A Framework for Analyzing the Antitrust Safety Zone

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Preliminary

Abstract

The idea of antitrust "safety zone" is stated in the *Antitrust Guidelines* by the U.S. Department of Justice and the FTC. Antitrust agencies, in principle, will not intervene in market activities if the degree of market power is within the safety zone. There is, however, no solid economic rationale for the precise degree of market power that can justify this safety zone. I propose a model that can give practical guidance on the antitrust safety zone. I in particular focus so-called competition-restricting activities by the incumbent such as advertising, political lobbying, protection of innovations through patents, creation of excess capacity, coalition formation etc. where increasing returns exist and study its impact on the market power balance between the incumbent and a competitive fringe in a dynamic-competition framework. The model can derive a threshold level of market-power balance between them; above the threshold, the market tends towards monopoly; below the threshold, it tends toward competition in the long run. Antitrust agencies might describe the region below the threshold as the "safety zone".

JEL codes: L10, L20 & L40

Key words: antitrust safety zone, competition-restricting investment, entry-detering capital

1 Introduction

This paper studies a model that can offer practical guidance on the antitrust "safety zone" for a specific market of the industry. The idea of an antitrust safety zone is stated in the *Antitrust Guidelines for the Licensing of Intellectual Property* by the U.S. Department of Justice and the Federal Trade Commission as follows:

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> Absent extraordinary circumstances, the Agencies will not challenge a restraint in an intellectual property licensing arrangement if (1) the restraint is not facially anticompetitive and (2) the licensor and its licensees collectively account for no more than twenty percent of each relevant market significantly affected by the restraint.

This suggests that antitrust agencies, in principle, will not intervene in activities in a market if the degree of market power is in the safety zone. There is, however, no solid economic rationale for the precise degree of market power that can justify this safety zone.

Much of the recent work, i.e., contestable market theory and game theory, uses static models; antitrust and competition laws in the U.S. and Europe consequently adhere to the static blueprint of the perfect competition paradigm. Modern corporations, however, take a much longer-run perspective than the traditional theory assumes. For example, competition-restricting activities such as advertising and lobbying by incumbents are regarded as a sort of investment rather than a one-shot strategy. Competition-restricting investment is these days significant relative to investment in physical production capacity.

As is widely believed, competition in modern industries involves different kinds of strategies. In addition to a traditional price-cutting strategy, non-price strategies explain a large part of competition. Antitrust agencies are particularly interested in so-called competition-restricting activities such as advertising, political lobbying, protection of innovations through patents, creation of excess capacity, coalition formation etc., all of which can directly affect the market competitive environment. There are many studies that account for those strategies taken by a single firm to maximize its own revenue, but not many of them refer to its impact on the balance of market power between the dominant firm and a competitive fringe.

Moreover, the safety zone should be market specific: it is questionable that the aforesaid twenty percent in the *Antitrust Guidelines* can apply to all different sorts of markets. It should instead be determined by the nature of products and the types of strategies usually taken in a specific market.

This paper proposes a model that incorporates those essential points of dynamic competition that are missing in the existing theory. In particular, based on Brock (1983), Brock and Dechert (1985), and Kato and Semmler (2006), I model so-called competition-restricting activities attempted by the dominant firm (or a dominant group) in order to inhibit competition. Instead of being exposed to price competition, firms in my model can build up barriers to reduce market competition with potential rivals (through advertising, political lobbying, protection of innovations through patents, creating excess capacity, coalition formation, etc.). The optimal level of competition-restricting investment is determined by market-specific conditions such as the obsolescence rate of new technologies or products, the length of protection of patented innovation, the patent fees, the shift in customers' tastes, the change of regulatory environment, etc..

The proposed model may also provide practical guidance on the antitrust safety zone for specific markets. When local increasing returns of competition-restricting activities are assumed, two basins of attraction arise; one suggests a competitive market and the other a monopolistic market. Between the two basins, a threshold level of market-power balance between incumbents and fringe firms exists; above the threshold, the market tends toward monopoly; below the threshold, it tends toward competition in the long run. Antitrust agencies might describe the region below the threshold as the safety zone. As long as the market is in the safety zone, they wouldn't intervene in the market. When, on the other hand, the dominant firm builds up entry-deterring capital beyond the threshold, antitrust agencies are aware that the market tends to monopoly in the long run. Note that the threshold level is determined by market-specific parameters and that therefore the safety zone will also be market specific. Antitrust agencies can also affect the threshold level through various regulatory instruments. One example is the life-time of a patent: Shorter patent life causes entry-deterring capital to depreciate faster and this will reduce a monopolistic basin of attraction. Stronger regulatory controls and monitoring, tougher penalties and higher law suit costs also reduce the monopolistic basin of attraction. The dominant firm is discouraged from making competition-restricting investment and the market tends to competition.

The remainder of the paper is organized as follows. Section 2 shows some empirical evidence that indicates market-specific safety zones. I show that the industries that have a high obsolescence rate of patent tend to maintain a competitive market and have less antitrust cases. Section 3 introduces a model of the competition-restricting activities attempted by the dominant firm (or a dominant group) and the resulting market dynamics. The long-run outcome of the activities may lead to competition or monopoly depending on the market-specific parameters such as the obsolescence rate of entry-deterring capital, the deterrence efficiency of the dominant firm, the discount rate, etc.. Based on the model's result, in Section 4, I define the safety zone and discuss how the competition policy should be pursued by the antitrust agencies. Section 5 concludes the paper.

2 Empirical Data

If the antitrust safety zone should be market specific, the number of antitrust cases has to reflect market-specific factors. One of the key factors that determines the safety zone in my model is the obsolescence rate of the entry-deterring capital. Although the types of entry-deterring capital vary, patent protection may most reflect the nature of the market, e.g., the obsolescence rate of the acquired patents is expected to be high in the market where contents of innovation become obsolete fast (e.g., entertainment and software) and expected to be low in the R&D intensive market (e.g., pharmaceuticals and biotechnology). This section studies the relationship between the obsolescence rate of patent value and the number of antitrust cases.

Obsolescence rate of patent value

I shall use patent renewal as a positive indicator of the rate at which knowledge becomes obsolete. Pakes and Simpson (1989) and Schankerman (1998), etc. have estimated the value of patents at the two-digit level using patent-renewal data. I use Pakes and Simpson (1989)'s Finish data the period 1969-1987. Table 1 presents data by clustering the industries into the highest-patent-renewal-rate Group 1, and so on down to the lowest-patent-renewal rate Group 5. Column 2 of the Table provides the names of the two-digit industries. Column 3 provides the corresponing SIC codes. Of course, I interpret high rates of renewal to mean low rates of obsolescence, and low renal rates to mean high obsolescence of knowlede.

Antitrust cases

Column 4 of Table 1 provides the number of antitrust cases in the U.S.. "The Antitrust Case Browser" (http://www.stolaf.edu/people/becker/antitrust/index.htm) by Anthony D. Becker provides useful summaries of U.S. antitrust cases filed under federal antitrust laws; the Sherman Antitrust Act of 1890, 15 U.S.C. 1, the Clayton Act, 15 U.S.C. 12, and the Federal Trade Commission Act, 15 U.S.C. 41, both passed in 1914. The cases listed in Becker's web cover 173 cases from the oldest, U.S. v. E. C. Knight Company (1985), to the most recent, USPS v. Flamingo Industries (1994). Among those I picked 64 antitrust cases that involve the produces produced in manufacturing industry and classfied them using the SIC codes.

	Pakes & Simpson (1989)	SIC	Antitrust cases
Group 1	Food and kindred products	20 Food And Kindred Products	23
	Chemicals and allied products	28 Chemicals And Allied Products	7
	Machinery	35 Industrial And Commercial Machinery And Computer Equipment	7
	Drugs and medicines	28 Chemicals And Allied Products	5
	Rubber and plastic products	30 Rubber And Miscellaneous Plastics Products	1
	Lumber, wood, and paper	24 Lumber And Wood Products, Except Furniture	0
Group 2	Communication equipment	36 Electronic And Other Electrical Equipment And Components, Except Computer Equipment	5
	Professional, scientific, and electrical equipment	36 Electronic And Other Electrical Equipment And Components, Except Computer Equipment	1
Group 3	Primary metals	33 Primary Metal Industries	2
	Fabricated metals	34 Fabricated Metal Products, Except Machinery And Transportation Equipment	0
	Stone, clay, and glass	32 Stone, Clay, Glass, And Concrete Products	0
Group 4	Farm, motor, and air	37 Transportation Equipment	8
Group 5	Other	21 Tobacco Products	3
	Other	23 Apparel And Other Finished Products Made From Fabrics And Similar Materials	2
	Other	31 Leather And Leather Products	0
	Other	25 Furniture And Fixtures	0
	Other	26 Paper And Allied Products	0
	Other	27 Printing, Publishing, And Allied Industries	0
	Other	38 Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	0
	Other	39 Miscellaneous Manufacturing Industries	0
	Textiles, apparel, and leather	22 Textile Mill Products	0

Table 1: Patent value depreciation and antitrust cases in manufacturing

Interpretation of the results in Table 1

The main fact that the Table emphasizes is the negative relation between the degree of obsolescence (Column 2) and the number of antitrust cases (column 4). This confirms the model's implication that when obsolescence of knowledge is low, concentration is likely to be high because the barriers to entry persist. Conversely, when obsolescence is high, entry is not deterred to any important extent and, as a result, concentration levels tend to be low in the long run. The relation is true in the data for the most part, but there are exceptions, most notably in Group 4, where we see that Transportation Equipment, for example, has eight antitrust cases (signifying high concentration) while the rate of obsolescence of knowledge is estimated to be relatively high according to Column 2.

3 Model

The model discussed here is very much same with the model in Kato and Semmler (2006). The dominant firm's objective is to maximize the discounted future net cash flows:

$$\max_x \int_0^\infty e^{-rt} \left[pq - C(q) - x - \varphi(x)\right] dt \tag{1}$$

subject to

$$\dot{E} = x - \delta E \tag{2}$$

where r is the discount rate, q is the output of the dominant firm, p is the market price, C is the cost of production, x is the competition-restricting investment where the price of a unit of investment good is 1, and φ is the adjustment cost with $\varphi' \gtreqless 0$ for $x \gtreqless 0$ and $\varphi'' > 0$. The fringe firms produce the rest of the market demand $d - p$. The entry-deterring capital become obsolete at rate δ.

By presuming price setting power of the dominant firm, we conveniently assume that the product price is a monotonically increasing function of the market share of the dominant firm

$$p = p(s) \text{ for } 0 \leq s \leq 1 \tag{3}$$

where $p'(s) > 0$, $p(0) = p^c$ and $p(1) = p^m$. The parameter p^c is the competitive price and p^m the monopolistic price. The dominant firm's market share s depends on the level of entry-deterring capital that can be accumulated through the competition-restricting investment. With a downward sloping market demand, the dominant firm's output is

$$q = s(E; \chi)d(p). \tag{4}$$

The market share of the dominant firm s is a monotonically increasing function of the entry-deterring capital E for given entry-deterrence efficiency of the dominant

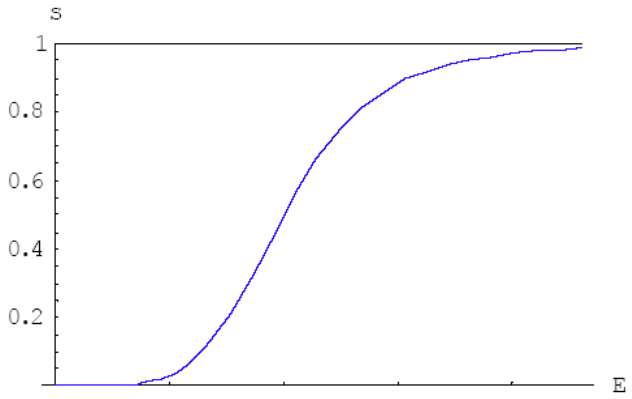

Figure 1: Dominant firm's market share

firm χ. The rest of the market share goes to the competitive fringe firms. Here we allow local increasing returns to E in the market share function as shown in Figure 1, i.e., $0 < s(E) < 1$ with properties $s(0) = 0$, $s(+\infty) = 1$, $s'(E) \geq 0$, and $s'(0) = s'(+\infty) = 0$ for a given χ.Since the entry-deterring capital cannot be negative $-E \leq 0$,[1] we impose a non-negativity constraint to the equation of motion for E:

$$h = -E \ \leq 0 \Rightarrow \ \dot{h} = -\dot{E} = -(x - \delta E) \leq 0 \text{ whenever } h = 0. \tag{5}$$

Let the Lagrangian be written as

$$\mathcal{L} = p(s)q - C(q) - x - \varphi(x) + \lambda(x - \delta E) - \theta\dot{h}. \tag{6}$$

Applying Pontryagin's maximum principle, the first-order conditions are

$$\mathcal{L}_x = -1 - \varphi'(x) + \lambda + \theta = 0, \tag{7}$$

$$\mathcal{L}_\theta = -\dot{h} = x - \delta E \geq 0 \quad \theta \geq 0 \qquad \theta\mathcal{L}_\theta = 0, \tag{8}$$

$$-E \leq 0 \qquad \theta E = 0, \tag{9}$$

where (9) is the complementary-slackness condition appended to (8) that ensures that (8) is valid only when the constraint is binding ($E = 0$), and at points where θ is differentiable,

$$\dot{\theta} \leq 0 \quad (= 0 \text{ when } -E < 0), \tag{10}$$

$$\begin{aligned} \dot{\lambda} \ = \ & (r + \delta)\lambda - p'(s)s'(E)s(E)d(p) \\ & -(p(s) - c)\{s'(E)d(p) + s(E)d'(p)p'(s)s'(E)\} + \theta\delta, \text{ and} \end{aligned} \tag{11}$$

the transversality conditions.

[1]Since h is not allowed to exceed 0, then whenever $h = 0$, we must forbid h to increase. Thus, the problem has a state-space constraint.

Out-of-steady-state dynamics

From the first-order conditions, the market dynamics can be summarized by two equations of motion:

$$\begin{aligned} \dot{x} &= \frac{1}{\varphi''(x)}[(r+\delta)(1+\varphi'(x)) - p'(s)s'(E)s(E)d(p) \\ &\quad -(p(s)-c)\{s'(E)d(p) + s(E)d'(p)p'(s)s'(E)\} - \theta r + \dot{\theta}] \end{aligned} \tag{12}$$

and (2). The steady state level of the entry-deterring capital can be found by solving $\dot{x} = \dot{E} = 0$. There are possibly three steady states in the non-negative region, $0 = E_1^* < E_2^* < E_3^*$. The local stability about these steady states shows that E_1^* and E_3^* are saddle stable and E_2^* is unstable. The first steady state is zero entry-deterring capital, i.e., zero barriers to entry of competitive fringes. Thus, one can regard this state as competition. The dynamics suggest that in the long run either competition E_1^* or high concentration E_3^* will be achieved. In other words, there are two basins of attraction; one suggests a competitive market and the other a monopolistic market. Between the two basins, a threshold level of market-power balance between incumbents and fringe firms exists; above the threshold, the market tends toward monopoly; below the threshold, it tends toward competition in the long run. Antitrust agencies might describe the region below the threshold as the safety zone. There are four possible scenarios about the long-run market dynamics.

Four possible scenarios

(a) Dominance of high market share: There are three steady states. Yet, for any given entry-deterring capital $E(0)$, the dominant firm chooses to increase the entry-deterring capital to E_3^* and this will entail a high concentration of the market in the long run. The entire non-negative region is the *non*-safety zone.

(b) Threshold dynamics: There are three steady states, but there exists a threshold level of $E^T > 0$ separating different domains of attraction. The dominant firm, for any $E(0)$ above the threshold, has an incentive to increase the entry-deterring capital to E_3^* and thus high concentration of the market is achieved in the long run. The dominant firm, on the other hand reduces the entry-deterring capital to zero for any $E(0)$ below the threshold and the market restores a competitive state in the long run. This happens as the marginal benefits of building up E is larger (smaller) than the costs of it when $E(0)$ is above (below) the threshold. The safety zone is only the region below the threshold.

(c) Restoration of competitive market: There are three steady states. Yet, for any $E(0)$, the dominant firm reduces E to E_1^* and gradually loses the dominance

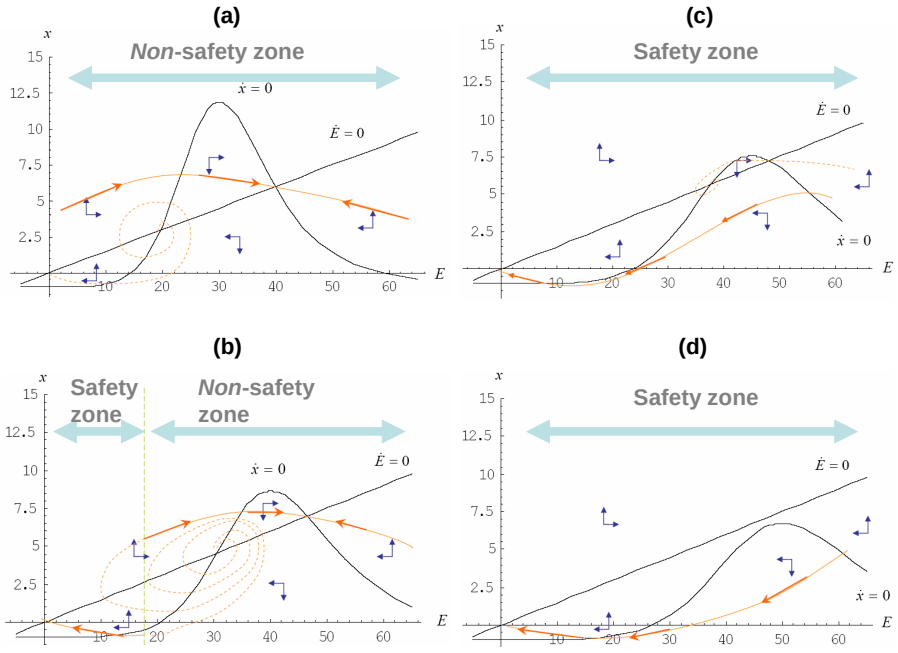

Figure 2: Possible scenarios of market dynamics

of the market share. A competitive state of the market will be restored in the long run. The entire non-negative region is the safety zone.

(d) Competitive region as sole attractor: There is a unique steady state E_1^*. For any $E(0)$, the dominant firm reduces E to E_1^* and a competitive state of the market will be restored in the long run. The entire non-negative region is the safety zone.

The corresponding phase diagrams are in Figure 2.

4 Locating the Antitrust Safety Zone

The antitrust safety zone can be defined as the region below the threshold of the entry-deterring capital E^T. We can also define the safety zone, instead of E^T, of the market-power balance between incumbents and fringe firms as $[0,\ s(E^T)]$ that is more practical. As long as the market is within the safety zone, competition will be restored in the long run and thus the antitrust agencies wouldn't intervene such a market. There are several key parameters that determine the long-run scenario of the market.

Key determinants

1. *Current market share of the dominat firm* $s(E_0)$.—It is important only when the market is in the threshold dynamics (Scenario 2) where the market tends to monopoly when $s(E_0) > E^T$ and it tends to competition when $s(E_0) < E^T$. The antitrust agencies in this scenario may want to catch, for example, any patent requisition that has a large impact on the entire market in particular in a R&D intensive market such as pharmaceuticals and biotechnology or natural monopolies such as utilities like oil, gas, electricity, etc., where high fixed costs can deter entry. These markets are more likely to be above the threshold, i.e., outside the safety zone.

2. *Obsolescence rate of entry-deterring capital* δ.—It may measure the reducing effect of advertising and lobbying on the market dominance declines as time passes. Industries that have a rapid rotation of products such as apparel and fast food are expected to have a large δ. Larger depreciation makes competition-restricting investments more costly and this enlarges the safety zone or makes the entire region competitive. It also measures the obsolescence rate of the acquired patents; δ is expected to be high in the market where contents of innovation become obsolete fast (e.g., entertainment and software) and expected to be low in the R&D intensive market (e.g., pharmaceuticals and biotechnology). One can also view δ as representing the life time of entry-deterring capital under regulations and competition policies set by antitrust agencies. Regulatory agency, for example, can counteract the dominant firm's entry-deterring efforts such that it accelerates the obsolescence of entry-deterring capital by applying a shorter life time of patent, higher patent renewal fees, lower legal limit of political donations, etc.. These regulatory policies increase δ and enlarge the antitrust safety zone.

3. *Deterrence efficiency* χ.—We presume that χ represents the dominant firm's deterrence efficiency. Higher deterrence efficiency leads to higher marginal benefits of increasing E and promotes competition-restricting activities. As the deterrence efficiency increases, the safety zone enlarges.

4. *Discount rate* r. —The discount rate reflects exogenous uncertainty in future market. In a more uncertain market, less weights are put on the future cash flows and thus less investment is made to secure the future market share. An increase in r enlarges the antitrust safety zone.

Numerical Study

In Section 2, some data show that the industries that have a high obsolescence rate of patent tend to maintain a competitive market and have less antitrust cases. This is an example that a long-run outcome of the competition-restricting activities may

lead to competition or monopoly depending on the market-specific parameters. The model also predicts that the safety zone enlarges as the obsolescence rate of entry-deterring capital increases. We have numerical examples using the following specific functions:

$$C(q) = cq, \tag{13}$$

$$\varphi(x) = \alpha x^2, \tag{14}$$

$$s(E, \chi) = \frac{E^\rho}{\chi^\rho + E^\rho} < 1 \tag{15}$$

$$p(s) = p^c + (p^m - p^c)s \quad \text{for } 0 \leq s \leq 1, \text{ and} \tag{16}$$

$$d = b - ap \tag{17}$$

where a, b, c, and α are positive constants,.the functional form (15) has local increasing returns as in Figure 1 for any $\rho > 1$, and χ measures the deterrence efficiency of the dominant firm where a smaller χ means higher deterrence efficiency, i.e., the same amount entry-deterring capital contributes more to an increase in the share.

Let's set the benchmark parameters as $r = .02$, $\delta_E = .15$, $\rho = 5$, $\chi = 30$, $c = .001$, $\alpha = .5$, $p^m = 8$, $p^c = 2$, $b = 10$, $a = .5$. By solving $\dot{x} = \dot{E} = 0$, three steady states are found in the non-negative region and the global analysis suggests that the benchmark case has Scenario (a) dominance of high market share (Figure 3). Thus the third steady state is actually achieved in the long run for any $E_0 > 0$, i.e., there is no safety zone. In the long run, the dominant firm's market share climbs up to 80.5% and that incurs positive welfare loss, $l^* = 11.67$.[2]Next, we apply a higher obsolescence rate $\delta = .24$ with the other parameters kept same. Figure **??** shows that there are three steady states in the non-negative region but the steady state that is actually reached in the long run will be the first competitive state. This is Scenario (c) restoration of competitive market. The safety zone is the entire non-negative region.By increasing the obsolescence rate further to $\delta = .26$, we find a unique steady state at a competitive state (Figure 5). This is Scenario (d) competitive region as sole attractor. The entire non-negative region is the safety zone.Note that Scenario (b) threshold dynamics arises between Scenarios (a) and (c), thus for some δ between .15 and .24. Figure 6 summarizes the location of the safety zone (shadowed) and *non*-safety zone (white) for different δs. The boundary line between the safety zone and the non-safety zone is the threshold level of market share of the dominant firm. When the market has a lower obsolescence rate of the entry-deterring capital, δ_l, there is no safety zone. Thus the dominant firm with any positive market share

[2]The welfare loss can be computed by

$$l \equiv \int_c^{p(s^*)} d(p)dp - (p(s^*) - c)d(p(s^*)).$$

	(1)	(2)	(3)
E^*	0.00	19.6056	39.8492
x^*	0.00	2.9408	5.9774
s^*	0.00	0.1065	0.8053
p^*	2.00	2.6391	6.8316
d^*	9.00	8.6805	6.5842
l^*	0.00	1.74	11.664

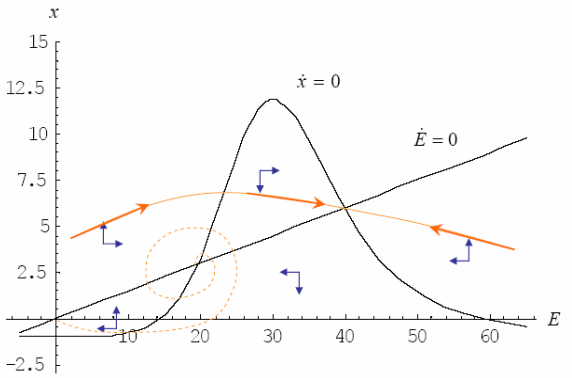

Figure 3: Benchmark case ($\delta = .15$) leads to high concentration

	(1)	(2)	(3)
E^*	0.00	26.3148	30.7209
x^*	0.00	6.3156	7.3730
s^*	0.00	0.3418	0.5296
p^*	2.00	4.0507	5.1779
d^*	9.00	7.9746	7.4111
l^*	0.00	4.1001	6.7000

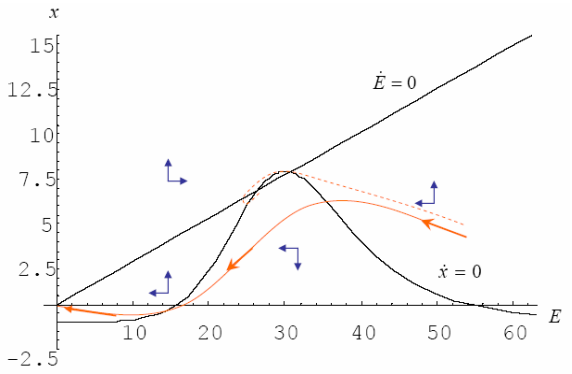

Figure 4: A higher obsolescence rate ($\delta = .24$) restores competition

	(1)
E^*	0.00
x^*	0.00
s^*	0.00
p^*	2.00
d^*	9.00
l^*	0.00

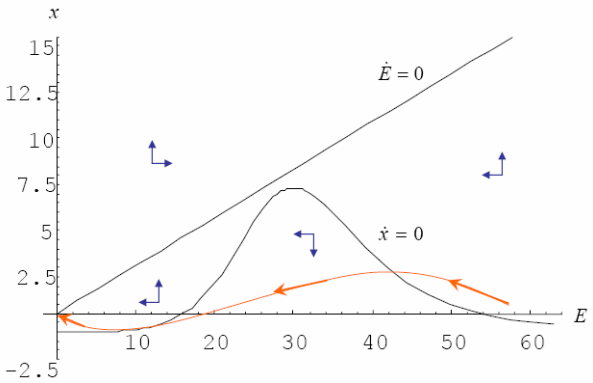

Figure 5: A sole competion attractor emerges for a higher obsolescence rate ($\delta = .26$)

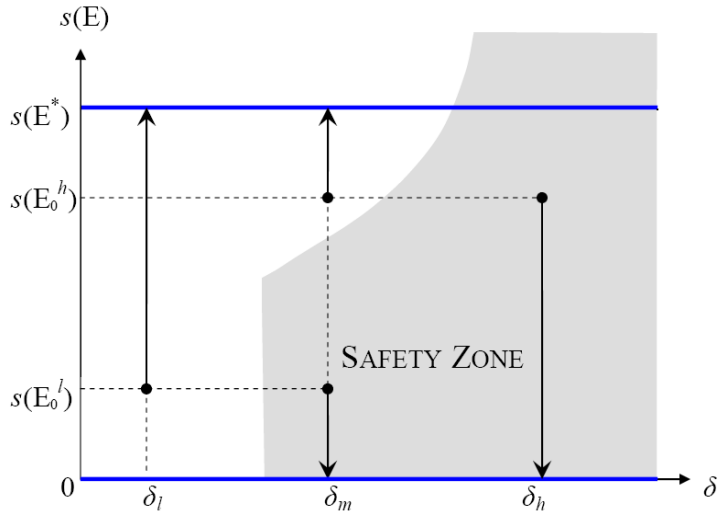

Figure 6: Obsolescence rate and safety zone

$s(E_0)$ tends to be monopolistic in the long run. When the obsolescence rate is δ_m, threshold dynamics arise where the safety zone enlarges as δ increases. The long-run market share of the dominant firm will be monopolistic when the current market share is above the threshold, $s(E_0^h) > s(E^T)$, while it will be competitive when the current share is below the threshold, $s(E_0^l) < s(E^T)$. When the market has a higher obsolescence rate, δ_h, the entire region is the safety zone. Regardless of the current market share of the dominant firm, the market tends toward competition.Note that the other market-specific parameters, χ and r, have the similar effects on the safety zone. Thus, the safety zone or the threshold level of the market share cannot be common to all markets as the *Antitrust Guidelines* assumes.

5 General Lessons from the Model

This paper provides a theoretical framework of analyzing market-specific antitrust safety zone. I model so-called competition-restricting activities attempted by the dominant firm where firms in can build up barriers to reduce market competition with potential rivals. The model implies a threshold level of market-power balance between incumbents and fringe firms; above the threshold, the market tends towards monopoly; below the threshold, it tends toward competition in the long run. Antitrust agencies might describe the region below the threshold as the "safety zone" The threshold level is determined by the nature of products and the types of strategies often taken in a specific market. Therefore, it is questionable that the said twenty percent in the *Antitrust Guidelines* can apply to all different sorts of markets. The model produces market-specific antitrust policy prescriptions in place of the current

uniform antitrust guidelines for all markets and allows us to analyze social costs that may result from the competition-restricting activities of a dominant firm.

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