

Good Turnover and Bad Turnover: Barriers to Business and Productivity

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Abstract. Entrepreneurship, as reflected in industry turnover rates, is a central force behind output and productivity growth. However, cross country comparisons suggest turnover rates are remarkably independent of barriers to business: Singapore, one of the most entry-friendly countries in the world, has the same industry turnover rate as Uzbekistan, a country where entry is considerably more difficult. In this paper, I suggest the solution to this apparent puzzle lies in the effect of survival barriers, which, like entry barriers, are higher in Uzbekistan than in Singapore. In other words, with similar turnover rates, Singapore is characterized by “good” turnover, whereas Uzbekistan is characterized by “bad” turnover.

By means of reduced form econometric estimation and structural model calibration, I estimate the impact of various barriers to business. While entry barriers decrease firm turnover and survival barriers increase industry turnover, both types of barriers to business decrease productivity, either by decreasing the extent of “good” turnover or by increasing the extent of “bad” turnover.

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1. Introduction

Entrepreneurship plays a central role in the process of economic growth. According to Santarelli and Vivarelli (2006), “entrepreneurship [is] the process by which new enterprises are founded and become viable, and the most common way of measuring it is to look at entry rates.” For this reason, the rate of industry turnover — the number of entries and exits in a given industry — is considered a sign of a healthy industry in terms of economic growth. For example, a report by the OECD (2003) claims that firm turnover accounts for between 20 and 40 percent of total productivity growth in eight selected countries. Johansson (2005) in turn argues that the “turnover rate of firms is found to have a significantly positive effect on industry growth.”

Consistently with this view, one would predict a negative relation between barriers to business and firm turnover (and thus a negative relation between barriers to business and economic growth). In fact, such negative relationship would follow from a model such as Hopenhayn (1992) or Asplund and Nocke (2007). However, aggregate cross-country plots seem largely inconsistent with this theoretical prediction. Figure 1 plots the average firm entry rate in each country against that country’s position in the World Bank’s doing business ranking, where the top rank corresponds to the economy with most favorable conditions to doing business. As can be seen, there is essentially no relation between how good the conditions for doing business are and the entry rate. Singapore, the country ranked first in terms of ease of business, has an entry rate of 19.4%, approximately the same as Uzbekistan (18.2%), which is ranked 166th (and last in my sample) in terms of business friendliness.

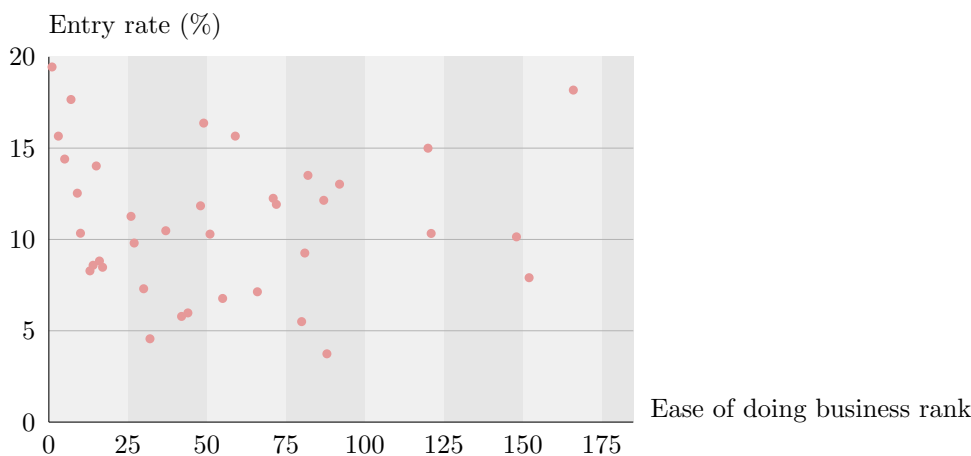
In this paper, I propose a solution to this “turnover puzzle.” The idea is that some barriers to business (e.g., the cost of starting a business) lead to lower industry turnover, whereas other barriers to business (e.g., the difficulty in obtaining operating credit) lead to higher industry turnover. To the extent that the level of these barriers is correlated across countries, we are likely to observe a weak relation between business friendliness and industry turnover. Put differently, an economy like Singapore, with very low barriers to business, may have the same rate of industry turnover as an economy like Uzbekistan, with very high barriers to business. However, the *nature* of industry turnover is likely to be very different in these two economies. Turnover in Singapore corresponds primarily to higher productivity firms replacing lower productivity firms, that is, industry turnover is part of a process of “natural selection” by firm productivity. By contrast, turnover in Uzbekistan corresponds primarily to involuntary exit: firms that are productive enough to survive but are unable to do so because they cannot access financing or are otherwise prevented from continuing activity.

I call the Singapore and the Uzbekistan entry dynamics “good turnover” and “bad turnover,” respectively. Good turnover takes place when firm exit is primarily determined by a voluntary decision that follows observation of low productivity levels. By contrast, “bad turnover” takes place when firm exit is primarily determined by an “involuntary” decision that follows the inability to surpass an “artificial” survival barrier in a non-level playing field.

From a policy point of view, my analysis suggests that industry turnover is neither a good policy goal nor a good indicator of policy success. By contrast, barriers to business are unequivocally bad for industry productivity: they either decrease the level of “good

Figure 1

Ease of doing business and industry turnover in various countries. Source: World Bank.



turnover” or increase the level of “bad turnover.” The question is then, which barriers to business matter the most, namely in terms of decreasing good turnover and increasing bad turnover (and ultimately decreasing industry productivity); and to what extent do cross-country differences in barriers to business explain productivity differences. Answering these questions is the main goal of this paper. I do so from two different approaches: reduced-form statistical analysis and structural model calibration. Broadly speaking, my results confirm the above hypotheses: (a) different barriers to business have different, possibly opposite, effects on industry turnover, resulting in a pattern whereby industry turnover is essentially unrelated to the level of barriers to business; (b) barriers to business, to the extent that they decrease good turnover and increase bad turnover, have a significant negative impact on industry productivity, both statistically and economically significant.

Related literature: To be completed

The rest of the paper is organized as follows. In the next section, I empirically test some of the predictions of the above hypothesis regarding the impact of barriers to business on industry turnover and on productivity. Next, in Section 3, I present and develop a simple model of entry and survival that features two types of barriers to business: entry and survival barriers. In Section 4, I present the main results of the paper, dealing with the effect of barriers to business on industry turnover and productivity. In Sections 5 and 6, I calibrate the theoretical model, reproduce the “turnover puzzle,” and estimate the productivity impact of barriers to business. In Section 7, I derive and test additional empirical implications. Section 8 concludes the paper.

2. Reduced form estimation

There are several possible explanations for “turnover puzzle” presented in the previous section. In particular, one limitation of Figure 1 is that it is based on aggregate country data. It is well known that different industries have very different turnover rates (e.g., Geroski, 1996). Therefore, the absence of a relation between barriers to business and industry turnover may simply result from an industry aggregation error. To address this limitation,

Table 1

Tabulation of variable m1a from Enterprise Survey data set.

most serious obstacle affecting the operation of this establishment	Freq.	Percent	Cum.
1-Access to finance	9,110	15.68	15.68
2-Access to land	1,530	2.63	18.32
3-Business licensing and permits	1,588	2.73	21.05
4-Corruption	3,744	6.45	27.50
5-Courts	569	0.98	28.48
6-Crime, theft and disorder	3,288	5.66	34.14
7-Customs and trade regulations	1,567	2.70	36.83
8-Electricity	8,163	14.05	50.89
9-Inadequately educated workforce	4,314	7.43	58.31
10-Labor regulations	2,218	3.82	62.13
11-Political instability	4,848	8.35	70.48
12-Practices of competitors in the info	7,856	13.52	84.00
13-Tax administration	1,813	3.12	87.12
14-Tax rates	5,963	10.27	97.39
15-Transport	1,517	2.61	100.00
Total	58,088	100.00	

in this section I consider firm-level data and control for industry fixed effects. Specifically, I obtain indicators of industry turnover and firm productivity and relate them to indicators of barriers to business.

Anecdotal evidence — or the perusal of survey questionnaires such as the World Bank’s Entrepreneurship Surveys — suggest that there are many different sources of barriers to economic activity: red tape (for example, the number of procedures required to set up a new firm); availability of infrastructures (for example, the reliability of water and electricity supply); corruption (for example, the need to bribe officials in order to obtain an export license); financing constraints (for example, availability and cost of credit); and so forth. Some of these conditions are obstacles to the creation of a firm; some are an obstacle to post-entry growth and survival; and many are both (e.g., financing constraints).

The World Bank and other data sources provide a wealth of country-level measures of barriers to business. Not surprisingly, we observe a high level of correlation among these measures, which makes statistical analysis difficult. My strategy is to consider barriers to business which (a) are important, (b) can be quantified, and (c) I can find data for. Specifically, I consider two barriers to business, one primarily a barrier to entry, one primarily a barrier to survival.

Regarding barriers to entry, I consider the cost of starting a new business. I follow the methodology pioneered by LaPorta et al (2000), where the cost of starting a new business includes both the monetary cost and the opportunity value of time (divided by per-capita income).

Table 1 depicts survey answers to the question, “What is the most serious obstacle affecting the operation of this establishment?” As can be seen, access to finance comes out

Table 2
Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
age	39692	16.83228	17.17173	0	205
productivity	8244	2.634956	1.183109	-2.652903	8.647682
startcost	39692	54.24792	48.35967	9.7	310.5
interestrate	33741	5.335262	9.802397	-32.00046	42.06884
creditrates	39032	46.80165	34.55943	8.832066	167.1985

as the top reason.¹ consistently with that, I measure access to credit as an indicator of barriers to survival. I consider both the difficulty in obtaining credit, measured by the ratio of private domestic credit over GDP; and the cost of credit, measured by the real interest rate.

As for dependent variables, I consider firm age as an (inverse) indicator of industry turnover. In fact, the greater industry turnover the lower the average firm age. Additionally, following the methodology presented in Asker, Collard-Wexler and DeLoecker (2011), I obtain an estimate of firm productivity.²

As data sources, I combine three different World Bank datasets: (a) Enterprise Surveys, (b) Doing Business, and (c) Development Indicators and Global Development Finance.³ From the first data set (a firm-level data set), I obtain firm age as the difference between survey year (a14y in the Enterprise Surveys questionnaire) and the year the firm started its operations (b5). From this questionnaire I also obtain information on the firm's industry (a4) and country (a1). From the second data set I obtain a country-level measure of entry cost (monetary entry cost divided by per capita GDP plus number of days required to process entry divided by 250, my estimate of the number of working days in a calendar year). Finally, from the third data set I obtain country-level data on the real interest rate and the ratio of domestic private credit over GDP.

In this way I created a dataset of about 40,000 firm-level observations. Table 2 presents summary statistics of the main variables. There is considerable variation both in terms of firm age and productivity and in terms of country-level barriers to business. The coefficients of variation are all about 1. The cost of starting a business, for example, can be as low as 9.7% of per capita GDP (Romania) or as high as 3.105 times per capita GDP (Cambodia). The real interest rate varies from a negative 32% (Guyana) to a positive 42% (Brazil). The credit rate varies from 8.8% of GDP (Malawi) and 167% of GDP (Spain).

Broadly speaking, there are two hypothesis regarding barriers to business that one would like to test. First, the idea that some barriers to business decrease firm turnover (increase firm age) whereas other barriers to business increase firm turnover (decrease firm age). Specifically, barriers to business that affect primarily the creation of a business should decrease firm turnover, whereas barriers to business that affect primarily firm survival increase

1. Two other factors come close in importance: electricity supply and competition by the informal sector. Unfortunately, it is not easy to find good data on these.

2. I use the first estimate proposed by Asker, Collard-Wexler and DeLoecker (2011).

3. All of these datasets are available at <http://databank.worldbank.org/>. Last visited November 2011.

Table 3

Barriers to business and firm age (with industry fixed effects).

Linear regression, absorbing indicators	Number of obs =	33641
	F(3, 33610) =	38.83
	Prob > F =	0.0000
	R-squared =	0.0425
	Adj R-squared =	0.0417
	Root MSE =	17.15

age	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
startcost	-.0102604	.0029523	-3.48	0.001	-.016047	-.0044738
interestrates	.0268157	.010145	2.64	0.008	.0069312	.0467002
creditrates	.0297832	.0034536	8.62	0.000	.023014	.0365524
_cons	16.08376	.2788055	57.69	0.000	15.53729	16.63023

Table 4

Barriers to business and firm productivity (with industry fixed effects).

Linear regression, absorbing indicators	Number of obs =	7564
	F(3, 7538) =	139.19
	Prob > F =	0.0000
	R-squared =	0.0939
	Adj R-squared =	0.0909
	Root MSE =	1.1161

productivity	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
startcost	.0004898	.0003338	1.47	0.142	-.0001645	.0011442
interestrates	-.0252781	.0020511	-12.32	0.000	-.0292988	-.0212574
creditrates	.0071095	.0005538	12.84	0.000	.0060238	.0081952
_cons	2.394334	.0472151	50.71	0.000	2.301779	2.486889

Table 5

Economic effects: regression coefficient of x on y times σ_x/σ_y . Source: Tables 2, 3, and 4.

	age	productivity
startcost	-0.03	0.02
interestrate	0.02	-0.21
creditrates	0.06	0.21

firm turnover. So I would expect the cost of starting a business to be positively related to firm age. Regarding the variables relating to financing barriers, it is difficult to take an ex-ante stance as they potentially affect both the creation and the survival of a business.

Table 3 displays the results of the regression of age on the various measures of barriers to business. In this (and the next) regression I control for industry fixed effects. The coefficient on *start* has the opposite sign to what theory would predict: a higher barrier to the creation of a new firm should lead to a lower entry rate and consequently a higher average firm age. Notice however that the economic effect is rather small. This can be seen from Table 5, where I measure the effect of a one standard deviation increase in each independent variable in terms of standard deviations of the dependent variable. The coefficient of -0.03 thus means that a one standard deviation increase in the cost of creating a new firm leads to a decrease of .03 of a standard deviation of firm age, a rather small effect. Still, the effect is opposite to the theoretical prediction and is significantly different from zero. One possible explanation for the “wrong” sign is that the variable *start* may be correlated with omitted variables that lead to higher industry turnover (and thus lower firm age).

Table 3 also suggests that the real interest rate has a positive impact on firm age, that is, a negative impact of firm turnover. This is consistent with the interpretation that a higher rate of interest has primarily a negative impact on the firm’s entry decision. However, I note again that the economic effect is rather small (if statistically significant): a one standard deviation increase in the real interest rate changes firm age only by .02 standard deviations.

Finally, an increase in the credit rate (that is, the ratio of domestic private credit over GDP) leads to higher firm age, that is, lower industry turnover. This is consistent with the interpretation that difficult access to credit (a lower value of *creditrates*) implies that firms are more likely to exit (involuntarily), thus increasing the turnover rate and decreasing average firm age. The coefficient is significant and the economic effect is greater than the previous ones, though still small: a one standard deviation increase in the credit rate is associated to a .06 standard deviation increase in firm age.

I next turn to the results on the effects of barriers to business on firm productivity. Theory would predict that the higher the barriers to business the worse the average productivity level, either because there is less industry turnover or because the turnover is of the “bad turnover” type (mainly consisting of involuntary exit). In other words, I would expect a negative coefficient on *start* and *interestrate* and a positive coefficient on *creditrates*.

The results on Table 4 are partly consistent with theory. As with the regression for firm age, the coefficient of start-up cost on firm productivity has the wrong sign. However, it is neither statistically significant nor economically significant. By contrast, the coefficients on *interestrate* and on *creditrates* have the expected sign, are statistically significant, and

correspond to a very significant economic effect: a one standard deviation of either variable leads to a change of about .21 standard deviations of the dependent variable.

Reduced form analysis has the benefit of direct measurement of the variables of interest. However, it is limited by potential biases introduced by omitted variables, not to mention measurement error. As an alternative strategy, I next turn to developing a theoretical model of entry, survival and exit. This will allow me to formalize the hypotheses mentioned earlier regarding the effect of barriers to business on industry turnover and productivity. Moreover, a calibration of the model's parameters provides an alternative estimate of the impact of barriers to business on productivity.

3. Model

In this section, I propose a simple theoretical model of firm entry and exit. It follows the tradition started by the seminal work of Jovanovic (1992), who considered a competitive industry where each entrant gradually learns its type upon entry. My model also follows Hopenhayn (1992) by considering a stationary equilibrium where the entry rate equals the exit rate. One important difference with respect to these models is that I explicitly consider a barrier to survival that leads to involuntary exit, that is, exit that takes place by an exogenous reason and not because the firm's discounted present value is negative.

Consider an industry in steady state equilibrium. There is an infinite supply of atomless ex-ante undifferentiated entrants. Specifically, potential entrants know they are of some type θ but only know the distribution $F(\theta)$. Upon entry, that is, having paid the entry sunk cost and the first period fixed cost, a new entrant learns its type θ . (Unlike Jovanovic, 1982, I assume learning takes place immediately.) At the end of the each period, each firm must decide whether to remain active or exit. Moreover, with probability λ each firm is subject to a shock that leads to involuntary exit. We thus have both voluntary and involuntary exit.⁴

Notice that, since a firm's type is revealed during the first period, in a steady-state equilibrium all voluntary exit takes place during the first period. In other words, if a firm decides to remain active in the first period, it also decides to remain active in all subsequent periods. Let $x = x(p)$ be the fraction of firms that decide to exit, where p is equilibrium price. In what follows I will simply write x , though it should be understood that x is endogenous and a function of market price.

For simplicity, I will follow the notation convention whereby exogenous parameters are denoted by Greek characters, whereas endogenous variables are denoted by Roman characters. (For functions, I will combine Greek and Roman characters so as to follow common usage.) In addition to θ and λ , the set of exogenous parameters includes the entry cost ψ , and the discount factor δ . Regarding functions, I denote firm profit by $\pi(q; \theta, p)$ and market demand by $D(p)$, both of which are exogenously given. Finally, with respect to endogenous variables, we have x , the voluntary exit rate; p and q , market price and firm output; Q , total output; n , the measure of new entrants in each period; m , the total measure of active firms in each period; and $r \equiv 2n/m$, the steady-state measure of industry turnover turnover

4. I will assume λ is independent of firm size or age, though a simple extension of the model could include those possibilities.

(notice that, in the steady state, the number of exiters is equal to the number of entrants, so $r = (n + n)/m$).

4. Results

The fraction of new firms surviving past the first period is given by $(1 - \lambda)(1 - x)$. This corresponds to a measure $n(1 - \lambda)(1 - x)$. Hence, the measure of new firms exiting is given by $n(1 - (1 - \lambda)(1 - x))$. The measure of old firms exiting in each period is in turn given by $(m - n)\lambda$.

In a steady-state, the measure of incoming firms must be equal to the measure of exiting firms:

$$n = n(1 - (1 - \lambda)(1 - x)) + (m - n)\lambda$$

Solving with respect to n yields

$$n = \frac{\lambda}{1 - (1 - \lambda)x} m \quad (1)$$

It follows that the equilibrium turnover rate is given by

$$r \equiv \frac{2n}{m} = \frac{2\lambda}{1 - (1 - \lambda)x} \quad (2)$$

Recall that x is an endogenous variable. Hence, when measuring the impact of barriers to entry (ψ) and barriers to survival (λ) on the turnover rate (r), we must take into account both the direct effect and the effect through changes in x , the voluntary exit rate. I now turn to the derivation of x .

In each period, an active type θ firm chooses output to maximize $\pi(q; \theta, p)$. Let q^* be the maximand, which I assume is unique, and let $\pi^*(\theta, p)$ be the optimum level of profit, which I assume is increasing in θ and p .

Expected firm value conditional on survival after the first period is given by

$$\frac{\pi^*(\theta, p)}{1 - \delta(1 - \lambda)} \quad (3)$$

where δ is the discount factor. It follows that a firm with sufficiently low θ prefers to exit even if it is not forced to. Let $\theta' = \theta'(p)$ be the threshold value of θ below which the firm voluntarily exits, that is, θ' is given by $\pi^*(\theta', p) = 0$; and let $x(p) = F(\theta')$ be the probability of voluntary exit.

Expected value upon entry and conditional on $\theta > \theta'$ is given by (3). If in turn $\theta < \theta'$, then expected value upon entry is simply $\pi^*(\theta, p)$. Together, this implies that ex-ante expected payoff for an entrant is given by

$$\begin{aligned} & \int_{-\infty}^{\theta'(p)} \pi^*(\theta, p) dF(\theta) + \frac{1}{1 - \delta(1 - \lambda)} \int_{\theta'(p)}^{-\infty} \pi^*(\theta, p) dF(\theta) = \\ & = \int_{-\infty}^{+\infty} \pi^*(\theta, p) dF(\theta) + \frac{\delta(1 - \lambda)}{1 - \delta(1 - \lambda)} \int_{\theta'(p)}^{-\infty} \pi^*(\theta, p) dF(\theta) \end{aligned}$$

The equilibrium free entry condition is therefore given by

$$\int_{-\infty}^{+\infty} \pi^*(\theta, p) dF(\theta) + \frac{\delta(1-\lambda)}{1-\delta(1-\lambda)} \int_{\theta'(p)}^{+\infty} \pi^*(\theta, p) dF(\theta) = \psi \quad (4)$$

where ψ is entry cost.

I am now ready to present my first theoretical result.

Theorem 1. *Equilibrium industry turnover is (a) decreasing in entry barriers, and (b) increasing in survival barriers (the latter provided λ is sufficiently low or sufficiently high).*

The proof may be found in the Appendix. Part (a) of Theorem 1 confirms the conventional wisdom that barriers to entry lead to lower turnover rates. It is also consistent with the theoretical results in Asplund and Nocke (2007). To the extent that barriers to entry lower social welfare (which they do in a competitive model) and to the extent that barriers to entry are the main source of variation, we may also conclude that higher levels of industry turnover are associated to higher levels of social welfare.

The novel part of Theorem 1 is that survival barriers may *increase* the level of industry turnover. Since survival barriers decrease social welfare, this result breaks the link between industry turnover and social welfare which would result from entry barriers alone. Moreover, to the extent that entry barriers and survival barriers are correlated across countries, the simple regression of industry turnover on entry barriers is likely to suffer from an omitted variable bias.

It is instructive to understand why part (b) of Theorem 1 is only a possibility result. An increase in λ has two effects. The direct effect (partial derivative of r with respect to λ) simply states that an increase in the rate of involuntary exit results in an increase in the exit rate, which is part of industry turnover. But there is also an indirect effect: survival barriers are a barrier to entry as well. In other words, a potential entrant, looking ahead at higher survival barriers, is less likely to enter an industry. In this sense, an increase in λ reduces the entry rate, which is also part of industry turnover. Which of the two effects is higher?

Theorem 2. *Average industry productivity is decreasing in entry barriers and in survival barriers.*

The above results imply an interesting corollary, in line with the theory of second best. Let r^* be the turnover rate corresponding to the “natural” levels of ψ and λ . Since we consider a competitive industry, social welfare is maximum in this situation (see, for example, Hopenhayn, 1990, 1992); thus r^* is the optimal turnover rate, that is, the turnover rate corresponding to the socially optimum levels of ψ and λ . Suppose now that the current equilibrium level of r is lower than r^* . Then an increase in λ brings r closer to the welfare optimum level but is nevertheless welfare decreasing. This is a standard second-best result; cf Lipsey and .

To be completed

5. Calibration

In what follows, I consider specific functional forms and calibrate parameter values. My goal is twofold. First, the second part of Theorem 1 is simply a possibility result: whether survival barriers lead to higher turnover rates is an empirical question. Second, any welfare analysis of the impact of entry and survival barriers requires specific functional forms for demand and cost functions.

■ **Firm profits.** Suppose that each firm's cost is given by

$$C(q; \theta) = \frac{1}{2\theta} q^2 \quad (5)$$

It follows that the profit function is given by

$$\pi(q; p, \theta) = p q - \frac{1}{2\theta} q^2 - \phi$$

The first-order condition for profit maximization is

$$q = \theta p \quad (6)$$

It follows that optimal profit is given by

$$\pi^*(p, \theta) = \frac{\theta}{2} p^2 - \phi \quad (7)$$

■ **Voluntary exit.** The indifferent firm is given by $\pi^*(p, \theta) = 0$. From (7), this results in

$$\theta' = \frac{2\phi}{p^2} \quad (8)$$

It follows that the probability of voluntary exit is given by

$$x(p) = F\left(\frac{2\phi}{p^2}\right) \quad (9)$$

■ **Equilibrium price.** The free-entry condition (4) becomes

$$\bar{\theta} \frac{p^2}{2} - \phi + \frac{\delta(1-\lambda)}{1-\delta(1-\lambda)} \int_{\frac{2\phi}{p^2}}^{+\infty} \left(\theta \frac{p^2}{2} - \phi\right) dF(\theta) = \psi \quad (10)$$

Notice that the left-hand side is monotonically increasing in p , ranging from a negative value for $p = 0$ to ∞ when $p = \infty$. It follows that there exists a unique p that solves (10), and moreover $p > 0$.

■ **Demand and consumer surplus.** Suppose market demand is linear, $Q = \alpha - p$. Given p , we obtain Q . Moreover, consumer surplus is given by

$$\int_p^{+\infty} Q(z) dz = \frac{1}{2} (\alpha - p)^2 \quad (11)$$

■ **Total supply and number of active firms.** Total supply is given by total output supplied by new firms plus total output supplied by old firms. A firm of type θ supplies θp . A young firm's θ is randomly drawn from the population, thus the average θ is $\bar{\theta}$. Old firms' θ are greater than $\theta' = \frac{2\phi}{p^2}$, thus their average θ is given by $\int_{\theta'}^{+\infty} \theta p dF(\theta)/(1 - F(\theta'))$. Therefore, total supply is given by

$$Q = n\bar{\theta}p + (m - n) \int_{\theta'}^{+\infty} \theta p dF(\theta)/(1 - F(\theta')) \quad (12)$$

From (1), we obtain

$$m - n = m - \frac{\lambda}{1 - (1 - \lambda)x} m = \frac{(1 - \lambda)(1 - x)}{1 - (1 - \lambda)x} m \quad (13)$$

Substituting (13) for $m - n$ in (12), as well as (1) for n , (8) for θ' ; and taking into account that $1 - F(\theta') = 1 - x$, I get total supply

$$Q = \frac{p}{1 - (1 - \lambda)x} \left(\lambda\bar{\theta} + (1 - \lambda) \int_{\frac{2\phi}{p^2}}^{+\infty} \theta dF(\theta) \right) m$$

and thus a measure of active firms given by

$$m = \left(\frac{p}{1 - (1 - \lambda)x} \left(\lambda\bar{\theta} + (1 - \lambda) \int_{\frac{2\phi}{p^2}}^{+\infty} \theta dF(\theta) \right) \right)^{-1} Q \quad (14)$$

■ **Turnover rate.** Given m , the value of n is determined by (1). Industry turnover, in turn is given by $r = 2n/m$.

■ **Productivity and welfare.** Given the simplified nature of my model, total factor productivity is simply given by output divided by cost, that is, $y = q(p, \theta)/C(q; p, \theta)$.⁵ Substituting (6) for q and simplifying we get $y = 2/p$.

Total welfare is given by consumer surplus, profits by new firms (net of entry costs), and profits by old firms.

$$W = \int_p^{+\infty} Q(z) dz + n \left(\int_{-\infty}^{+\infty} \pi^*(p, \theta) dF(\theta) - \psi \right) + (m - n) \left(1 - F(\theta'(p)) \right)^{-1} \int_{\theta'(p)}^{+\infty} \pi^*(\theta, p) dF(\theta) \quad (15)$$

For the particular functional forms considered above, consumer surplus is given by (11), where p is given by (10). The measure of active firms, m , is given by (14). From this and (1), I get n ; and from (13), $m - n$. Finally, π^* is given by (7) and θ' by (8).

■ **Parameter values.** The parameter values I use in my base simulation are listed in Table 6. Since I can arbitrate price and output units, I normalize price units so that the fixed

5. Suppose that output is given by $q = \sqrt{\theta L}$, where L is quantity of labor. Normalize units such that wage (which I assume is constant) equals $\omega = \frac{1}{2}$. Then the cost function is given by (5). Moreover, labor productivity q/L is equal to output per cost unit.

Table 6

Calibrated parameter values.

Parameter	Description	Value
δ	discount factor	0.9
μ	average of θ	1
σ	standard deviation of θ	1
ϕ	fixed cost	1
α	demand intercept	1.2
λ	involuntary exit rate	0.015
ψ	entry cost	1.25
σ_λ	st. dev. involuntary exit rate	0.012
σ_ψ	st. dev. entry cost	1.11

cost ϕ is equal to 1, and I normalize output units so that μ , the average of θ (firm type) is also equal to 1. Empirical evidence on the firm-size distribution in various industries suggests a log-normal distribution and a coefficient of variation of about 1 (cf Cabral and Mata, 2003). Since output is proportional to θ , I assume θ is distributed according to a log-normal distribution with $\mu = 1$ and standard deviation $\sigma = 1$. As to the discount factor, I consider a value of $\delta = .9$.

This leaves me with three parameters: α , λ and ψ . I calibrate the demand intercept α so that demand elasticity is equal to -1. This yields the value $\alpha = 8.64$. Finally, I calibrate the entry and survival barriers parameters so as to satisfy two conditions. First, from Bartelsman et al (2009), I compute an average turnover rate of $r = 11.7\%$. Second, total investment in the economy where my firms live is given by $n\psi$, whereas the investment rate (investment divided by total sales) is $n\psi/(m\pi^*(p;\mu)) = n\psi/(mp^2)$. The average investment rate across all economies for which data is available is about 20%.⁶ Accordingly, I determine the values of ψ and λ so that (a) the turnover rate is about $r = 11.7\%$ and (b) the investment rate is about $n\psi/(mp^2) = 20\%$. Accordingly I set $\lambda = 0.015$ and $\psi = 1.25$ (which yields $r = 11.82\%$ and $\psi/(mp^2) = 20.19\%$).

For simulation purposes it is also helpful to estimate the standard deviation of λ and ψ . I do so as follows. From Bartelsman et al (2009), I estimate a standard deviation of turnover rates of 3.04%. Model simulation reveals that industry turnover is an approximately linear function of λ , with $r \approx 2.4\lambda$. This leads to an estimate of $\sigma_\lambda = 1.17\%$. Regarding entry barriers, the data presented in Section 2 indicates a coefficient of variation of 0.8915, therefore my estimate of standard deviation is $\sigma_\psi = 0.8915 \times 1.25 = 1.11$

6. Numerical results

Recall that part (b) of Theorem 1 only establishes a possibility result; I cannot guarantee as a general result that r is increasing in λ . The first step in simulating the model consists

6. See http://www.photius.com/rankings/economy/investment_2011.0.html

Table 7

Regressions of r on ψ along (coefficient β) and ψ and λ (coefficients β_1 and β_2) based on randomly generated observations from the calibrated model. Each column corresponds to a different level of correlation between ψ and λ . p values under coefficient estimates.

	Correlation between ψ, λ :		
Coefficient	0	.3	.6
β	-0.0146	-0.0031	-0.0063
p value	0.002	0.509	0.216
β_1	-0.0158	-0.0149	-0.0154
p value	0.000	0.020	0.000
β_2	184	206	195
p value	0.000	0.000	0.002
n	100	100	100

of confirming that r is indeed increasing in λ for relevant parameter values. I performed a series of simulations and in all of them obtain r increasing in λ (if fact, r almost linear in λ).

■ **Omitted variable bias.** One might think that the absence of a negative, statistically significant relation between r and ψ is due to measurement error and small samples. I next argue that this is probably not the case, rather what we have is a case of omitted variable bias together with a positive correlation between ψ and the omitted variable, λ . To see this, in Table 7 I present the results from a series of regressions. I first generate three sets of 100 observations from the model, each corresponding to a different degree of correlation between ψ and λ : 0, 0.3 and 0.6. For each dataset I run two different linear regressions: one of r on ψ alone and one of r on ψ and λ . The regression models with ψ and λ produce very similar coefficient estimates regardless of the correlation between ψ and λ . Regressing r on ψ alone produces an estimate of β that is close to β_1 when the correlation between ψ and λ is zero. However, when ψ and λ are positively correlated, then the regression of r on ψ alone produces a lower coefficient and a lower level of statistical significance. To be completed

Several previous studies have attempted to relate regulatory variables (which are thought to be related to ψ and λ) to the level of industry turnover. For example, Brandt (2004) reports that “none of the estimated coefficients measuring the relation between regulation indicators and hazard rates are significant” (p 17). My analysis above suggests that this may simply be the result of an omitted variable bias.⁷

In addition to the omitted variable bias, my analysis of barriers to entry and barriers to survival implies that the impact of barriers to business on industry turnover is in general uncertain. The reason is that many barriers to business are both a barrier to entry and a barrier to survival. For example, previous studies have shown that financial constraints

7. Not all studies fail to uncover a statistical relation. For example, Scarpetta et al (2002) find that burdensome regulation on entrepreneurial activity as well as high costs of adjusting the workforce seem to negatively affect the entry of new small firms.

matter both for the entry and the post-entry growth of small firms. Specifically, Aghion et al (2007) argue that

Many countries, including those in Continental Europe, should improve their financial markets so as to get the most out of creative destruction, by encouraging the entry of new (especially small) firms and the post-entry growth of successful young businesses.

In this context, it is not clear what the effect of lowering this barriers is on industry turnover. Do better financial markets lead to greater industry turnover? Maybe, or maybe not. Empirically, the results from the reduced form regressions in Section 2 suggest that the effect of financing constraints is primarily to create a barrier to survival, whereby more barriers to credit lead to higher industry turnover; but conceptually the opposite could also be the case.

■ **Barriers to business, turnover and productivity.** What is the effect of barriers to business on firm turnover and productivity? Table 8 summarizes the simulation of industry equilibrium under four possible scenarios of barriers to business: the base case, where λ and ψ are set at their mean values, μ_ψ and μ_λ ; a high entry barriers case, where $\psi = \mu_\psi + \sigma_\psi$; a high survival barriers case, where $\lambda = \mu_\lambda + \sigma_\lambda$; and a high barriers to business case, where $\psi = \mu_\psi + \sigma_\psi$ and $\lambda = \mu_\lambda + \sigma_\lambda$.

Table 8 presents three indicators of interest. First, industry turnover, which is about 12% in the base case, increases to nearly 20% when survival barriers increase by one standard deviation and drops to about 9% when entry barriers increase by one standard deviation. If both entry barriers and survival barriers increase by one standard deviation, then industry turnover increase by about 3.5%. In other words, the calibrated model results suggests that, on average, the effect of survival barriers dominates that of entry barriers when it comes to explaining industry turnover. This is broadly consistent with the empirical results described in Section 2.

These results speak to the literature on barriers to business and degree of entrepreneurship. The idea of entrepreneurship as the engine of growth goes back at least to Schumpeter (1946). The degree of entrepreneurship is frequently measured by the rate of entry and exit of firms (industry turnover). The natural next step in this line of reasoning is to state that higher turnover rates are associated to higher growth rates. Various authors have attempted to estimate this relation empirically, but the results have been rather mixed. For example, Johansson (2005) reports that “the turnover rate of firms is found to have a significant positive effect on industry growth,” but Audretsch and Fritsch (1996) find rather mixed evidence.⁸ The above results regarding the relation between ψ , λ and r suggest that, to the extent that ψ and λ are positively correlated, it should not be surprising that no statistical relation is found.

In terms of effects on productivity, Table 8 suggests that a one-standard deviation increase in survival barriers decreases productivity by about 2.5%. However, a one-standard deviation increase in entry barriers decreases productivity by 11.2%. So, while survival

8. They find a positive relation in the U.S. but not in Germany. Mixed results are also obtained by Fritsch (1996).

Table 8

Barriers to business, firm turnover and productivity

Parameter / variable	Base case	High λ	High ψ	High λ, ψ
ψ	1.25	1.25	2.36	2.36
λ (%)	1.50	2.70	1.50	2.70
Industry turnover (%)	11.82	19.36	9.15	15.19
Involuntary exit (%)	23.96	25.37	31.43	33.16
Productivity loss (%)	0.00	2.58	11.20	13.99

barriers seem to dominate the effect on industry turnover, entry barriers seem to dominate the effect on productivity. Finally, note that a simultaneous increase in both entry barriers and survival barriers has an effect on productivity that is approximately additive. In other words, while the cross-partial derivative of productivity loss with respect to barriers to business is positive it is also close to zero.

7. Robustness and extensions

My theoretical and empirical analysis suggests that firm turnover is both a misguided policy goal and a misleading performance measure. The reason is that, in addition to barriers to entry, one must also consider barriers to survival; the latter are typically positively correlated with the former but have the opposite effect on turnover rates. This implies that (a) the relation between barriers to entry and firm turnover is likely to be too noisy to be of any relevance; and (b) the relation between firm turnover and industry performance is also likely to be insignificant.

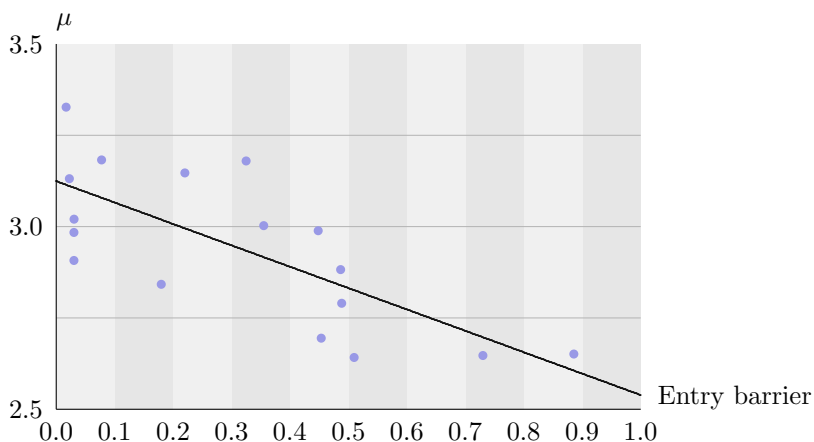
The work of Bloom and van Reenen (2010) and Bloom et al (2011) shows that (a) there is a high correlation between firm productivity and management quality, and (b) management quality depends on a number of country and industry characteristics. While the effect of barriers to entry on industry turnover is empirically difficult to detect, for the reasons described above, the welfare effect of entry barriers should be unequivocally negative. In particular, given the positive correlation between entry barriers and barriers to survival, high entry barriers are typically associated to “bad turnover,” the situation where a firm’s survival is determined by “luck” (good contacts, corruption, etc) rather than productivity and quality.

One way to test the above prediction is to relate entry barriers to average management quality at a country level. Figure 2 does that using the data described in Bloom and van Reenen (2010).⁹ As expected, we find a negative relation, significant both economically and statistically. For example, a country with barriers to entry of 0.9 (as is the case of India) is expected to have a level of management quality that is about 15% lower than a country with a barrier to entry close to zero.

9. The data consists of 5850 observations from 17 countries: Australia, Brazil, Canada, China, France, Germany, Great Britain, Greece, India, Italy, Japan, Northern Ireland, Poland, Portugal, Republic of Ireland, Sweden, U.S.

Figure 2

Entry barriers and management quality. Source: Bloom and Van Reenen and author's calculations (dependent variable); Djankov et al (independent variable). Regression slope has a p value of 0.0007



8. Conclusion

In a recent book on entrepreneurship, Baumol et al (2007) stress the difference between “good” and “bad” capitalism. They also remind us that not all entry corresponds to entrepreneurship. Along similar lines, I argue that there is “good” turnover and there is “bad” turnover. For these reasons, it is incorrect to use industry turnover as a target variable or as an indicator of how entrepreneurial a given industry or economy is. That notwithstanding, my analysis suggests that barriers to business are unequivocally barriers to productivity, either because they increase bad industry turnover or because they decrease good industry turnover.

Appendix

Proof of Theorem 1: Let $p^* = p^*(\lambda, \delta, \psi)$ be the value of p that solves the free entry condition (4). By definition, $\pi^*(\theta'(p), p) = 0$. This implies that the partial derivative of the left-hand side of (4) with respect to p is positive (since profits are increasing in market price). Moreover, straightforward derivation shows that the left-hand side of (4) is increasing in δ and decreasing in λ , whereas the right-hand side is increasing in ψ . Together, this implies that p^* is increasing in ψ and λ , and decreasing in δ .

Straightforward derivation of (2) shows that $\partial r / \partial \lambda > 0$ and $\partial r / \partial x > 0$. Moreover, $\partial r / \partial x \rightarrow 0$ as $\lambda \rightarrow 0$. Since $\pi^*(\theta, p)$ is increasing in p , both $\theta'(p)$ and $x(p)$ are decreasing in p .

Now consider an increase in ψ . From (4) and the discussion above, we conclude this results in an increase in p , which in turn results in a decrease in x , which in turn results in a decrease in r .

Consider now an increase in λ . In this case, I must consider both the direct effect of a change in λ as well as the effect through changes in x . The direct effect on r , given by $\partial r / \partial \lambda$, is positive. However, from (4), an increase in λ leads to an increase in p , which in turn leads to a decrease in x , which in turn leads to a decrease in r , an effect of opposite sign to the previous one. I next show that when $\lambda = 0$ or $\lambda = 1$ then the indirect effect is zero, resulting in a total effect that is positive. Specifically,

$$\frac{dr}{d\lambda} = \frac{\partial r}{\partial \lambda} + \frac{\partial r}{\partial x} \frac{dx}{d\lambda} = \frac{1-x}{(1-x(1-\lambda))^2} + \frac{\lambda(1-\lambda)}{(1-x(1-\lambda))^2} \frac{dx}{d\lambda}$$

The first term is positive for all values of λ . Since $tderx\lambda$ is finite, the second term is zero for $\lambda = 0$ or $\lambda = 1$. ■

Proof of Theorem 2: Given the simplified nature of my model, total factor productivity is simply given by output divided by cost, that is, $y = q(p, \theta) / C(q; p, \theta)$. In fact, suppose that output is given by $q = \sqrt{\theta L}$, where L is quantity of labor. Normalize units such that wage (which I assume is constant) equals $\omega = \frac{1}{2}$. Then the cost function is given by (5). Moreover, labor productivity q/L is equal to output per cost unit. Substituting (6) for q and simplifying we get $y = 2/p$. It follows that price is a sufficient statistic for productivity (both firm productivity and average industry productivity). To be completed ■

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