WPS6860

Policy Research Working Paper 6860

Too Small to Regulate

Kaushik Basu
Avinash Dixit

The World Bank
Development Economics Vice Presidency
Office of the Chief Economist
May 2014

Policy Research Working Paper 6860

Abstract

The paper argues that to achieve compliance of firms with regulations such as product quality or environmental or health standards it is better to have industries with a few large corporations than numerous small firms. A model is constructed to show that limited liability constraints bind more easily in competitive industries, making it harder to impose sufficiently severe penalties and costlier to send sufficient monitors. Having large corporations allows the government effectively to delegate some of its monitoring functions to the managers of the corporation. The tradeoff between this issue and the usual argument in favor of competition is considered.

This paper is a product of the Office of the Chief Economist, Development Economics Vice Presidency. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at kbasu@worldbank.org and dixitak@princeton.edu.

Too Small to Regulate

Kaushik Basu

Senior Vice President and Chief Economist

The World Bank

and

C. Marks Professor and Professor of Economics

Cornell University

and

Avinash Dixit

Sherrerd University Professor Emeritus

Princeton University

1 Introduction

An entrenched opinion in economics, going back to at least Cournot's (1838) seminal work, holds that for an economy or a market it is better to have many small firms than a few large ones. Many firms means greater competition; that usually lowers prices closer to marginal costs, and therefore achieves greater total social surplus and greater efficiency, taking the economy closer to its Pareto frontier. This view has been prevalent, and with good reason, in industrial organization theory. Recent experience from the financial crisis of 2008 brings a new dimension to the argument. When banks and finance corporations become too big, their failure has systemic implications, inflicting collateral damage on individuals who may have nothing directly to do with those banks or corporations. Governments then feel compelled to rescue these large entities in order to minimize the collateral damage, and the anticipation of such bailout promotes reckless behavior. This phenomenon gave rise to the doctrine of Too Big to Fail (TBTF). This has recently led the International Monetary Fund (2014) to propose, as one possible solution, limiting the size of banks.

The aim of this paper is to argue the converse, namely, that there are situations where it is better to have few large firms rather than many small ones. In itself, this is not new. There are special situations where arguments in favor of monopoly have been made. It is, for instance, believed that when it comes to creating money, it is best to have only one agent doing this in one economy, namely its central bank. And in industrial organization, complementary goods are better sold by a monopolist than by separate firms, so as to avoid double marginalization.

Here we develop a different argument, to do with the scope for and efficacy of government regulation and the agency of the state. In essence, we argue that having many firms may make them Too Small to Regulate (TSTR); conversely, having few firms makes it easier to regulate and administer them.

Consider an environmental regulation. Suppose all firms in an industry are required to install some equipment meant to prevent them from polluting the environment. To make sure that they comply, government has to send out inspectors to make spot checks. The same problem crops up in other areas. Government often has to impose minimal health and safety standards on restaurants. Just asking restaurants to do so is unlikely to be enough. It has to put together a system for monitoring and for punishing offenders. Tax authorities must similarly monitor firms and punish tax-evaders. All these problems give rise to challenges in administration.

These problems of administration and regulation are typically more acute in industries where there are numerous separate firms. In most countries, cars are manufactured by a few large firms and sold by their dealerships, and a buyer can be quite confident that the cars will meet with the standards required of them—ranging from pollution control to safety. However, second-hand car markets are characterized by thousands of small firms, so there is much greater uncertainty about these standards. In olden days, when milk was supplied to households by hundreds and thousands of small dairy 'firms,' adulteration in the form of dilution with water was rampant. A study of milk supply by small farmers and dairy producers in rural Bangladesh revealed that 100% of the milk samples were so adulterated (Chanda et al, 2012). Now, in the segment of the industry which is catered to by a few large firms, such regulatory violations are few and far between.

Examples of this kind can be found in many countries and in many sectors. Martin Wolf (2014) recently conjectured that "banking systems dominated by a few large institutions might be more stable than competitive ones." Indeed, the traditional moneylender system violated usury laws with much greater abundance than large modern banks do.

The argument that we propose in order to explain this stylized fact is simple. Consider the hamburger industry. Suppose first that there are thousands of small burger shops, each one an independent firm. There is some regulation, R, about the ingredients of burgers that they are supposed to comply with. When one of these small firms is caught violating R, there is a limit to how much such a firm can be punished. The government can for instance, take away all its profits and maybe even the owner's car but beyond a point there are natural limits to the size of punishment on a small player. This threat of punishment is often inadequate to ensure compliance, using a standard crime-and-punishment argument (Becker 1968). Now consider, for the sake of argument, the case where all those burger outlets are owned by one firm, MacDuck. If any of the outlets is caught violating R, the government can impose a much larger punishment on this large firm that has the capacity to pay the bigger penalty (for instance, its entire profit). In other words, the limited liability constraint on punishments is much more easily binding on small firms than big firms.

However, the simple verbal statement is not enough. For example, we know from Bernheim and Whinston (1990) that in a repeated interaction with multiple contacts, good behavior is not always sustained by the threat of punishing one transgression by ending all interactions: the optimal response to such a strategy may instead be to transgress in all dimensions at the same time. Therefore it is important to prove that the drastic punishment strategy does work in the present context. We do this in the formal model of the next section, proving that it is easier for government to regulate a monopolistic industry than a competitive one.

The idea that limited liability is more binding for small firms also exists in the literature; for example Shavell (1984) studies its implications for product safety and liability regulation (fines versus standards). In this paper we focus on the implications for antitrust policy itself. We do not intend this to be an unequivocal case for large firms, because we have to weigh on the other side the usual costs of monopoly. But it is an important enough argument to deserve attention in the real world of policymaking. Regulation is a part of modern industry; and so creating an environment that makes it incentive compatible for firms to abide by the regulation is important for running a successful and efficient economy. In the concluding section we discuss briefly how this can be combined with the usual case for greater competition.

2 The Model

Consider n small firms subject to some regulation concerning quality, environmental damage, etc. that is costly to comply with. Each firm's profit if it complies is π_l. If it violates the requirement and gets away with it, the profit is $\pi_h > \pi_l$.

The government has $m < n$ inspectors to enforce the regulation. Each visits a randomly chosen firm but without any duplication (sampling without replacement). Focus on any one firm. The probability that it is not visited is

$$\begin{aligned} P_1 &= \Pr(\text{first inspector goes to one of the other } (n-1) \text{ firms}) \\ &\quad \cdot \Pr(\text{second inspector goes to one of the other } (n-2) \text{ out of the remaining } (n-1) \text{ firms}) \ldots \\ &\quad \cdot \Pr(m^{\text{th}} \text{ inspector goes to one of the other } (n-m) \text{ out of the remaining } (n-(m-1)) \text{ firms}) \\ &= \frac{n-1}{n} \cdot \frac{n-2}{n-1} \cdots \frac{n-m}{n-(m-1)} \\ &= \frac{n-m}{n} \end{aligned}$$

Suppose this firm violates the regulation. If it is not visited, it enjoys π_h; if it is visited, it suffers the maximum possible penalty. We normalize its payoff in this situation at 0.[1]

[1]Expected utility being cardinal, the theory works just as well with any other level. The important

Therefore its expected profit from violation is

$$P_1 \ \pi_h + (1 - P_1) \ 0 = \frac{n-m}{n} \ \pi_h$$

Successful deterrence requires this to be $< \pi_l$, or

$$(n-m) \ \pi_h < n \ \pi_l, \quad \text{or} \quad m \ \pi_h > n \ (\pi_h - \pi_l)$$

or

$$\frac{m}{n} > \frac{\pi_h - \pi_l}{\pi_h} \tag{1}$$

Now suppose there is just one large firm that owns all n branches or outlets. It can choose any subset of them, say k, to violate and the other $(n-k)$ to comply. Let P_k denote the probability that the firm is not caught.

$$\begin{aligned} P_k \ = \ & \Pr(\text{first inspector goes to one of the complying } (n-k) \text{ branches}) \\ & \cdot \Pr(\text{second inspector goes to one of the complying } (n-k-1) \\ & \quad \text{out of the remaining } (n-1) \text{ branches}) \ldots \\ & \cdot \Pr(m^{\text{th}} \text{ inspector goes to one of the complying } (n-(m-1)-k) \\ & \quad \text{out of the remaining } (n-(m-1)) \text{ branches}) \\ = \ & \frac{n-k}{n} \cdot \frac{n-1-k}{n-1} \ \ldots \ \frac{n-(m-1)-k}{n-(m-1)} \end{aligned}$$

Replacing k by $(k-1)$ in this,

$$\begin{aligned} P_{k-1} &= \frac{n-(k-1)}{n} \cdot \frac{n-1-(k-1)}{n-1} \ \ldots \ \frac{n-(m-1)-(k-1)}{n-(m-1)} \\ &= \frac{n+1-k}{n} \cdot \frac{n-k}{n-1} \ \ldots \ \frac{n-(m-1)-k+1}{n-(m-1)} \end{aligned}$$

Dividing,

$$\frac{P_k}{P_{k-1}} = \frac{n-(m-1)-k}{n+1-k} = \frac{n+1-m-k}{n+1-k} \tag{2}$$

---

assumption is that the large firm's punishment is exactly n times that of each small firm. If the large firm can be subjected to even greater punishment, for example by fining away the profits of a conglomerate in other lines of business, our argument will be further strengthened.

This recursion equation can be solved to evaluate P_k, starting with $P_0 = 1$. For example, if $n = 100$ and $m = 10$,

$$
\begin{aligned}
P_1 &= P_0 \, \frac{91-1}{101-1} = 0.9, \\
P_2 &= P_1 \, \frac{91-2}{101-2} = 0.9 \; * \; 0.898989, \\
P_3 &= P_2 \, \frac{91-3}{101-3} = 0.9 \; * \; 0.898989 \; * \; 0.897959 \ldots \\
P_{91} &= P_{90} \, \frac{91-91}{101-91} = 0
\end{aligned}
$$

Lemma: $\ln(P_k)$ is a decreasing concave function of k.

Proof: From (2) we have $P_k/P_{k-1} < 1$, so $\ln(P_k) - \ln(P_{k-1}) < 0$, and the function is decreasing. For concavity, use (2) to write

$$\ln(P_k) - \ln(P_{k-1}) = \ln(n+1-k-m) - \ln(n+1-k)$$

$$\ln(P_{k+1}) - \ln(P_k) = \ln(n-k-m) - \ln(n-k)$$

Subtracting,

$$
\begin{aligned}
\ln(P_{k+1}) - 2\,\ln(P_k) + \ln(P_{k-1}) &= \ln(n-k-m) - \ln(n-k) - \ln(n+1-k-m) + \ln(n+1-k) \\
&= \ln\left[\frac{n+1-k}{n-k} \, \frac{n-k-m}{n+1-k-m} \right] \qquad (3)
\end{aligned}
$$

Now

$$\frac{n+1-k}{n-k} < \frac{n+1-k-m}{n-k-m}$$

if and only if

$$(n+1-k)\;(n-k-m) < (n+1-k-m)\;(n-k),$$

or

$$n(n+1) - n\,k - (n+1)(k+m) + k(k+m) < n(n+1) - n(k+m) - (n+1)k + k(k+m),$$

or

$$n\,[(k+m)-k] < (n+1)[(k+m)-k],$$

which is true.

Therefore the expression in the square brackets in (3) is less than 1, i.e. its log is negative. This proves

$$\ln(P_{k+1}) + \ln(P_{k-1}) < 2\,\ln(P_k)$$

so $\ln(P_k)$ is a concave function. This completes the proof of the lemma.

Consider the large firm's strategy of having k of its units violate. If even one violation is detected, it will be fined the maximum possible amount, namely profit from all its branches, and end up with 0. Therefore the expected payoff from its strategy is

$$\begin{aligned} V_k &= P_k\,[\,k\,\pi_h + (n-k)\,\pi_l\,] + (1-P_k)\;0 \\ &= P_k\,[\,n\,\pi_l + k\,(\pi_h - \pi_l)\,] \end{aligned}$$

Then

$$\ln(V_k) = \ln(P_k) + \ln[\,n\,\pi_l + k\,(\pi_h - \pi_l)\,]$$

Maximizing V_k is equivalent to maximizing $\ln(V_k)$.[2] The lemma proved that $\ln(P_k)$ is concave, and the log of a linear function is concave. Therefore $\ln(V_k)$ is concave, and can have only one (local cum global) maximum.

Therefore to ensure deterrence it suffices to check $V_0 > V_1$, that is

$$n\,\pi_l > P_1\,[\,n\,\pi_l + (\pi_h - \pi_l)\,] = \frac{n-m}{n}\,[\,n\,\pi_l + (\pi_h - \pi_l)\,]$$

The condition simplifies to

$$\frac{m}{n} > \frac{\pi_h - \pi_l}{n\,\pi_l + (\pi_h - \pi_l)} \tag{4}$$

Comparing (1) and (4), the expression in the denominator on the right hand side of (4) is larger than that in (1). Therefore the minimum ratio of m/n required for deterrence of one large firm is lower than that needed with separate firms. Thus deterring one large firm from engaging in any violations requires less inspection than deterring all of the separate small firms.

As an example, suppose $n = 100$ and $\pi_h = 2\,\pi_l$. From (1) the ratio of inspectors to firms with separate firms must be at least 1/2, so the government needs at least 50 inspectors to deter all firms. From (4) the ratio with one firm needs to exceed only 1/101, so just one inspector suffices to achieve total deterrence.

[2] P_k itself is a convex function; using it will not work to characterize maximization of V_k. That is why the method of proof used here is needed.

3 Possible Extensions

We argued that compliance with regulations such as those pertaining to product quality or environmental standards may be easier to achieve in an industry run by larger firms. In effect, the government can use the internal governance and incentive mechanisms of large corporations to undertake the tasks of enforcement of the regulations in a more cost-effective way than can the government's own monitoring system. Thus the model blurs the public-private dividing line in an interesting way.

Our argument was entirely based on limits to liability. It is however plausible that other reasons will bolster our conclusion. The fact of a firm being large suggests a capacity to effectively and economically manage small outlets or franchises that are components of the firm. Hence, checks done by such firms are likely to be better and cheaper than if they were done by bureaucrats in government. This bolsters the case for having large organized firms and delegating regulation from functionaries of the state to the managers of the firm.

Future work can incorporate our argument into more general models of antitrust and regulatory policies. Here is a brief starting point. Suppose there are n firms, each with f franchises or outlets. Thus the m inspectors must cover a total number $n\,f$ of establishments. If any of the f outlets of one firm is caught in violation of the regulation, it pays a fine equal to its profit from all f of its outlets. Then it is easy to see that the condition (4) for deterrence changes to

$$\frac{m}{n\,f} > \frac{\pi_h - \pi_l}{f\,\pi_l + (\pi_h - \pi_l)} \tag{5}$$

Let us see how this works with the illustrative numbers we used before. Remember that with $\pi_h = 2\,\pi_l$ when there were $n = 100$ firms each operating $f = 1$ outlet, 50 inspectors were needed to achieve deterrence. Suppose the government has only enough resources to provide $m = 6$ inspectors. Keeping $n\,f = 100$, (5) becomes

$$\frac{6}{100} > \frac{1}{f+1}, \qquad \text{or} \qquad f > 15.67\,.$$

Competition will be best served if the number of firms is as large as possible, so f should be as small as possible. To satisfy integer constraints, this requires $f = 20$ and $n = 5$. Thus 6 inspectors can achieve deterrence from 5 firms each of which operates 20 outlets. More generally, the analysis can be extended to find an optimal tradeoff between regulation and competition.

References

Becker, G. 1968. "Crime and punishment: An economics approach." *Journal of Political Economy* vol. 76, no. 2, Mar.-Apr., pp. 169–217.

Bernheim, B. Douglas and Whinston, Michael. 1990. "Multimarket contact and collusive behavior." *Rand Journal of Economics,* vol. 21, no. 1, Spring, pp. 1–26.

Chanda, T., Debnath, G.K., Hossain, M.E., Islam, M.A. and Begum, M. K. 2012. "Adulteration of raw milk in the rural areas of Barisal district of Bangladesh." *Bangladesh Journal of Animal Science* vol. 41, no. 2, pp. 112–115.

Cournot, Antoine-Augustin. 1838. *Recherches sur les Principes Mathématiques de la Théorie des Richesses.* Paris: L. Hachette.

International Monetary Fund. 2014. *Global Financial Stability Report: Moving from Liquidity to Growth Driven Markets.* IMF: Washington, D.C.

Shavell, Steven. 1984. "A model of the optimal use of liability and safety regulation." *Rand Journal of Economics* Vol. 15, No. 2, Summer, pp. 271-280.

Wolf, Martin. 2014. " 'Too big to fail' is too big to ignore." *Financial Times,* April 16, p. 7.