Evaluating the Effects of Entry Regulations and Firing Costs on International Income Differences*

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Abstract

This paper analyzes the effects of entry regulations and firing costs on cross-country differences in income and productivity. We construct a general equilibrium industry-dynamics model and evaluate it using the cross-country data on entry costs and firing costs. Entry costs lower productivity through making the establishment size inefficiently large, and firing costs lower productivity through reducing the reallocation of labor from low-productivity establishments to high-productivity establishments. We show that the quantitative effect of extreme costs, which we find for some countries in the data, can be substantial.

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JEL Classifications: D24, E23, J65, L11, O11

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1 Introduction

Continuous reallocation is an important feature of well-functioning market economies. Production resources are reallocated from low-productivity production units to high-productivity production units, promoting aggregate productivity growth. Recent empirical studies document that this process is quantitatively very important. For example, Foster, Haltiwanger, and Krizan (2001, Table 8.4) attribute about half of the multifactor productivity growth in the U.S. manufacturing sector during 1977-1987 to a broad sense of reallocation: 34% due to the change in output shares across plants and 24% due to the entry and exit of plants.

In this paper, we make an attempt to quantify the effects of barriers to factor reallocations on the aggregate total factor productivity (TFP). Many researchers attribute the main cause of the large differences in per-capita income across countries to differences in TFP.[1] One important research question is how institutional and policy differences contribute to the TFP differences.

Several recent studies, such as Hsieh and Klenow (2007) and Restuccia and Rogerson (2008), analyze how the costs of reallocation affect aggregate TFP. Our contribution here is that we consider *quantitatively measurable* barriers for many countries. In particular, we look at two types of barriers: entry barriers and labor reallocation barriers. In the past studies, the barriers are hypothetically given in the model (Restuccia and Rogerson) or measured as "wedges" compared to the frictionless allocation (Hsieh and Klenow).[2] We utilize the direct measures of these barriers from the World Bank's "Doing Business" dataset. We take the entry and exit process seriously by building a model with endogenous entry and exit, while the aforementioned two studies assume exogenous entry and exit. We mainly consider the problem of labor reallocation, in contrast to Hsieh and Klenow (2007) who mainly analyze the capital reallocation.

The analysis of entry cost is motivated by a large literature in development economics

[1] See, for example, Klenow and Rodríguez-Clare (1997).

[2] Alfaro, Charlton, and Kanczuk (2007) conduct an analysis similar to Hsieh and Klenow (2007) for a large set of countries.

which emphasizes the importance of entry regulations. For example, Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002), using an earlier version of the "Doing Business" dataset, describe how entry regulations in many forms differ across countries. Starting from de Soto's (2000) influential study, it has been argued that these difference in the costs of entry have important implications for cross-country differences in income and productivity. However, economists have not reached a consensus on the quantitative importance of these costs. We construct a general equilibrium model of industry dynamics, based on Hopenhayn and Rogerson (1993), to quantitatively evaluate the effect of these costs.[3]

In our analysis, we consider two different types of entry costs. First is the monetary cost of starting up: this includes the monetary cost of legal registration, which was 31 times the monthly minimum wage in de Soto's (2000) garment workshop. Second is the time cost of red tape—in many developing countries it takes time to legally start up a new operation. De Soto (2000) documents that, for example, registering a small garment workshop with one worker in Peru took 289 days with six hours of work every day. This is a substantial amount of labor cost, provided that the entering establishments tend to be very small.

In most of the paper, we consider an establishment to be the fundamental production unit. This is a natural choice given the description of the entry cost data (the entry cost has to be paid for each location of production). Many empirical studies in development economics deal with the firm-level data (some of which we compare with our model in Section 6). The distinction between an establishment and a firm may not make a significant difference given that over 95% of U.S. firms (in March 2005) are single-establishment firms,[4] but this would be an important distinction to make when the ownership structure is crucial (for example, in the analysis of the credit constraint). In our analysis, the ownership structure is not essential,

[3]Some other recent papers, which we became aware of after completing our first draft, also examine the effect of entry cost in industry-dynamics models using the "Doing Business" dataset. Poschke (2006) considers a model with technology choice upon entry and analyzes the productivity differences between the U.S. and Europe. Barseghyan and DiCecio (2009) analyzes a model which features a deterministic evolution of productivity for surviving firms.

[4]The data source is the Business Employment Dynamics from the Bureau of Labor Statistics. See, for example, `http://www.bls.gov/bdm/sizeclassqanda.htm`.

and we focus on the establishment level.

The effects of the firing cost have been extensively analyzed in the macroeconomics literature, starting from Bentolila and Bertola (1990) and Hopenhayn and Rogerson (1993). The past analysis, however, is almost exclusively carried out in the context of comparisons of U.S. and European labor markets. Lagos (2006) points out that the labor market policies such as firing costs can affect measured aggregate TFP. This insight, however, has not been put into a quantitative analysis. In our dataset (which is described in Section 2), we see that several poor countries have extremely large firing costs. This suggests that the firing cost may be an important source of low TFP in some countries.

One important aspect of our analysis is that we focus on the *formal* sector. It is well known that in many poor countries there is a large informal sector. A part of our measure of barriers—for example, the cost of legal registration—does not apply to firms in the informal sector. We focus on the formal sector not because we believe that the informal sector is unimportant, but because we view this analysis as the first step. The informal sector is different from the formal sector in many aspects, and incorporating the informal sector makes the analysis substantially more complex. In this paper, we obtain sharp theoretical predictions from the model by leaving out the complex issues of the informal sector. An important next step is to incorporate the informal sector—clearly, firms may decide to enter informally to avoid entry costs and firing costs.

Our model analysis provides a sharp prediction regarding the establishment size distribution. Although cross-country data on establishment distribution is difficult to obtain, we compare our prediction to studies of firm size distribution. As we discuss in Section 6, the results are mixed. This calls for further investigation into the study of firm size and the establishment size distribution in developing countries.

The paper is organized as follows. In the next section, we describe the "Doing Business" dataset and provide a overview of the entry costs and the firing costs across countries. Section 3 sets up the model and calibrate it to the U.S. data as the benchmark. Section 4 describes the

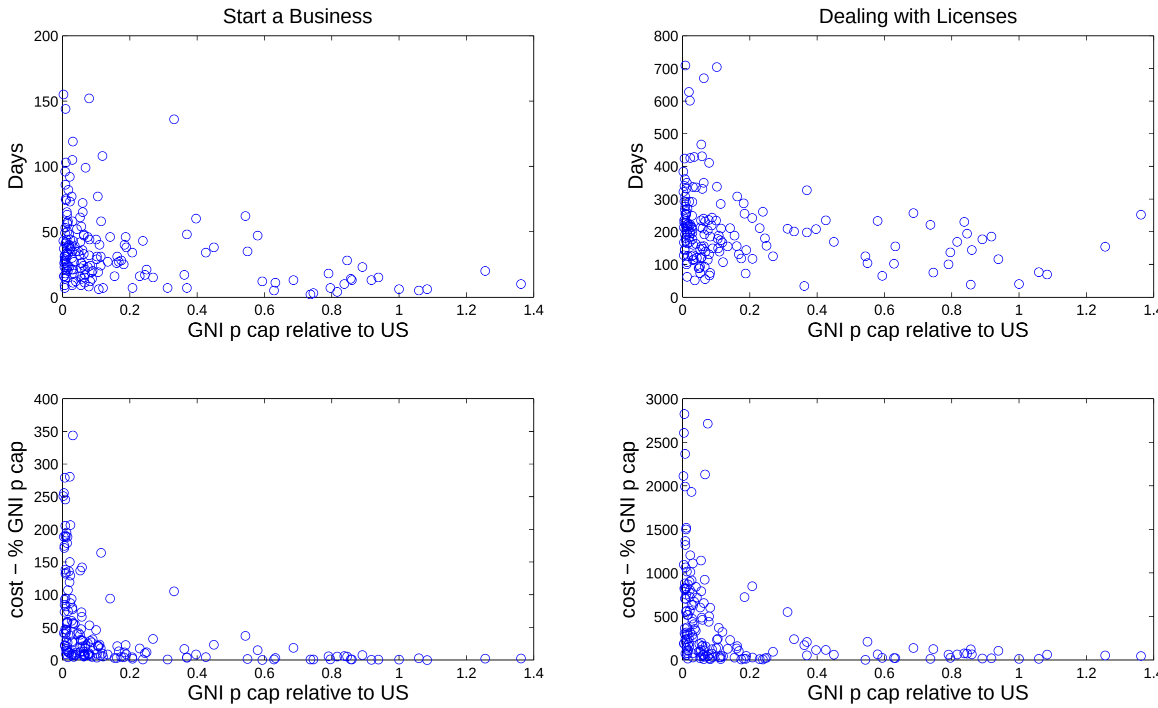

Figure 1: Time and cost of starting a business and dealing with licenses, against Gross National Income (GNI) per capita

results. In Section 5, we extend the model to include the capital stock. Section 6 compares the model outcome to the available cross-country micro-level data. Section 7 concludes.

2 Entry frictions and firing costs around the world

We utilize the "Doing Business" dataset created by the World Bank, which measures different aspects of business regulations across countries. The information collected covers a wide variety of regulations having to do with opening, operating and closing a business. It measures the cost in resources, time, and number of procedures that is related to these regulations. An attractive aspect of this database is its international comparability, achieved by reporting the cost of the opening, operating and closing of a standardized firm, which is set up in the same way across countries.

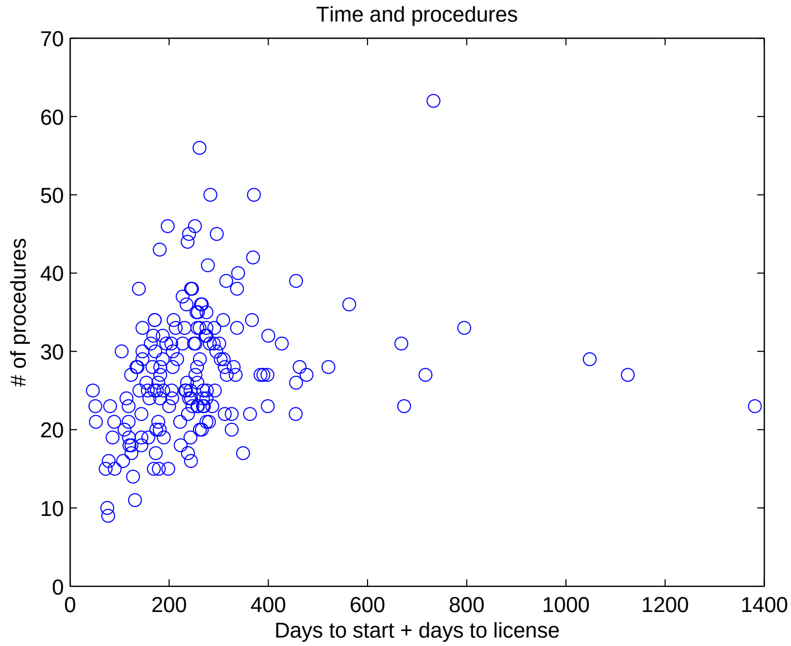

Figure 2: Relation between time and the number of procedures necessary to start a business

Figure 1 plots our entry cost measures against the Gross National Income (GNI) per capita.[5] The GNI per capita is scaled relative to the U.S. GNI per capita. The entry cost consists of two parts: the cost of starting (incorporating) a business (left panels) and the cost of dealing with licenses (right panels). Each cost consists of two parts: the time spent (upper panel) and the monetary cost (lower panel). As is discussed in de Soto's (2000) garment workshop experiment, the "time" is not just a waiting time but rather the firm has to actively work on the procedures. This can also be seen from Figure 2, which plots the relationship between the sum of the "time" measures of the entry cost and the number of procedures necessary to start a business (which is also available in the "Doing Business" dataset). The positive relationship suggests that the "time" reflects the amount of work that is required. In the quantitative model, we assume that the period "one day" here implies the cost equivalent to the labor cost (wage) of one worker for one day.

[5]In all of the figures in this section, the tail of the distribution is cut out for the presentation.

There is substantial variation of these entry cost measures across countries. In the U.S., the monetary cost of starting is effectively zero (0.7% of per-capita GNI). In some countries, this cost is considerable: in Sierra Leone the cost is over 1,000% of per-capita GNI, and in Congo and Liberia it is close to 500% of per-capita GNI. In the U.S. the time period for starting a business is zero days. In some countries, it can take a very long time: in Yemen it takes more than 2,000 days, and in Syria it takes about 10 years to complete the process of starting a business.

The cost of obtaining a licence—which is a cost of setting up a warehouse, including obtaining the necessary licenses and permits, completing required notifications and inspections, and obtaining utility connections—also displays large differences. The monetary cost is negligible in the U.S., at 13% of per-capita income. This has even larger variation than the start-up cost: in Liberia it costs more than 600 times per-capita income, and in Zimbabwe it costs more than 100 times per-capita income. The time cost is also substantial in some countries. In Haiti, it takes more than 1,000 days.

In Figure 3, we add up (after adjusting for units) all of the costs in Figure 1. This is the entry cost measured in the unit of annual wage. Here, the monetary costs are interpreted as % of the wage rather than % of the GNI per capita (as in the actual data), so it deviates from the actual cost as much as the wage deviates from the GNI per capita. However, we believe that this is a fairly good approximation.[6] We denote this as κ in the following. Therefore, the entry cost is κw, where w is the annual wage.

Note that no country above 40% of the GNI per capita of the U.S. has $\kappa > 5$. Only at the lower end of the distribution do we observe large starting costs, going up to above 600 in the case of Liberia.

For the firing costs, we use the direct measure that is included in the "Doing Business" dataset. This measures the cost of advance notice requirements, severance payments, and

[6] In the model calibration, the benchmark value of total earnings per period is 0.6 times the wage. Since the benchmark labor share is 0.64, the output (which corresponds to the GNI per capita here) is the total earnings times 1/0.64, which is about 94% of the wage. Therefore the wage and the GNI per capita in the benchmark case can be viewed as approximately the same.

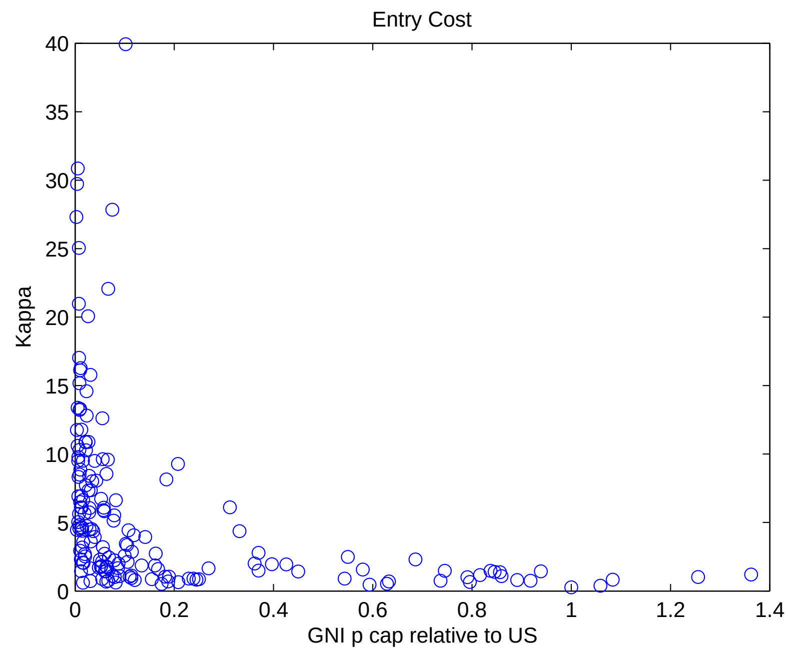

Figure 3: Total entry cost in wage units

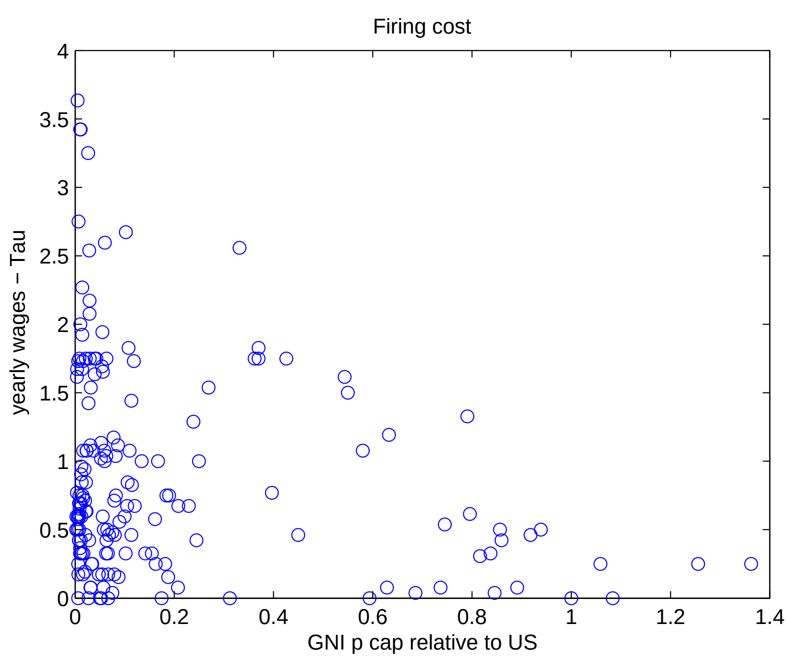

Figure 4: Firing costs in yearly wages

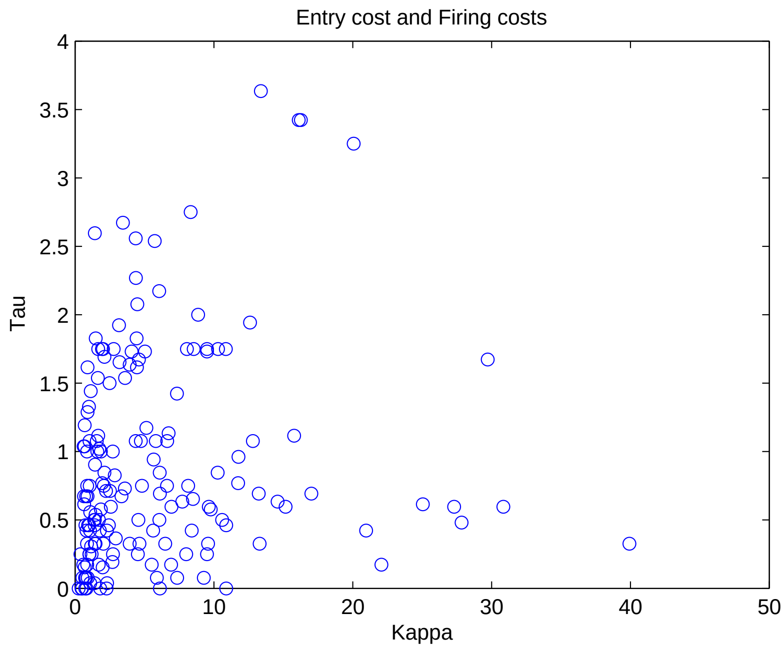

Figure 5: Relationship between starting costs (κ) and firing costs (τ)

penalties due when terminating a worker. It is measured in the unit of weekly wages in the dataset, and we convert it to annual wages. We denote it τ. Firing costs (τ) also have an interesting pattern when depicted against income. That relationship is shown in Figure 4. Here only at the lower end of the distribution do we observe firing costs above 2 times yearly wages. At an extreme, it is not possible to fire workers in Bolivia and Venezuela. Firing a worker requires more than 8 years of firing costs in Zimbabwe. In the U.S. the firing cost is zero.

Finally, in Figure 5 we show the relationship between κ and τ. The distribution is rather dispersed and not strongly correlated—the correlation coefficient is 0.23. This implies that a high-κ country does not necessarily correspond to a high-τ country, and both of them require separate theoretical examination.

3 Model

In this section, we describe our quantitative model. The model is based on Hopenhayn and Rogerson (1993).

Time is discrete. We set one period to be one year. There are two kinds of entities in the economy: establishments and consumers. The establishments produce the consumption goods for the consumers. The consumers supply labor (the only production factor) to the establishments. The consumers also own the establishments and receive profits.

3.1 Establishments

Here we describe the behavior of the establishments. First, we describe the timing of incumbent establishments. Then, we describe the entrants' timing.

An incumbent establishment starts period t with the individual state (s_{t-1}, n_{t-1}). s_{t-1} is the productivity level of the establishment at period $t-1$. n_{t-1} is its employment level at period $t-1$. The value function of an establishment at this stage is denoted as $W(s_{t-1}, n_{t-1})$.

First, the incumbent draws the fixed cost that is required for continuing the operation, c_f. c_f is an i.i.d. random variable with the distribution $\xi(c_f)$.[7] After observing c_f, the establishment decides whether to exit. We assume that there is a firing cost (in consumption goods) of the amount $\tau w \max\langle 0, n_{t-1} - n_t\rangle$ (where $\tau \geq 0$ and w is the annual wage rate), so an exiting establishment has to pay $\tau w n_{t-1}$ for adjusting the employment down to zero. $\tau \geq 0$ corresponds to the firing cost measure that is described in Section 2.

If the establishment decides to stay, it pays c_f and observes the current period's productivity s_t. The distribution of s_t given s_{t-1} is expressed by the conditional distribution $\eta(s_t|s_{t-1})$. The value function at this point is denoted as $V(s_t, n_{t-1})$. Then it decides the amount of employment in the current period, n_t, and produces. The production function is $f(n_t, s_t)$, which is increasing and concave in n_t.

To enter, the entrant has to pay $c_e + \kappa w$ units of consumption goods as an entry cost. c_e

[7]This type of randomness is necessary to obtain a realistic exit pattern. See the discussions in Lee and Mukoyama (2008). Samaniego (2008) also considers a similar setup.

can be interpreted as the sunk investment. $\kappa \geq 0$, which is completely wasted, measures the additional entry barrier in the unit of annual per capita wages—this is the entry cost measured in Section 2. Next, the entrants draw the initial productivity s_t from the distribution $\nu(s_t)$. Then it decides the employment n_t and produces.

The incumbent solves the Bellman equation

$$W(s,n) = \int \max\left\langle \int V(s',n)d\eta(s'|s) - c_f, -\tau wn \right\rangle d\xi(c_f),$$

and

$$V(s',n) = \max_{n'} \left\{ f(s',n') - wn' - \tau w \max\langle 0, n-n'\rangle + \beta W(s',n') \right\}.$$

Here, β is the discount factor. Let the decision rule of n' be $n' = \phi(s',n)$. Also define the decision rule for exiting as $\chi(s,n,c_f)$: $\chi(s,n,c_f) = 1$ when exiting and $\chi(s,n,c_f) = 0$ when staying.

The entrant's value V^e is calculated as

$$V^e = \int V(s',0)d\nu(s').$$

We assume free entry, therefore

$$V^e = c_e + \kappa w \tag{1}$$

holds in an equilibrium with positive entry.

3.2 Consumers

The representative consumer maximizes the expected utility:

$$\mathbf{U} = E\left[\sum_{t=0}^{\infty} \beta^t [\log(C_t) - AL_t]\right],$$

where $E[\cdot]$ is the expectation operator, C_t is consumption, and L_t is the labor supply. The consumer's discount factor is the same as the establishment's discount factor in the steady-state where C_t is constant. Below we focus on the steady state, so we express both by β. A is a constant parameter. The budget constraint is

$$C_t = w_t L_t + \Pi_t + T_t, \tag{2}$$

where Π_t is the total profit (including the exit value) and T_t is the lump-sum rebate of the firing tax. The first-order condition is

$$\frac{w_t}{C_t} = A. \tag{3}$$

3.3 General equilibrium

From here, we will focus on the stationary equilibrium where all of the aggregate variables are constant. Total profit is given by

$$\Pi_t = Y_t - w_t L_t - F_t - T_t - N_t(c_e + \kappa w_t), \tag{4}$$

where Y_t is total output, given by

$$Y_t = \int f(s_t, \phi(s_t, n_{t-1}))d\mu(s_t, n_{t-1}),$$

where $\mu(s_t, n_{t-1})$ is the (stationary) distribution of establishments that are going to produce at period t (including the new entrants, whose $n_{t-1} = 0$). T_t is the total firing tax:

$$T_t = T_t^p + T_t^x,$$

where T_t^p is the firing tax paid by the establishments which produces period t, and T_t^x is the firing tax paid by the establishments which exits in the beginning of period t.

$$T_t^p = \int \tau w \max\langle 0, \phi(s_t, n_{t-1}) - n_{t-1}\rangle d\mu(s_t, n_{t-1}).$$

From stationarity,

$$T_t^x = T_{t+1}^x = \int\int \chi(s_t, \phi(s_t, n_{t-1}), c_f)d\xi(c_f)\tau w \phi(s_t, n_{t-1})d\mu(s_t, n_{t-1})$$

N_t is the total number of entrants. The total exit value F_t can be calculated by

$$F_t = F_{t+1} = \int\int c_f(1 - \chi(s_t, \phi(s_t, n_{t-1}), c_f))d\xi(c_f)d\mu(s_t, n_{t-1}).$$

From (2) and (4),

$$C_t = Y_t - F_t - N_t(c_e + \kappa w_t).$$

Combining this with (3),

$$\frac{w_t}{Y_t - F_t - N_t(c_e + \kappa w_t)} = A \tag{5}$$

holds. The total labor demand is

$$L_t = \int \phi(s_t, n_{t-1}) d\mu(s_t, n_{t-1}). \tag{6}$$

Since the establishment decision rules are only affected by w_t, we can solve the Bellman equations and obtain the equilibrium w_t from (1). Given the decision rules obtained from the optimization, we can calculate $\mu(s_t, n_{t-1})$ for any given number of entering establishments. Let $\mu^1(s_t, n_{t-1})$ be the stationary distribution when the number of entrants is assumed to be one. Then, $\mu(s_t, n_{t-1}) = N_t \mu^1(s_t, n_{t-1})$ holds. Therefore, given the decision rules and w_t, (5) pins down the equilibrium value of N_t.

3.4 Calibration

We calibrate the model to the establishment-level data in the United States. The data on the establishment distribution is taken from the Statistics of U.S. Businesses (SUSB) dataset.[8] The table is calculated from the 2003–2004 data. Our strategy is to match the model moments with no entry regulation ($\kappa = 0$) and no firing tax ($\tau = 0$) to the U.S. data and use it as the benchmark.[9] Then we will experiment on the effects of the entry regulation and firing tax.

We assume that the production function is

$$f(s_t, n_t) = s_t n_t^{\theta}.$$

As in the standard real business cycles literature, we set $\beta = 0.94$ and $\theta = 0.64$. Following Hopenhayn and Rogerson (1993), we normalize the benchmark value of $w = 1$. This is achieved by setting c_e so that the free-entry condition (1) holds under $w = 1$. We also set the

[8]See `http://www.census.gov/csd/susb/` for more details of this dataset. The cross-sectional tables below are created as a customized table.

[9]In the "Doing Business" dataset, the U.S. entry cost is not exactly zero ($\kappa = 0.27$). Since this is a negligibly small amount, we regard this as zero in this section. In Section 6, we measure all of the κ's as the difference from the U.S. value of κ.

	Data	Model
$1-4$	72.04	72.04
$5-9$	14.03	14.03
$10-19$	7.32	7.32
$20-49$	4.27	4.27
$50-99$	1.37	1.37
$100-249$	0.72	0.72
$249-499$	0.12	0.12
$500-999$	0.06	0.06
$1000-$	0.04	0.03

Table 1: Size distribution of entrants (%), U.S. data and model

benchmark value of $L = 0.6$. This is done by first finding N that satisfy (6) with $L = 0.6$, and then setting A so that (5) holds with this N.

For the stochastic processes, we take the following strategy. First, we discretize the domain of s_t. In particular, we pick the grids of s_t so that the optimal level of employment (without firing tax) at each s_t corresponds to the 1/4, 1/2, and 3/4 point of the cells that are used to tabulate the SUSB dataset.[10] (For the largest cell, we pick $n_t = 1500$.) Then we try to match the model outcome to the cross-section property of the data. The entrant's distribution $\nu(s)$ is set so that the size distribution of the entrants matches the data, as in Table 1.[11]

We calibrate the distribution of c_f, $\xi(c_f)$, to match the exit rates in the data, shown in Table 2. We set $\xi(0) = 0.8$ and $\xi(\bar{c}_f) = 0.045$. $\bar{c}_f$ is a very large value and this in effect acts as the exogenous part of the exit. The rest of the probability is uniformly distributed across $[0, 45]$.

For the transition probabilities of s_t, we first assume that it follows an AR(1) process:

$$\log(s_{t+1}) = a + \rho \log(s_t) + \epsilon_{t+1},$$

[10] We make sure that we have enough grids on n, so that the optimal choice is not constrained by the discreteness of the grid.

[11] Within the cell, we distribute the probabilities equally.

	Data	Model
$1-4$	14.88	16.45
$5-9$	6.72	9.84
$10-19$	5.57	4.50
$20-49$	4.91	4.50
$50-99$	4.58	4.50
$100-249$	4.16	4.50
$250-499$	3.90	4.50
$500-999$	4.25	4.50
$1000-$	4.21	4.50

Table 2: Exit rates (%), U.S. data and model

where $\epsilon_{t+1} \sim N(0, \sigma^2)$. Then, we approximate this on the s grids, in a similar manner as Tauchen (1986). We set $\rho = 0.97$. This value is motivated from the highly persistent employment process in the U.S. manufacturing sector, as documented in Lee and Mukoyama (2008). The value of σ is set so that the total job creation rate (JC rate) becomes similar to the data.[12] a is set at 0.035 and this brings the average size of the total establishments close to the data. Table 3 summarizes the statistics from the U.S. data and the model. Table 4 depicts the size distribution of establishments in U.S. data and the model. Given that the calibration target is only the average value, this shows a very good match.

As is described in Section 2, the cross-country comparison of entry regulations and firing costs comes from the "Doing Business" dataset. The values of κ and τ in the data are described in Section 2.

4 Results

This section describes the results from our experiment. First we change the entry cost parameter (κ) and the firing cost parameter (τ) one by one and then we vary them both at the same time.

[12]Since our model is in a steady state, the total job destruction rate (JD rate) is equal to the total job creation rate.

	Data	Model
Avg size of total establishments	17.6	16.7
Avg size of opening establishments	8.3	9.2
Avg size of closing establishments	9.0	9.0
Entry rate (%)	11.6	10.7
Exit rate (%)	10.2	10.7
Total JC rate (%)	15.8	16.6
JC rate by opening establishments (%)	5.5	5.9
Total JD rate (%)	14.4	16.6
JD rate by closing establishments (%)	5.2	5.8

Table 3: Summary statistics

	Data	Model
$1-4$	48.52	42.14
$5-9$	21.52	22.70
$10-19$	14.24	17.57
$20-49$	9.77	11.44
$50-99$	3.32	4.19
$100-249$	1.87	1.52
$250-499$	0.47	0.32
$500-999$	0.17	0.08
$1000-$	0.10	0.02

Table 4: Size distribution of establishments in U.S. data and model (%)

	Benchmark	$\kappa = 10$	$\kappa = 100$
Y	0.94	0.84	0.57
L	0.60	0.59	0.58
w	1.00	0.90	0.63
Y/L	1.55	1.41	0.99
Y/L^θ	1.30	1.17	0.81
C	0.73	0.66	0.46
Avg size of total establishments	16.7	21.6	50.1
Avg size of opening establishments	9.2	12.2	32.6
Avg size of closing establishments	9.0	12.3	39.0
Entry rate (%)	10.7	9.5	6.0
Exit rate (%)	10.7	9.5	6.0
Total JC rate (%)	16.6	16.2	15.2
JC rate by opening establishments (%)	5.9	5.3	3.9
Total JD rate (%)	16.6	16.2	15.2
JD rate by closing establishments (%)	5.8	5.4	4.7

Table 5: Summary statistics for benchmark, $\kappa = 10$, and $\kappa = 100$

4.1 Entry costs

First we analyze the effect of κ. As we saw in Section 2, there is substantial variation in κ. The smallest is the U.S. (0.3) and the largest is Liberia (616.8). There are 32 countries with $\kappa > 10$ while there are 29 countries with $\kappa < 1$.

Now we analyze how the model behaves with $\kappa = 10$ and $\kappa = 100$, compared to the benchmark. Table 5 summarizes the results. We can see that a larger entry regulation translates into lower productivity through a lower entry rate and larger establishment size. The labor supply is similar across different κ. Fewer entrants mean that the there are fewer establishments in the economy, and thus each establishment hires more workers. Since there are decreasing returns to scale in labor, labor productivity is lower as each establishment with a given s hires more workers. Quantitatively, the effect is substantial—the TFP (Y/L^θ) is nearly 40% less when $\kappa = 100$. This means that in countries like Afghanistan ($\kappa = 214.1$), Burundi ($\kappa = 103.1$), Liberia ($\kappa = 616.8$), and Zimbabwe ($\kappa = 121.1$), the entry cost have a

	Benchmark	$\tau = 2$	$\tau = 8$
Y	0.94	0.79	0.61
L	0.60	0.55	0.48
w	1.00	0.86	0.67
Y/L	1.55	1.44	1.26
Y/L^θ	1.30	1.16	0.97
C	0.73	0.63	0.49
Avg size of total establishments	16.7	18.9	22.6
Avg size of opening establishments	9.2	6.8	6.2
Avg size of closing establishments	9.0	10.9	13.9
Entry rate (%)	10.7	9.2	7.6
Exit rate (%)	10.7	9.2	7.6
Total JC rate (%)	16.6	6.8	4.8
JC rate by opening establishments (%)	5.9	3.2	2.1
Total JD rate (%)	16.6	6.8	4.8
JD rate by closing establishments (%)	5.8	5.3	4.7

Table 6: Summary statistics for benchmark, $\tau = 2$, and $\tau = 8$

significant effect on productivity.

Another interpretation of a high κ is that it is acting as an investment tax. The entry cost c_e can be interpreted as a sunk investment in equipment and structure of the establishment. Increasing κ taxes this investment behavior, and reduces the output-labor ratio.

4.2 Firing costs

Next we analyze the firing costs. In Section 2, we saw that this cost also exhibits a large variation. In the U.S. the cost is zero. In 63 countries, more than 1 year's worth of wages has to be paid to fire a worker. In 15 countries, it is more than 2 years. In Bolivia and Venezuela, it is not possible to fire workers. In Zimbabwe, firing a worker requires more than 8 years of wages as the firing cost.

Table 6 summarizes the results of the experiment with $\tau = 2$ and $\tau = 8$. Here, productivity is lower largely due to the lack of reallocation of workers from unproductive establishments to productive establishments. Job creation and job destruction are substantially smaller relative to the benchmark. Quantitatively, the TFP (Y/L^{θ}) falls by about 25% when $\tau = 8$, which roughly corresponds to Zimbabwe ($\tau = 8.6$).

Interestingly, the size of an opening establishment is smaller with a larger τ, despite a lower wage. The establishments are forward-looking, and they avoid expanding because they would have to pay the firing tax when they shrink again.

Another somewhat interesting observation is that, here, L changes substantially with the firing cost. In this model, the wage w is determined by the free-entry condition, therefore the wage reflects the future profit opportunity for an *opening* establishment. Thus, the substitution effect for the consumer, which works through the change in the wage, reacts to the opening establishment's future profit. That is, when the opening establishment's future profit falls, the wage falls, and the labor supply L declines. The income effect works in the opposite direction for L, and it is related to the productivity of the *average* establishment. Here, the opening establishments face a larger effect of the firing tax than an average establishment. The reason is that because the opening establishments are relatively less productive, and thus more likely to exit in near future. Since they have to pay the firing tax when they exit, they are more heavily taxed than the average establishment. Therefore, the substitution effect prevails in determining L. For the same reason, the exit rate (and therefore the entry rate also) reacts substantially to the firing tax—it taxes the exiting behavior.

To see this, in Table 7, we assume that the exiting establishment are not subject to the firing cost. There, L increases with τ and the entry/exit rates also increase with τ. ($\tau = 2$ and $\tau = 8$ have the same result since there is firing occurs only when establishments exit in both cases.) In particular, for a large value of τ, exiting is an important channel through which τ has an effect on output and productivity.

4.3 Both combined

Table 8 reports the results of the experiments where both κ and τ are changed at the same time. The combination of the both barriers generate a larger effect than a single barrier. Zimbabwe, who is close to the "worst" cell in the experiment ($\kappa = 121.1$ and $\tau = 8.6$), would

	Benchmark	$\tau = 2$	$\tau = 8$
Y	0.94	0.89	0.89
L	0.60	0.62	0.62
w	1.00	0.96	0.96
Y/L	1.55	1.44	1.44
Y/L^{θ}	1.30	1.21	1.21
C	0.73	0.70	0.70
Avg size of total establishments	16.7	19.0	19.0
Avg size of opening establishments	9.2	7.4	7.4
Avg size of closing establishments	9.0	13.2	13.2
Entry rate (%)	10.7	11.4	11.4
Exit rate (%)	10.7	11.4	11.4
Total JC rate (%)	16.6	8.0	8.0
JC rate by opening establishments (%)	5.9	4.4	4.4
Total JD rate (%)	16.6	8.0	8.0
JD rate by closing establishments (%)	5.8	8.0	8.0

Table 7: Summary statistics for benchmark, $\tau = 2$, and $\tau = 8$, when $\tau = 0$ for exiting establishments

almost double the TFP measured by Y/L^{θ} and more than double Y, if these barriers were removed.

In Tables 9 and 10, we divided the countries into four income categories following the World Bank categories. The World Bank distinguishes between High Income Countries (HIC) and developing ones. In turn, Developing Countries are classified as Upper Middle Income Countries (UMIC), Lower Middle Income Countries (LMIC) and Low Income Countries (LIC). Roughly, countries are classified as HIC if their GNI per capita is higher than 25% of the US, UMIC if their GNI per capita falls between 8% and 25% of the US, LMIC if their GNI per capita falls between 2% and 8% of the US and LIC if their GNI per capita is below 2% of the US. Then we calculated the average values of κ and τ by income group, and ran the experiments with these values.[13]

Table 9 compares the model outcome with the data across countries. In terms of output

[13]See the Appendix for details of the countries and values of τ and κ.

	Benchmark	$\kappa = 10$ $\tau = 2$	$\kappa = 100$ $\tau = 2$	$\kappa = 10$ $\tau = 8$	$\kappa = 100$ $\tau = 8$
Y	0.94	0.72	0.50	0.57	0.42
L	0.60	0.55	0.53	0.48	0.47
w	1.00	0.79	0.57	0.63	0.48
Y/L	1.55	1.32	0.95	1.18	0.90
Y/L^{θ}	1.30	1.06	0.76	0.91	0.68
C	0.73	0.58	0.42	0.46	0.35
Avg size of total establishments	16.7	23.4	50.7	26.4	50.7
Avg size of opening establishments	9.2	8.8	22.8	7.6	19.2
Avg size of closing establishments	9.0	14.5	43.1	17.3	46.1
Entry rate (%)	10.7	8.3	5.5	7.1	5.0
Exit rate (%)	10.7	8.3	5.5	7.1	5.0
Total JC rate (%)	16.6	6.6	6.0	4.7	4.6
JC rate by opening establishments (%)	5.9	3.1	2.5	2.0	1.9
Total JD rate (%)	16.6	6.6	6.0	4.7	4.6
JD rate by closing establishments (%)	5.8	5.1	4.6	4.6	4.5

Table 8: Results for various combinations of κ and τ

	HIC		UMIC		LMIC		LIC	
Moment	Data	Model	Data	Model	Data	Model	Data	Model
Output per effective worker	0.93	0.96	0.45	0.94	0.37	0.90	0.15	0.77
Output per worker	0.71		0.26		0.19		0.06	
Formal Enry Rate	0.81	0.92	0.66	0.88	0.62	0.85	0.52	0.71
Business Density	1.91	0.91	1.12	0.86	0.49	0.8	0.09	0.55

Note: All moments are reported relative to the US value. Data on output per worker and effective worker is from Hall and Jones (1999). The Formal Entry rate and Business Density are taken from the 2008 World Bank Group Entrepreneurship Survey and Database. Data in terms of effective workers corresponds to Hall and Jones (1999), where one unit of effective worker equals one unit of human capital.

Table 9: Model vs Data across income groups

Income Level		HIC	UMIC	LMIC	LIC
	Benchmark	$\kappa = 1.4$ $\tau = 0.7$	$\kappa = 3.4$ $\tau = 0.8$	$\kappa = 6.5$ $\tau = 0.9$	$\kappa = 29.9$ $\tau = 1.2$
Y	0.94	0.85	0.82	0.80	0.66
L	0.60	0.57	0.57	0.57	0.55
w	1.00	0.92	0.89	0.86	0.73
Y/L^{θ}	1.30	1.22	1.19	1.14	0.97
C	0.73	0.67	0.65	0.63	0.54
Avg size of total establishments	16.7	18.4	19.4	21.0	30.5
Avg size of opening establishments	9.2	7.8	8.2	8.8	13.0
Avg size of closing establishments	9.0	10.3	11.1	12.3	20.1
Total JC rate (%)	16.6	8.8	8.5	8.1	7.3
JC rate by opening establishments (%)	5.9	4.2	4.0	3.8	3.2
Total JD rate (%)	16.6	8.8	8.5	8.1	7.3
JD rate by closing establishments (%)	5.8	5.5	5.4	5.3	5.0

Table 10: Results for various income levels.

per effective worker (the relevant measure here given that there is no human capital in the model) the model generates a drop in output of around 23% from the US to the LIC, which is about 27% of the observed change in output per effective worker. This decrease in output per worker is entirely explained by changes in measured total factor productivity.

In terms of firm dynamics, the model generates a monotonic drop in Business Density and entry rates.[14] The model generates about half of the drop in formal entry rates as the one observed in the data and is in the right direction in terms of business density for the poorer countries.

Consistent with the figures in Section 2, the values of κ and τ are decreasing in income. In particular, the value of κ varies substantially with income. This is consistent with the finding of Barseghyan (2008), who finds (using instrumental variable regressions) that entry costs have significant effects on productivity and output. The effect of these two costs is significant in the experiments. The total factor productivity falls by more than 20% once we

[14] Both Business Density and formal entry rates are obtained from the 2008 Entrepreneurship survey and database by the World Bank. Business Density is the ratio of registered businesses (the total number of the establishments in the model) to active population (L in the model) and the formal entry rate is the ratio of new formal establishments to incumbent formal establishments (entry rate in the model).

move from high income countries to low income countries.

5 Incorporating capital stock

So far, we have considered a model where the output is produced with only labor input. It is straightforward to extend the model to incorporate the capital stock, as in Veracierto (2001), as long as the reallocation of the capital stock is frictionless across the establishments. We assume that the consumers accumulate capital and rent it to the firms. The establishment production function is now $\tilde{f}(\tilde{s}, k, n) = \tilde{s}k^{\alpha}n^{\theta}$. Here, $\tilde{s}$ is the idiosyncratic productivity level. We assume that $\alpha, \theta \in (0, 1)$ and $\alpha + \theta < 1$ to maintain decreasing returns to scale with respect to k and n at the establishment level.

The establishment's decision of renting capital stock is static, therefore we can analyze it separately. In particular, the value added under the optimal amount of capital, given $\tilde{s}$ and n, is:

$$\pi(\tilde{s}, n) = \max_{k} \quad \tilde{s}k^{\alpha}n^{\theta} - rk = \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right) r^{\frac{\alpha}{\alpha-1}} \tilde{s}^{\frac{1}{1-\alpha}} n^{\frac{\theta}{1-\alpha}}.$$

Here, r is the rental rate of capital. In the steady-state, r is constant at

$$r = \frac{1}{\beta} - 1 + \delta$$

where δ is the depreciation rate of the capital stock, and therefore by re-scaling the productivity shock as

$$s \equiv \left(\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right) r^{\frac{\alpha}{\alpha-1}} \tilde{s}^{\frac{1}{1-\alpha}},$$

we can think of $\pi(\tilde{s}, n)$ as a production function

$$\pi(\tilde{s}, n) = \hat{f}(s, n) = sn^{\frac{\theta}{1-\alpha}}. \tag{7}$$

Thus, once we re-scale s from $\tilde{s}$, the only difference from the production function in the case without capital is the exponent on n: now it is $\theta/(1-\alpha)$. Since $\theta < \theta/(1-\alpha) < 1$, we can still use our baseline model, but with changing the value of θ to a larger number. Note that the quantity of the capital stock at each establishment can be calculated as

$$k = \arg\max_{k} \quad \tilde{s}k^{\alpha}n^{\theta} - rk = \left(\frac{r}{\alpha\tilde{s}n^{\theta}}\right)^{\frac{1}{\alpha-1}}.$$

The total amount of capital stock, K, can be calculated by summing up all k in the stationary distribution of s and n.

Now we assume that $\alpha = 0.27$ and $\theta = 0.64$. We recalibrate the model with these new parameter values[15] (we do not have to deal with $\tilde{s}$ since we can directly calibrate s in the same way as Section 3). The benchmark outcomes are in Tables 11, 12, and 13. They show that we can achieve a fairly good match to the U.S. establishment-level statistics, as before. Then we conduct the same experiments as in Section 4: the results are in Tables 14 and 15.

Interestingly, the effect of the entry cost and the firing cost on the labor productivity Y/L and the measured total factor productivity $Y/(K^{\alpha}L^{\theta})$ (it was Y/L^{θ} in the previous section) are much smaller now, although the wage, job creation/destruction, and entry/exit rates are still substantially affected. This is because the capital stock can be reallocated without frictions even though labor cannot move easily. There is a substantial degree of "substitution" between capital reallocation and labor reallocation. Considering the frictions for the reallocation of capital is beyond the scope of the current paper, but it has significant implications for the productivity effect of the reallocation frictions.

6 Comparison to the cross-country micro data

In Section 4, we found that entry barriers affect productivity through larger firm size, and firing costs affect productivity through less worker turnover. One natural question is: are these predictions consistent with the cross-country firm/establishment level micro data? As Bartelsman, Haltiwanger and Scarpetta (2007) emphasize, it is extremely difficult to obtain *cross-country comparable* micro-level datasets at the firm/establishment level. Here, we will only sketch the suggestive evidence.

[15] This implies that the exponent of n in (7), $\theta/(1-\alpha)$, is 0.88. Atkeson, Khan, and Ohanian (1996) argue that values of this exponent close to 1 are not consistent with the cross-country pattern of job flows.

	Data	Model
$1-4$	14.88	17.03
$5-9$	6.72	10.66
$10-19$	5.57	4.50
$20-49$	4.91	4.50
$50-99$	4.58	4.50
$100-249$	4.16	4.50
$250-499$	3.90	4.50
$500-999$	4.25	4.50
$1000-$	4.21	4.50

Table 11: Exit rates (%), U.S. data and model

	Data	Model
Avg size of total establishments	17.6	17.3
Avg size of opening establishments	8.3	9.2
Avg size of closing establishments	9.0	9.2
Entry rate (%)	11.6	10.9
Exit rate (%)	10.2	10.9
Total JC rate (%)	15.8	15.5
JC rate by opening establishments (%)	5.5	5.8
Total JD rate (%)	14.4	15.5
JD rate by closing establishments (%)	5.2	5.8

Table 12: Summary statistics

	Data	Model
$1-4$	48.52	40.15
$5-9$	21.52	22.36
$10-19$	14.24	18.51
$20-49$	9.77	12.43
$50-99$	3.32	4.54
$100-249$	1.87	1.58
$250-499$	0.47	0.32
$500-999$	0.17	0.08
$1000-$	0.10	0.01

Table 13: Size distribution of establishments in U.S. data and model (%)

	Benchmark	$\kappa = 10$	$\kappa = 100$
Y	0.68	0.62	0.51
K	1.76	1.60	1.31
L	0.60	0.59	0.58
w	1.00	0.92	0.77
Y/L	1.14	1.05	0.87
$Y/(K^{\alpha}L^{\theta})$	0.81	0.77	0.67
C	0.49	0.46	0.38
Avg size of total establishments	17.4	29.9	107.8
Avg size of opening establishments	9.2	17.6	72.8
Avg size of closing establishments	9.2	20.1	107.8
Entry rate (%)	10.9	7.4	4.5
Exit rate (%)	10.9	7.4	4.5
Total JC rate (%)	15.5	14.5	13.4
JC rate by opening establishments (%)	5.8	4.3	3.0
Total JD rate (%)	15.5	14.5	13.4
JD rate by closing establishments (%)	5.8	4.9	4.5

Table 14: Summary statistics for benchmark, $\kappa = 10$, and $\kappa = 100$

	Benchmark	$\tau = 2$	$\tau = 8$
Y	0.68	0.60	0.48
K	1.76	1.55	1.24
L	0.60	0.56	0.46
w	1.00	0.89	0.72
Y/L	1.14	1.07	1.05
$Y/(K^{\alpha}L^{\theta})$	0.81	0.77	0.75
C	0.49	0.44	0.35
Avg size of total establishments	17.4	21.1	22.6
Avg size of opening establishments	9.2	6.1	5.7
Avg size of closing establishments	9.2	13.3	13.3
Entry rate (%)	10.9	7.3	7.6
Exit rate (%)	10.9	7.3	7.6
Total JC rate (%)	15.5	4.9	4.5
JC rate by opening establishments (%)	5.8	2.1	1.5
Total JD rate (%)	15.5	4.9	4.5
JD rate by closing establishments (%)	5.8	4.6	4.5

Table 15: Summary statistics for benchmark, $\tau = 2$, and $\tau = 8$

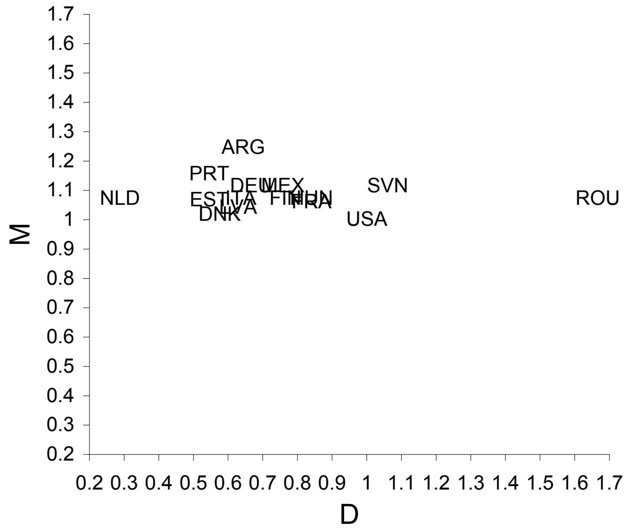

Figure 6: The average size of the firm (establishment) in the model (M) and data (D). Relative to U.S.

There are relatively more cross-country comparisons (including developing countries) in terms of the firm size than the turnovers. Tybout (2000), based largely on Liedholm and Mead (1987), argues that the firm size tends to be smaller in poorer countries. This seems to be at odds with our mechanism. However, Liedholm and Mead's (1987) study includes the informal sector, while our model describes only the formal sector. The informal firms tend to be small and the informal sector is larger in poor countries, thus the existence of the informal sector biases the size-income relationship in the positive direction.

The recent studies by Bartelsman, Haltiwanger and Scarpetta (2007) and Alfaro, Charlton and Kanczuk (2007) look at only the formal sector, and therefore these studies seem to be more comparable to our model. They indeed found that there is a negative relationship between firm size and income across countries. Thus, these studies are *qualitatively* consistent with the results of our model.

To assess whether this prediction is also consistent *quantitatively*, we compare the out-

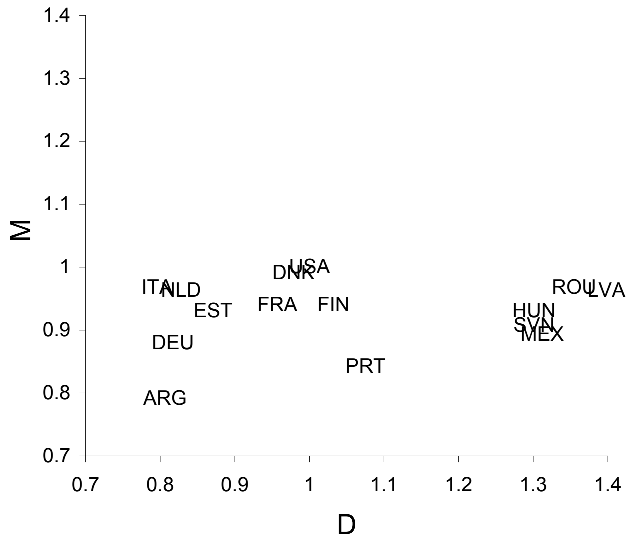

Figure 7: The gross turnover in the model (M) and data (D). Relative to U.S.

comes of our model (with κ and τ taken from the Doing Business dataset[16]) with the data from Bartelsman, Haltiwanger and Scarpetta (2007) in Figure 6. It can be seen that the correlation is very weak (in fact, the correlation coefficient is negative). In particular, the model result varies very little compared to the data. It turns out that the countries that are selected by Bartelsman, Haltiwanger and Scarpetta (2007) are the ones with relatively small κ: the largest is $\kappa = 3.4$ in Argentina. Thus it is difficult for the model to produce a large variation in average size across these countries.

Table 7 plots gross turnover from the data (again, from Bartelsman, Haltiwanger and Scarpetta (2007)) and the model (job creation plus the job destruction). Now the correlation coefficient is positive, but the correlation is very weak. The model again fails to generate the magnitude of the variation in the data. These countries, in fact, exhibit very little variation in τ as well—the largest τ is 2.7 in Argentina.

[16]Here, since the U.S. value of κ is not exactly zero, we subtract the U.S. value of κ from the original value of κ for each country.

In sum, the comparison between the data and the model in terms of size and turnover provides mixed results. The size prediction seems to be consistent with the data qualitatively, but with the currently available micro data with a small set of countries (that exhibit little variation in κ and τ) it is not clear if the model is consistent with the micro-level data quantitatively.

7 Conclusion

In this paper, we evaluated the effects of entry costs and firing costs on income and productivity. We used the World Bank's "Doing Business" dataset and quantitatively analyzed a general equilibrium industry-dynamics model based on Hopenhayn and Rogerson (1993).

We found that extreme values of entry costs and firing cost, found in some countries, can have a substantial effect on income and productivity. In extreme cases, TFP (measured by Y/L^{θ} in our experiment) can almost double and output can more than double if these costs are removed.

We focused on the costs that affect the mobility of labor. Although the main part of our model uses labor as the only input, we also extended the model to incorporate the capital stock. When capital is perfectly mobile, the effect of these costs on productivity is much smaller.

A high entry cost reduces productivity through the wage, which is too low, which makes the average establishment size too large. A high firing cost reduces reallocation of labor from low-productivity establishments to high-productivity establishments. We made an attempt to compare these predictions directly to the micro-level data. However, the results are mixed largely due to the limited availablity of micro datasets.

In our study, we focused only on the formal sector in which the firms have to follow all of the official procedures. Clearly, as official procedures become more burdensome there are more incentives for firms to operate informally. In fact, it is well known that poor countries tend to have large informal sectors. As de Soto (2000) argues, the informal sector itself suffers from various inefficiencies. From the viewpoint of the model, the general equilibrium interaction of formal and informal sectors may generate different outcomes from a model which incorporates only the formal sector. Although incorporating informal sector into our analysis is beyond the scope of this paper, it is an important next step.

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Appendix: Countries list

Low income			Lower middle income		
Country	τ	κ	**Country**	τ	κ
Afghanistan	0.0	214.1	Albania	1.1	5.8
Bangladesh	2.0	8.9	Algeria	0.3	1.4
Benin	0.7	6.1	Angola	1.1	15.8
Bhutan	0.2	2.7	Armenia	0.3	4.5
Burkina Faso	0.7	8.5	Azerbaijan	0.4	8.4
Burundi	0.5	103.1	Belarus	0.4	1.8
Cambodia	0.8	4.8	Bolivia	0.0	4.1
Central African Republic	0.4	5.6	Bosnia and Herzegovina	0.6	9.6
Chad	0.7	13.2	Brazil	0.7	2.2
Comoros	1.9	3.2	Bulgaria	0.2	5.5
Congo, Dem. Rep.	0.6	27.3	Cameroon	0.6	14.6
Côte d'Ivoire	0.9	5.7	Cape Verde	1.8	8.1
Ethiopia	0.8	11.8	China	1.8	9.5
Gambia	0.2	6.9	Colombia	1.1	6.7
Ghana	3.4	16.1	Congo, Rep.	0.6	7.7
Guinea	0.5	4.6	Djibouti	1.1	12.8
Guinea-Bissau	1.7	29.7	Dominican Republic	1.7	2.1
Haiti	0.3	13.3	Ecuador	2.6	1.4
India	1.1	6.6	Egypt	2.5	5.7
Kenya	0.9	1.4	El Salvador	1.7	3.2
Kyrgyz Republic	0.3	6.5	Fiji	0.0	1.1
Lao PDR	0.4	2.9	Georgia	0.1	0.7
Liberia	1.6	616.8	Guatemala	1.9	12.6
Madagascar	0.6	9.8	Guyana	1.1	4.7
Malawi	1.6	4.5	Honduras	1.4	7.3
Mali	0.6	15.2	Indonesia	2.1	4.5
Mauritania	0.6	6.9	Iran	1.8	8.6
Mongolia	0.2	0.6	Iraq	0.0	10.9
Mozambique	2.8	8.3	Jamaica	1.2	5.1
Nepal	1.7	5.0	Jordan	0.1	5.9
Niger	0.6	30.8	Kazakhstan	0.2	22.1
Nigeria	1.0	11.8	Kiribati	0.1	7.4
Pakistan	1.7	9.5	Lesotho	0.8	10.3
Papua New Guinea	0.8	2.1	Macedonia, FYR	0.5	1.7
Rwanda	0.5	10.6	Maldives	0.2	0.9

Low income

Country	τ	κ
São Tomé and Principe	1.8	10.3
Senegal	0.7	3.6
Sierra Leone	3.6	13.4
Solomon Islands	0.8	6.1
Sudan	2.3	4.4
Tajikistan	0.4	21.0
Tanzania	0.6	25.0
Timor-Leste	0.3	2.0
Togo	0.7	17.0
Uganda	0.3	9.5
Uzbekistan	0.4	2.3
Vietnam	1.7	4.6
Yemen	0.3	4.6
Zambia	3.4	16.3
Zimbabwe	8.6	121.1
Group Average	**1.2**	**29.9**

Lower middle income

Country	τ	κ
Marshall Islands	0.0	0.7
Micronesia	0.0	1.8
Moldova	0.7	2.5
Montenegro	0.8	6.6
Morocco	1.6	3.9
Namibia	0.5	2.4
Nicaragua	0.5	10.9
Paraguay	2.2	6.1
Peru	1.0	2.7
Philippines	1.8	1.7
Samoa	0.2	1.7
Serbia	0.5	27.8
Sri Lanka	3.3	20.1
Suriname	0.5	6.1
Swaziland	1.0	1.7
Syria	1.5	3.6
Thailand	1.0	0.7
Tonga	0.0	2.3
Tunisia	0.3	9.6
Ukraine	0.3	8.0
Vanuatu	1.1	4.4
West Bank and Gaza	1.8	10.9
Group Average	**0.9**	**6.5**

Upper middle income

Country	τ	κ
Argentina	2.7	3.4
Belize	0.5	1.0
Botswana	1.7	4.1
Chile	1.0	1.9
Costa Rica	0.7	3.4
Croatia	0.8	8.1
Czech Republic	0.4	0.8
Dominica	1.1	1.7
Equatorial Guinea	2.6	4.4
Estonia	0.7	0.6
Gabon	0.8	2.9
Grenada	0.6	1.1
Hungary	0.7	0.9
Latvia	0.3	0.9
Lebanon	0.3	3.9
Lithuania	0.6	1.9
Malaysia	1.4	1.1
Mauritius	0.7	0.8
Mexico	1.0	1.6
Oman	0.1	9.3
Palau	0.0	0.5
Panama	0.8	2.1
Poland	0.3	2.7
Romania	0.2	2.0
Russia	0.3	39.9
Seychelles	0.8	1.1
Slovakia	0.3	1.0
South Africa	0.5	0.9
St. Kitts and Nevis	0.2	0.7
St. Lucia	1.1	1.0
St. Vincent and the Grenadines	1.0	0.6
Trinidad and Tobago	1.3	0.9
Turkey	1.8	4.4
Uruguay	0.6	2.6
Venezuela	0.0	5.0
Group Average	**0.8**	**3.4**

High income

Country	τ	κ
Antigua and Barbuda	1.0	0.9
Australia	0.1	0.8
Austria	0.0	1.4
Belgium	0.3	1.2
Brunei	0.1	0.9
Canada	0.5	1.5
Denmark	0.0	0.8
Finland	0.5	1.4
France	0.6	0.7
Germany	1.3	1.0
Greece	0.5	1.4
Hong Kong, China	1.2	0.7
Iceland	0.3	0.4
Ireland	0.5	0.7
Israel	1.8	1.9
Italy	0.0	2.3
Japan	0.1	0.8
Korea	1.8	2.0
Kuwait	1.5	2.5
Luxembourg	0.8	0.9
Netherlands	0.3	1.5
New Zealand	0.0	0.5
Norway	0.3	1.2
Portugal	1.8	1.5
Puerto Rico	0.0	6.1
Saudi Arabia	1.5	1.7
Singapore	0.1	0.5
Slovenia	0.8	2.0
Spain	1.1	1.6
Sweden	0.5	1.4
Switzerland	0.3	1.0
Taiwan, China	1.8	2.8
United Arab Emirates	1.6	0.9
United Kingdom	0.4	1.1
United States	0.0	0.3
Group Average	**0.7**	**1.4**