ENDOGENOUS MAVERICK BEHAVIOR:
A MODEL

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ABSTRACT

Key questions about the concept of a maverick firm have long remained unanswered. These include what causes a firm to behave like a maverick and whether such behavior is an inherent characteristic of the firm or a strategy choice, and if the latter, what determines that choice. The latter possibility has important policy implications. This paper offers a model in which a small low-cost entrant into a market initially finds it optimal to engage in aggressive "maverick" behavior but as it grows or its cost advantage erodes, it switches to more cooperative behavior with its larger rival. This model highlights the observable determinants of endogenous maverick behavior, notably, the maverick's capacity. We offer some observations on the maverick behavior of actual firms and implications of this model for competition policy.

I. Introduction

The concept of a maverick firm plays an important but unusual role in economic research and antitrust policy. It is important because it captures the commonsense notion that there are firms whose aggressive behavior disrupts otherwise greater cooperation in a market. The economics and business literature as well as the popular press, for example, have often referred to companies such as Southwest Airlines and T-Mobile as maverick firms, citing well-documented evidence of their disproportionate impact on pricing and promotion in their markets. Consistent with that, Merger Guidelines in the U.S. ascribe special importance to the maverick, which it identifies as a firm that has "an incentive to take the lead in cutting price or other competitive conduct" or has "resisted otherwise prevailing industry norms."

On the other hand, it is not at all clear precisely what a maverick firm is, why it exhibits maverick behavior, and why it chooses to be disruptive instead of cooperative. Much of the literature simply references characteristics of firms that are viewed as mavericks. A standard list of characteristics includes a firm's uniquely low costs, excess capacity, ability to secretly expand output, or a larger discount factor. There is no doubt that these characteristics are disruptive to coordination; indeed, they are well understood in standard oligopoly theory as giving rise to different price and output preferences.

Yet there are reasons why this focus on characteristics does not represent a true definition. One reason is that not all firms with such characteristics in fact behave like maverick firms. After all, every industry has one firm with the lowest cost; many periodically experience excess capacity; yet not every industry has a recognized disruptive maverick. Rather, some firms with these characteristics continue to play a more cooperative game, leaving unanswered the

question of what makes one such firm behave as a maverick and another not.

Adding to the confusion, the terms "maverick firm" and "maverick behavior" are often used interchangeably. The latter term suggests that "maverick-ness" is more about firm behavior or strategy rather than some fixed underlying characteristic such as low costs. The Merger Guidelines, for example, describe a maverick as a firm that is "threatening to disrupt market conditions with a new technology or business model." This suggests that a maverick firm could be one that chooses a more competitive business strategy than its rivals. But that begs the question as to why that firm finds it profitable to adopt such a strategy when cooperation is an alternative and when all other firms apparently would prefer the latter.

The consequences of this lack of a theory or framework are apparent in the antitrust arena. The merger guidelines in the U.S. and other jurisdictions highlight the disproportionate importance of maverick firms and caution against mergers that would eliminate them. Yet some mergers and acquisitions of apparent maverick firms have been approved based on a stated belief that the consolidation would in fact preserve maverick behavior. Some firms have even been known to argue that a merger would strengthen their ability to behave as a maverick.

But a policy that allows for all possibilities--that a merger may preserve maverick behavior, or extinguish it, or even create or enhance it—all without a coherent framework to distinguish these varied predictions, is not much of a policy at all. For these reasons some have called for abandoning the concept of a maverick firm altogether (Fruits, 2019), although others have elevated the concept to potentially central status for mergers involving allegations of coordination (Baker, 2002). Most would likely agree with Breunig and Menezes' conclusion that "there is no established understanding or explicit theory why maverick firms behave in such

a way."[1]

This discussion suggests a series of questions. Critically, what causes a firm to be a disruptive maverick? Is it the result of some immutable characteristic of a firm, such as low cost, a short time horizon, or a superior product? Or is such rivalrous behavior endogenously determined, that is, a profit-maximizing business strategy? And if the latter, what causes the firm to choose such a strategy when others in its market behave more cooperatively? How can both strategies be profit-maximizing? Or is it precisely because others tend toward more cooperative behavior that the one firm can gain advantage by acting more aggressively? And if one firm chooses a disruptive strategy, which firm will do so, and will it always do so, or might it change strategy as conditions change? And crucially from a policy perspective, when a maverick succeeds and grows, might it at some point find it more profitable to switch to more cooperative behavior? And will a merger or acquisition of a maverick alter its behavior, and if so, under what circumstances?

Our analysis addresses these questions. It sets out a model in which a firm finds it more profitable to engage in maverick behavior under some circumstances but then switches to more cooperative conduct as its market evolves. Thus, rather than assuming such behavior without a basis for predicting when it arises or whether it will persist, this model both explains the basis and identifies conditions for when a firm might choose maverick vs. a more cooperative strategy vis-à-vis it rivals.

Our model assumes a dominant incumbent firm and a small, lower-cost, and capacity-constrained rival producing a homogeneous product in quantity competition. Knowing its rival is

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[1] Breunig and Menezes (2007), p. 5.

capacity constrained, the large firm maximizes its profit against residual demand in Stackelberg-like competition. The small rival sells all of its capacity at the larger firm's chosen price, earning a larger margin on its smaller output. It compares this profit from independent behavior to the profit it would earn from cooperating or colluding with the larger firm. So long as its share remains "small," a strategy of maximum output (equal to its constrained capacity) is more profitable. But if the entrant is—or becomes--sufficiently large, the incumbent faces diminished residual demand, resulting in a lower market price and profit to the small firm. We show the range of capacities for which the rival finds it more profitable to cease acting as a maverick and to switch and cooperate with the initially dominant incumbent.

This last feature makes maverick behavior endogenous: a small rival chooses to behave as a maverick by selling its entire capacity, but at some point defined by its capacity, cooperation with the larger firm is more profitable. To our knowledge, this is the first analysis to have such predictive capability. It demonstrates the incentive for a firm to behave like a maverick; it captures a firm characteristic—size—that is central to that incentive; and it explains how as that characteristic changes—that is, as the firm grows--the incentive to act cooperatively dominates.

This scenario is plausible on its face and broadly consistent with experience in markets viewed as having maverick firms. We nonetheless understand the specificity and limitations of this model but we believe its serves as a demonstration of the possibility of explaining rather than assuming maverick firm behavior. It may also provide a foundation for future empirical verification of how a supposed maverick firm may rationally choose and then cease to play that role.

This paper begins with a review of the concept of a maverick firm in the economics

literature and in competition policy matters. That is followed by the modeling, including a numerical simulation and variations in the assumptions. We conclude with some observations about the actual behavior of one firm commonly described as a maverick.

II. The Maverick Firm in the Literature and Policy

A The Literature

There is only a modest literature on maverick firms. Much of it is focused on mergers involving a maverick, the rest describing actual firms that are said to exhibit such characteristics. There are, for example, many analyses of Southwest Airlines showing that beginning in the 1980s it priced significantly below the level of traditional airlines on the same routes, thereby restraining the prices charged by traditional carriers (Borenstein, 2008; Brueckner at al, 2013). This phenomenon was so widespread and so well established that it earned its own designation as the "Southwest effect" (Bennet and Craun, 1993). Studies showed that Southwest had especially low costs but in addition it seemed to follow a different business model focused on steady expansion and displacement of traditional carriers.

In many industries, certain firms have been labeled as mavericks for similar reasons. Eckert and West (2005) report that volatility of retail gasoline pricing in two Canadian cities was greater in the presence of one particular maverick firm. Breunig and Menezes (2007) examine mortgage providers in Australia with a view to identifying maverick firms by certain their priori characteristics. And in airlines, other low-cost and ultra-low-cost airlines besides Southwest have been shown to restrain pricing by traditional ("legacy") carriers, as well as among themselves (Kwoka, et al 2016).

Baker (2002) proposes several methods for identifying a maverick firm. The first method is simply to note which firm or firms initiate price cuts or refuse to follow price increases. The second is to examine the differential response of firms to exogenous shocks, with those affecting maverick firms having decidedly greater market effects. And third, Baker suggests investigating certain factors that arguably underlie maverick behavior, including those noted previously--a firm's uniquely low costs, excess capacity, its ability to secretly expand output, and a larger discount rate. These factors are well understood in the standard economic theory of coordination as giving rise to different price and output preferences for a firm, but they do not constitute a theory explaining such behavior.

Kwoka (1989) takes a different approach, arguing that a maverick is best identified as a firm with a different business strategy—represented by a different conjectural variation, reflecting the notion that one firm in an industry might use its assets more aggressively than others. He then shows how a merger that eliminates such a firm can bring about greater cooperation throughout the market. That demonstration, however, suffers from the same limitation as most discussions, namely that it leaves unexplained why the supposed maverick should adopt such a strategy in the first place.

One effort to address the origins of maverick behavior in a more fundamental way is due to Loertscher and Marx (2018). They analyze coordination among a subset of suppliers in a procurement setting, casting it as a bidder selection scheme in which each coordinating supplier might be chosen, with some probability, as the bidder. Within a given subset of suppliers, each can determine whether it is better off participating in the bidder selection scheme than not. A maverick firm is one which, if present, renders coordination for the subset of firms unprofitable,

but if absent, coordination becomes rational. While this focuses on the disruptive properties of a maverick firm, the specialized setting in which this model arises, the challenge of operationalizing the relevant probabilities, and the difficulty of adapting this framework to standard oligopoly models limit its applicability.

B   Competition Policy

As previously noted, in the U.S. and some other countries, mergers involving maverick firms are the cause of special antitrust concern. Starting with the 1992 version, the U.S Horizontal Merger Guidelines have specifically noted the disruptive role of a maverick firm and underscored concern with its elimination. They state that a "merger eliminating a maverick firm in a market vulnerable to coordinated conduct is likely to cause adverse competitive effects" and therefore is likely to be challenged. Coate (2006) reports that nearly 20 percent of the mergers challenged by the Federal Trade Commission between 1993 and 2003 on grounds of coordinated effects included allegations that one of the merging firms was a maverick whose restraining effect would be lost. Despite the frequency with which this is raised, the difficulty of predicting how a merger affects maverick behavior has resulted in few cases that actually focus on that issue. Rather, maverick behavior is typically mentioned as a secondary argument corroborating the principle competitive concerns, rather than the central allegation with respect to a merger.

In addition, it is difficult to find consistency in the application of the maverick firm argument in merger cases where it has been raised. The Justice Department, for example, opposed the simultaneous mergers in 1998 between Cardinal Health and Bergen-Brunswig and

between AmeriSource and McKesson,[2] arguing in each case that one of the merging parties was a maverick whose elimination would free the remaining firms to act more cooperatively. The FTC made a similar argument in opposing Schick's recent attempt to acquire its maverick rival Harrys.[3] And the Antitrust Division of the Justice Department successfully opposed the 2010 merger between AT&T and T-Mobile based in part on concern it would result in the loss of disruptive maverick behavior in the nationwide wireless market by T-Mobile (DeGraba and Rosston, 2019).

Yet DOJ approved the recent merger between T-Mobile and Sprint based in part on the claim that maverick behavior would persist in the market. But in an unusual twist, that maverick behavior was not expected from the merged firm, but rather, from the company to which most divested assets would be transferred: Dish. This assertion was not supported by any explanation as to how the mantle of maverick behavior would be transferred to Dish, nor was there any effort to reconcile this decision with the DOJ's previous opposition to wireless merger.[4]

In yet a further variation on the argument, Heinz and Beech Nut—neither firm historically a maverick--claimed that their consolidation would in fact strengthen their ability to behave as a maverick and bring about greater competition with the leading baby food company. Interestingly, this possibility of merger-induced maverick behavior is explicitly acknowledged in

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[2] The FTC Complaint in the latter case, for example, stated that "AmeriSource is the most aggressive competitor -- the maverick -- frequently beating its national competitors with low prices."

[3] "Schick Owner Abandons Take-Over of Harry's Following FTC Suit to Block It," *Wall Street Journal*, February 10, 2020.

[4] The judicial opinion cited unnamed partnerships planned by Dish in support of its conclusion that "Dish would compete as a disruptive 'maverick' … offering low prices for innovative and high-quality services." *FierceWireless*, February 11, 2020. This view was seconded by the Assistant Attorney General for Antitrust Makan Delrahim, who opined that "The remedies set up Dish as a disruptive force in wireless." *Wall Street Journal*, July 19, 20209.

the US Merger Guidelines. In discussing efficiencies, that document states that "incremental cost reductions [from a merger] may make coordination less likely or effective by enhancing the incentive for a maverick firm to lower price or by creating a new maverick firm."

The airline industry further illustrates the incoherent state of the policy argument. The Justice Department initially opposed the 2016 merger of US Airways and American Airlines in part due to its concern over a US Airways strategy of offering low prices for connect service on routes where it competed with nonstop service by its rivals. The Justice Department documented the price restraining effect of this "maverick" program and cited its likely termination as one reason for its opposition to the merger.[5] Oddly, therefore, the same Justice Department a few years earlier had permitted the merger of two low-cost maverick airlines--Southwest and AirTran Airlines. Neither the larger size of the merged firm nor the elimination of one—or both-- maverick firms elicited any comment or expression of concern about post-merger behavior or competition.

Other jurisdictions vary in the degree of attention paid to maverick firms. At one extreme, the New Zealand Merger Guidelines list several specific market features associated with a maverick firm. These include a history of aggressive pricing or innovative behavior, low costs or excess capacity, especially if held by a low market share firm, or simply having a different business model. At the other extreme, for the longest time the EU Merger Control Regulation made no mention whatsoever of a maverick firm. That changed with the 2004 version of its guidelines, which expressed concern with a merger involving a maverick firm. It specifically defined a maverick as a firm with a history of disruptive behavior, failing to follow price

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[5] That said, the Justice Department subsequently withdrew its opposition to the merger.

increases, or otherwise having incentives to pursue a different business strategy. Bromfeld and

Olczag's (2018) review of EU merger cases since 2000 found references to maverick firms in

only 22 of 274 merger investigations. Of those, DG Comp in fact pursued and prevailed in

arguing maverick behavior in exactly five cases, or less than 2 percent.

The discrepancy between stated concern over maverick firms and actual merger

enforcement actions to protect them likely has several explanations. We would argue that one

important explanation is the absence of a coherent framework for analyzing maverick behavior

and predicting the effect of a merger on such behavior. It is that issue to which we now turn.

III. A Model of Maverick Firm Behavior

A. Overview of the Model

Our model is based on a Stackelberg game between a large incumbent firm and an

initially small entrant producing a homogeneous product in quantity competition. Both firms

have constant unit costs. The entrant has lower costs but is at any point in time capacity

constrained.[6] The entrant chooses between maverick behavior and coordination (i.e., joint profit

maximization or collusion) with the incumbent, where maverick behavior entails selling its entire

available capacity, leaving the (initially large) residual demand for the dominant incumbent.

In this scenario the incumbent maximizes its profit under residual demand defined by

subtracting the entrant's capacity (and hence output) from market demand. That determines its

optimum output and hence market price, which the entrant matches.[7] The Nash equilibrium

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[6] The capacity limitation could be interpreted as the result of a physical impossibility of more rapid expansion by a new entrant, or a slow-growth strategy to avoid provoking retaliation by the incumbent.
[7] This is unlike standard Bertrand pricing, where the entrant would set its price at epsilon below the dominant firm's higher marginal cost since in this case the capacity-constrained entrant gains no sales from undercutting price.

result is that the entrant earns in profit its capacity multiplied by its price-cost margin, where its margin is larger than that of the dominant firm due to its own lower cost. Figure 1 illustrates this outcome in which the entrant produces out to capacity K_1, but remains relatively small in a sense defined below. The dominant incumbent firm determines its profit maximizing quantity by setting its marginal revenue (under its residual demand curve) equal to its marginal cost. That in turn determines the price set by the incumbent, which is matched by the small rival.

At all times the entrant's alternative strategy is coordination with the incumbent. Joint profit maximization would still involve the small entrant producing to its full capacity, since it has lower cost, but the market output and price would be set by the higher cost incumbent which equates its marginal cost to marginal revenue in the overall market. Assuming that profits accrue to each firm in accordance with its share of total output, the incumbent firm prefers coordination essentially throughout.[8] Coordination will not emerge, of course, unless and until it is also in the interest of the entrant. Crucially, therefore, the model implies that when "small," the entrant earns greater profit from maverick behavior than from coordination.

This conclusion—that maverick behavior can yield greater profit—is not invariant to the entrant's size. Rather, if it were sufficiently large, the entrant would earn greater profit by changing strategies and cooperating with the dominant firm. The reason is that, when it is larger, the maverick's profit from coordination is greater (due to its larger low-cost output) while its profit from continuing to engage in aggressive output expansion is smaller (due to the falling price resulting from continued Stackelberg behavior of the incumbent firm). Figure 2 illustrates this case of a much larger rival than in Figure 1, in competition with a correspondingly smaller

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[8] Extrapolating the model to its limit, there is a small interval where the entrant nearly fully displaces the incumbent. At that point the latter no longer earns significant profit and would presumably opt out.

incumbent. While the once-dominant incumbent continues to set price through its quantity

choice, that price falls and with it the profit earned by the maverick firm from its larger output.

Clearly therefore there is a point at which both the rival and the incumbent would prefer

coordination. That point is given by a level of entrant capacity relative to market size that can be

determined from demand conditions and cost parameters. Thus, in this model it is not that the

entrant *is* a maverick but rather that it *chooses* to behave as a maverick when it is profit-

maximizing to do so. Put differently, the model predicts--rather than assumes—maverick

behavior, and a shift in that strategy based on the rival's size and cost advantage.

This and some further issues are formalized in the model in the next section.

B. A Model of Maverick Behavior

Formally, we assume a small entrant--firm 1—with fixed capacity K_1 that produces a

homogeneous product in quantity competition with an initially dominant incumbent firm 2.

Without limitation, we assume that firm 1 has unit cost of zero and a cost advantage over the

incumbent.[9] Thus,

$$0 = c_1 < c_2$$

The incumbent's capacity K_2 is "large" in the sense that

$$K_2 \geq D(p = 0)$$

while the entrant's capacity is "small" relative to the market in the sense that it cannot respond

significantly to zero output by the second firm, That is,

$$K_1 << q_1(q_2 = 0)$$

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[9] The assumption of lower cost represents any advantage held by the entrant over the incumbent that results in profit increment at a common price. This might, for example, consist of superior quality or service or location relative to the dominant incumbent.

Demand is given by

$$D(p) = 1 - p$$

The firms engage in Stackelberg competition, with Firm 1 moving first by setting output at its capacity, that is, $q_1 = K_1$. Having observed Firm 1's output choice, the larger firm 2 maximizes profit under the residual demand given by market demand less K_1. Its resulting profit is given by

$$\pi_2{}^M = \left(\frac{1 - K_1 - c_2}{2}\right)^2 \tag{1}$$

which implies a market price of

$$p^M = \frac{1 - K_1 + c_2}{2} \tag{2}$$

This in turn makes the rival's profit (at $c_1 = 0$)

$$\pi_1{}^M = \frac{(K_1 - K_1^2 + K_1 * c_2)}{2} \tag{3}$$

At all points in time, the small rival's alternative strategy is to cooperate with the incumbent in setting a joint profit maximizing price and then receiving a share of total profit equal to its output share. Given that the rival is "small" in the sense described above, market price and output are determined by the incumbent firm. Setting that firm's marginal cost to the market marginal revenue would yield incumbent output of

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$$q_2^c = \frac{1 - 2K_1 - c_2}{2} \qquad (4)$$

And price given by

$$p^c = \frac{1 + c_2}{2} \qquad (5)$$

Each firm in this cooperative arrangement earns profit given by its output multiplied by its price cost margin. For the entrant this would be

$$\pi_1^c = \tfrac{1}{2} * \frac{K_1(c_2^2 + 2c_2(2K_1 - 1) + 1)}{1 - c_2} \qquad (6)$$

And for the incumbent, this would be:

$$\pi_2^c = \tfrac{1}{4} * \frac{(1 - 2K_1 - c_2)(c_2^2 + 2\,c_2(2K_1 - 1) + 1)}{1 - c_2} \qquad (7)$$

To establish our key proposition, we first determine the range of K_1 for which the entrant chooses maverick behavior, that is, where $\pi_2^c < \pi_2^M$. This inequality holds when

$$K_1^* < \frac{2\,c_2(1 - c_2)}{3\,c_2 + 1} \qquad (8)$$

Up to this capacity, the small firm will optimally engage in maverick behavior in which it fully utilizes its capacity, leaving the incumbent firm to maximize its profit under the residual demand curve. For larger values of K_1, the small firm switches to cooperative rather than maverick

behavior.

This is our key result: maverick behavior is chosen by the entrant whenever it is profit-maximizing to do so. Maverickness is not an inherent characteristic of the firm. It is not exogenously determined behavior. And it is not invariant to firm and market conditions, including changes in its size or share. Rather, when the entrant achieves sufficient size, cooperation becomes the superior choice of the firm and establishes that as the market equilibrium. At that point, total output will have fallen and price risen to their profit-maximizing values, and each firm collects a share of total profit equal to its output share.

There are two additional points worth noting. First, a different equilibrium might emerge if the firms recognize the opportunity to increase total profits by shifting more of the final profit-maximizing level of total output from the incumbent to the entrant with its lower unit cost. The firms might simply agree for the entrant to continue to expand and the incumbent to contract by the same amount. Cartel stability would then require a side payment to the incumbent to compensate for its diminished output and share. If that were possible, then the process of capacity expansion by the entry would continue, in principle until the incumbent were fully displaced.[10]

Second, the need for side payments is not immediate in the sense that the entrant, while "cooperating," can expand its capacity past the switching point K1* by some amount before the incumbent's profit falls below that which it earns from the alternative. That point can be determined by solving for the values of entrant's capacity K_1 for which $\pi_1^c \geq \pi_1^m$. That inequality requires that

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[10] At this point, there would be a new market equilibrium reflecting the lower marginal cost of the price-determining firm.

$$K_1' < \frac{4 c_2 (1 - c_2)}{7 c_2 + 2} \qquad (9)$$

It can be shown that $K_1' > K_1*$ so there remains a range of optimal maverick behavior but this also demonstrates the need for side payments under a production rationalization strategy by the two firms.

C. A Numerical Simulation

Our key results can be illustrated with a simple numerical example. Suppose demand is given by $Q = 1 - p$, $c_1 = 0$, and $c_2 = .2$. Table 1 shows a sequence of capacities for firm 1 and for each, firm 1's profit from maverick behavior. The latter is simply its capacity multiplied by the margin given by market price less its zero cost. Column (c) in that table shows profit in the case of cooperative behavior by firm 1. Up through capacity equal to 0.20, the entrant earns greater profit by maverick behavior, but past that point cooperation yields greater profit. Figure 3 illustrates this result. The profit that firm 1 earns from each strategy as its capacity (and hence sales) rise is shown by the two lines. The intersection represents the critical value where it optimally switches behavior.

In summary, when K_1 is small, the rival acts as a maverick and the incumbent—while it prefers cooperation—accedes to that behavior. At some point as the rival's capacity grows, however, both firms find it advantageous to coordinate pricing behavior.[11] These numerical results illustrate our key finding that maverick behavior arises endogenously from a more fundamental maximization problem, so that when underlying conditions—here, maverick firm

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[11] When the rival grows to the point that it is capable of supplying much or most of market demand, coordination is no longer the optimum strategy to both firms since price approaches the incumbent's higher cost. This latter result, however, is the result of extrapolating the model to extreme conditions where maverick behavior is implausible.

size--change, a different strategy choice is superior.

We now generalize this result by varying the assumptions about the cost advantage and the incumbent firm.

D. The Cost Advantage

The above model assumes a cost asymmetry between the maverick and the incumbent for all capacity levels. This section explores the implications for firm behavior and market equilibrium from changes in the magnitude of that cost differential, rather than in the magnitude of the maverick's capacity. To demonstrate the effects, we hold the entrant's capacity constant at a level that causes it to behave as a maverick. We then show, as the cost differential decreases, the conditions under which maverick behavior ceases in favor of coordination with the incumbent, even as K_1 remains constant.

The relevant conditions in our basic model can be derived explicitly by taking the partial derivative of the equation for the crossing point K_1^* with respect to the incumbent's cost. Holding constant the entrant's cost at zero, that yields the following:

$$\frac{\partial K_1^*}{\partial c_2} = \frac{-6c_2^2 - 4c_2 + 2}{(3c_2 + 1)^2} \qquad (10)$$

This condition implies that the capacity at which the entrant finds it profitable to cooperate in fact falls with the decrease in the incumbent's cost—that is, narrowing the cost differential--but only so long as the cost differential is less than one-third. In terms of the entrant's cost, if that increases so that the entrant's cost advantage over the incumbent is smaller, the entrant prefers collusion at a smaller capacity.

This result can also be shown in our numerical example, as follows: Let the entrant's capacity be fixed at $K_1=0.2$ and its costs at $c_1 = 0$. We then set out different values of c_2 and evaluate the profitability of maverick versus coordinated behavior as the cost differential changes. As shown in Table 3 and Figure 4, the entrant's more profitable strategy switches from maverick to cooperative behavior when the incumbent's cost falls to 0.2, that is, where the differential decreases to 0.2.

This formulation establishes that maverick behavior and the eventual switch to cooperation can arise from varying cost asymmetry, independently of capacity expansion.

E. Multiple Incumbent Firms

The models above assume there is a single incumbent firm in a Stackelberg game with single entrant. Many markets, of course, are characterized by more than one incumbent, and in this section we explore the implications of varying our original assumption about incumbency. For present purposes, we analyze the case of two identical incumbents engaged in quantity-Cournot competition between themselves and now facing a lower-cost entrant. Thus, the incumbents are neither perfectly competitive nor perfectly coordinating (which would replicate our earlier findings of a single incumbent).

The competitive process now unfolds as follows: the entrant produces out to its fixed capacity. The incumbents collectively face the usual residual demand and then interact as Cournot rivals between themselves in determining their collective output. As in the standard Cournot result, output is greater and market price correspondingly lower than for the case of a single incumbent. That lower price reduces the profitability of the small firm's fixed output, making maverick behavior less profitable and causing it to prefer coordination at a lower level of

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capacity than in the previous case.[12]

The equations for entrant profit when facing two incumbents is [13]

$$\pi_1{}^M = \frac{K_1 - K_1^2 + 2K_1 * c_2}{3} \qquad (11)$$

The switching point is then:

$$K_1^* = \text{½} * \frac{(c_2 - 1) * (7c_2 - 1)}{5c_2 + 1} \qquad (12)$$

Our numerical example is extended in Table 4 to highlight the change when facing two incumbent firms, using the same costs as above. Here we see the crossing point is at $K_1 = 0.08$, considerably smaller than for a single incumbent, namely, $K_1 = 0.2$

IV. Maverick Behavior and Switching in Practice: Some Indications

Empirical testing of this model must await further work, but it may be instructive to take a closer look at the behavior of perhaps the most prominent "maverick firm," namely, Southwest Airlines. As is well known, Southwest has grown from a small regional carrier to the third or

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[12] If on the other hand, the alternative is a 3-firm Cournot outcome, this would reduce the incentive to cease maverick behavior.

[13] Since industry profits remain the same under cooperation, the following generalization holds for n firms: $\pi_1{}^M = \frac{K_1 - K_1^2 + n*K_1*c_2}{n+1}$ and $K_1^* = -\frac{(c_2-1)*(n(3c_2-1)+c_2+1)}{2(2nc_2+c_2+1)}$

fourth largest airline (depending on the measure) overall. Its growth has been fueled by low fares that have reflected its cost advantage, plus a business model that has emphasized gradual growth and indirect competition rather than direct confrontation with major airlines.

These forces are documented in Tables 5 and 6. Table 5 shows Southwest's growth in size and share over twenty-five years. Over this period it tripled its domestic passenger count and doubled its share to about 20 percent. More importantly for purposes of our model, by 2010 Southwest had become the largest single carrier on 16 percent of all routes in the country, with an average share on routes served of 81.2 percent.[14] As noted, the single most important driver of Southwest's success has been its low cost. Table 6 shows that Southwest's cost per seat mile began 30 percent lower than the average of legacy carriers, but its costs rose in virtually each and every year. By 2007 its cost advantage had shrunk to 19 percent and then to 7 percent in 2014.

/   Our model offers specific predictions about behavior as a result of growing share and declining cost advantage by an entrant that initially behaves as a maverick firm. In fact, studies of Southwest's behavior over time have found a number of indications of these predicted effects. An MIT study examined airline service changes at various airports and by several carriers in the period 2007-2012. After careful analysis of data on Southwest, it concluded as follows (MIT, 2013, p. 7):

> [A]s operating costs at Southwest have continued to rise, the nation's largest low-cost carrier has started to undertake the capacity discipline strategies also practiced by larger network carriers. Southwest cut nearly 10% of its domestic departures from 2007 to 2012.

The same report later (p. 8-9) stated:

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[14] Source: Kwoka et al. Routes are defined as airport pairs.

While other LCCs/ULCCs were increasing flights and showing some growth in smaller markets, Southwest Airlines was cutting scheduled flights at many of the markets it helped create.

Other evidence exists of Southwest's increased tendency to cooperate rather than aggressively compete with traditional carriers. A public report on a 2011 investor call with the CEOs of United, Delta, American, US Airways, and Southwest quoted a series of statements concerning their capacity plans for the following year (*Wall Street Journal*, 2011). After Delta stated its intent to extend its already planned capacity cuts of 2-3%, United followed with an assurance that it would maintain its prior capacity, American indicated it would be cutting capacity by an additional 0.5%, and Southwest assured investors and its rivals that it would keep capacity flat "or slightly down" the next year. The report concluded that the major airlines—specifically including Southwest—were exercising "discipline on capacity" rather than "expanding and chasing market share," in order to "keep a recent run of price increases on track."

Southwest's role in price determination has also been widely studied in the economics literature (e.g., Borenstein, 2011; Brueckner et al, 2013). The study that most closely bears on the specific issues in this paper is that by Kwoka et al (2016). Consistent with other studies, it reports that Southwest's mere presence in a market in 2009-2010 lowered prices by incumbent legacies by about 27 percent on average. But this study is of particular interest since it went beyond that overall finding to report how Southwest's effect on prices varied with its market share. Holding all else constant, if Southwest's share on a route was less than 25 percent, its price reducing effect was 21 percent. If it was somewhat larger—between 25 and 50 percent—prices were an additional 8.9 percent lower. But if it was larger yet—with a share between 50

and 75 percent—its incremental effect actually decreased from 8.9 to 7.4 percent, and if above

75 percent of the market, the incremental effect was zero. That is, while Southwest continued to

hold price down, that effect shrank wherever its market share was larger.

This finding suggests that aggressive maverick behavior is more characteristic of

Southwest where it is small to medium size on a route. Where it comes to dominate on a route,

its pricing behavior moderates, undoubtedly because an aggressive "maverick" strategy is less

profitable. Together with the anecdotal evidence cited above, this provides some support for the

behavioral change that lies at the heart of our model of maverick behavior.

V. Summary Observations

The question addressed in this paper concerns the foundation and the implications of the

concept of a maverick firm. We set out a model in which maverick behavior arises as the result

of an optimizing decision by a firm, rather than an assumption of such behavior. Our model

predicts that an initial low-cost capacity-constrained firm will cease its strategy of aggressive

output and capacity expansion as it either grows in size or loses its cost advantage relative to a

large incumbent. We predict that the rival will then switch to a cooperative strategy with the

original dominant firm. While perhaps neither of these predictions is altogether novel, we

believe our model may be the first to offer this as an implication rather than as an assumption or

simply an anecdote. In addition, the model identifies the observable factors that render it optimal

for the firm to act as a maverick, notably, its capacity but also its cost advantage and the number

of incumbent firms.

Our model has a number of specific features and limitation.. These include the division of profits under cooperation. The process by which the entrant expands capacity is taken as exogenous. Neither the rival nor the incumbent views its actions in a dynamic setting. Despite these limitations, we are encouraged to think that this approach may result in a firmer foundation for the use of the maverick firm concept in economics and for a more fundamental understanding of its importance in antitrust.

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Table 1
Entrant's Profit from Alternative Strategies

(a)	(b)	(c)
Entrant Capacity	Profit as Maverick	Profit from Cooperation
0.11	0.060	0.050
0.12	0.065	0.055
0.13	0.070	0.060
0.14	0.074	0.066
0.15	0.079	0.071
0.16	0.083	0.077
0.17	0.088	0.082
0.18	0.092	0.088
0.19	0.096	0.094
0.2	0.100	0.100
0.21	0.104	0.106
0.22	0.108	0.112
0.23	0.112	0.118
0.24	0.115	0.125
0.25	0.119	0.131
0.26	0.122	0.138
0.27	0.126	0.144
0.28	0.129	0.151
0.29	0.132	0.158

Table 2
Incumbent's Profit from Alternative Rival Strategies

(a) Entrant Capacity	(b) Profit from Stackelberg	(c) Profit from Cooperation
0.1800	0.0961	0.1078
0.1900	0.0930	0.1040
0.2000	0.0900	0.1000
0.2100	0.0870	0.0960
0.2200	0.0841	0.0918
0.2300	0.0812	0.0876
0.2400	0.0784	0.0832
0.2500	0.0756	0.0788
0.2660	0.0711	0.0711
0.2700	0.0702	0.0696
0.2800	0.0676	0.0648
0.2900	0.0650	0.0600
0.3000	0.0625	0.0550
0.3100	0.0600	0.0500
0.3200	0.0576	0.0448
0.3300	0.0552	0.0396
0.3400	0.0529	0.0342
0.3500	0.0506	0.0288
0.3600	0.0484	0.0232

Table 3
Entrant's Profit from Alternative Strategies and Cost Differences

(a)	(b)	(c)
Incumbent Cost	Profit of Maverick	Profit from Cooperation
0.400	0.120	0.113
0.375	0.118	0.111
0.350	0.115	0.108
0.325	0.113	0.106
0.300	0.110	0.104
0.275	0.108	0.103
0.250	0.105	0.102
0.225	0.103	0.101
0.200	0.100	0.100
0.175	0.098	0.099
0.150	0.095	0.099
0.125	0.093	0.099
0.100	0.090	0.099

Table 4
Entrant's Profit from Alternative Strategies (Facing 2 Incumbents)

(a)	(b)	(c)
Entrant Capacity	Profit of Maverick	Profit from Cooperation
0.01	0.0046	0.0041
0.02	0.0092	0.0082
0.03	0.0137	0.0125
0.04	0.0181	0.0168
0.05	0.0225	0.0213
0.06	0.0268	0.0258
0.07	0.0310	0.0305
0.08	0.0352	0.0352
0.09	0.0393	0.0401
0.1	0.0433	0.0450
0.11	0.0473	0.0501
0.12	0.0512	0.0552
0.13	0.0550	0.0605
0.14	0.0588	0.0658
0.15	0.0625	0.0713

Table 2: Rival's Profit from Alternative Strategies

Table 5

Southwest's Size and Share History

(a)	(b)	(c)
Year	Domestic Passengers (Millions)	% of Domestic Passengers
1995	50.04	0.102
1996	55.37	0.106
1997	55.94	0.104
1998	59.05	0.107
1999	65.29	0.114
2000	72.57	0.121
2001	73.63	0.131
2002	72.45	0.131
2003	74.72	0.128
2004	81.07	0.129
2005	88.38	0.134
2006	96.28	0.146
2007	101.91	0.150
2008	101.92	0.156
2009	101.34	0.164
2010	106.23	0.169
2011	110.59	0.173
2012	112.23	0.175
2013	115.32	0.179
2014	126.69	0.191
2015	142.41	0.205
2016	148.82	0.207
2017	153.81	0.207
2018	159.04	0.204
2019	158.42	0.195

Table 6

Cost Per Available Seat Mile (cents)

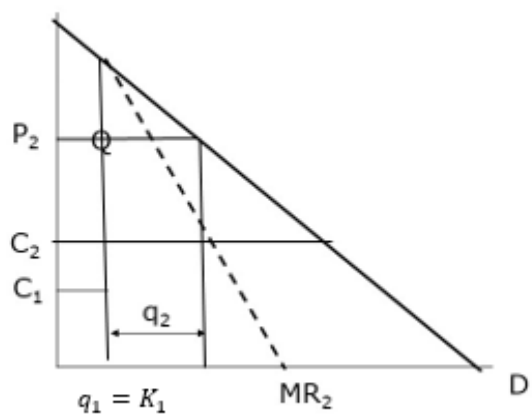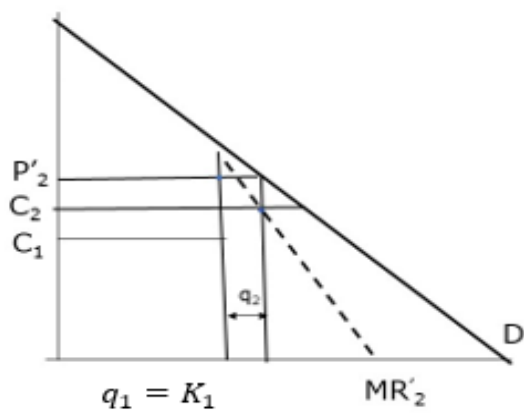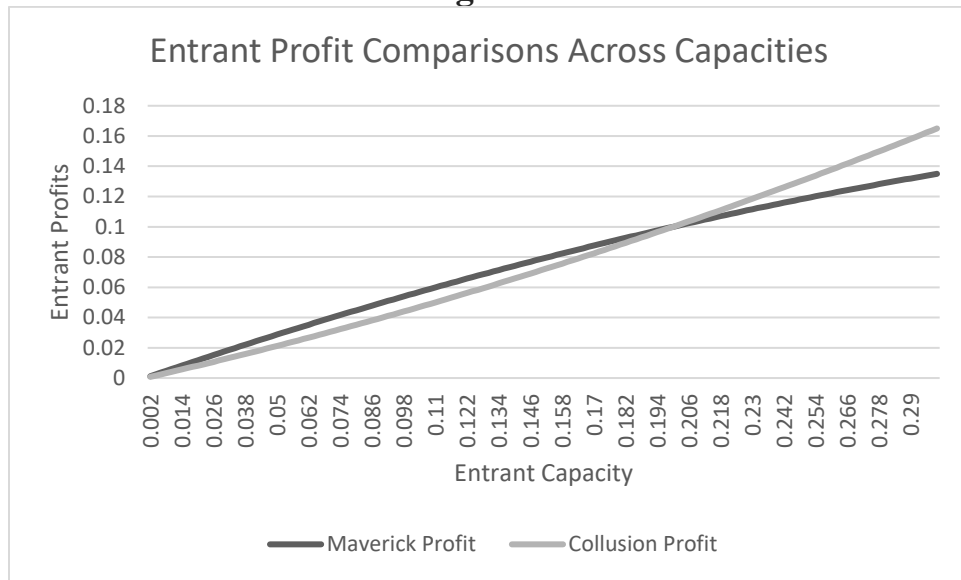| (a)	(b)	(c)	(d)
Year	Southwest	Legacy Average	Lowest Legacy
2002	7.4	10.3	10.9
2003	7.6	10.1	10.1
2004	7.8	10.1	10.0
2005	7.9	10.4	10.4
2006	8.8	10.9	11.0
2007	9.1	11.2	11.4
2008	10.2	13.2	13.9
2009	10.3	11.4	10.8
2010	11.3	12.2	12.3
2011	12.5	13.5	13.8
2012	14.8	14.2	14.1
2013	14.5	14.0	14.1
2014	13.3	14.3	13.8
2015	11.1	12.4	12.3
2016	11.2	12.1	12.0
2017	11.4	12.8	12.4
2018	11.7	13.5	13.2
2019	12.2	13.4	12.9

Figure 1

Figure 2

Figure 3

Figure 4

Entrant Profit Comparisons Across Cost Disparities