Financial Structure, Informality and Development*

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Preliminary

Abstract

This is a theory of total factor productivity based on measurable capital market imperfections and costs of creating and operating formal sector establishments. We develop a firm dynamics model with endogenous formal and informal sectors where firms face a technology adoption opportunity. The model predicts that countries with a lower degree of debt enforcement and higher costs of formality are characterized by the use of inefficient technologies, lower allocative efficiency, bigger share of the labor force in the informal sector and lower total factor productivity. We find that this mechanism is quantitatively important. When frictions are parameterized using the World Bank *Doing Business* database, the model explains up to 60% of total factor productivity differences between the US and developing economies.

Keywords: Financial Structure, Informal Sector, Productivity, Policy Distortions. *JEL Classifications*: D24, E26, L11, O16, O17

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1 Introduction

In this paper, we develop a theory of total factor productivity (TFP) based on measurable institutional differences across countries. In particular, we consider institutional heterogeneity in terms of entry costs to the formal sector, differences in the tax structure (not only tax rates but also cost of tax compliance), and also in the efficiency of debt enforcing mechanisms (measured as debt recovery rate and debt enforcing costs). The question we are after is: how much of the international differences in total factor productivity can be explained by measured costs of doing business?.

We build a model of firm dynamics with endogenous entry and exit that incorporates capital financing and bankruptcy decisions. The model allows for the existence of a formal and an informal sector. Entering and operating in the formal sector is costly, but allows firms to operate advanced technologies, while providing the firms with access to credit markets with better commitment (given by observed recovery rates and associated costs). The degree of debt enforcement varies across countries and affects the interest rate that firms face. Countries have access to the same production possibilities but we impose country-specific institutions, which we base on those measured by the World Bank as reported in its *Doing Business* database. We find that, by increasing capital misallocation, the frictions explain up to 60% of total factor productivity differences between the US and developing economies.

As Figure 1 shows, informal activity is a feature that, around the world, seems to be correlated to productivity and output per worker. Agents involved in the informal sector make explicit efforts not to be detected, which makes measuring the informal sector extremely challenging. Of the various measures of informal activity, we focus on the fraction of the labor force that participates in the underground economy. In the data, it is measured as the share of the labor force that is not covered by a pension scheme. [1]

[1] Other measures include indirect estimates of informal output from energy consumption or money demand or from discrepancies between official and actual employment from household surveys. As a measure of informality, we focus on the the share of labor force not covered by pension schemes because it is available for the largest number of countries, and can be directly compared to our model. Moreover, measures of output have the problem of distinguishing household production from informal output. Schneider and Enste (2000) report various measures of the informal sector across countries, and is the most comprehensive study to our knowledge regarding

The fraction of the labor force that is engaged in production outside of the formal sector ranges from around 10% in developed countries to almost 100% at the low end of the income distribution. Even when measures of informal activity are extremely noisy, such a large sector of the economy cannot be ignored if we want to better understand economic development around the world.

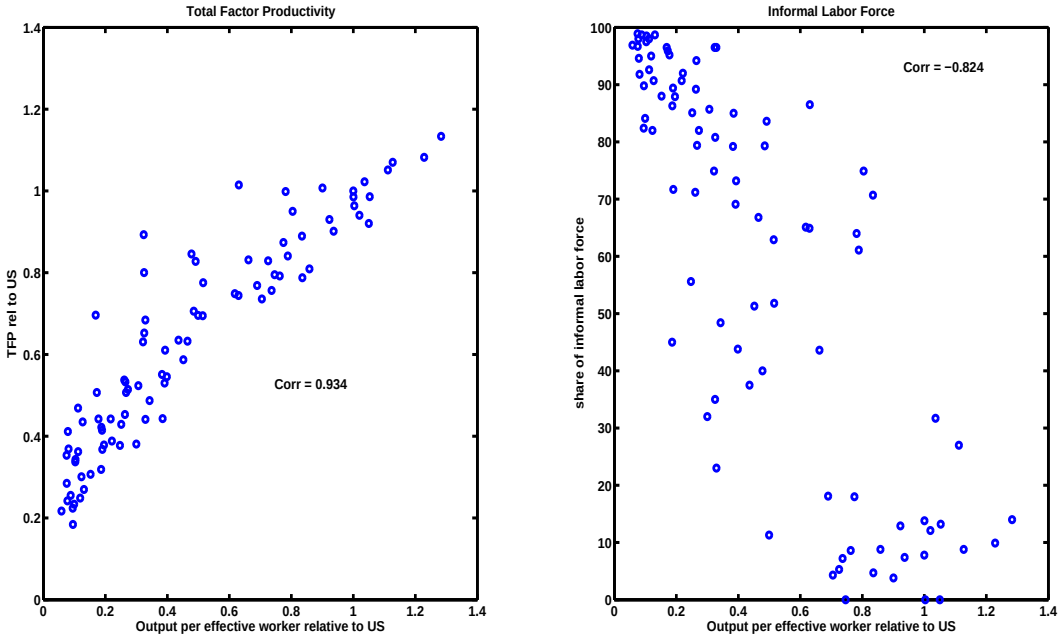

Figure 1: Total Factor Productivity and Size of the informal sector.

Note: Output per effective worker refers to output per unit of human capital as reported by Hall and Jones (1999). Total Factor productivity refers to the value reported by Hall and Jones (1999) raised to the power $(1-\alpha)$. The share of informal labor force corresponds to the share of the labor force not covered by a pension scheme as reported by the *World Development Indicators* 2006

It should not be surprising to observe a large number of firms producing in the underground economy in countries where the costs of entering and operating in the formal sector are extremely high and the benefits (the ability to enforce contracts) are almost negligible. Under these conditions, firms endogenously choose to operate in the informal sector and are subject to restrictions as well. They do not pay taxes, but have limited access to credit markets. When the firm cannot borrow, the size and growth of the firm are limited. That is, production ends up

informality in a cross country setting.

taking place at an inefficient scale and therefore output and productivity are below the optimal levels.

This is not the first paper to link the costs of doing business to the aggregate level of output and productivity. In particular, we trace our steps back to De Soto (2000), which he describes the process by which a firm enters the formal sector in Peru. He argues that costly entry mechanisms in the formal sector prevent firms from producing at an efficient level. He measures the entry cost in time and resources and concludes that one of the reasons production is undertaken in the informal sector has to be the high costs associated with becoming formal. He continues to describe the functions of physical capital, and how it has a "parallel life"as collateral in the formal sector. Under this view, the benefit of formality lies in the ability to use physical capital as collateral with which to secure the interests of third parties in the event of breaches of contract. Using a similar approach, the World Bank launched the "*Doing Business* "project. Under this project, the costs associated with many dimensions of doing business are recorded across countries. They measure, among other things, costs to incorporate a firm, to obtain licenses to operate in a physical location, to hire workers, to pay taxes, and to close the business. The interesting feature of this project is that instead of collecting observed data for each aspect of doing business in a country (which depends on endogenous aspects such as the size of a firm), they run an experiment in which they try to operate the same standardized firm across countries. This way the different costs across countries can be directly compared.

Our approach to firm dynamics originated with Hopenhayn (1992) and Hopenhayn and Rogerson (1993), and is close to Cooley and Quadrini (2001) who studied the effects of financial constraints in a similar set up. Recent related literature on the distributional consequences of frictions in this context include Hsieh and Klenow (2007), Restuccia and Rogerson (2008) and Arellano, Bai, and Zhang (2008). In all cases, they back up the implied frictions in the firm's environment necessary to generate the observed distribution of firms. In this paper, as in Barseghyan and DiCecio (2009) and Moscoso Boedo and Mukoyama (2008), the frictions that the firms face are those observed in the data collected by the World Bank. This paper introduces imperfect capital markets, and along that dimension the most closely related papers include

Antunes and Cavalcanti (2007), Castro, Clementi, and MacDonald (2008), Erosa and Hidalgo Cabrillana (2008), and Quintin (2008). Castro et al. (2008) and Erosa and Hidalgo Cabrillana (2008) study the effects of financial contracts in environments with asymmetric information. Antunes and Cavalcanti (2007) and Quintin (2008) study endogenous informal sectors that result from imperfect contract enforcement. This paper builds on this literature by analyzing a model of firm dynamics with idiosyncratic uncertainty and endogenous technology adoption. We also consider different financial contracts where default costs are constrained by limited liability.

The relevant empirical literature regarding firm dynamics across countries include Tybout (2000), Foster, Haltiwanger, and Krizan (2001), and Alfaro, Charlton, and Kanczuk (2007). Tybout (2000) is the only one that reports data on firm characteristics in the informal sector, while the other two use different data sources but are focused on firms operating in the formal sector.

The paper is organized as follows. In Section 2, we present the institutional differences across countries as measured by the World Bank. We consider differences in the costs of entry to the formal sector, tax codes, and efficiency of the contract enforcement mechanisms. In Section 3 we present the theoretical model, based on Hopenhayn and Rogerson (1993), with physical capital and credit markets. Section 4 describes the stationary equilibrium of the model. Section 5 is devoted to the calibration of the model to the US data. In Section 6, we experiment with different measured institutions and compute their impact in terms of total factor productivity and firm dynamics. Finally, Section 7 concludes.

2 Institutional Differences across Countries

What firms have to do in order to enter, operate in, and exit from the formal sector varies across countries. In order to compare these different costs the World Bank, through its *Doing Business* project, follows a standardized firm across countries and measures regulations to entry, operations, and exit. They measure the costs in terms of time and resources along many dimensions affecting the firm, such as starting a business, getting construction permits, employing workers,

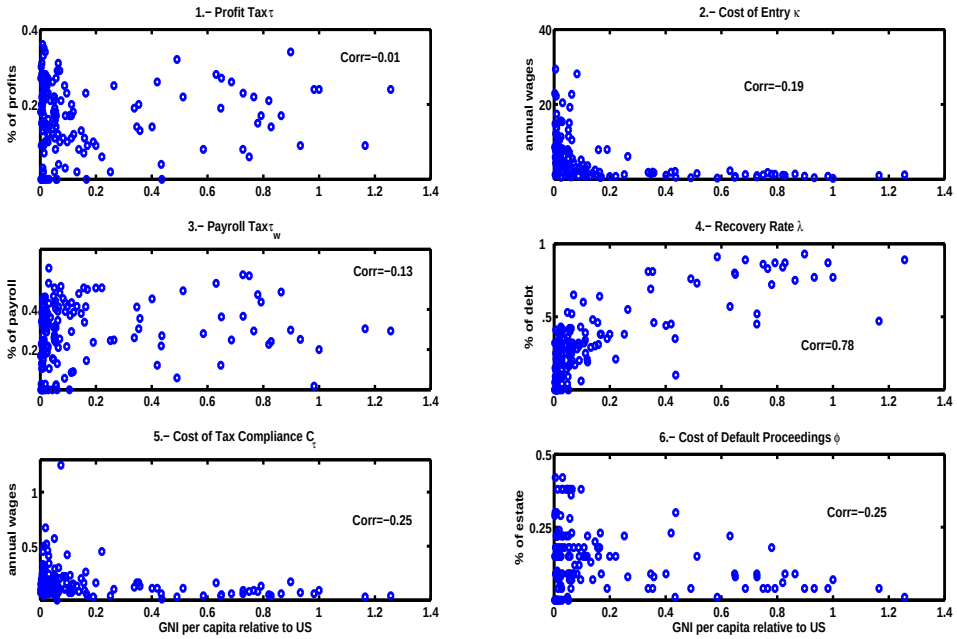

Figure 2: Cost to entry, income tax rate, cost of tax compliance, recovery rate, and cost of default proceedings from the Doing Business Database. Outliers omitted.

obtaining credit, protecting investors, paying taxes, trading across borders, enforcing contracts, and closing a business. Of particular interest to us in this paper are the cost of entering the formal sector, the tax rate and the level of tax compliance difficulty (while operating in the formal sector), and the efficiency of the debt enforcing mechanisms if the firm decides to default on its debt. These costs are depicted in Figure 2 against GNI per capita relative to the US.

The cost of entering the formal sector is constructed as in Moscoso Boedo and Mukoyama (2008). It is the sum of two parts. It includes the costs of incorporating a business and of dealing with licences to operate a physical locale. Both costs have a monetary cost and a time cost (which is translated to monetary units by assuming that one worker has to be employed full time in order for the firm to go through the entry process). The cost of entering the formal sector as a fraction of the wage (denoted by $w\kappa$) varies greatly across countries, with high levels of κ observed only at the low end of the income distribution. Incorporating a business in the US costs 0.7% of GNI per capita, while in Sierra Leone it is over 1000% of GNI per capita. In

terms of time, in the US a business can be started immediately while in Yemen and Syria it takes more than five years to start a formal business. Dealing with licenses also displays great variation across countries. The cost is 13% of GNI per capita in the US and 600 times per capita income in Liberia and 100 times in Zimbabwe. In terms of time, it takes 40 days to obtain a license in the US and up to 1000 days in Haiti.

The tax rate paid on profits by the firms (τ) and payroll taxes (τ_w) do not seem to exhibit a pattern over the distribution of income per capita, as shown by panels 1 and 3 in Figure 2. What does exhibit a similar pattern to the entry cost is the cost of tax compliance (wc_τ). This cost reflects the time that it takes to pay taxes in each country. We assume that there is a full time worker during this time devoted to the tasks related to tax compliance, and therefore translate time into costs as the worker's annual wages. The cost of paying taxes only displays levels above 10 weeks for countries below 20% of the US GNI per capita. Paying taxes takes no time in the Maldives, 12 hours in the UAE, 187 hours in the US, and more than 1000 hours in Vietnam, Bolivia, Belarus, Cameroon, and Brazil. This indicates a great deal of variation across countries in terms of the complexity of their tax code. Firms have to bear not only the tax rate per se but also the cost of complying with the tax code, which at the low end of the income distribution is not insignificant.

Finally, the efficiency of the system in the event of default has two components, a cost component and a recovery rate. The cost of the system (ϕ), reported as a percentage of the estate's value, includes court fees and the cost of insolvency practitioners, such as legal and accounting fees. It ranges from 1% of the estate's value in countries like Norway and Singapore to more than 40% in Sierra Leone, Liberia, and the Ukraine, and above 70% in the Central African Republic. The recovery rate refers to what external lenders obtain once the firm decides to default on its debt (λ). It is effectively zero for many extremely poor countries in sub-Saharan Africa. On the other hand, only in developed countries it is above 75%. Note that this is the return obtained by the external creditor conditional on the borrower defaulting. It measures the cents on the dollar recovered from that point on, and includes different channels to resolve the contract breach such as foreclosure, liquidation, and reorganization, as reported by Djankov

et al (2008).

3 Environment

We build a standard firm dynamics model based on Hopenhayn (1992) and incorporate capital and credit markets as in Cooley and Quadrini (2001). Time is discrete, and we set one period to be one year. There are three kinds of entities in the economy: establishments, lenders and consumers. Establishments produce the consumption and capital goods used in the economy. They are the capital owners and pay dividends to the consumers. Lenders make loans to establishments. Consumers supply labor to the establishments, and receive their profit net of entry costs.

3.1 Consumers

There is an infinitely lived representative consumer who maximizes the expected utility:

$$\mathbf{U} = \mathbb{E}\left[\sum_{t}^{\infty} \beta^t u(C_t)\right],$$

where $E[\cdot]$ is the expectation operator, C_t is consumption and $\beta \in (0,1)$ is the discount factor. The household is endowed with one unit of labor which it provides to the firm at the market wage rate w, and receives the profits of the operating firms and a lump sum transfer from taxes collected on these firms. The consumer is also responsible for the creation cost of new firms. All of the saving and borrowing decisions are made by firms, so effectively the household is not allowed to borrow or save.

3.2 Technology

The unit of production is an establishment. Each establishment is described by a production function $f(z,k,n)$ that combines capital k and labor n. The parameter z represents the productivity of the plant. We assume that the production function has decreasing returns to scale.

In particular, we let $f(z,n,k) = zk^{\alpha}n^{\gamma}$ with $0 < \alpha + \gamma < 1$ and $\alpha, \gamma \in (0,1)$. There are two productivity processes for z: one complex and one simple. The complex process can only be operated in the formal sector, whereas the simple one can be operated in both the formal and informal. This assumption captures features of some production processes that can only be operated in the formal sector. These features include, among others, the protection of intellectual property rights, the need for advertisement and sophisticated contracts with customers and suppliers. Having two technological processes is one of the channels that allows the model to generate capital missallocation together with small informal establishments as observed in the data by Bartelsman et. al. (2008) and Perry et. al. (2007). Each process is described by a productivity distribution $N(\mu_j, \sigma_j)$ and a transition matrix $\eta_j(z'|z)$ where $j = x, s$ for complex and simple. Establishments can only operate one type of technology during their life.

Firms maximize expected discounted dividends d:

$$\mathbb{E}\left[\sum_{t}^{\infty} \beta^t d_t\right],$$

at the rate of the representative consumer's β.

Establishments can be created by paying a cost c_e. After paying this cost, firms observe an initial level of productivity $z_{0,j}$ for each technology. Their initial level of productivity $z_{0,j}$ is drawn from the distribution $\nu_j(z_0)$. Draws from this distribution are assumed to be i.i.d across firms and technologies. With this information in hand, they choose between staying out of the market or operating one of the technologies as a formal or informal firm.

There is a random fixed cost of production c_f, measured in units of output, that is iid across firms and over time with distribution $\xi(c_f)$. A firm that does not pay this fixed cost is not allowed to produce. Establishments own their capital and can borrow from financial intermediaries in the form of non-contingent debt $b \geq 0$. They finance investment with either debt or internal funds.

If the firm operates in the formal sector, it is subject to a proportional tax on profits τ, a cost in labor units of filling those taxes $c_\tau w$, and a payroll tax τ_w. Creating a formal sector

firm requires an entry cost κw. In the calibration, taxes and the costs are set directly from the corresponding measures in the *Doing Business* data set.[2]

3.3 Credit Markets

The credit industry makes loans to the formal and informal sector firms. Creditors are risk-neutral and competitive. Each country behaves as a small open economy where intermediaries can borrow or lend at the exogenous risk-free rate r. Asset markets are incomplete. In each period, firms borrow using only one period non-contingent debt denoted by b. Since there is perfect information, prices depend on firm's characteristics given by their choice of sector (formal or informal), their future level of capital (k'), their level of borrowing (b'), and their current technology (z). In particular, firms in the formal sector will borrow at price $q_j^f(k', b', z)$ and firms in the informal sector will borrow at price $q^i(k', b', z)$. In each period, firms can default on their debt. A default triggers a bankruptcy procedure that liquidates the firm. When making a loan to a formal sector firm, lenders take into account that in the case of default they can recover up to a fraction λ of the original loan. The formal bankruptcy procedure has an associated cost equal to a fraction ϕ of the firm capital. The values of the recovery rate λ and the bankruptcy cost ϕ are obtained from the *Doing Business* database. Because the capital of the informal firm is not legally registered, the recovery rate of a loan to an informal sector firm that defaults is assumed to be zero.

Consistent with bankruptcy law across countries, we follow the limited liability doctrine. This limits the owner's liability to the firm's capital.

[2]While government policies can be endogenous, in this paper we focus on measuring their effects on aggregates and policies are taken as exogenous. However, the equilibrium we find is consistent with the solution to a model that incorporates a one time political game with full commitment and the government optimally chooses the taxes and costs reported by the World Bank.

4 Equilibrium

We focus on the stationary equilibrium of the model. In this equilibrium the wage rate and the schedule of loan prices are constant. Every equilibrium function depends on the set of loan prices and the wage rate. For ease of exposition we avoid making this dependence explicit. Before defining the equilibrium concept we study the problem of the agents in the economy. First, we describe the problem of incumbent establishments in the formal sector and informal sector, respectively. Then, we describe the entrants' problem and the representative consumer's problem.

4.1 Formal Sector Incumbent

An incumbent establishment in the formal sector with technology $j \in \{s, x\}$ (complex or simple respectively), starts the period with capital k, debt b, and previous productivity z_{-1}. Then, the establishment draws the fixed cost that is required for continuing the operation, c_f, and decides to operate the technology, exit after repayment of debts, or default and liquidate the firm. If the establishment decides to exit after repayment, it receives $k - b$. If it decides to default and liquidate the firm, it receives the maximum of the remainder of the capital after paying the recovery rate (net of the costs associated with default proceedings) to the outside investors and zero. The value function of an establishment at this stage is denoted as $W_j^f(z_{-1}, k, b, c_f)$. If it decides to remain in business, it pays c_f and observes the current period's productivity z. The value function of a firm operating in the formal sector is denoted as $V_j^f(z, k, b, c_f)$. If the firm decides to operate, it decides the amount of employment in the current period, n, capital and assets for the following period, k' and b', and produces. Recall that in the formal sector it is then subject to income taxes τ, the cost of preparing those taxes $c_\tau w$, and the payroll tax τ_w.

The incumbent solves the Bellman equation

$$W_j^f(z_{-1}, k, b, c_f) = \max \left\{ \int V_j^f(z, k, b, c_f) d\eta_j(z|z_{-1}), \max\{0, (1-\phi)k - \lambda b\}, k - b \right\}$$

and

$$V_j^f(z,k,b,c_f) = \max_{n,k',b'} d_j^f(z,k,b,c_f) + \beta \int W_j^f(z,k',b',c_f')d\xi(c_f)$$

s.t.

$$\begin{aligned} d_j^f(z,k,b,c_f) = (1-\tau)\left[zk^\alpha n^\gamma - c_f - w(1+\tau_w)\left(n + c_\tau\right)\right] \\ - k' + (1-\delta)k + q_j^f(k',b',z)b' - b \geq 0 \end{aligned}$$

The solution to this problem provides the exit decision rule $\chi_j^f(z_{-1},k,b,c_f)$ that takes the value of 0 if the firm continues to operate, 1 if the firm decides to default, and 2 if the firm decides to exit after repayment. We also obtain the optimal capital and debt decision rules $k_j'^f(z,k,b,c_f)$ and $b_j'^f(z,k,b,c_f)$, respectively, for a firm in the formal sector.

4.2 Informal Sector Incumbent

An incumbent establishment in the informal sector, after observing the fix operating cost c_f, can choose to stay informal, to pay the formal entry cost κw and switch operations to the formal sector, or to exit the market after a default. More specifically, the informal incumbent establishment solves the following Bellman equation [3]

$$W^i(z_{-1},k,b,c_f) = \max\left\{ \int V^i(z,k,b,c_f)d\eta_s(z|z_{-1}), \int \widetilde{V}_s^f(z,k,b,c_f)d\eta_s(z|z_{-1}), k \right\}$$

where the value of remaining in the informal sector is given by

$$V^i(z,k,b,c_f) = \max_{n,k',b'} d^i(z,k,b,c_f) + \beta \int W^i(z,k',b',c_f')d\xi(c_f)$$

[3] We omit the j subscript, given that only the simple technology can be operated in the informal sector.

s.t.

$$d^i(z,k,b,c_f) = zk^\alpha n^\gamma - c_f - wn$$
$$- k^{'} + (1-\delta)k + q^i(k^{'},b^{'},z)b^{'} - b \geq 0.$$

The value of switching to the formal sector is

$$\widetilde{V}_j^f(z,k,b,c_f) = \max_{n,k^{'},b^{'}} \widetilde{d}_j^f(z,k,b,c_f) + \beta \int W_j^f(z,k^{'},b^{'},c_f^{'})d\xi(c_f)$$

s.t.

$$\widetilde{d}_j^f(z,k,b,c_f) = (1-\tau)\left[zk^\alpha n^\gamma - c_f - w(1+\tau_w)\left(n + c_\tau + \kappa\right)\right]$$
$$- k^{'} + (1-\delta)k + q_s^f(k^{'},b^{'},z)b^{'} - b \geq 0$$

The solution to this problem provides the exit decision rule $\chi^i(z_{-1},k,b,c_f)$ that takes the value of 0 if the firm continues to operate in the informal sector, 1 if the firm decides to default, and 2 if it decides to switch its operations to the formal sector. We also obtain the optimal capital and debt decision rules $k'^i(z,k,b,c_f)$ and $b'^i(z,k,b,c_f)$ for a firm operating in the informal sector, and capital and debt decision rules $\widetilde{k}_j'(z,k,b,c_f)$ and $\widetilde{b}_j'(z,k,b,c_f)$ for a firm that switches from the informal to the formal sector.

4.3 Entrants

In order to draw from the pool of ideas, potential entrants pay a creation cost given by c_e. The value of a potential entrant W_e is given by:

$$W_e = \int\int \max_{j=s,x}\left\{W_s^i(z_{0,s},0,0,0), \widetilde{V}_x^f(z_{0,x},0,0,0)\right\} d\nu_s(z_0)d\nu_x(z_0) - c_e.$$

Effectively, an entrant has no capital, no debt, and the cost of production c_f equals zero. The entrant chooses between technologies, conditional on the restriction that the complex technology

cannot be operated in the informal sector. The sector and technological decision are made after paying c_e and observing the productivity level $z_{0,j}$, $j \in \{s, x\}$, which affects the conditional distribution from which the first productivity parameter will be drawn. Differences in the volatility of the process together with differences in initial productivity are going to generate differences in the decisions by the entrants and by the potential lenders. That introduces differences in behavior as a function of volatility and contract enforceability. In equilibrium, $W_e = 0$ will hold.

The solution to this problem provides the entry decision rule $\Xi^e(z_{0,s}, z_{0,x}) \in \{s, x\}$.

4.4 Lenders

Lenders make loans to formal and informal establishments while taking prices as given. Profit for a loan b' to a firm in the formal sector with future capital k', productivity z, and operating the technology $j \in \{s, x\}$ is

$$\pi_j^f(k^{'}, b^{'}, z) = -q_j^f(k^{'}, b^{'}, z)b^{'} + \frac{1 - p_j^f(k^{'}, b^{'}, z)}{1 + r}b' + \frac{p_j^f(k^{'}, b^{'}, z)}{1 + r} \min\left\{\lambda b', (1 - \phi)k'\right\},$$

where $p_j^f(k^{'}, b^{'}, z)$ denotes the default probability of this borrower.

Profit for a loan b' to a firm in the informal sector with future capital k' and productivity z is

$$\pi^i(k^{'}, b^{'}, z) \quad = \quad -q^i(k^{'}, b^{'}, z)b^{'} + \frac{\left[1 - p^i(k^{'}, b^{'}, z)\right]}{1 + r}b'$$

where $p^i(k^{'}, b^{'}, z)$ denotes the default probability of the informal borrower. In equilibrium, the schedule of prices will adjust so $\pi_j^f(k^{'}, b^{'}, z) = 0$ and $\pi^i(k^{'}, b^{'}, z) = 0$ for all (j, k', b', z).

4.5 Consumer's Problem

Because we are looking for the stationary equilibrium, aggregates in the economy are constant. This, and the fact that the consumer supplies its unit of labor inelastically, implies that the

consumer maximizes expected discounted utility subject to the following budget constraint:

$$C = w + \Pi + T - E + X,$$

where Π is the total profit, T is the lump-sum transfer from the income and payrroll taxes, E is the aggregate creation cost, and X is the exit value of firms. Note that the consumer is not making any decision, only receiving transfers, profits, and wages which are consumed period by period.

4.6 Definition of equilibrium

A stationary competitive equilibrium is a set of value functions $\{W_j^f, W^i, V_j^f, V^i, \widetilde{V}_j\}$, decision rules (capital, debt, default, exit and sector), a wage rate w, aggregate distributions of firms in the formal $\vartheta(k, b, z, j; M)$ and informal $\widehat{\vartheta}(k, b, z; M)$ sectors, and a mass of entrants M such that:

1. Given prices, the value function of the firms and the decision rules are consistent with firms' optimization.

2. The free entry condition is satisfied: $W_e = 0$.

3. Lenders make zero profit for every type of loan.

4. Invariant distributions ϑ and $\widehat{\vartheta}$ are stationary.

5. Aggregate consumption: $C = w + \Pi + T - E + X$.

6. The labor market clears:

$$1 = \left(\int n(z,k) d\vartheta(k, b, z, j; M) + \int n(z,k) d\widehat{\vartheta}(k, b, z, j; M) \right).$$

5 Calibration

In this section we calibrate the model to the US economy. The basis for this calibration can be found in Moscoso Boedo and Mukoyama (2008) and D'Erasmo (2009).

The productivity process for the complex technology is given by

$$\ln(z_{t+1}) = (1-\rho)\mu_x + \rho \ln(z_t) + \epsilon_{t+1}$$

with $\epsilon_{t+1} \sim N(0, (1-\rho^2)\sigma_x^2)$, where σ_x^2 is the variance of the process. We assume that the operating fixed cost can take values of $\{0, \widehat{c_f}, +\infty\}$.

The volatility of the complex technology σ_x is set to 0.2305 and the autocorrelation parameter ρ to 0.885 as estimated for the U.S. manufacturing sector by Cooper and Haltiwanger (2006).[4] The process will be discretized to obtain the grid for z and the transition probabilities $\eta_x(z'|z)$ following the method explained in Tauchen (1986). The number of grid points for z is set to 17. From the transition matrix $\eta_x(z'|z)$ we can derive the unconditional probabilities $\eta_x^*(z)$. We set the distribution of initial shocks $\nu_x(z_0) = \eta_x^*(z)$. As a benchmark, given the obvious lack of information about the distribution of establishments in the informal sector, we set $\sigma_s = 0$ so productivity in the simple technology is constant.

The labor share γ is set to 0.64, a standard value, and the capital share is based on previous estimates of the degree of decreasing returns to scale at the firm level. In particular, we set $\alpha = 0.21$, so $\alpha + \gamma = 0.85$ as reported in Restuccia and Rogerson (2008). The risk free interest rate r is set to 4% per year to match the average real return on a 5 year T-bill over the last 30 years. We assume that $\beta = \frac{1}{1+r}$. The depreciation rate δ is set to 7%. The value of the entry cost c_e is calibrated as in Hopenhayn and Rogerson (1993). In particular, we normalize the wage rate to 1 and find the value of c_e that, in equilibrium, satisfies the free entry condition with equality.

The parameters $\{\tau, c_\tau, \tau_w, \kappa, \lambda, \phi\}$ are taking directly from the values reported in the *Doing*

[4]These parameters were estimated from registered manufacturing firms. In the model, the formal sector could include establishments operating both technologies, simple and complex. However, the fraction of simple establishments in the formal sector for the calibrated parameters is negligible.

Business data base for the U.S. economy (see Table 4 below). We set the tax rates $\tau = 0.23$, $c_\tau = 0.09$ and $\tau_w = 0.20$; the entry cost $\kappa = 0.26$; and the bankruptcy parameters to $\lambda = 0.77$ and $\phi = 0.07$.

We are left with five more parameters to calibrate: the mean of the productivity process of the complex and simple technologies μ_x and μ_s respectively, the operating cost $\widehat{c_f}$, and the associated probabilities $\xi(\widehat{c_f})$ and $\xi(\infty)$. To obtain values for these parameters, we target the size of the informal labor force, measured as those workers not covered by a pension scheme (as reported by World Development Indicators 2006), the average size of formal establishments in the U.S. and the exit rates distribution across the size of firms. The data regarding the size distribution of establishments (in the formal sector) and exit rates in the US comes from the *Statistics of US Business* (SUBS) data set for the years 2003-2004. It is the same data used in Moscoso Boedo and Mukoyama (2008).[5]

Table 1 displays the calibrated parameters and a summary of the moments used.

Table 1: Model Parameters

Parameter		Value	Moment (US economy)
Discount Factor	β	0.9615	Avg. yearly return 5-year T-Bill
Depreciation Rate	δ	0.07	Manufacturing Sector
Labor Share	γ	0.64	Labor Share
Capital Share	α	0.21	Degree of Decreasing Returns
Std Dev	σ_x	0.2305	Manufacturing Sector
Autocorrelation	ρ	0.885	Manufacturing Sector
Entry Cost	c_e	0.11	Entry Condition
Mean process	μ_x	$\log(1.62)$	Avg. Operating Establishment
Mean process	μ_s	$\log(0.762)$	Size Informal Sector
Positive Operating Cost	$\widehat{c_f}$	8.0	Exit Rate Distribution
Distribution Op. Costs	$\{\xi(\widehat{c_f}), \xi(\infty)\}$	$\{.10, .042\}$	Exit Rate Distribution

[5] A description of this data set can be found in *http* : *//www.census.gov/epcd/susb/introusb.htm*. *Statistics of U.S. Businesses* basic data items are extracted from the Business Register, a file of all known single and multi-establishment employers maintained and updated by the U.S. Census Bureau. The annual Company Organization Survey provides individual establishment data for multiestablishment companies. Data for single-establishment companies are obtained from various Census Bureau programs, such as the Annual Survey of Manufactures and Current Business Surveys, as well as from administrative records of the Internal Revenue Service, the Social Security Administration, and the Bureau of Labor Statistics.

Table 2 shows moment values from the data, used for the calibration, and those produced by the model.

Table 2: Target Moments

Moment	US Data	Model
Average Formal Est.	17.6	17.6
Informal Sector (fraction Labor Force)	7.8%	7.8%
Exit Rate Distribution by Employment Size	(%)	(%)
1-4	14.88	13.22
5-9	6.72	7.78
10-19	5.57	5.57
20-49	4.91	4.20
50-99	4.58	4.20
100-249	4.16	4.20
250-499	3.90	4.20
500-	4.22	4.20

Note: the size of the informal labor force is measured as those workers not covered by a pension scheme (World Development Indicators 2006). The data regarding the size distribution of establishments (in the formal sector) and exit rates in the US comes from the *Statistics of US Business* (SUBS) data set for the years 2003-2004 (see Moscoso and Mukoyama 2008).

After the calibration exercise is done, we test the model in different dimensions. In particular, we ask how the distribution of entrants and operating establishments generated by the model compare with those of the US. We also contrast the average entry and exit rate. Table 3 shows that the model does a good job in matching the number of small establishments, not only for the operating firms but also for newly created establishments in the formal sector. It is important to note that the distribution of entrants in our model is an endogenous object and not the result of the calibration of initial firm productivity. By construction, the average entry rate and exit rate in the model are identical. Compared to the US data, the model average entry and exit rates are three and two percentage points lower respectively. The distance between the model and data entrant size, entry and exit rates is partly due to the way the data is collected. In the data, establishments are observed at one point in time. Those establishments that are less than one year old, are considered entrants. However, the model counterpart for entrant establishments is defined as those establishments that are exactly one year old.

Table 3: Test of the Model

Employment	Operating Formal Model (%)	US Data (%)
1-4	28.9	48.5
5-9	25.1	21.5
10-19	20.1	14.2
20-49	18.4	9.8
50-99	5.1	3.3
100-249	2.1	1.9
250-499	0.2	0.5
500 +	0.0	0.3
Avg. Size Entrant	14.6	8.3
Entry Rate	8.0	11.1
Exit Rate	8.0	10.2

6 The Effects of Country Specific Institutions

In this paper, we ask whether institutional differences, quantified by differences in the cost of entry to the formal sector, the tax structure, and the efficiency of debt enforcing mechanisms can help explain aggregate productivity differences across countries. Due to the high computational burden of the exercise, we limit the number of observations and group countries by income level following the World Bank's definition. The World Bank distinguishes between High Income Countries (HIC) and Developing Countries. 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.

In order to implement this experiment, we use the *Doing Business* database for the year 2009 to obtain the median $(\lambda, \phi, \tau, c_\tau, \tau_w, \kappa)$ for each income group. Table 4 shows parameter values for the US economy (used in the benchmark calibration) and those of High, Upper Middle,

Lower Middle and Low Income countries.

Table 4: Frictions across income groups

	λ	ϕ	τ	c_τ	τ_w	κ
US	0.77	0.07	0.23	0.09	0.20	0.26
High (HIC)	0.72	0.08	0.18	0.07	0.28	1.08
Upper Middle (UMIC)	0.30	0.15	0.17	0.10	0.37	1.33
Lower Middle (LMIC)	0.25	0.15	0.17	0.14	0.31	5.08
Low (LIC)	0.15	0.09	0.20	0.13	0.23	7.03

Note: Countries are classified following the World Bank's income groups. Countries are 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. Median values for each group and friction are reported.

We will compare the benchmark case (calibrated to the US) with the equilibrium across income groups. Our experiment can be described as follows. First, calibrate the model to the US economy by using $(\lambda, \phi, \tau, c_\tau, \tau_w, \kappa)_{US}$. In this case, we normalize $w = 1$ to then iterate on the set of loan prices $q_j^f(k', b', z)$ and $q^i(k', b', z)$ until lenders make zero profit on each contract and find the mass of potential entrants M that clears the labor market. Next, for each income group, we adjust the group specific parameters to $(\lambda, \phi, \tau, c_\tau, \tau_w, \kappa)_g$, where $g \in \{HIC, UMIC, LMIC, LIC\}$ and iterate on the wage rate w, and loan prices $q_j^f(k', b', z)$ and $q^i(k', b', z)$ until lenders make zero profits and the labor market clears (given M obtained for the US). Finally, we adjust the creation cost for each income group c_e until the free entry condition is satisfied.

Table 5 displays the main results for each income group and compares the model to the data. Values of total factor productivity, output per effective worker, and capital per effective worker are taken from Hall and Jones (1999).[6] The formal entry rate and business density are those reported by the 2008 *Entrepreneurship Survey and Database* by the World Bank. Formal entry rate refers to the ratio of new formal establishments to incumbent formal establishments. Business density is the ratio of registered businesses to the active population. The informal labor force is the one reported by the 2006 *World Development Indicators* by the World Bank as the share of the labor force not covered by a pension scheme. Finally, domestic credit to

[6]One unit of effective worker corresponds to one unit of human capital in Hall and Jones (1999).

private sector is taken from the *World Development Indicators* (average 2004-2007) and refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.

Table 5: Main Results

			Developing Countries					
	HIC		UMIC		LMIC		LIC	
	Data	Model	Data	Model	Data	Model	Data	Model
TFP	0.95	0.90	0.63	0.79	0.54	0.72	0.36	0.72
Informal labor force (%)	8.8	29.8	45	72.0	71.7	92.3	95	93.9
Output per eff. worker	0.94	0.87	0.45	0.71	0.32	0.63	0.12	0.52
Other Moments:								
Capital per eff. worker	0.99	0.91	0.41	0.75	0.10	0.65	0.04	0.64
Domestic Credit to Private Sector (% GDP)	54.9	81.4	21.3	30.7	16.0	6.6	7.5	3.7
Formal Entry Rate	0.81	0.65	0.65	0.61	0.62	0.56	0.47	0.55
Business Density	1.62	0.46	0.93	0.13	0.31	0.01	0.03	0.01

Note: TFP, Output per effective worker, Capital per effective worker, Formal Entry Rate, Business Density and Domestic Credit to Private Sector are reported relative to the US value. Data on TFP, Output per effective worker and Capital per 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*. The size of the informal labor force is taken from the *World Development Indicators*(2006) as the share of the labor force not covered by a pension scheme. Domestic Credit to GDP is also taken from the *World Development Indicators* (average 2004-2007). Data in terms of effective workers corresponds to Hall and Jones (1999), where one unit of effective worker equals one unit of human capital. Model TFP is calculated as $TFP \equiv \frac{Y}{K^{\widetilde{\alpha}}}$ where $\widetilde{\alpha} = 1/3$ as in Hall and Jones (1999). The model Business Density is obtained as total formal labor force over the average size of formal establishments which equals the measure of formal establishment to total population. Domestic credit to private sector in the model is computed as the ratio of formal debt to total output.

The most important result of the paper is that the model accounts for up to 60% of TFP differences between the US and Developing Countries. In particular, it accounts for 58%, 60% and 44% of total factor productivity differences between the US and the median Upper Middle, Lower Middle and Low Income Country respectively.[7]

In terms of informal activity the model generates sizable informal sectors that are negatively correlated with GDP per worker, as observed in the data. The model delivers an informal labor force that is on target across income levels, ranging from around 10% in the US to almost 94% at the low end of the income distribution. However, the model overshoots the data in the middle of the income distribution. This is not a significant drawback of the model since we understand

[7]These values are obtained by taking the ratio of the model difference in relative TFP to the data difference in relative TFP. For example, for UMIC: $0.58 = \frac{(1-0.79)}{(1-0.63)}$.

the data to be a lower bound for the measure of informal labor force.[8]

The model output per effective worker values are up to five times higher than what is seen in the data, in the case of the Low Income Countries. This discrepancy comes from differences of the same order of magnitude in terms of capital per effective worker that result from the fact that lenders in each country have access to the same risk free rate.

Similar to what we observe in the data, the model generates a sharp decrease in the stock of domestic credit to private sector as a percentage of GDP. In the data for developing economies, domestic credit to private sector ranges from 21% (UMIC) to 7.5% (LIC) relative to the US, whereas the model counterpart goes from 31% to 4%. The model moment includes only the stock of formal credit because the data contains loans from formal entities, and to our knowledge there is no accurate measure of the stock of informal credit across countries. It is important to note that data on private domestic credit includes not only business loans but also personal loans, so these values should be taken as an approximation of the observed relationship between firms credit and country income.

Differences in measured TFP are the result of capital being inefficiently distributed in the economy. One of the main channels affecting capital reallocation is the process of entry into and exit out of the formal sector. We observe that as frictions increase, the exit rate (and the entry rate, by construction) decreases. For example, the exit rate in the US is about 180% of that of LMIC as observed in the data. This implies that even though the entry threshold is higher for Low Income Countries and only the most productive firms in those countries operate the advanced technology, firms stay in business for much longer, preventing the natural process of churning of unproductive firms. Also, the model generates a relative business density that is in line with the observed one (measured as the number of registered businesses as a percentage of the active population). The business density drops to 1% of the US's for the Low Income Countries. High frictions generate low density, which generates low competitive pressures in the labor markets, generating low turnover in the formal sector (as observed by the low entry rate

[8]In the data, a worker is categorized as formal if he/she is covered by a pension scheme. In many cases, workers can be covered by a pension scheme and still participate of informal production. For example, a worker with one formal and one informal job is included in the formal labor force.

in developing economies), and lower average productivity.

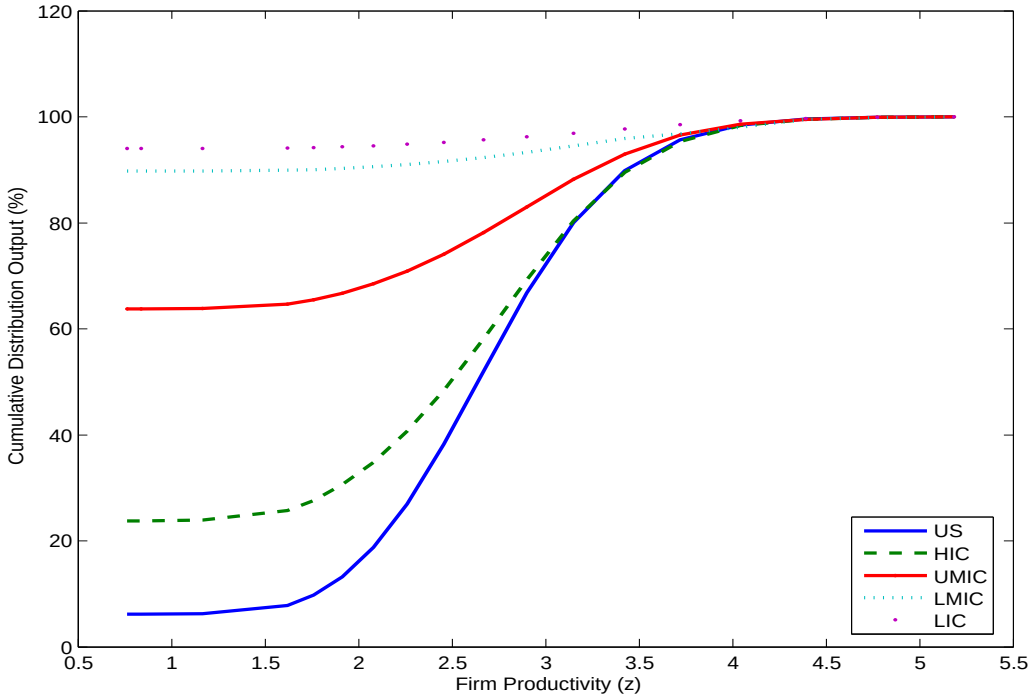

Figure 3: Distribution of Output over Productivity across Income Groups

In Figure 3, we observe how output is distributed over firms' productivity z. The increase in the entry cost κ raises the entry threshold to the formal sector, generating a reallocation towards more productive firms in that sector. However, as this cost rises the share of production in the informal sector (less productive firms) also increases. We observe that the latter effect dominates, that is when distortions are higher the share of output produced by low productivity firms increases. For example, firms with productivity less than or equal to 1.5 ($z \leq 1.5$) account for about 10% of output in the US, 25% in HIC, 55% in UMIC and around 90% in LMIC and LIC.

It is crucial to provide a measure that captures how efficiently resources are allocated in the economy. To address this issue we use a decomposition of weighted average plant-level productivity originally proposed by Olley and Pakes (1996) (used also by Bartelsman et al (2008) for example):

$$\widehat{z} = \int z_i \omega_i di = \overline{z} + cov(z_i, \omega_i)$$

where $\widehat{z}$ is the average of plant level productivity weighted by output share, ω_i are the output shares of each establishment, and $\overline{z}$ is the un-weighted mean productivity. Therefore, the output weighted productivity can be decomposed into the un-weighted average of firm-level productivity (first term) plus a covariance between output share and productivity (second term). The covariance captures allocative efficiency because it reflects the extent to which firms with higher than average productivity have a greater market share. Table 6 displays the values of this decomposition across income groups.

Table 6: Firm Productivity Decomposition

Group	$\widehat{z}$	$\overline{z}$	$cov(z_i, \omega_i)$	share covariance (%)
US	2.69	0.77	1.93	71.43
HIC	2.37	0.76	1.60	67.68
UMIC	1.56	0.76	0.80	51.19
LMIC	1.03	0.76	0.27	25.96
LIC	0.91	0.76	0.15	16.59

We observe that the value of output-weighted productivity correlates with our value of measured TFP. As distortions increase, the value of $\widehat{z}$ decreases. Moreover, although the covariance is positive for every income group, we observe a sharp decrease as we move from the US to LIC showing that as the frictions increase, the correlation between market share and productivity decreases. The share of the covariance in $\widehat{z}$ is lower in all income groups than in the US. This implies that allocative efficiency becomes less important as frictions increase in importance in explaining total output weighted productivity.

Understanding how capital is allocated across establishments in the formal sector is also central to the analysis, because all measured institutional differences across countries relate to firms in this sector. In a frictionless world with commitment, the Modigliani-Miller theorem applies and optimal allocations can be derived from a static problem. Conditional on surviving,

firms solve:

$$\max_{k,n} \left\{ (1-\tau)(zk^{\alpha}n^{\gamma} - w(1+\tau_w)n) - (r+\delta)k \right\}$$

The solution to this problem implies that the capital-labor ratio for each country is constant across firms and depends only on factor prices, i.e independent of productivity. More specifically,

$$\widetilde{(k/n)} = \frac{\alpha}{\gamma} \frac{w(1-\tau)(1+\tau_w)}{(r+\delta)}.$$

This relation breaks down in a world with no commitment where input prices differ across firms but it provides a natural benchmark for comparison because the implied variation in the capital to labor ratio is null. Using a notion of efficiency that is similar to the one we use to study productivity, we define a measure of the capital to worker ratio in the formal sector as follows:

$$\widehat{(k/n)} = \overline{(k/n)} + cov((k/n)_i, \omega_i)$$

This measure captures differences in prices, and as before can be decomposed in a "mean" effect and "variation" effect. An efficient allocation will imply a covariance equal to zero. Table 7 displays the values of $\widehat{(k/n)}$ and its decomposition for each income group.

Table 7: Capital Per Worker Decomposition in the Formal Sector

Group	$\widehat{(k/n)}$	$\overline{(k/n)}$	$cov((k/n)_i, \omega_i)$	$\frac{\widehat{(k/n)}}{\widetilde{(k/n)}}$
US	2.29	2.63	-0.33	0.83
HIC	2.25	2.82	-0.57	0.83
UMIC	1.96	2.70	-0.73	0.75
LMIC	1.55	2.52	-0.96	0.66
LIC	1.37	2.25	-0.88	0.64

We observe that the output-weighted capital to labor ratio decreases in the formal sector as we move from the US to less developed economies. Part of this decrease is related to the decreases in after-tax wages across countries that affect the efficient ratio, $\widetilde{(k/n)}$, as well as the model average, $\overline{(k/n)}$. But as the last column of Table 7 shows, the departure from optimal

levels increases as we move towards lower income countries. This suggests the existence of higher effective average interest rates in the poorer countries completely generated by financial frictions heterogeneity. We also note that most of this decrease in $\widehat{(k/n)}$ comes from the covariance. Low income countries display a larger covariance term (in absolute value), implying that large firms substitute away from capital and towards labor more than small firms. This is the result of differences in the endogenous firm specific schedule of loan prices.

Restuccia and Rogerson (2008) emphasized that heterogeneity in prices faced by establishments can lead to sizeable decreases in TFP and output per worker. Our model generates these differences endogenously. In Table 8, we provide other relevant summary statistics for each income group that reflect this fact.

Table 8: Model Moments Across Income Groups

			Developing Countries		
Moment	US	HIC	UMIC	LMIC	LIC
Wage w	1	0.86	0.76	0.73	0.72
Avg. b/k Formal Sector (%)	40.5	30.8	27.4	20.9	22.14
Avg. Employment Formal Sector Est.	17.6	29.0	41.5	108.6	132.3
Avg. Employment Informal Sector Est.	0.01	0.03	0.08	0.11	0.11
Total Capital Stock Formal Sector	2.12	1.58	0.55	0.12	0.07
Total Capital Stock Informal Sector	0.07	0.41	1.09	1.31	1.32

The wage rate decreases and credit terms adjust to incorporate changes in default probabilities. These differences are reflected in the debt to capital ratios, average employment, and total capital stock by sector. Figure 4 displays loan prices $q_a^f(k, b', z)$ for the US and LMIC. On the x-axis we have future debt b', on the y-axis we have future capital k' and a darker color implies a lower price (higher interest rate). We note that firms in the formal sector in the US face lower interest rates (higher q) for most combinations of future capital and debt. This implies tighter borrowing limits for firms in less developed countries.

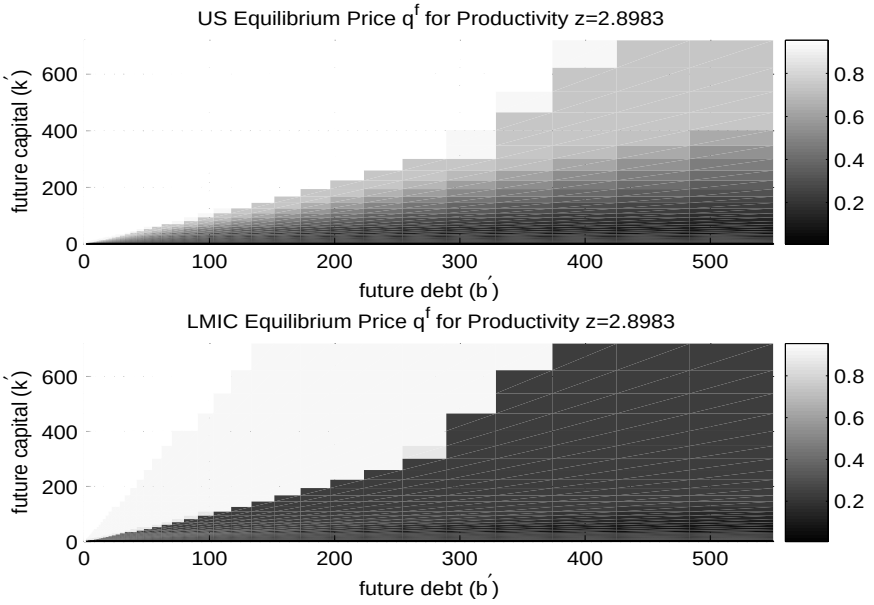

Figure 4: Differences In Financial Structure (US vs LMIC)

Changes in prices directly impact the optimal combination of debt and capital (especially in the formal sector) that we observe in Table 8. Figure 5 shows the distribution of firms over the debt to capital ratio (b/k) for each income group in the formal sector. As we move from the US to countries with lower income, we observe that this distribution shifts towards small values. Two effects are present here. First, as firms face higher interest rates, they are able to borrow much less. For example, we observe that in LMIC, compared to the US, the number of firms at $b/k = 0$ increases by 46% (57% vs 39% respectively). Second, since the price function is much steeper for countries with more frictions, firms over-accumulate capital in order to avoid reaching a constrained region, i.e. where they face a high price for debt. Due to decreasing returns, firms that are bigger than optimal reduce efficiency in the economy.

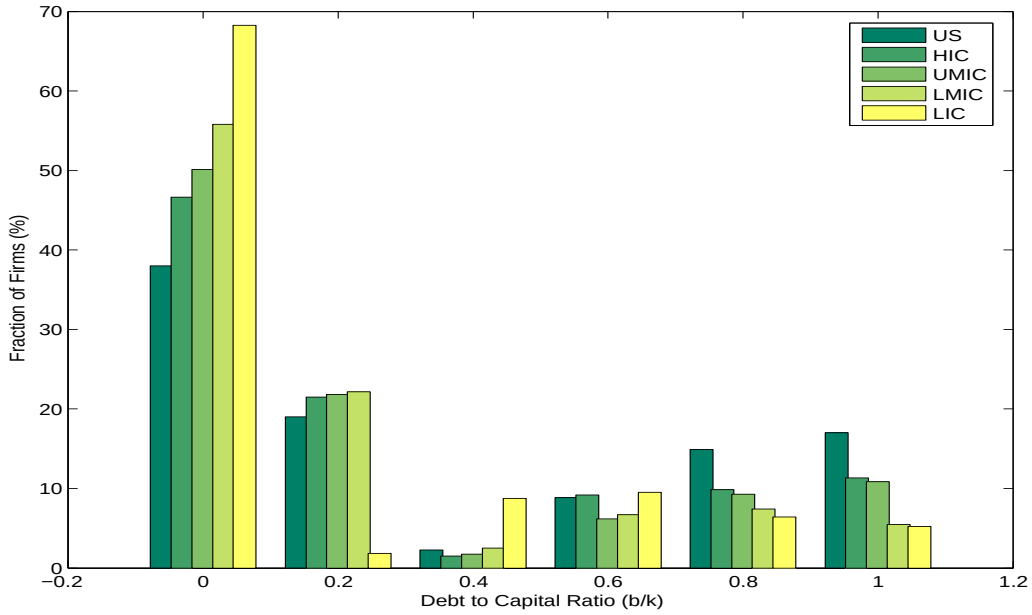

Figure 5: Distribution of Debt to Capital Ratio (Formal Sector) across Income Groups

7 Conclusion

In this paper, we quantify the effects of differences across countries in the financial structure, as well as the cost of starting, operating and closing a business. We developed a general equilibrium firm dynamics model with imperfect credit markets and endogenous formal and informal sectors.

Our model explains up to 60% of total factor productivity differences between the US and developing countries. For example, if the median lower middle income country was to adopt the financial, tax, and formal sector structure of the US, their TFP would increase by 38% and output per effective worker by 60%. Consistent with the data, we find a strong negative correlation between income per-worker and the size of the informal sector.

Differences in measured TFP are mostly due to capital being inefficiently allocated in the economy. We showed that, even when the technology available is the same across income groups, production shifts towards less productive firms as distortions increase. Endogenous differences in prices across income groups create the incentives to shifts firms towards inefficient scales. Finally, we discover that the covariance between the share of output produced and labor productivity

decreases as we move from the US to less developed economies.

One of the main differences with previous papers in the literature is that we discipline the changes in parameters with the *Doing Business* Data Set. In particular, differences across countries are derived from their measure of recovery rates, cost of bankruptcy, tax structure and formal entry costs. We also restrict the ex-ante heterogeneity to be identical across countries, so differences in the ex-post distribution of firms are completely endogenous.

8 References

Alfaro, Laura, Charlton, Andrew and Kanczuk, Fabio (2007). "Firm-Size Distribution and Cross-Country Income Differences."Mimeo. Harvard Business School, London School of Economics and Universidade de Sao Paulo.

Antunes, Antonio and Cavalcanti, Tiago (2007). "Start up costs, limited enforcement, and the hidden economy,"European Economic Review 51: 203-224.

Arellano, Cristina, Yan Bai and Jing Zhang (2008). "Firm Dynamics and Financial Development."Manuscript, University of Minnesota.

Barseghyan, L. and DiCecio R. (2009). "Entry Costs, Misallocation, and Cross-Country Income and TFP Differences,"Working Paper 2009-005A, Federal Reserve Bank of St. Louis.

Bartelsman, E., Haltiwanger J. and Scarpetta, S. (2008). "Cross-country differences in productivity: The role of allocative efficiency,"manuscript, University of Maryland.

Castro, Rui, Clementi, Gian Luca and MacDonald, Glenn (2008). "Legal Institutions, Sectoral Heterogeneity, and Economic Development,"forthcoming on the Review of Economic Studies.

Cooley, Thomas and Vincenzo Quadrini (2001). "Financial Markets and Firm Dynamics,"American Economic Review 91(5), 1286-1310.

Cooper, Russell and John C. Haltiwanger (2006) "On the Nature of Capital Adjustment Costs,"Review of Economic Studies 73(3), 611-633.

D'Erasmo, Pablo (2009). "Investment and Firm Dynamics."Mimeo. University of Maryland.

De Soto, Hernando (2000). "The Mystery of Capital,"New York: Basic Books.

Djankov, Simeon, Rafael La Porta, Florencio Lopez-De-Silanes, Andrei Shleifer, 2002. "The Regulation Of Entry,"The Quarterly Journal of Economics, MIT Press, vol. 117(1), pages 1-37, February.

Djankov, Simeon, Hart, Oliver, McLiesh, Caralee and Shleifer, Andrei (2008). "Debt Enforcement Around the World,"Journal of Political Economy, forthcoming.

Erosa, Andres and Hidalgo Cabrillana, Ana (2008). "On Finance as a Theory of TFP,

Cross-Industry Productivity Differences, and Economic Rents,"forthcoming at the International Economic Review.

Foster, Lucia, Haltiwanger, John and Krizan C. J. (2001). "Aggregate Productivity Growth: Lessons from Microeconomic Evidence". In Charles R. Hulten, Edwin R. Dean, and Michael J. Harper (eds) "New Developments in Productivity Analysis," Chicago, University of Chicago Press.

Hall, R. and Jones, C. "Why do some countries produce so much more output per worker than others?," Quarterly Journal of Economics 114(1), 83-116.

Hopenhayn, Hugo (1992). "Entry, exit, and firm dynamics in long run equilibrium,"Econometrica 60(5), 1127-1150.

Hopenhayn, Hugo and Rogerson, Richard (1993). "Job Turnover and Policy Evaluation: A General Equilibrium Analysis,"Journal of Political Economy 101, 915-938.

Hsieh, Chang-Tai and Klenow, Peter (2007). "Misallocation and Manufacturing TFP in China and India,"mimeo. University of California, Berkeley and Stanford University.

Moscoso Boedo, Hernan and Mukoyama, Toshihiko (2008). "Evaluating the Effects of Entry Regulations and Firing Costs on International Income Differences."Mimeo. University of Virginia.

Olley, Steven and Pakes, Ariel (1996). "The Dynamics of Productivity in the Telecommunications Equipment Industry,"Econometrica, 64(6): 1263-1297.

Perry, Guillermo, Maloney, William, Arias, Omar, Fajnzylber, Pablo, Mason, Andrew, and Saavedra-Chanduvi, Jaime (2007). "Informality: Exit and Exclusion,"World Bank, Washington DC.

Quintin, Erwan (2008). "Contract Enforcement and the Size of the Informal Economy,"Economic Theory, 37: 395-416.

Restuccia, Diego and Rogerson, Richard (2008). "Policy Distortions and Aggregate Productivity with Heterogeneous Establishments,"Review of Economic Dynamics, Forthcoming.

Schneider, Friedrich and Enste, Dominik (2000). "Shadow Economies: Size, Causes, and Consequences,". Journal of Economic Literature, 38: 77-114.

Syverson, Chad, (2004), "Substitutibility and Product Dispersion," Review of Economics and Statistics, 86 (2), 534-550.

Tauchen, George (1986). "Finite state Markov-chain approximation to univariate and vector autoregressions," Economics Letters 20:177-81.

Tybout, James (2000). "Manufacturing Firms in Developing Countries: How Well Do They Do, and Why?" Journal of Economic Literature, 38: 11-44.