Antitrust Law and Internal Firm Efficiency

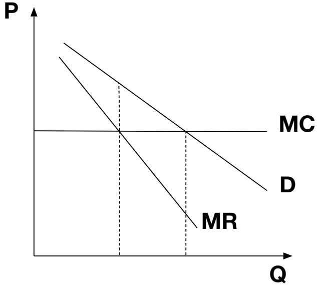
Richard Holden and Eric Posner

UNSW and University of Chicago

December 17, 2014

Standard view of antitrust/competition law

- Standard economic view of why monopoly (more generally, market power) is bad because it reduces allocative efficiency



1.pdf

X-Efficiency

- But only part of the story
- What about the internal efficiency of firms?
- To businesspeople and practitioners an obvious concern
- But not to economists until 1980s (with roots in 1930s)
- Hicks (1937): "The best of all monopoly profits is a quiet life".

X-Efficiency

- In 1960s and 70s Harvey Leibenstein at Harvard pushed the idea of X-efficiency
- The welfare loss from internal inefficiencies might be larger than from allocative inefficiencies
- Transfers versus welfare losses
- X-efficiency v. Pareto efficiency
- Key question: how does X-efficiency interact with product market competition

Our idea

- Consider any potential violation of the Sherman Act, or Clayton/Robinson-Patman
- e.g. a merger or acquisitions that substantially reduces market competition
- Instead of being a violation, it should be a **rebuttable presumption** that a violation has occured (applies to *per se*! and "rule of reason" violations)
- Recall that a *per se* violations involves Section 1 violations such as"agreements, conspiracies or trusts in restraint of trade"
- And we offer a framework for analysing the mertis of a given rebuttal
- Utilize a pretty general framework that intgrates the Grossman-Hart approach to the principal-agent problem with monotone comparative statics techniques (see also, Holden, 2006).

Models of X-Efficiency

- Many formal models of X-Efficiency
- Hart (1983), Nalebuff-Stiglitz (1983), Scharfstein (1988), Hermalin (1992), Horn-Lang-Lundgren (1994), Martin (1993), Schmidt (1997), Raith (2003)
- Anything goes: depending on the structure of product market competition increased competition could increase or decrease the agent's action
- Plus: welfare loss is difference b/w first and second-best action
- Many don't consider equilibrium effects
- But, e.g., increase in number of Cournot competitors *decreases* X-efficiency (in equilm, too).
- Competition reduces output of a given firm, so marginal benefit of manager's action goes down, marginal cost unchanged

A general framework

- There are two players, a risk-neutral principal and a risk-averse agent
- The principal hires the agent to perform an action
- She does not observe the action the agent chooses, but observes profits, which are a noisy signal of the action
- Let $\phi \in \mathbb{R}$ be a measure of product market competition which affects the profits which accrue to the principal
- A higher value of ϕ means that, all else equal, profits are lower
- Suppose that there are a finite number of possible gross profit levels for the firm: $q_1(\phi) < ... < q_n(\phi)$.
- These are profits before any payments to the agent

A general framework

- Let S be the standard probability simplex, i.e. $S = \{y \in \mathbb{R}^n | y \geq 0, \sum_{i=1}^{n} y_i = 1\}$ and assume that there is a twice continuously differentiable function $\pi : A \to S$. The probabilities of outcomes $q_1(\phi), ..., q_n(\phi)$ are therefore $\pi_1(a), ..., \pi_n(a)$.
- Let the agent's von Neumann-Morgenstern utility function be of the following form:
$$U(a, I) = G(a) + K(a)V(I)$$
where I is a payment from the principal to the agent, and $a \in A$ is the action taken by the agent
- Make Grossman-Hart (1983) assumptions A1-A3 (agent's preferences over income lotteries are independent of actions, A2 says that for every action a, there exists a payment such that the agents' reservation utility is achieved, $\pi_i(a)$ is bounded away from zero so no Mirrlees schemes)

A general framework

- An **incentive scheme** is an n-dimensional vector $\mathbf{I} = (I_1, ..., I_n) \in \mathcal{I}^n$.
- Given an incentive scheme the agent chooses $a \in A$ to maximize her expected utility $\sum_{i=1}^{n} \pi_i(a) U(a, I_i)$
- So P's problem is

$$\max_{(a,\mathbf{I})\in F} \left\{ \sum_{i=1}^{n} \pi_i(a) (q_i - I_i) \right\} \tag{1}$$

subject to

$$a^* \in \arg\max_{a} \left\{ \sum_{i=1}^{n} \pi_i(a) U(a, I_i) \right\} \tag{IC}$$

$$\sum_{i=1}^{n} \pi_i(a^*) U(a^*, I_i) \geq \overline{U} \tag{IR}$$

$$\hat{I} \geq 0, \forall i. \tag{LL}$$

A general model

- The model is solved in two stages (following Grossman-Hart)
  - Stage 1: P determines the lowest cost way to implement a given action
  - Stage 2: she chooses the action which maximizes the difference between the expected benefits and costs
- Stage 2 problem is non-convex
- But here concerned with comparative statics w.r.t. product market competition variable
- So use Topkis-Milgrom-Shannon Monotone Comparative Statics

Proposition

Suppose that LL does not bind, then the following condition is necessary and sufficient for a^{**} to be non-decreasing in ϕ

$$\sum_{i=1}^{n} q_i'(\phi)\pi_i'(a) \geq 0, \forall a, \phi. \tag{2}$$

When Does Competition Increase Effort?

- What characteristics high profit states of nature have
- Write profit in state i as:

$$q_i = p_i(x_i)x_i - \psi_i(x_i), \tag{3}$$

where x is quantity and ψ is the cost function.

- What does it mean to be to in a high profit state
  - Costs could be low–if "hard" actions by the agent make low cost states more likely then this is a natural interpretation
  - Or, prices might be higher in high profit states–might be the case if "hard" actions affect demand, or if they aid collusion among firms

When Does Competition Increase Effort?

- Suppose that agent effort lowers costs and that product market competition affects revenues, with more competition lowering revenues
- Hence, equation (3) becomes:

$$q_i = p_i(x_i, \phi)x_i - \psi_i(x_i),$$

with $\psi_1 > \psi_2 > ... > \psi_n$.

- A "high profit" state is one in which, all else constant, there are low costs–and *vice versa.*
- From (2) competition increases agent effort iff:

$$\sum_{i=1}^{n} \pi_i'(a)x_i \frac{\partial p(x_i, \phi)}{\partial \phi} > 0 \tag{4}$$

When Does Competition Increase Effort?

- Need not hold in general
- Consider, for example, the case where there are just two possible outcomes
- Noting that $\pi'_H(a) = -\pi'_L(a)$, the above condition then becomes:
$$\pi'_H(a)\left(x_H\frac{\partial p(x_H,\phi)}{\partial \phi} - x_L\frac{\partial p(x_L,\phi)}{\partial \phi}\right) > 0.$$
By FOSD $\pi'_H(a) > 0$ and hence we require:
$$x_H\frac{\partial p(x_H,\phi)}{\partial \phi} > x_L\frac{\partial p(x_L,\phi)}{\partial \phi}.$$
- Reasonable: quantity produced in the low cost state will be higher than in the high cost state, so that $x_L > x_H$.
- But unclear that $\partial p(x_H,\phi)/\partial\phi > \partial p(x_L,\phi)/\partial\phi$.

When Does Competition Increase Effort?

- More generally, write $q_i(a, \phi)$. The required condition is now:

$$\frac{\partial^2 B}{\partial a \partial \phi} = \sum_{i=1}^{n} \left[\pi_i'(a) \frac{\partial q_i(a, \phi)}{\partial \phi} + \pi_i(a) \frac{\partial^2 q_i(a, \phi)}{\partial \phi \partial a} \right] > 0.$$

- Again consider the two outcome case and this becomes:

$$\pi_L'(a) \left(\frac{\partial q_L(a, \phi)}{\partial \phi} - \frac{\partial q_H(a, \phi)}{\partial \phi} \right) + \pi_L(a) \frac{\partial^2 q_L(a, \phi)}{\partial \phi \partial a} + \pi_H(a) \frac{\partial^2 q_H(a, \phi)}{\partial \phi \partial a}$$

Nesting

- Schmidt (1997): firm goes bankrupt if realized profits are below a certain level
- An increase in ϕ corresponds to a more competitive product market
- Agent is risk-neutral but LL applies
- Agent effort affects costs
- Two possible states: high cost and low (L and H)
- Loss to the agent of $\overline{L}$ if the firms goes bankrupt (e.g. a reputation cost), which occurs with positive probability in the high cost state and with zero probability in the low cost state
- Assumes that the probability of this occurring is $l(\phi)$ with $l'(\phi) > 0$.

Nesting

- Schmidt's main result is that the increase in agent effort is unambiguous if IR binds and is ambiguous otherwise
- To see this in the context of our model note that if IR binds then

$$\pi_L(a)\, I_L + \pi_H(a)\, I_H = \bar{U}.$$

- Since LL binds it must be that $I_H = 0$, and hence $\pi_L(a)\, I_L = \bar{U}$.

$$\begin{aligned} C(a^*, \phi) &= \pi_L(a^*) I_L + \pi_H(a^*) I_H \\ &= \pi_L(a^*) I_L \\ &= \bar{U}. \end{aligned}$$

- Hence $d^2 C(a^*, \phi)/da d\phi = 0$.

Nesting

- Given MLRP, our key necessary and sufficient condition becomes:

$$\pi_L'(a)\left[q_L'(\phi) - q_H'(\phi)\right] > 0$$

- By FOSD $\pi_L'(a) > 0$ (a harder action makes the low cost state more likely)
- Schmidt's result requires $q_H'(\phi) < q_L'(\phi)$.
- Since the agent suffer a loss of $\overline{L}$ with positive probability in the high cost state and with zero probability in the low cost state the P's profits are lower in the high cost state since it affects the agent's utility and hence the payment that the Principal must make if IR binds

Nesting

- In effect, then $q_H(\phi) = \overline{q}_H(\phi) - l(\phi)\overline{L}$.
- Clearly $q_L'(\phi) > q_H'(\phi)$, since the expected loss of $l(\phi)\overline{L}$ occurs only in state H.
- If the PC is slack at the optimum then the effect of competition is ambiguous because the loss of L is only equivalent to profits being lower if L is sufficiently large
- Thus, for $\overline{L}$ sufficiently small we have $q_L'(\phi) = q_H'(\phi)$ and hence the condition is not satisfied.

Some examples

- Merger between Cournot competitors
  - X-efficiency effect is postive
  - How big is the X-efficiency effect?
  - Bigger when it reduces output more (number of firms, demand curve)
  - Managerial effort affects marginal cost?
- Merger between differentiated products Bertrand competitors
  - Raith: A business stealing effect: more elastic firm-level demand functions mean lower cost firms attract business from rivals. So, fixing prices, more competition increases MB of cost reductions
  - Also a scale effect: a firm whose rivals charge lower prices loses market share so MB of cost reductions goes down.
  - Effects cancel out in Raith, but which bigger perhaps empirically testable

Some examples

- Bankruptcy possibility (a la Schmidt 1997)
  - Suppose IR constraint binds (additively separability utility in action and reward will suffice)
  - Then more competition helps X-Efficiency
  - So in industries with material bankruptcy possibility rebuttable presumption unlikely to be met

Concluding remarks

- Competition law and policy does not just affect allocative efficiency–also internal firm efficiency
- To take account of this effect make what is currently a Sherman-Robinson-Patman Act breach a rebuttal presumption of guilt
- Fairly general analytic framework gives some insight as to when the rebuttal should be effective