we need to understand what components make up the *IA*.

The first main driver of *IA* is the expected future rate of innovation. The rate at which future entrants choose to innovate depends on the prize that they expect from innovation. This implies that *IA* is decreasing in the rate of innovation; intuitively, the expected lifetime of incumbency is equal to the expected length of time between new product improvements. The higher the rate of innovation, the shorter the lifetime of incumbency. What this implies, is that *w* is decreasing in the rate of innovation. Specifically, the tradeoff associated with greater innovation, is the reduction in the innovation prize. This market constraint on the rate of innovation and the prize associated with innovation and is akin to the demand constraint firms face in the market; firms can only sell more units if they are willing to do so at a lower price. Here the market is unable to offer both a high rate of innovation and a high prize.

This negative relationship between the benefits associated with innovation and the rate of innovation can be represented by a decreasing function, $B(w)$. We let $B(w)$ be the maximum likelihood of generating an innovation tomorrow in a market with innovation size *w*. Comparison of the supply and benefit functions associated with innovation highlights a fundamental tension. Since innovation supply is dictated by *S(w)*, a higher prize is needed if we want to encourage entrants to innovate more. In contrast, since *B(w)* is decreasing in *w*, a lower prize is needed in order to sustain a higher level of innovation,. SW note that the same tension between supply and demand exists in all markets. Moreover, like in any market, the innovation rate targeted must equal the innovation rate supplied, and so the intersection of $B(w)$ and $S(w)$ dictates the equilibrium

level of w. Note from Figure 1, which illustrates this concept, if $w > w^e$, entrants want to supply a greater level of innovation than can be supported by the prize – hence, the prize will necessarily fall. In contrast, if $w < w^e$, the *IA* is too high and entrants do not want to supply too much innovation. Consequently, the innovation prize will rise to eliminate the shortage of innovation.

What is useful about this representation of antitrust policy is that it is relatively straightforward to examine the impact of policy changes on the equilibrium rate of innovation. For instance, if the only effect of antitrust policy was to increase immediate entrant profits, this would shift the *B* curve upwards and the new equilibrium point would result in a higher level of innovation. This is fairly intuitive as such profits are an important driver of the size of the innovation prize.

It is for this reason that it is so important that we understand *all* of components that make-up *IA*. SW use a dynamic equilibrium approach to analyze these components; the equations are presented in the appendix. Here I will motivate the issues using a more intuitive approach by asking, *what is the maximum an entrant would be willing to pay to become an incumbent*?

To begin with, note that the profit received by the incumbent in each period is less than it would receive were it a monopoly, since, in the presence of competition, it must compete with an entrant for profit. The maximum an entrant would be willing to pay to become the incumbent would be the additional amount it would earn if it were able to switch places with the incumbent. Were this possible, the entrant's payoff would rise by the difference between the incumbent's and its own profits in periods in which there is competition, and the monopoly profit in periods with no competition. There will always

be competition in the period following the entrant's success in introducing a new product. Thus, the value of incumbency is a strict average (weighted by the probability of innovation in any given period) between the monopoly profit received when there is no competition (that is, when there is no innovation) and the difference between the incumbent and entrant profits when there is competition (that is, when an innovation occurs). In other words, the *IA* is a function of incumbency profits, weighted by the probability of entry.

Impact of Antitrust Policy

Two features of antitrust policy become particularly interesting once we view *IA* in this light. First, antitrust policy that increases immediate entry profits may lead to a change in *w*. As has already been noted, an increase in immediate entry profits raises the immediate payoff to the entrant from innovation. Note however, that a rise in immediate entry profits also reduces the incumbency advantage because the payoff associated with being an entrant also rises. Since the benefit attributed to the entrant is necessarily incurred in future periods, and thus discounted, whereas the rise in incumbency profits are immediate, the second effect is outweighed by the first. Importantly, however, this analysis demonstrates that once dynamic considerations are taken into account, the quantitative impact of antitrust policy may differ from the estimated cost or benefit derived from a static analysis.

Secondly, antitrust policy can affect the expected immediate payoff to the incumbent of innovation. Since the incumbent only receives this increase in profits in the absence of entry, the *IA* depends on the probability that the incumbent is not overtaken by a competitor.. In this regard, if there is a practice that can reduce the probability that an

entrant innovates, the incumbent will be willing to accept a reduction in its expected immediate payoff in order to reduce the probability of entry. That is, in an attempt to retain its incumbency advantage, the incumbent is willing to invest today in R&D deterrence tomorrow.

Putting these two features together generates find an important result:

> *Outlawing any incumbent practice whose profitability is dependent on a reduction in entrant innovation will increase the equilibrium rate of entrant innovation.*

It is important to note that this argument assumes that prohibiting the practice will raise immediate entrant profits. Similarly, it is critical to acknowledge the fact that while incumbents might engage in practices that raise their profits, this does not necessarily mean that such practices raise the incumbency advantage – the driver of entrant innovation. So, even though the prize for entrant innovation is dependent on the expected profits of an incumbent, practices that are themselves only profitable should future entrant innovation be reduced will, it turns out, lead to outcomes that erode the incumbency advantage.

This result is consistent with Ordover and Willig's (1981) definition of predatory behavior as any behavior that eliminates existing rivals. SW essentially extends this definition to include behavior that reduces the likelihood of innovative entry.

III. Using Static Analysis

According to Evans and Schmalensee (2002), in industries where dynamic considerations are important, competition for the market is more important for welfare than competition within the market. My interpretation of this is that when investigating industries in which dynamic considerations are important, antitrust authorities can be

somewhat relaxed about practices that allow dominant firms in the market to increase their profits since increased incumbent profits will serve to stimulate innovative entry.

The SW framework both captures and refines this argument. For example, if prohibiting a practice causes a disproportionately large fall in expected incumbent profits per period relative to the increase in immediate entrant profits, then the rate of entrant innovation may fall as a result of antitrust policy.. In order to identify which policies will lead to a fall in entrant innovation, we must first examine in more detail a range of different policies.

Evans and Schmalensee (2002) point to the case of Microsoft and the District Court's decision that Microsoft's promotion of Internet Explorer as a competitor to Netscape was, in fact, anti-competitive. Their argument relied on the conjecture that Microsoft would not have expended such a large quantity of resources into the promotion of Internet Explorer had it not come to the conclusion that it was in a 'winner-take-all' race to be the dominant browser. Thus, the District Court concluded, that the profitability of Microsoft's investment was contingent on Netscape's exit.

At first glance, this argument contradicts the result of SW described in detail above. By considering the broader case as put forward by the Department of Justice and its economic expert Franklin Fisher (2000), however, it becomes apparent that these two views are not in fact contradictory. The Department of Justice argued that Microsoft engaged in a variety of practices to promote Internet Explorer (including pre-installation and integration with their operating system), and that the profitability of each of these practices was contingent on deterring entry and innovation in its operating system and related products, rather than simply in the market for web browsers.

In this context, the difference between the two arguments put forward rests on the definition of the relevant market in which Microsoft was deemed to have been dominant. In Evans and Schmalensee's (2002) description, the prohibition on activities that lead to an accelerated development of Internet Explorer would make little sense if the market in which Microsoft was deemed to be creating market power was simply the market for web browsers. Indeed, SW, who include an extension of their model to involve incumbent innovation, would argue that such innovation would not be a problem for competition and, moreover, that its promotion should be a goal of antitrust policy.

According to Fisher, however, Microsoft's investments in the development of Internet Explorer (and here I am leaving aside other related issues such as tying), would only be profitable in markets where it unambiguously held a dominant position – that is, in markets which extended beyond the market for web browsers.

The point here is that the evaluation of these competing arguments rests not so much on the notion that monopoly power is the prize associated with 'winner take all' markets. Instead it relies on both the definition of which markets are relevant when evaluating anti-competitive practices (in this case, the relevant market might be the market for browsers, or a somewhat broader market), and also the possibility that, contingent on the presence of monopoly power in at least one of the relevant markets, the practice under consideration could raise barriers to entry The fact that the browser market may have been a 'winner-take-all' market was important for understanding whether achieving market dominance would raise barriers to entry into the market for operating systems. In other words, the risk that prohibiting Microsoft's development of Internet Explorer would damage innovation in the web browser market did not depend on whether

the market was a 'winner-take-all' market or not. The dynamic considerations advanced by Evans and Schmalensee (2002) did not appear to come into play.

A similar argument can be made in relation to other practices that were under investigation in the Microsoft case. Consider, as an example, the investigation into Microsoft's decision to tie or bundle Internet Explorer with the Windows operating system (either deeply or through pre-installation[1]). Evans and Schmalensee (2002) argued that "the analysis of tying claims in new-economy industries must consider the ubiquity of integration as a competitive strategy and the extreme risk of having judges and juries second-guess product design decisions." (p.34) This argument, however, is not a dynamic one in which competition is primarily 'for the market', but instead a static argument based on the idea that efficiencies are associated with certain product bundles that serve to reduce price or increase consumer value in the context of 'within the market' competition. For SW, this same trade-off is borne out if it was the case that prohibiting product integration substantially reduced on-going monopoly profits; once again focusing attention on the static drivers of dynamic competition and innovation.

In summary, SW's analysis teaches us that when evaluating antitrust policies and their impact on innovation in a dynamic environment, we must focus on the impact of antitrust policies on period-by-period profits under both monopoly and competition. Traditional tools of static market analysis can, therefore, be applied to analyze whether a practice will harm entrant profits – often by raising standard entry barriers – in a way that is not justified by other efficiencies, or in a way that reflects behavior that would normally take place in an industry, which does not face the prospect of entrant

[1] Carlton, Gans and Waldman (2010) argue that pre-installation can lead to welfare reductions even when deep integration would be of benefit to consumers.

innovation. Whether the market is 'winner-take-all' is not something that will necessarily prove decisive in such an analysis.

IV. Antitrust and Cooperative Commercialization

Much antitrust analysis, including the discussion and papers referred to above, assume that entrant innovators commercialize new technologies primarily by entering product markets and competing head-to-head with incumbent firms. In actuality, this is not the dominant path for commercialization in many industries. Rather, entrant innovators engage in cooperative commercialization; contracting in some manner with incumbent firms. For example, they might license their patents to established firms, joint venture with them, or be acquired.

Rationale for Cooperative Commercialization

The rationale for the pursuit of such cooperation is straightforward. First, entry into a product market following successful innovation can be costly. In particular, incumbents may already have complementary assets (in marketing, distribution, and regulation) that would involve large sunk expenditures to replicate. Moreover, these complimentary assets would themselves be devalued by duplicative entry. As Teece (1987) argues, such duplication can be avoided through contracting between entrants and incumbents.

Second, and of particular relevance to this discussion, contracting can allow entrants and incumbents to avoid head-to-head competition – even if only temporary – and consequent rent dissipation (Gans and Stern, 2000). Again, this is a mutual benefit that can be realized through some cooperative arrangement.

Avoiding duplication and rent dissipation are two static reasons why cooperative commercialization might arise. From an antitrust perspective, evaluating the deals themselves would be similar to analyzing the consequences of a merger – specifically, we are interested in whether the savings associated with not having to duplicate fixed assets outweigh the potential harm to consumers that arises from a lack of competition. The question here, however, is whether there are dynamic considerations that make it necessary to analyze such transactions differently to the static analysis of mergers. Similarly, we are concerned with whether incumbent behaviour influences the terms of transactions differently under static and dynamic considerations.

To understand how this question can be answered, consider the total payoff to the incumbent and an innovating entrant if they cooperate immediately after a new product is generated. This is given by:

Per Period Monopoly Profit + Market Leader's Future Profits
+ Entrant's Future Profits as a Non-Producer

That is, the incumbent and the innovating entrant will, despite the new innovation, jointly earn a monopoly profit, the incumbent will remain the market leader and the entrant will earn future profits as a continuing innovator (but non-producer) in the industry. In contrast, if they fail to cooperate, they will return to the competitive scenario as examined earlier. In this case, their total payoff will be:

Immediate Profits in Competition + Market Leader's Future Profits
+ Incumbent's Future Profits as a Follower

That is, in the absence of cooperation the incumbent and entrant will remain in immediate competition, the entrant will become the market leader, and each party will earn their respective future profits. In this scenario, the incumbent will take on the role of follower.

In comparing these outcomes, notice that, under cooperation, the incumbent continues to earn market leader profits in the future, whereas under cooperation, after an initial bout of competition, the innovating entrant takes the market leader position. Thus, a cooperative deal will be struck if the total payoff from cooperation exceeds the total payoff from competition; that is:

Immediate Gain in Monopoly Rents >
Incumbent's Future Profits as a Follower – Entrant's Future Profits as Non-Producer

Notice that the Market Leader's future profits do not play a role in determining whether a cooperative deal is struck since these profits will be realized regardless. Notice, however, that in order for cooperation to occur, the static drivers of cooperation −namely, saving duplicative assets and avoiding rent dissipation − must be such that future profits (if any) of the incumbent outweigh what the entrant would receive (by never being the incumbent; that is, not producing). Consequently, it is possible that a deal might not be struck if, in the absence of market leadership, the incumbent was able to earn a high level of future profits (say, by bouncing back and regaining that leadership quickly), while the entrant was not. Thus, while in a static environment, the case for licensing is compelling, in an environment in which dynamic considerations play an important role, the case for licensing is less conclusive.

Determinants of the Innovation Prize

What we are interested in, of course, is what drives innovation when licensing is expected? In order to examine the determinants of the innovation prize, suppose that the condition above that supports a licensing outcome holds. If this is the case, the entrant's innovation prize is simply the license fee (or other payment) it expects to receive as a result of innovating, plus the difference between its future profits with and without an

immediate innovation. Thus, by innovating today, the entrant will benefit from a license payment, will 'lose' the profits they would have received had they not generated an innovation, and will gain the profits they would receive in the post-innovation environment. It is likely that these post-innovation future profits are less than or equal to the profits that the entrant would expect to receive from its innovative efforts in the current generation.

To understand the nature of this prize, the first task is to pin down the license fee. Here I use the Nash bargaining solution that posits that the license fee will be that which equates each party's payoff less their outside option. In this case (as is demonstrated in the appendix), the prize becomes:

$$\begin{aligned} w = {} & \tfrac{1}{2}(\text{Static Gains from Licensing}) + IA \\ & + \tfrac{1}{2}\,\text{Entrant's Future Profits with Innovation under competition} \\ & - \tfrac{1}{2}\,\text{Incumbent's Future profits without Innovation under competition} \end{aligned}$$

Notice that the prize has three components. The first is a share of the static gains from cooperation. The second term is the pre-innovation incumbency advantage of being the incumbent rather than the entrant innovator; this concept is the same as the one that played a role in determining the prize under competitive commercialization. The final term is a share of the advantage (if any) in terms of profits that the entrant has over the incumbent if it displaces the incumbent as the market leader; that is, the post-innovation incumbency advantage.

Impact of Antitrust Policy

To understand the impact of antitrust policy, we need to understand the primitive drivers of the innovation prize under cooperation. In the appendix, it is demonstrated that w is increasing in the difference between (a) the per period profits of a competitive

entrant and (b) the per period profits of an incumbent. *w* is also increasing in discounted per period monopoly profits. Thus, in contrast to the case of competitive commercialization, when cooperation is expected any antitrust policy that shifts rents under competition from the incumbent to the entrant (that is, increases entrant profits while decreasing incumbent profits) will increase the innovation prize, so long as the reduction in on-going monopoly profits is not too large.

What is significant is that, compared with the competitive case, under cooperative commercialization, any negative impact of antitrust policies on incumbent profits under competition stimulate rather than reduce incentives for entrant innovation. This is because the entrant shares in the incremental benefits that the incumbent receives from avoiding competition and preserving monopoly. Thus, antitrust authorities should be primarily concerned with actions that both shift rents from the incumbent to the entrant and take place prior to or immediately following an entrant innovation, but before any licensing deal is signed.

One such example is exclusive customer contracts. SW analysed these in the context of competitive commercialization and argued that, should an entrant innovate, an incumbent has an incentive to provide customers with discounts if they agree not to purchase from the entrant. Exclusive contracts have the effect of limiting the share of customers that the entrant can compete for (thus reducing immediate entrant profits under competition), but as SW show, after the initial period, the incumbent ceases to provide consumers with a discount.. Consequently, restricting such contracts improves entrant profits while leaving expected incumbent profits per period (after the initial entry period) unchanged. Thus, such a prohibition is likely to increase the rate of entrant innovation.

The level of the discount required to entice consumers to sign an exclusive contract is related to the rate of entrant innovation. The sooner consumers expect entrant innovation, the larger the discount necessary in order to compensate consumers for the prospective inability to purchase the improved product in the future. When there is cooperative commercialization in the industry, it is the incumbent rather than the entrant who provides new products to the market following entrant innovation. Knowing this, consumers incur no costs associated with signing an exclusive deal with the incumbent. This shrinks the size of the entrant's potential customer base, should a licensing deal not be signed, thus lowering the entrant's outside option, and hence lowering the license fee agreed upon between the entrant and the incumbent. As a result, exclusive contracts have the effect of increasing incumbent profits under competition and reducing ongoing monopoly profits. A prohibition on exclusive customer contracts would have the reverse effect. Thus, exclusionary practices are less costly for incumbents when there is cooperative commercialization. A prohibition of exclusive customer contracts would increase the innovation prize.

Another example of a practice that should alert antitrust authorities is accelerated product development by incumbents. These practices are designed to reduce license or acquisition fees by encouraging customer purchases of products that are known to be inferior to the entrant's new product. Of course, this suggests that if antitrust authorities observe intense competition between the incumbent and the entrant, a possible enforcement mechanism would be to prohibit cooperative activities. Knowing this, however, the incumbent would refrain from intense competition in an attempt to avoid prohibition.

Nonetheless, playing these games is difficult and risky. For instance, the incumbent might refrain from product development that for fear of being prohibited from cooperative deals, even when this product development is efficient. In addition, if the entrant is unlikely to be successful in penetrating the market a cooperative deal may be the only means by which the entrant's innovation can be commercialized.[2] If this is the case, the prohibition may be more harmful to the entrant than the incumbent.[3]

The broader point here is that when cooperative commercialization is a means by which entrant innovation is stimulated in an industry, the evaluation of those cooperative deals from an antitrust perspective does not currently move beyond a static analysis. It would be better to permit such deals on the basis of dynamic considerations – since the overall impact may be a rise in the rate of innovation. Thus, antitrust policy should be permissive of cooperative commercialization deals, but should remain aggressive with respect to competitive practices and should directly limit these practices rather than resort to indirect punishments.

Merger Analysis

The above analysis suggests that vigilant antitrust enforcement of practices that shift rents from entrants to incumbents in periods of innovative entry will have the additional impact of stimulating entrant innovation in industries where cooperative commercialization is the norm. This lends support to the notion that dynamic considerations strengthen the case for strong antitrust action.

[2] Of course, in that situation, the incumbent may not want to discourage or to even be seen to discourage entrant innovation (Gans and Stern, 2003).
[3] Of course, such factors could protect incumbents in useful ways (Rasmussen, 1988).

But what effect do other antitrust policies, say, in relation to the cooperative commercialization deals, have on entrant innovation? I suggested earlier that if such deals were primarily associated with preventing rent dissipation, static merger analysis could be applied, but this would overestimate consumer surplus today and fail to acknowledge any potential reduction in innovation in the future. That is, static analysis of these situations focuses on 'in the market' competition rather than 'for the market' competition.

But what if competition is really 'winner-take-all' in the sense that Evans and Schmalensee (2002) envisage it, and that consumers do not actually benefit in the short-run? Were this the case, the entrant would displace the incumbent as the monopolist immediately, and there would be no instantaneous competitive profits. Yet, the question still begs to be asked: does this necessarily imply a permissive licensing or merger policy?

These issues are addressed in further detail in Gans (2009), but I nonetheless briefly highlight the main results here. Consider a cooperative licensing arrangement. As noted above, when a licensing deal is struck, the incumbent retains its role as market leader and the entrant is free to develop future innovations. Thus, in determining the rules of the licensing agreement, the parties are effectively negotiating over which role each will take in expanding R&D resources for the next generation. Given their current position, both the incumbent and the entrant have a joint interest in ensuring that resources are provided sparingly rather than excessively.

As is well known (Arrow, 1962; Reinganum, 1982), one problem that arises is that the incumbent has less incentive than the entrant to expend resources in R&D since innovation hastens the cannibalization of the incumbent's existing product. Thus, if the

incumbent and entrant are asymmetric with respect to their capabilities in research, the next incumbent will be the firm with the greatest propensity to innovate. The conditions for, dynamic economic efficiency, however, are the converse.

This suggests two somewhat contradictory statements: firstly, that when parties have an incentive to license we should prohibit them from doing so, and secondly, when parties do not wish to license, we should encourage them to do so. While the economic argument for such a policy is straightforward (indeed, it was simply explained above), it is easy to see that such a policy would be hard to enact. Nonetheless, a prohibition on licensing, which is possibly an easier policy to implement than one that encourages licensing, would still provide some welfare improvement according to this logic, since it would prevent licensing when firms wish to do so, and would have little effect on welfare when firms do not seek out licensing possibilities

Mergers are different from licensing deals in that both firms become the incumbent in the former but not the latter. When the incumbent has fewer research opportunities than the entrant, a merger will be mutually advantageous since it allows the consolidation of research capabilities. In contrast, should this consolidation of research capabilities make a third party, and stronger, research organization likely to innovate more intensely than if the two were separated, the incumbent and potential entrant will not choose to merge. The end result is that, when pursued, mergers are likely to result in dynamic inefficiencies.

The purpose of this argument is not to suggest that licensing and merger deals are undesirable;. the environment considered here is unique, and one in which many other considerations may come into play. Rather, the point that I wish to raise is that it is far

from obvious that dynamic considerations lead us to a more permissive antitrust stance on cooperative arrangements. It is certainly true that dynamic considerations are a key issue that needs to be addressed, but it is not clear that we currently possess the tools to adequately address these concerns in a general. Rather, in the mean time, while we wait for these tools to be developed, we should constrain ourselves to a case-by-case approach.

V. Conclusions

This paper uses the recent analysis of SW to analyze how antitrust authorities should alter their evaluation procedures and which tools should be used to conduct this analysis when dynamic considerations (specifically, the importance of competition for the market) play an important role. I argue that, in many cases, the tools associated with static analysis are the appropriate tools to apply even when dynamic considerations are an important factor. This is because the primitives upon which this analysis is based – market definition and practices that raise entry barriers – drive dynamic innovation 'for the market' just as they drive competition 'in the market'.

Nonetheless, in some industries entrant innovators commercialize via contracting (for example, licensing) or by being acquired by existing incumbents (through mergers). In these cases, applying static tools to evaluate antitrust practices pose special difficulties; the cooperation in these industries is itself a difficult issue for antitrust authorities to analyse since it drives innovation in the industry. Complications also arise because these practices are, to some extent, salient in situations where cooperative commercialization breaks down, and so it is the threat of such practices rather than the ability to enforce

these practices that is the key issue. Static tools are simply not equipped to address these concerns. Moreover, it is not clear whether antitrust policy should be permissive or vigilant.

Hopefully, future research will be able to further untangle these issues. In particular, the role of intellectual property protection in providing a separate instrument to stimulate innovation is an important issue that needs to be addressed. Brennan (2009) argues that if intellectual property law can be used to preserve innovative rewards, there is no reason why antitrust authorities should be less vigilant in pursuing activities than they would be were they to simply rely on static analysis to draw conclusions regarding optimal policy choice. A similar argument is put forward by SW who provide an example in which the optimal patent policy completely eliminates any ambiguity as to whether prohibiting certain practices will be harmful to innovation. The interaction of IP protection and antitrust policy is therefore likely to be an important focus of future research in this area.

VI. Appendix: Technical Details

Here I briefly state the equations and technical results from SW and Gans (2010). The model involves an infinite horizon under discrete time with a common discount rate of $\delta \in [0,1]$ for all participants. Innovations occur sequentially with each innovation being a new product that yields valuable quality advantages over the previous generation. The firm that develops the innovation receives an infinitely lived patent; although the expected economic life of the product will be finite. At any given point in time there is one firm, the incumbent (*I*), who holds the patent rights to the current leading product or generation. Apart from the first period, the product generates a constant flow of monopoly rents, π_m, until it is displaced by a new innovation. If it should generate an innovation, the entrant (*E*) should it compete implies that *I* can no longer achieve monopoly profits. Instead, *I* earns π_I and *E* earns π_E (where $\pi_I + \pi_E \leq \pi_m$). If the entrant competes, it incurs a fixed cost of *f*, which is sunk. I assume that such entry is credible; that is, $\pi_E \geq f$.

I follow SW's assumption that only the entrant's R&D that leads to an innovation. This entrant is drawn from a pool of firms which is infinite in number and may include the previously displaced incumbent or, if there is no such displacement as a cooperative deal is negotiated, the previous innovating entrant. The probability that a displaced incumbent becomes the next lead entrant innovator is σ_I, while that probability is σ_E for the prior entrant innovator if they have not become the incumbent. These probabilities may reflect dynamic capabilities that each firm has accumulated through its past activities as a producer (for the incumbent) or as an innovator (for the entrant).

In each period, the entrant innovator, *E*, chooses its R&D intensity, $\phi \in [0,1]$ this is also the probability that it generates an innovation in the current period. Let the cost of R&D be denoted by $c(\phi)$, where $c(.)$ is an increasing, strictly convex function with $c(0) = 0$.

I confine attention to stationary Markov perfect equilibria using SW's dynamic programming approach. For this purpose, let V_I and V_E be the expected present value of profits, at the beginning of any given period of an incumbent firm and an innovating entrant, respectively. These values will satisfy:

$$V_E = (1-\phi)\delta V_E + \phi(\pi_E - f + \delta V_I) - c(\phi) \qquad \text{(VE)}$$

$$V_I = (1-\phi)(\pi_m + \delta V_I) + \phi(\pi_I + \sigma_I \delta V_E) \qquad \text{(VI)}$$

Note that, following an entrant innovation, the entrant continues in the industry by default (as the incumbent) while the incumbent only continues in the industry as an innovating entrant with probability, σ_I.

For an entrant innovator, the equilibrium level of R&D intensity is given by the following equation:

$$\phi \in \arg\max_{\varphi \in [0,1]} \left\{ \varphi\left(\pi_E - f + \delta(V_I - V_E)\right) - c(\varphi) \right\}$$

Following SW, we let *w* denote the "innovation prize or benefit." In this case,

$$w = \pi_E - f + \delta\left(V_I - V_E\right) \qquad \text{(IB-Comp)}$$

so that an entrant is effectively solving in each period:

$$\phi \in \arg\max_{\varphi\in[0,1]}\left\{\varphi w - c(\varphi)\right\} \qquad \text{(IS)}$$

Note that $IA \equiv \delta\left(V_I - V_E\right)$. Since $c(.)$ is convex, this gives an "innovation supply" relationship between the quantity of R&D (ϕ) and its price (w).

The equilibrium level of R&D by the entrant is determined by solving (VI) and (VE) simultaneously and using these equations to find the intersection of the (IB) and (IS) functions. Solving (VI) and (VE) simultaneously yields:

$$V_E = \frac{(1+\delta(-1+\phi))c[\phi] + \phi(-\delta\phi\pi_I + (-1+\delta-\delta\phi)(\pi_E - f) + \delta(-1+\phi)\pi_m)}{-(1+\delta(-1+\phi))^2 + \delta^2\phi^2\sigma_I}$$

$$V_I = \frac{-(1+\delta(-1+\phi))(\phi\pi_I - (-1+\phi)\pi_m) + \delta\phi(c[\phi] + \phi(f - \pi_E))\sigma_I}{-(1+\delta(-1+\phi))^2 + \delta^2\phi^2\sigma_I}$$

Suppose that α represents stronger antitrust policy and that profits depends on α with $\pi_E'(\alpha) > 0$ and $\pi_I'(\alpha) \le 0$. Plugging the values of V_E and V_I back into (IB-Comp) and taking the derivative with respect to α, we have $\pi_E'(\alpha) + \frac{\delta}{1-\delta(1-\phi)}\left((1-\phi)\pi_m'(\alpha) + \phi\pi_I'(\alpha)\right) \ge 0$ as stated in the text.

Licensing

Turning now to consider licensing (based on the model in Gans, 2010). There will be gains to trade from licensing if:

$$\underbrace{\pi_m - \tau + \delta V_I}_{\text{Joint Payoff from Cooperation}} + \underbrace{\tau + \sigma_E\delta V_E}_{\text{Joint Payoff from Competition}} \ge \underbrace{\pi_I + \sigma_I\delta V_E + \pi_E - f + \delta V_I}_{} \qquad (1)$$

$$\Rightarrow \pi_m - (\pi_I + \pi_E - f) \ge \left(\sigma_I - \sigma_E\right)\delta V_E$$

Then the license fee, τ, is found by solving:

$$\max_\tau \left(\pi_m - \tau + \delta V_I - \pi_I - \sigma_I\delta V_E\right)\left(\tau + \sigma_E\delta V_E - (\pi_E - f + \delta V_I)\right) \qquad (2)$$

This gives $\tau = \frac{1}{2}(\pi_m - \pi_I + \pi_E - f) + \delta\left(V_I - \frac{1}{2}(\sigma_E + \sigma_I)V_E\right)$.

In the licensing case, the (conjectured) equilibrium continuation payoffs are:

$$V_I = \pi_m + \delta V_I - \phi\tau \qquad \text{(VI)'}$$

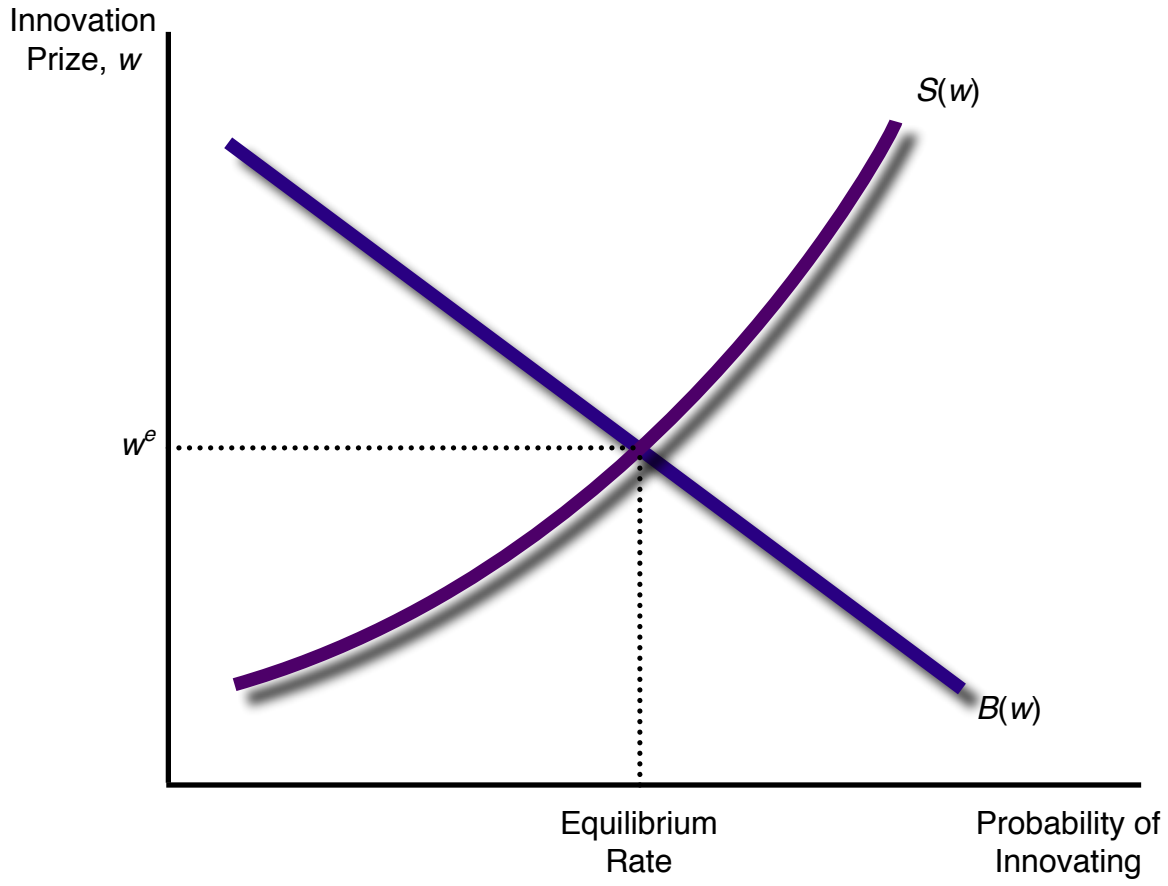
$$V_E = (1-\phi)\delta V_E + \phi(\tau + \sigma_E\delta V_E) - c(\phi) \qquad \text{(VE)'}$$

In this case, the innovation prize is:

$$w = \tau - (1-\sigma_E)\delta V_E \qquad (3)$$

Solving, it can be readily verified that strong antitrust policy will increase the rate of entrant innovation if $\pi_E'(\alpha) - \pi_I'(\alpha) + \frac{1+\delta}{1-\delta}\pi_m'(\alpha) \ge 0$.

Figure 1: Equilibrium Rate of Innovation



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