On Finance as a Theory of TFP, Cross-Industry Productivity Differences, and Economic Rents.

Andrés Erosa and Ana Hidalgo Cabrillana*

April 3, 2007

Abstract

We develop a theory of capital-market imperfections to study how the ability to enforce contracts affects resource allocation across entrepreneurs of different productivities, and across industries with different needs for external financing. The theory implies that countries with a poor ability to enforce contracts are characterized by the use of inefficient technologies, low aggregate TFP, low development of financial markets, large differences in labor productivity across industries, and large employment shares in industries with low productivity. These implications of our theory are supported by the empirical evidence. The theory also suggests that entrepreneurs have a vested interest in maintaining a status quo with low enforcement since it allows them to extract rents from the factor services they hire.

Keywords: Macroeconomics, Capital-Market Imperfections, Total-factor Productivity, Relative Prices, Sectorial Allocation, Limited Enforcement

JEL Codes: E2, E5, O16,017,041

*Joel Blitz provided superb research assistance. We thank Belén Jerez, Boyan Jovanovic, Diego Restuccia, Edward C. Prescott, José Vicente Rodriguez-Mora, Luisa Fuster, Matt Mitchell for helpful discussions. We owe special thanks to Ig Horstmann, Tatyana Koreshkova, and an anonymous referee, whose comments lead to substantial revisions of the paper. Erosa: University of Toronto. E-mail: andres.erosa@utoronto.ca Hidalgo: Universidad Carlos III. E-mail: ahidalgo@eco.uc3m.es

1 Introduction

One of the most important research questions faced by economists is why poor countries use productive resources inefficiently. Evidence suggests that poor countries are characterized by *i*) low aggregate total-factor productivity (TFP), *ii*) large differences in output per worker across industries, and *iii*) high employment shares in sectors with the lowest labor productivity in the economy. Moreover, relative prices differ systematically between rich and poor countries.[1] These observations raise many important questions in economic development: Why do poor countries use inefficient technologies? Why do they allocate productive resources inefficiently? What prevents labor in poor countries to move to the sectors with the highest labor productivity? What accounts for cross-country differences in relative prices?

In this paper we propose a theory of capital-market imperfections that can account for the above observations. Our focus on capital-market imperfections is motivated by evidence indicating that capital markets tend to perform badly in poor countries and that productivity is positively correlated with indicators of financial development across countries (see Levine (1997), and Erosa (2001)). Motivated by the empirical findings in Laporta et al. (1998), we study how the ability to enforce contracts affects resource allocation and total factor productivity in the model economy.[2] We find that economies with low enforcement are characterized by the use of inefficient technologies, low aggregate TFP, low development of financial markets, large differences in labor productivity across industries, and large employment shares in industries with low-productivity. In our theory, capital-market imperfections also generate cross-country differences in relative prices and allow entrepreneurs to extract

[1] Prescott (1998), Hall and Jones (1999, 2000), and Parente and Prescott (2000) argue that cross-country differences in TFP are crucial for understanding income inequality across countries. Since the work of Kuznets (1966), it is well known that developing countries face substantial differences in labor productivity across sectors in the economy. More recently, Gollin et al. (2002), Restuccia et al. (2003), and Van Biesebroeck (2005) emphasize that in poor countries agriculture has, relative to non-agriculture, very low labor productivity. Restuccia and Urrutia (2001) and Restuccia et al. (2003) document that relative prices vary systematically across rich and poor countries.

[2] Laporta et al. (1998) find that poor countries are characterized by poor law enforcement and low accounting standards, which negatively impacts on the development of their capital markets.

economic rents.

The theory builds on a growth model with a final-goods sector and many intermediate-goods industries. The technology to produce intermediate goods is symmetric across industries but for a fixed cost of operation, which varies across sectors and is meant to capture the observation that some industries rely more heavily on external financing than others (as documented by Rajan and Zingales (1998)). The production of intermediate goods is organized by entrepreneurs who need to borrow in order to operate their technologies at optimal scales. External financing is affected by two problems: First, the productivity of entrepreneurs cannot be observed by lenders. Second, due to limited enforcement, a lender can enforce contract payments from a borrower only up to a fraction of the borrower's net worth. In this environment, financial intermediaries arise as an incentive-compatible and enforcement-feasible mechanism for the allocation of resources to their most productive use. In our economy, the degree of enforcement determines the contracting environment and, as a result, the optimal way to provide incentives. We can then analyze how an exogenous variation in the capacity to enforce contracts across model economies affects resource allocation.

We find that low enforcement leads to the use of technologies with low productivity because of two effects: First, low enforcement implies a low ability to punish entrepreneurs who lie about the true value of their investment opportunity. Second, general equilibrium price effects (such as depressed wages and inflated output prices) make the operation of low-productivity technologies profitable. When enforcement is perfect, only the high-productivity technology is profitable, and output per worker is constant across industries. When enforcement is imperfect, and the output of some or all industries is constrained by enforcement problems, output per worker varies across industries and is higher in the industries facing a more binding enforcement constraint. Thus, poor countries in our theory are characterized (relative to rich countries) by large cross-industry productivity differentials. We also show that this prediction of the theory is supported by the data: Using cross-country data on industries in the manufacturing sector, we document that labor productivity is much more unequally distributed across industries in poor than it is in rich countries.

What precludes factors of production from moving to the sectors where they are most productive? In our theory, it is limited enforcement that generates a barrier to factor mobility across industries. Sectors with the highest returns are exactly the ones with the most binding enforcement constraints, where the scale of production is restricted by the limited commitment of entrepreneurs to pay for the factor services. An increase in enforcement then allows for factor inputs to be allocated more efficiently across entrepreneurs and industries, diminishing the dispersion in labor productivity across industries. The theory implies that capital-market imperfections reduce employment more in the sectors that rely heavily on external financing. As a result, the share of employment in these sectors is predicted to be positively associated with the level of financial development (enforcement). Using the measures of external-finance dependence across industries in Rajan and Zingales (1998) and cross-country data on employment across industries in manufacturing, we find evidence supporting this prediction of the theory (see section 2).

Our paper is closely related to the seminal work of Parente and Prescott (1999, 2000) in that we also build a theory to explain why inefficient technologies are used in equilibrium. While Parente and Prescott (1999, 2000) study equilibria with monopoly-type arrangements, we develop a theory of TFP with competitive markets. In our theory, entrepreneurs take prices as given, but the equilibrium allocation resembles the outcome of a collusive agreement. Capital-market imperfections constrain entrepreneurial output, increasing the price of the output good produced by entrepreneurs and depressing the equilibrium wage rate. Entrepreneurs, as a class, benefit from capital-market imperfections since they allow entrepreneurs to extract rents. Our theory thus suggests that entrepreneurs may have a vested interest in maintaining a status quo with low enforcement. Entrepreneurs could also extract rents through a collusive agreement, but that would be difficult to enforce since each entrepreneur would face incentives to increase production. In our framework, capital-market imperfections provide an *incentive-compatible* mechanism benefiting entrepreneurs, a result that is consistent with the views of Rajan and Zingales (2003). In discussing the impediments to financial development, Rajan and Zingales point out that industrial incumbents may lose with financial development since the latter breeds competition which, in turn, erodes incumbents' profits.[3]

We view our contribution as complementary to the line of inquiry advocated in Prescott (1998) and Hall and Jones (1999), who argue that a theory of TFP is crucial for understanding the economic development problem. Parente and Prescott (2000), Holmes and Schmitz (2001), and Herrendorf and Teixeira (2003) build theories in which the protection of monopoly rights impedes the adoption of superior technologies. In a framework in which limited enforcement restricts the ability of the social planner to tax individuals and redistribute social surplus, Kocherlakota (2001) shows that limited enforcement and high inequality are crucial for understanding why societies choose institutions leading to the inefficient use of the means of production. Sokoloff and Engerman (2000) discuss episodes in economic history in which inequality has affected the course of development through its impact on the institutions that have evolved. Our findings also point to the importance of inequality and limited commitment but in the context of a growth model in which limited enforcement affects the provision of incentives in the capital markets. Following Townsend (1978), there is a large literature studying how financial intermediaries emerge endogenously to improve resource allocation.[4] In this paper we analyze how enforcement limitations affect the contracting problem faced by financial intermediaries.[5] However, the main contribution of our paper is to study limited enforcement in a multisector general-equilibrium model. To our knowledge, this is the first paper in the literature to build a theory addressing the cross-industry implications of capital-market imperfections. We also present novel evidence in support of the implications of the theory.[6]

[3]While we do not model the reasons to explain why enforcement differs across countries, our theory does offer some interesting clues. For a political economy theory of technological change see Krusell and Ríos-Rull (1996).

[4]See, for instance, Bencivenga and Smith (1991), Boyd and Prescott (1986), Greenwood and Jovanovic (1990), Imrohoroglu and Kumar (2002), and Levine (1997) for a survey.

[5]In a related paper, Castro et al. (2003) also study how investor protection (limited enforcement) affects credit markets that are subject to private information problems, but they focus on capital accumulation rather than on TFP.

[6]Rajan and Zingales (1998) were the first ones to find empirical support for the idea that capital-market imperfections affect industries differently.

The paper is organized as follows. Section 2 presents cross-country data on employment, financial dependence, and the labor productivity by industry that motivates the theory developed in this paper. Section 3 presents the model economy. The contracting problem faced by entrepreneurs is discussed in Section 4. In Section 5 we study the general equilibrium of our economy and analyze the implications of cross-country differences in enforcement for economic development. Section 6 concludes. Proofs are collected in an appendix.

2 Industry Data across Countries

This section presents evidence motivating the theoretical approach of the paper. First, we compare two broad sectors in the economy: agriculture and non-agriculture. Second, we consider the industries within the manufacturing sector. The first observation is that poor countries are characterized by a very low labor productivity in the agricultural sector.

Observation 1: *The labor productivity in the agricultural sector relative to the non-agricultural sector is much lower in poor than in rich countries. Relative to rich countries, poor countries employ a large fraction of their labor force in agriculture.*

Figure 1 graphs the labor productivity of workers in the agricultural sector (as a fraction of labor productivity in manufacturing) for a cross-section of countries in the year 1985.[7] While labor productivity in agriculture is about 67 percent of labor productivity in non-agriculture for the richest 10 percent of countries in the world, it is only 4 percent for the poorest 10 percent of countries. Despite this fact, poor countries allocate a large fraction of the labor force in agriculture: The poorest 10 percent of countries employ 82 percent of the labor force in agriculture. On the contrary, the employment share of agriculture is low in rich countries, with the top 10 percent of the richest countries employing 5 percent of workers (see Figure 1, panel b). Next, we focus on industries within the manufacturing sector.

Observation 2: *Relative to rich countries, poor countries exhibit large differences in*

[7] We thank Diego Restuccia for providing us with the data on employment and labor productivity in agriculture (the data is available in his website). The original source of data is the Food and Agriculture Organization of the United Nations (FAO).

labor productivity across industries in the Manufacturing sector.

We use data from UNIDO (2003) to compute for each country the dispersion in log-output per worker across industries in Manufacturing. Table 1 reports that the standard deviation of the logarithm of output per worker across industries was .91 during the period 1996-2000 among countries with less than $10,000$ dollars of per-capita income in the year 2000. This statistic is a much lower .50 among countries with more than $20,000$ dollars of per-capita income in the year 2000. The cross-country data plotted in Figure 2 reveal that the dispersion in labor productivity is negatively correlated with per-capita income across countries, with a correlation coefficient of $-.65$.

Observation 3: *Relative to rich countries, poor countries exhibit large differences in labor productivity across workers in the Manufacturing sector.*

The fact that in poor countries labor productiviy is highly unequal across industries, does not necessarily imply that it is also highly unequal across workers. This is because the dispersion in labor productivity across workers is also determined by how labor productivity covaries with employment across industries. To measure inequality in labor productivity across workers we compute a Gini index for each country during the period 1996-2000.[8] The results are plotted in Figure 3. We find a strong negative relationship between the Gini index of labor productivity and per capita income across countries, with a correlation coefficient of $-.80$. Moreover, the dispersion in labor productivity varies substantially across countries: While the Gini index for countries with more than $20,000$ dollars of per-capita income in the year 2000 is, on average, .16., it increases by a factor of two (to a value of .38) in countries with less than $10,000$ dollars of per capita income in the year 2000 (see Table 1).

The above observations raise important questions about economic development: Why do

[8] For each country, we order the 28 industries in the UNIDO (2003) data by their productivities (with the first industry having the lowest productivity), and consider 28 subsets of industries such that the n-th subset contains industries from 1 to n. We then compute the shares of the aggregate manufacturing employment and output for each of the 28 subsets of industries. The data obtained describes the Lorenz Curve of the distribution of labor productivity in manufacturing, which graphs the cumulative share of value added against the cumulative share of employment by each of the 28 industry groups. The Gini index is computed as twice the area between the 45-degree line and the Lorenz curve.

Table 1: Summary of Data across Countries: Manufacturing Industry (1996-2000)

	Country Category*		
	Poor	Middle	Rich
Labor productivity across industries:			
Coefficient of variation	1.5	1.42	.80
Standard deviation of ln	.91	.68	.50
Labor productivity across workers:			
Gini Index	.38	.27	.16

The first panel reports two measures of inequality in labor productivity across industries in the manufacturing sector. The second panel reports the shares of employment in manufacturing by industries at the bottom 25% and at the bottom 50% of the labor productivity distribution.

*The countries are divided in three income groups according to their real GDP per capita in the year 2000. The Poor group includes countries with less than $10000 of income; the Rich group includes countries with more than $20000 of income; other countries belong to the Middle group.

Source: Real GDP per capita from Penn World Tables. Data on industries across countries is obtained from UNIDO.

poor countries exhibit large cross-industry productivity differentials relative to rich countries? Why is labor productivity so unequally distributed across workers in poor countries? What prevents workers from moving to the sectors with the highest labor productivity? We now discuss evidence that capital-market imperfections may provide an explanation for these puzzling observations.

Observation 4: *Industries differ in their dependence on external financing. The share of manufacturing-employment by industries with high external dependence increases with the level of financial development across countries. The opposite is true for industries with low external dependence. Moreover, the within-country variation in labor productivity across* *industries that differ in their reliance on external finance decreases with the level of financial development across countries.*

In an influential paper, Rajan and Zingales (1998) provide evidence that industries differ in their needs for external funds. They argue that the industry demand for external financing is determined by technological factors. For instance, because the pharmaceutical industry requires large initial investments, it is much more dependent on external financing than the average industry in the economy. Using the industry measures of external dependence in Rajan and Zingales (1998), we divide industries in the Manufacturing sector evenly into three groups according to their dependence on external financing (low, medium, and high). For each country, we compute the share of employment during the period 1996-2000 across the three industry categories. Countries are split evenly in three groups according to their level of financial development, as measured by the amount of credit to private enterprises divided by GDP. Note that the facts that we report next are not sensitive to the time period analyzed and to the grouping of countries and industries. Figures 4 and 5 show that the distribution of employment across the industry groups varies systematically with the level of financial development: The share of employment in industries that rely heavily on external financing tends to be increasing with the level of financial development, with a correlation coefficient of .33. Moreover, the share of employment in industries that are the least dependent on external financing tends to be decreasing with the level of financial development, with a correlation coefficient of $-.40$. Table 2 presents summary statistics. While the industry category that relies heavily on external financing accounts for 33% of the aggregate employment in Manufacturing in the countries with low levels of financial development, it accounts for 49% of the Manufacturing employment in countries with a high level of financial development. Moreover, countries with low levels of financial development employ 30% of the manufacturing labor force in sectors that have the least dependence on external financing, while countries with the highest level of financial development employ only 11% percent in similar sectors.

Table 3 reveals that the dispersion in output per worker across the three industry-categories is substantially larger in countries with low than it is in countries with high

Table 2: Employment-Shares and External Dependence (1996-2000)

	Countries by financial development		
	Low	Medium	High
Industries by external dependence:			
Low	.30	.20	.11
Medium	.37	.38	.40
High	.33	.42	.49

The three groups of industries were formed according to their external dependence, as measured by Rajan and Zingales (1998). Industries were splited evenly across the three groups. Countries were divided evenly into three groups (Low, Medium, and High) according to the level of financial development as measured by the credit to private enterprises divided by GDP (Levine 1997).
Each column reports the distribution of employment across the three industry categories defined by their external dependence. Each column corresponds to a different country group defined by their level of financial development.

financial development. While in poor countries output per worker varies from 1.29 to .80 of manufacturing labor productivity for industries with low and high external dependence, this variation in output per worker is substantially smaller for countries with high development of financial markets and ranges from 1.14 to .99. While one may expect output per worker to vary across industries (due to differences in the skill and capital intensities of industries), it is a striking observation that the dispersion in labor productivity − across industries that differ in their needs for external funds − tends to diminish with the level of financial development in the cross-country data.

Table 3: Labor Productivity and External Dependence (1996 − 2000)

	Countries by financial development:		
	Low	Medium	High
Industries by external dependence:			
Low	1.29	1.34	1.14
Medium	1.08	.99	.91
High	.80	.90	.99

Labor productivity is computed as value added per worker. For each industry category, we add up the value added of all industries in the group and divide that sum by the total number of workers in the industry group. The resulting value is expressed as a fraction of the labor productivity in the manufacturing sector. Industry groups and country groups were constructed as in Table 2.

3 The Economy

We now present a theory of capital-market imperfections that provides an explanation for the observations documented in Section 2.

Agents

The economy is populated by two groups of agents: *i*) two-period lived overlapping generations of entrepreneurs and by *ii*) households. Entrepreneurs are endowed with 1 unit of labor in each period of their lives and with a production technology when old. At age 2, entrepreneurs choose whether to operate their technology or work for someone else. Entrepreneurs are risk neutral and consume by the end of their second period of life. We assume that households are infinitely lived and that they make consumption and savings decisions as in the standard Cass-Koopmans growth model. This assumption is made for simplicity, and it implies that the steady-state interest rate is equal to the households' rate of time preference ($\frac{1}{\beta}-1$, where β denotes the discount rate). We could obtain similar results by considering a storage technology or by modeling a small open economy that takes the interest rate as given. The aggregate labor supply is given by the sum of the labor endowments of households, young entrepreneurs, and old entrepreneurs who decide to work for a wage. Assuming no population growth, we normalize the mass of infinitely-lived households to 1 and denote by ϵ the size of each cohort of entrepreneurs.

Production

At each point in time, there are $n+1$ produced goods: a single final good and n intermediate goods. The final output good is produced by combining capital K, labor N, and intermediate goods inputs Z according to a constant-returns-to-scale technology

$$Y = F(K_y, Z_y, N_y) = A_y (K_y^{\alpha} N_y^{1-\alpha})^{1-\mu} Z_y^{\mu}, \tag{1}$$

where $Z_y \equiv \left(\sum_{j=1}^{n} \frac{1}{n} Z_j^{\rho}\right)^{1/\rho}$ is a C.E.S. aggregator of intermediate goods. We assume that firms in the final-goods sector sector take prices as given, and thus these firms make zero profits in equilibrium. Without loss of generality, the number of firms in the final-goods sector sectors is normalized to 1. Capital depreciates at a rate δ.

Intermediate goods are produced combining fixed and variable inputs. The fixed inputs are the entrepreneurial time and a fixed amount of consumption goods, where the latter varies across industries. The variable inputs are capital and labor services. An entrepreneur in industry j incurs fixed production costs f_j, uses capital K_j and labor N_j to produce an amount of goods given by $Z_j = \min\left\{A_i K_j^{\alpha} N_j^{1-\alpha}, \widehat{Z}\right\}$, where A_i can take the values $\{A_l, A_h\}$ representing low- and high-productivity technologies ($A_h > A_l$), respectively, and $\widehat{Z}$ represents the maximum scale of operation of the entrepreneurial technology. It is important to notice that the entrepreneurial technology features increasing returns to scale. Due to the presence of fixed inputs in the production technology, the per-unit cost of production decreases as the scale of production increases.

We assume that each entrepreneur is born with a technology to operate in only one industry, so that the total number of entrepreneurs in each industry is given by ϵ/n, and that the fraction of low-productivity entrepreneurs is equal to ν in all industries. The fixed cost f_j varies across industries and is meant to capture the fact that industries have different cash-flows and needs for external financing, as emphasized by Rajan and Zingales (1998).

As industries with a higher fixed cost f_j require a higher expenditure, the financing problem faced by entrepreneurs differs across industries.

We assume that entrepreneurs take prices as given. Entrepreneurs face a constant marginal cost of production and, due to the fixed inputs, a decreasing average cost. The marginal cost of production (in terms of consumption goods) does not vary across industries but varies across entrepreneurs with different productivity. The marginal cost for type i entrepreneurs is obtained from the following cost-minimization problem

$$\begin{aligned} y_i \quad &\equiv \quad \min_{K,N} \{ \, rK + wN \} \\ s.t. \quad &: \qquad A_i K^{\alpha} N^{1-\alpha} = 1, \end{aligned}$$

where $i =\in \{h, l\}$ and (r, w) are the cost of capital and labor services, respectively. It is easy to show that $y_i = \frac{1}{A_i}(\frac{r}{\alpha})^{\alpha}(\frac{w}{1-\alpha})^{1-\alpha}$. Notice that the marginal cost of production does not depend on the scale of project operation as long as the output is below $\widehat{Z}$. Moreover, the marginal cost of a low-type entrepreneur relative to a high-type entrepreneur is equal to the inverse of their relative productivities: $\frac{y_l}{yh} = \frac{A_h}{Al}$. These properties will be useful for solving analytically the contracting problem faced by entrepreneurs.

Financial Intermediaries

In our framework, financial intermediaries arise as an incentive-compatible mechanism to allocate resources among entrepreneurs. In order to operate their technology at an efficient scale, an entrepreneur needs to raise external funds as his net worth does not provide sufficient resources (entrepreneur's net worth η is given by $w(1 + r - \delta)$). External financing is difficult due to two capital-market imperfections: First, financial intermediaries can enforce contract payments up to a fraction of borrowers' resources. In particular, we assume that entrepreneurs can commit to pay at most a fraction ϕ of output. Second, the ability of entrepreneurs is not known by the lenders.

We assume that financial intermediaries announce contracts before entrepreneurs learn their type. This assumption implies that private information is revealed after contracting, and it is made in order to avoid the problems of the non-existence of equilibria that arise with adverse selection (See, for instance, Prescott and Townsend (1984)).[9] Our main results

[9] As we show later, the efficient allocation of resources among entrepreneurs in our framework requires

should not be sensitive to this modeling assumption since it is intuitive that limited enforcement makes the provision of incentives (separation of types) more difficult, whether private information is ex-ante or ex-post. An advantage of our approach is that it allows us to obtain a simple analytical solution to the contracting problem faced by intermediaries. We assume that financial intermediaries announce production plans and repayment schedules for each type of entrepreneur. A production plan specifies, for each type of entrepreneur, the fraction of entrepreneurs that work for a wage, the fraction of entrepreneurs that get to operate their technology, the resources available for operating the technology (capital and labor services), and the repayment schedules. Payments are constrained by enforcement problems since we assume that entrepreneurs can commit to pay at most a fraction $\phi < 1$ of output. The timing of events can be summarized as follows:

1. Entrepreneurs decide whether they want to contract with financial intermediaries or not.

2. Financial intermediaries write contracts in order to organize the production of intermediate goods and to raise external funds. Contracts are represented by an $8 - tuple$ $\left\{(e_l, Z_l, L_l, L_l^F), (e_h, Z_h, L_h, L_h^F)\right\}$. For each ability type i, the contract specifies the fraction of entrepreneurs e_i that operate their production technology while the rest (fraction $1 - e_i$) are assigned to work for a wage. For entrepreneurs who are called to operate their technology, the contract specifies how much output Z_i they should produce and how much they should pay (L_i, L_i^F) to the financial intermediary after production has taken place (as discussed below, the payment is conditional on the report that the entrepreneur makes to the intermediary). The financial intermediary finances production activities with external funds E and entrepreneurial net worth η.

3. Entrepreneurs learn their ability and report it to the financial intermediary.

cross-subsidies across different types of entrepreneurs. Consequently, efficiency requires that intermediaries make positive profits with some entrepreneurs and negative profits with others. This outcome cannot be supported as an equilibrium with free entry.

4. The financial intermediary selects the entrepreneurs that operate production technologies for each type (presumably by a randomization device). These entrepreneurs incur the production fixed cost f_j and hire capital and labor services with resources provided by the financial intermediary (type i entrepreneurs in industry j receive an amount of resources worth $y_i Z_i + f_j$). The entrepreneurs that are not chosen to operate their production technology do not receive resources and supply their labor services in the labor market for a wage rate.

5. Production takes place. Entrepreneurs that operate their technology sell the output of intermediate goods and make payments to the financial intermediary. Since we assume that production is publicly observable, financial intermediaries learn whether entrepreneurs have reported their true type or not. Loan repayments are contingent on entrepreneurial type and their reports. Type-i entrepreneurs that have operated their technology and reported truthfully their type pay L_i. Type-i entrepreneurs that have falsely reported their type pay L_i^F (the superscript F stands for false). Because of limited enforcement, payments cannot exceed a fraction ϕ of the value of output. Thus, a low value of ϕ implies a low ability to "punish" entrepreneurs that have misrepresented their type.

We have assumed that financial intermediaries can randomly select who, for each type of entrepreneur, will be called to operate a project. This randomization device could be interpreted as a form of credit rationing. We have allowed for randomization because it is efficient in our environment. Due to the discrete occupational choice, lotteries enhance welfare by convexifying the production. Efficiency requires projects to be operated at a maximum scale because the average cost of production is decreasing (due to fixed costs). Had we ruled out randomization, financial intermediaries would have to use the scale of production in order to ration resources across entrepreneurs. This will certainly make capital-market imperfections much more detrimental to production efficiency than we are currently considering. In this case, projects would not be run at an optimal scale and too many projects would be operated. Our main results about the consequences of capital-market imperfections for production efficiency and economic rents do not depend on allowing for randomization.

Financial intermediaries maximize entrepreneurs' expected consumption subject to resource feasibility, enforcement, incentive compatibility, and participation constraints. The allocation solving this maximization problem can be viewed as arising from competitive financial intermediaries bidding for loan contracts and with free entry in the intermediation business. Below, we formally describe the decision problem faced by financial intermediaries. Because financial intermediaries face a similar problem across industries, we focus on one industry. To simplify notation we do not index allocations and intermediate goods prices by the industry index although it should be understood that these objects will vary across industries. We also normalize the number of entrepreneurs dealing with each financial intermediary to 1 in order to keep the notation simple.

Entrepreneurs' consumption

The Revelation Principle allows us to focus, without loss of generality, on allocations where entrepreneurs truthfully report their type. Consider an entrepreneur of type i who operates his technology with probability e_i. The entrepreneur obtains an output of intermediate goods worth qZ_i in terms of consumption goods, pays an amount L_i to the financial intermediary, and consumes $qZ_i - L_i$ (where q is the price of the intermediate good produced by the entrepreneur). With probability $1 - e_i$ the entrepreneur is assigned to work for others and consumes his wage. The expected consumption of a type i entrepreneur is then given by

$$c_i = e_i \left(qZ_i - L_i\right) + (1 - e_i)w. \tag{2}$$

Entrepreneurs' expected consumption when they contract with financial intermediaries (before knowing their ability) is thus

$$c^e = \nu c_l + (1 - \nu)c_h. \tag{3}$$

Participation constraint

Since financial intermediaries maximize entrepreneurs' utility, and since they can achieve any allocation that entrepreneurs can achieve on their own, entrepreneurs are (weakly) better off by contracting with financial intermediaries. We shall later restrict model parameters so that in general equilibrium with perfect enforcement, entrepreneurs are indifferent between contracting with a financial intermediary or becoming workers. In this case, expected consumption of an entrepreneur is equal to the sum of the wage rate and entrepreneurial net worth: $c^e = w + \eta$, where $\eta = w(1 + r - \delta)$. In equilibrium, a fraction of entrepreneurs contract with financial intermediaries, and the rest become workers. When enforcement is imperfect, however, entrepreneurs will be strictly better off by contracting with a financial intermediary. The financial intermediary selects the entrepreneurs who run projects and the ones who work.

Enforcement and Incentive Compatibility Constraints

Since the ability type is not publicly observed, contracts are written so that entrepreneurs have incentives to report their true type. The incentive compatibility constraint for a type i is

$$c_i = e_i\,(qZ_i - L_i) + (1 - e_i)w \geq e_j(qZ_i^F - L_i^F) + (1 - e_j)w. \tag{4}$$

A type i entrepreneur that falsely claims to be type j, will operate his productive technology with probability e_j. In this case, he will be assigned an amount of resources $y_j Z_j + f$ in order to produce Z_j units of output. With this amount of resources, however, type i entrepreneurs will produce $Z_i^F = \min\{\frac{y_j}{y_i} Z_j, \widehat{Z}\} = \min\{\frac{A_i}{A_j} Z_j, \widehat{Z}\}$ instead of Z_j (recall that the ratio of per-unit cost of production across entrepreneurs is equal to the inverse of their relative productivity, and that output is bounded above by $\widehat{Z}$). Since the entrepreneur pays L_i^F to the financial intermediary when he misrepresents his type, he nets $qZ_i^F - L_i^F$.

As financial intermediaries have a limited ability to enforce repayments by entrepreneurs, loan repayment is constrained by

$$L_i \leq \phi\, q\, Z_i \quad \text{and} \quad L_i^F \leq \phi\, q\, Z_i^F. \tag{5}$$

Our contract does not allow financial intermediaries to make lump sum transfers to low-productivity entrepreneurs in order to give them incentives to reveal their types. By using lump-sum transfers, financial intermediaries could minimize the amount of projects operated by entrepreneurs with low productivity. We have ruled out transfers because they would not be feasible under a mild (and reasonable) variation of the economic environment. To make this point clear, consider the case where the economy has a large number of individuals who do not face any opportunity costs of pretending to be a bad type of entrepreneur. Then, if lump-sum transfers were part of the optimal contract, these individuals would have an incentive to collect a transfer by claiming to be a bad type of entrepreneur, and the optimal contract would not be resource feasible. It is also worth pointing out that our main results still go through if we allow for lump-sum transfers. In particular, low-type entrepreneurs will operate projects under sufficiently low enforcement. For sufficiently low enforcement, general equilibrium prices will be such that the operation of low-productivity projects becomes profitable for financial intermediaries. As a result, low-productivity projects will still be operated if we allow for lump-sum transfers.

Feasibility

We assume that each financial intermediary deals with a sufficiently large number of entrepreneurs so that, by the law of large numbers, it faces a fraction ν of entrepreneurs with low-quality projects. Financial intermediaries obtain funds from two sources: contributions from entrepreneurs (net worth) and external funds. Because the financing problem is intra-period, the opportunity cost of funds is given by 1. Expenditures of a financial intermediary are then constrained by

$$\nu\ e_l\ (Z_l\ y_l + f) + (1-\nu)\ e_h\ (Z_h\ y_h + f) = E + \eta, \tag{6}$$

where E denotes external funds raised by the financial intermediary, and η represents entrepreneurs' net worth. In the contract, only a fraction e_i of type i entrepreneurs are called to operate their technology. Each of these entrepreneurs receives an amount of resources worth $Z_i\ y_i + f$ in terms of consumption goods, where y_i denotes the marginal cost of production faced by type i entrepreneurs. Payments collected at the end of the period should satisfy

$$E = \nu\ e_l\ L_l + (1-\nu)\ e_h\ L_h. \tag{7}$$

Notice that with technologies exhibiting increasing returns to scale, it is optimal for entrepreneurs to pool their net worth and redistribute it across the operated projects. By allowing entrepreneurs to pool their resources, we are making capital-market imperfections less severe.

Intermediaries' Problem

The objective of financial intermediaries is to maximize the expected consumption of entrepreneurs by choosing $\left\{(c_l, e_l, Z_l, L_l, L_l^F), (c_h, e_h, Z_h, L_{h,} L_h^F), E\right\}$ in order to solve

$$\begin{aligned} &Max \ \{\nu c_l + (1-\nu)c_h\} \\ &s.t. \ (4) - (7). \end{aligned}$$

Contracts have to be incentive, resource, participation, and enforcement feasible. Financial intermediaries take the prices of intermediate goods and factor services as given.

Market Clearing

We end the description of the economic environment with the market-clearing conditions. In equilibrium, the following markets need to clear for all $t \geq 0$:

1. Labor market

$$N_y(t) + N_z(t) = 1 + \frac{\epsilon}{n}\sum_{j=1}^{n}\left[1 + \nu(1 - e_{lj}(t)) + (1-\nu)\left(1 - e_{hj}(t)\right)\right],$$

where ϵ denotes the measure of entrepreneurs and $N_z(t)$ denotes the labor used in the production of intermediate goods which satisfies

$$N_z(t) = \frac{\epsilon}{n}\sum_{j=1}^{n}\frac{(1-\alpha)}{w(t)}\left[\nu y_l(t)e_{lj}(t)Z_{lj}(t) + (1-\nu)y_h(t)e_{hj}(t)Z_{hj}(t)\right].$$

2. Capital market

$$k(t) + \epsilon w(t-1) = K_y(t) + K_z(t),$$

where $k(t)$ is the capital supplied by households, $\epsilon w(t-1)$ is the capital supplied by entrepreneurs, and $K_z(t)$ denotes the capital used in the production of intermediate goods which satisfies

$$K_z(t) = \frac{\epsilon}{n}\sum_{j=1}^{n}(\frac{\alpha}{r(t)})\left[\nu y_l(t)e_{lj}(t)Z_{lj}(t) + (1-\nu)y_h(t)e_{hj}(t)Z_{hj}(t)\right].$$

3. Intermediate goods

$$Z_j(t) = \epsilon \left[\nu e_{lj}(t) Z_{lj}(t) + (1-\nu) e_h(t) Z_{hj}(t)\right], \text{ for } j = 1, ..., n.$$

4. Consumption good

$$C(t) + K(t+1) - (1-\delta)K(t) + \frac{\epsilon}{n}\sum_{j=1}^{n} f_j \left[\nu e_{lj}(t) + (1-\nu) e_{hj}(t)\right] = Y(t),$$

where $C(t) = c(t) + \frac{\epsilon}{n}\sum_{j=1}^{n} c_j^e(t)$, $c(t)$ denotes households' consumption, $c_j^e(t)$ represents consumption of entrepreneurs in industry j (as defined in expression (3)), and $K(t) = K_z(t) + K_y(t)$ is the aggregate capital stock in the economy.

4 The Optimal Contract

In this section, we characterize, for fixed prices, the allocation that maximizes entrepreneurs' consumption subject to resource feasibility, participation, enforcement, and incentives constraints. Our main result is that under sufficiently low enforcement, capital-market imperfections can lead to the use of inefficient technologies. We consider the contracting problem of one industry and, for simplicity of notation, we omit the subscript j indexing industries.

To start, note that it is optimal to operate the entrepreneurial technology at its maximum scale $\widehat{Z}$, a result that follows from the increasing returns-to-scale property of the entrepreneurial technology.

Lemma 1. *In an optimal contract, a project is operated only at its maximum scale of operation* $\widehat{Z}$.

The intermediary, in principle, would like to operate only projects of high productivity (set $e_h > 0$ and $e_l = 0$). However, this goal is not feasible when entrepreneurs of low productivity have incentives to misrepresent their type. Using (4) we know that when $e_l = 0$, low-productivity entrepreneurs reveal their type truthfully if the contract satisfies

$$w \geq e_h(qZ_l^F - L_l^F) + (1-e_h)w. \tag{8}$$

A low-productivity entrepreneur that lies obtains an output $Z_l^F = \frac{A_l}{A_h}\widehat{Z}$ (since projects are operated at maximum scale). To deter lying, it is optimal to set the punishment for lying to the maximum possible value which implies

$$L_l^F = \phi \; q \; \widehat{Z}. \tag{9}$$

Combining (8) and (9), it is easy to see that lying is not optimal if the wage rate is higher than the profits made by operating the production technology, that is, if $w \geq q\frac{A_l}{A_h}(1 - \phi)\widehat{Z}$. The right-hand side of this inequality is decreasing in the enforcement parameter ϕ. Intuitively, we see that the higher the enforcement parameter ϕ, the higher the ability to punish entrepreneurs that misreport their type. Moreover, we shall see that, in general equilibrium, an increase in enforcement ϕ leads to an increase in the wage rate w and to a decrease in the price of intermediate goods q. The changes in relative prices associated with an increase in enforcement thus further reduce the incentives of low-quality entrepreneurs to lie.

We now focus on determining the amount that low-productivity entrepreneurs are asked to repay when they operate their technology. To this end, let us express the repayment of low-type entrepreneurs as $L_l = \chi q \widehat{Z}$, where $\chi \in [0, \phi]$. The optimal choice of χ involves the following trade-off: On the one hand, maximizing repayments by low-productivity entrepreneurs allows the financial intermediary to raise more external funds and fund more projects. As a result, maximizing the repayment by low-type entrepreneurs ($\chi = \phi$) maximizes the amount of resources devoted to the production of intermediate goods. On the other hand, minimizing repayments by low-productivity entrepreneurs improves the ratio of good-to-bad technologies in operation. Consequently, output per unit of productive resources increases. In order to show this last point, we set the incentive-compatibility constraint of low-productivity entrepreneurs at equality and use the fact that projects are operated at its maximum scale to obtain

$$\frac{e_h}{e_l} = \frac{(1-\chi)\widehat{Z} - w/q}{(1-\phi)\;\frac{A_l}{A_h}\widehat{Z} - w/q}. \tag{10}$$

Note that the ratio of high-to-low productivity projects operated $(\frac{e_h}{e_l})$ is decreasing in the repayment of low-productivity entrepreneurs (χ) because expected consumption of low-productivity entrepreneurs *decreases* with the amount they are asked to pay (χ) and *increases* with the fraction of low-productivity entrepreneurs that operate their technology (e_l). Then, when the incentive constraint for low-productivity entrepreneurs binds, an increase in repayment χ requires an increase in e_l for the constraint not to be violated. A higher repayment by low-productivity entrepreneurs (χ) is thus associated with a lower ratio of high-to-low productivity projects in operation ($\frac{e_h}{e_l}$).

In Lemma 2 we show that the aforementioned trade-off is resolved in favour of a corner solution: The optimal contract prescribes either $\chi = 0$ or $\chi = \phi$. The proof of Lemma 2 relies on the fact that the optimal contract can be expressed as a linear-programming problem.

Lemma 2: *If* $e_l > 0$, *then either* $L_l = 0$ *or* $L_l = \phi q \widehat{Z}$.

The fraction of low projects operated in equilibrium is obtained by combining (at equality) feasibility, payment, and incentive-compatibility constraints for low-productivity entrepreneurs:

$$e_l = \frac{\eta}{\nu \left\{ (y_l - \chi q)\widehat{Z} + f \right\} + (1-\nu) \left\{ (y_h - \phi q)\widehat{Z} + f \right\} \left(\frac{(1-\chi) q \widehat{Z} - w}{(1-\phi)\ q\ \frac{A_l}{A_h} \widehat{Z} - w} \right)}. \tag{11}$$

We can now characterize the optimal contract.

Proposition 1 (Low Enforcement). *If the incentive-compatibility constraint for low-productivity entrepreneurs binds (* $w < q \frac{A_l}{A_h}(1-\phi)\widehat{Z}$ *), then the optimal contract has the following properties:*

i) Both low- and high-productivity technologies are operated ((e_l, e_h) *are given by (10) and (11)).*

ii) *The ratio between the number of low- to high-productivity technologies in operation* (e_l/e_h) *decreases with the level of enforcement (*ϕ*).*

iii) *When the low-productivity technology is profitable (*$(q - y_l) * \widehat{Z} - f > w$*), low-productivity entrepreneurs are required to transfer a fraction* ϕ *of their output to the financial intermediary by the end of the period (*$\chi = \phi$*). When the low-productivity technology is* *not profitable* ($(q - y_l) * \widehat{Z} - f < w$), *low-productivity entrepreneurs are not required to make a transfer to the financial intermediary at the end of the period* ($\chi = 0$).

We say that the low-productivity technology is profitable when the profit from operating this technology is higher than the opportunity cost of the entrepreneur's time, that is, $\widehat{Z}(q - y_l) - f \geq w$. Proposition 1 shows that when the low-productivity technology is profitable, it is optimal to set $\chi = \phi$ so that the number of projects in operation is maximized (even if this involves a decrease in the average productivity of the technologies in operation). On the contrary, when the low-productivity technology is not profitable, it is optimal to set $\chi = 0$ in order to maximize the average productivity of the technologies in operation (even if this comes at the cost of reducing the number of projects in operation).

It is worth noting that, for fixed prices, an increase in enforcement leads to an increase in the ratio of good-to-bad projects being operated (see equation (10)). In the next section of the paper, we show that this effect is amplified in general equilibrium. In fact, an increase in the level of enforcement induces price changes that further increase the incentives to operate high-productivity technologies relative to low-productivity technologies.

5 General Equilibrium

This section focuses on how limited enforcement affects the contracting problem, and thus allocations, in general equilibrium. In particular, we evaluate the predictions of the theory for the variation of the equilibrium allocations across economies with different enforcement levels and discuss how these predictions relate to the cross-country observations documented in section 2.

5.1 Optimal Contracts in General Equilibrium

The analysis below focuses on steady-state equilibria and consists of a comparative statics exercise across economies that differ in enforcement levels (ϕ). In order to obtain analytical results, we assume that capital fully depreciates in a period ($\delta = 1$).

We define entrepreneurial rents as the ex-ante profits (net of the opportunity costs of entrepreneurs' time)

$$\pi_j \equiv (1-\nu)e_{hj}\left[(q_j - y_h)\widehat{Z} - w - f_j\right] + \nu e_{lj}\left[(q_j - y_l)\widehat{Z} - w - f_j\right],$$

where the first term of the sum represents the aggregate profits from the operation of high-productivity projects. Alternatively, entrepreneurial rents can be expressed as the industry revenue minus the cost of fixed inputs and payments to factors of production

$$\pi_j = q_j m_j \widehat{Z} - [m_j f_j + wN_j + wm_j + rK_j], \tag{12}$$

where $m_j \equiv \frac{\epsilon}{n}[(1-\nu)e_{hj} + \nu e_{lj}]$ is the number of projects operated in industry j (recall that ϵ/n is the measure of entrepreneurs in each sector, ν is the fraction of entrepreneurs with low productivity, and e_{ij} is the probability that an entrepreneur of type i in sector j will operate his technology, where $i = l, h$, and $j = 1, ..., n$).

In equilibrium, intermediate goods are produced only if entrepreneurial rents are non-negative ($\pi_j \geq 0$). The next proposition establishes that enforcement problems are at the origin of (positive) entrepreneurial rents.

Proposition 2. *Entrepreneurial rents in industry j are positive if and only if enforcement in industry j binds ($\chi_h = \phi$).*

Next, we derive an expression for output per worker in industry-j that will be useful for the analysis that follows. Note that value added by industry j (VA_j) is given by the value of its output ($q_j m_j \widehat{Z}$) minus the fixed cost of operation in this industry ($m_j f_j$). Using (12) we obtain

$$VA_j = q_j m_j \widehat{Z} - m_j f_j = wN_j + rK_j + wm_j + \pi_j. \tag{13}$$

Output per worker in industry j can then be expressed as

$$va_j = \frac{VA_j}{N_j} = w + rk + w\frac{m_j}{N_j} + \frac{\pi_j}{N_j}, \tag{14}$$

where k is the capital-to-labor ratio (which is constant across industries since the production technology has a constant capital intensity α across all industries), and $\frac{m_j}{N_j}$ is the inverse of the number of workers per project operated in industry j.

In Proposition 3 (see below) we show that if enforcement is sufficiently high (ϕ close to 1), then in equilibrium the low-productivity technology is not used and profits are equal to zero in all industries. Since only the high-productivity technology is used in all industries, the average quality of projects in operation does not vary across industries. Then, the number of workers per entrepreneur ($\frac{N_j}{m_j}$) does not depend on j. Thus, setting $\pi_j = 0$ in equation (14), it follows that value added per worker (va_j) is equal across industries (does not depend on j). Economies with high enforcement are thus characterized by high total-factor productivity, no dispersion in value added per worker across industries, and no economic rents.

Since the enforcement constraints do not bind when ϕ is sufficiently close to 1, a small change in ϕ around 1 does not affect equilibrium allocations. As the capacity to raise external funds decreases with ϕ, there exist a treshold level of enforcement ϕ^e and an industry $\bar{j}$ such that, for all economies with ϕ in the left neighborhood of ϕ^e, the enforcement constraint only binds in industry $\bar{j}$. Proposition 2 implies that in these economies, equilibrium profits are equal to zero in all industries but industry $\bar{j}$. Moreover, output per worker is higher in industry $\bar{j}$ than in any other sector in the economy. While industry $\bar{j}$ features higher marginal products of capital and labor than other sectors in the economy, factor inputs do not move to industry $\bar{j}$ because this industry faces a binding enforcement constraint. The allocation of productive resources in the economy is thus inefficient. Unlike in the case with ϕ close to 1, now a small increase in enforcement does have interesting consequences: It allows factors of production to move towards industry $\bar{j}$, thereby improving resource allocation. As a result, the share of employment and the output produced by industry $\bar{j}$ rises with the level of enforcement.

Proposition 3 also establishes that when enforcement is sufficiently low (ϕ close to 0), the low productivity technology is used in all industries. Here, a small increase in enforcement implies that more resources can move from the final-goods sector to the intermediate-goods industries facing binding enforcement constraints. These changes in resource allocation are accompanied by a decrease in the prices of intermediate goods and a rise in the wage rate. Thus, the ratio w/q_j increases with enforcement when the enforcement constraint of industry j binds. These general equilibrium price effects increase the reward of working relative to operating a technology so that the incentive-compatibility constraint of low-productivity entrepreneurs becomes less binding. We conclude that in economies where the low-productivity technology is operated (economies with ϕ close to 0), an increase in enforcement leads to a better selection of entrepreneurs (the ratio e_{hj}/e_{lj} rises) and improves the average productivity of the projects operated.

The proof of Proposition 3 relies on the following two assumptions:[10]

Assumption A1. Let $\widehat{Z} \geq z^* \frac{(1+2\epsilon)}{(1-\nu)\epsilon}$ (for some z^* defined in the proof of Proposition 3) and $\mu > \mu^* = \frac{(1-\alpha)A_h\epsilon}{(1-\alpha)A_h\epsilon + A_l}$.

Assumption A2. The elasticity of substitution between intermediate goods is equal to 1 ($\rho = 0$).

Proposition 3. *Assume A1-A2 hold. Consider steady-state equilibria of economies that differ in the level of enforcement ϕ, where $\phi \in [0,1]$. There exists a treshold level of enforcement $\phi^e < 1$ such that*

i) In economies with $\phi > \phi^e$, entrepreneurial rents are zero, the low-productivity technology is not operated, value added per worker is equal across industries, and the distribution of workers across industries is not affected by a small change in enforcement ϕ.

ii) In economies with $\phi < \phi^e$ there is, at least, one industry for which the enforcement constraint binds and entrepreneurial rents are positive. The higher the fixed cost of an industry, the more binding is the enforcement constraint of that industry.

[10] Assumption $A1$ ensures that the scale of operation is large enough so that when $\phi = 1$ economic rents are 0 and there are no productivity differentials across industries in the economy. This economy provides a convenient benchmark. We emphasize that the important result in Proposition 3 is that a decrease in ϕ leads to an increase in economic rents and higher inter-industry productivity differentials, a result that does not require assumption $A1$ to hold. Assumption $A2$ implies a unitary elasticity of substitution between intermediate goods in the production of final goods, which simplifies the algebra in the proof of Proposition 3. The elasticity of substitution plays an important role in determining how changes in enforcement affect labor productivity across industries. This issue is discussed in the next section of the paper.

a) *Value added per worker varies across industries: It is lowest in the final-goods sector and it is the highest in the industries where the enforcement constraint binds the most (industries with the highest fixed costs). The dispersion in labor productivity across industries declines with an increase in enforcement.*

b) *The distribution of employment across industries varies with the level of enforcement in the economy. A rise in the level of enforcement raises the number of workers employed in industries with binding enforcement constraints. Moreover, the higher the fixed cost of the industry is, the more responsive is the employment in the industry to changes in enforcement. As a result, industries with high fixed costs employ a low share of workers in economies with low enforcement.*

c) *If enforcement is sufficiently low (ϕ close to 0), then the low-productivity technology is operated in all industries. A small increase in enforcement increases the fraction of high productivity technologies in operation.*

Proposition 3 (part (i)) establishes that, in general equilibrium, entrepreneurial rents are equal to zero in all sectors in the economy when enforcement is sufficiently high. In this case, high-quality entrepreneurs are indifferent between operating their technologies and working for others, and low-quality entrepreneurs strictly prefer to work instead of operating their technology. The intuition behind this result is straightforward. In order to make up for the opportunity cost of entrepreneurial time and the fixed cost of operation, the price of intermediate goods (q_j) should be higher than the marginal cost of production (y_h) in equilibrium. Since the price of intermediate goods is above its marginal cost, the contract repayment by high-productivity entrepreneurs can be enforced in full as long as ϕ is close to 1 ($q_j > y_h$ implies $\phi q_j > y_h$). As a result, entrepreneurial production is not limited by enforcement problems. By choosing the maximum scale of production $\widehat{Z}$ large enough, we find conditions such that the fraction of high-quality entrepreneurs operating their technology is strictly less than 1 in equilibrium ($e_{jh} < 1$). In this case, profits from operating the high-quality technology are equal to the wage rate, and high-quality entrepreneurs are indifferent about whether to operate or not ($(q_j - y_h)\widehat{Z} - w - f = 0$ for all $j = 1, ..., n$). Moreover, the low-productivity technology is not profitable ($y_l > y_h$ implies that $(q_j - y_l)\widehat{Z} - w - f < 0)$). We conclude that the low-productivity technology is not operated in any sector ($e_{jl} = 0$ for all $j = 1, ..., n$) and that entrepreneurial rents are equal to zero when enforcement is high.

In part (iii) of Proposition 3, we find a restriction in the parameter space such that the low-productivity technology is used, in equilibrium, in all sectors provided enforcement is low enough (ϕ close to 0). This restriction on the parameters implies a lower bound on the share of intermediate goods in the production function of final goods (as stated in Assumption $A1$). Intuitively, as the importance of intermediate goods in the production function rises (μ increases), intermediate goods become more valuable. When enforcement is low (ϕ close to 0) and intermediate goods are scarce (μ sufficiently high), the price of intermediate goods is high enough to encourage low-productivity entrepreneurs to operate their technology. In this case, entrepreneurial rents are positive in all sectors.

Are the model predictions in Proposition 3 driven by the assumption that entrepreneurs have a positive productivity in only one industry? In other words, would the profits be equalized across sectors if entrepreneurs were to face a nontrivial choice of industry? The answer is no, provided that entrepreneurs are not equally productive across sectors. This is because the key driving force behind positive profits is scarcity, and scarcity is likely to vary across industries that differ in their needs for external financing. Scarcity arises from the fact that the resources used in an industry are bounded by the aggregate collateral that entrepreneurs can provide, which is the sum of their aggregate net worth and a fraction ϕ of the industry revenue from sales. The industry choice by entrepreneurs acts as a force towards equalization of profits across sectors: Sectors with the highest profits attract more entrepreneurs $-$ and hence collateral $-$ thereby increasing these industries' output and reducing their profits. However, to the extent that entrepreneurs are heterogeneous in their relative productivities across sectors, only a subset of entrepreneurs finds it profitable to operate in any given sector in the economy. Since the mobility decisions of entrepreneurs are constrained by the distribution of their productivities across sectors, the extent of scarcity is not necessarily equal across industries. Thus, in general, profits vary across industries, which together with (14) implies that output per worker varies across industries as well.

5.2 Implications for Development and the Evidence

Laporta et al. (1998) provide evidence that poor countries tend to be characterized by low enforcement relative to rich countries. We now summarize the main predictions of the theory regarding how enforcement affects equilibrium allocations and compare these findings to the cross-country data.

Total-Factor Productivity. Our theory implies that economies with low enforcement exhibit low total-factor productivity, low aggregate output, and low development of their financial system (as measured by the amount of assets intermediated relative to output). All of these implications are consistent with the empirical evidence (see Levine 1997). In our framework, low enforcement leads to the use of technologies with low productivity as a result of two effects: First, low enforcement implies a poor ability to punish entrepreneurs that lie about the true value of their investment opportunity (Proposition 1). Second, general equilibrium price effects (such as depressed wage rates and inflated output prices) make the operation of low-productivity technologies profitable (Proposition 3).

Economic Rents. Entrepreneurs do not extract economic rents when enforcement is high but they do so in economies with low enforcement (Proposition 3). Entrepreneurs are constrained in the amount of capital and labor that they can hire when enforcement is low (because of their inability to commit payment). By restricting the aggregate demand for factor inputs, limited enforcement puts downward pressure on factor prices. In equilibrium, entrepreneurs pay factors of production an amount below their marginal product and extract economic rents. The presence of economic rents suggests that entrepreneurs may have a vested interest in maintaining a status quo with low enforcement. Our theory also implies that income inequality (as measured by the entrepreneurial income relative to the wage rate) is larger when capital markets do not function well.

Labor Productivity and Employment across Industries. When enforcement is high (ϕ sufficiently close to 1), output per worker is constant across industries (Proposition 3). When enforcement constraints bind for some or all industries, output per worker varies across industries and is higher in industries with more binding enforcement constraints. Poor countries in our theory are characterized by large cross-industry productivity differentials relative to rich countries. What precludes factors from moving to the sector where they are most productive? The answer is that factors cannot move to the sectors with highest productivity because entrepreneurs in these industries cannot commit to pay for their services. Limited enforcement generates a barrier to factor mobility and, as a result, capital and labor are inefficiently allocated across industries. An increase in the level of enforcement then allows factor inputs to be allocated more efficiently across industries, diminishing the dispersion in output per worker across sectors in the economy.

The theory predicts that capital-market imperfections affect more negatively employment in the sectors that rely heavily on external financing and, as a result, the share of employment in these sectors is predicted to be positively associated with the level of financial development (enforcement). These predictions are consistent with the evidence reviewed in Section 2 (see Table 2 and Figures 4 and 5)). Moreover, the theory also accounts for the observation that the dispersion in output per worker is substantially larger in countries with low than in countries with high financial development (see Table 3).

We now focus on two additional regularities in the data that require more discussion. First, in the cross-country data, industries with low external dependence tend to have higher labor productivity than industries with high external dependence. The aggregate labor productivity in industries with low external dependence, as a fraction of labor productivity in manufacturing, is above 1 in the three country groups: It is 1.29 in countries with low financial development, 1.34 in countries with middle financial development, and 1.14 in countries with high financial development (see Table 3). The fact that labor productivity is high in industries with low external dependence suggests that these industries are either capital intensive, skill intensive, or both. Although our analysis did not address this issue, our model can be extended to incorporate differences in capital and skill intensities across sectors, pending the availability of the data.[11] A second regularity in the data is that a decrease in the level of financial development − across countries − tends to be associated with a decrease in the labor productivity of industries with high external dependence relative to the labor productivity in industries with low external dependence. Our theory is able to

[11] Notice that the Unido data do not provide measures of capital and skill intensities across industries.

account for these patterns, provided the elasticity of substitution between intermediate goods is high (above 1). The intuition is as follows.

When the elasticity of substitution is equal to 1 − as in Proposition 3 − producers of final goods spend a fixed expenditure share on each intermediate good. Hence, a reduction in enforcement implies a reduction in aggregate income that translates into a proportional reduction in the demand for all intermediate goods. It also implies a decrease in the supply of all intermediate goods, but this reduction is not symmetric across industries: It is higher in industries with a high fixed cost of operation. As a result, a decrease in enforcement makes the goods produced by these industries relatively more scarce, thereby increasing their relative prices. These changes in prices, in turn, lead to an increase in the relative labor productivity of industries with high fixed costs. However, when the elasticity of substitution is above 1, the effects of enforcement on labor productivity across industries can be reversed. Here, as enforcement decreases, final-goods producers substitute inputs towards the cheaper inputs produced by the low fixed-cost industries. As a result, a decrease in enforcement raises the demand for the low-cost intermediate goods relative to the high-cost goods.[12] When these changes in the demand are sufficiently strong, the industries with low fixed costs will experience an increase in the relative prices of their output and, hence, an increase in their labor productivities relative to other sectors in the economy.[13] Thus, the value of the elasticity of substitution determines how enforcement affects labor productivity across industries with different degrees of external dependence.

[12] Note that the share of employment by industries with high fixed costs decreases with a reduction in enforcement. The *quantitative* importance of these effects is higher the higher the elasticity of substitution between intermediate goods.

[13] For tractability reasons, Proposition 3 only considers the case of a unitary elasticity of substitution. Nonetheless, we have verified numerically that when the elasticity of substitution is sufficiently above 1, the relative labor productivity of industries with high fixed costs decreases with the level of enforcement in the economy.

5.3 Discussion

There are several distinctive features of the theory that merit further discussion. As in the seminal work of Parente and Prescott (1999, 2000), our theory explains why inefficient technologies are used in equilibrium. While Parente and Prescott (1999, 2000) study equilibria with monopoly-type arrangements, we develop a theory of TFP with competitive markets. In our theory, entrepreneurs take prices as given but the equilibrium allocation resembles the outcome of a collusive agreement. Capital-market imperfections constrain entrepreneurial output, increasing the price of intermediate goods and depressing the equilibrium wage rate. Entrepreneurs, as a class, benefit from credit-market imperfections since they allow them to extract rents. Entrepreneurs could also extract rents through a collusive agreement, but that would be difficult to enforce since each entrepreneur would face incentives to increase his production. It is thus important that capital-market imperfections provide an *incentive-compatible* mechanism benefiting entrepreneurs, a result that is consistent with the views of Rajan and Zingales (2003). In discussing the impediments to financial development, Rajan and Zingales point out that industrial incumbents may lose with financial development since the latter breeds competition which, in turn, erodes incumbents' profits. Industrial incumbents may also find it advantageous to leave finance underdeveloped as opposed to directly banning entry. Direct-entry restrictions often require costly enforcement, especially when the product whose market is being restricted has many close substitutes. Moreover, the bureaucracy in charge of regulation is likely to demand a fraction of the profits made by the industrial incumbents. In contrast, as Rajan and Zingales argue, leaving finance underdeveloped is an act of omission and may thus be much easier to implement.

Economic historians and economists (North (1988); Engerman and Sokoloff (1997); Acemoglu, Johnson and Robinson (2000)) have long emphasized that institutions are crucial for understanding the differential path of development across similar countries in the world. This view raises the challenge of explaining where the differences in institutions come from. Kocherlakota (2001) addresses this question using a mechanism design approach. He develops a framework in which limited enforcement restricts the ability of the social planner to tax individuals and redistribute social surplus. He shows that limited enforcement and high inequality are crucial for understanding why societies choose institutions leading to the inefficient use of the means of production. Our findings also point to the importance of inequality and limited commitment but in the context of a growth model in which limited enforcement affects the provision of incentives in the capital markets. In discussing episodes from economic history, Sokoloff and Engerman (2000) argue that the different environments in which the Europeans established their colonies may have led to societies with very different degrees of inequality and that these differences might have persisted over time and affected the course of development through their impact on the institutions that evolved.

Restuccia et al. (2003) find that the low agricultural productivity in poor countries is explained by low use of intermediate goods (such as pesticides, chemical fertilizers, and fuel). They also document that prices of intermediate goods are relatively high in poor countries. They calibrate a two-sector growth model with an explicit agricultural sector and find that cross-country differences in relative price play an important role in understanding cross-country differences in the use of intermediate goods and, thus, in agricultural productivity. They argue that "barriers to labor mobility" are needed in order to explain the high employment share of agriculture in poor countries. While our paper does not model the agricultural sector explicitly, it does provide a theory with the ingredients for explaining the observations in Restuccia et al. (2003): In our theory, a decrease in enforcement increases the relative price of intermediate goods, thereby decreasing the use of intermediate goods and labor productivity in the final-goods sector sector. Moreover, low enforcement limits employment in the intermediate goods sectors with high relative productivity. Thus, the theory implies that to the extent that the production of agricultural inputs in poor countries are subject to capital-market imperfections, we should expect poor countries to be characterized by low labor productivity and a high employment share in agriculture, as documented in Section 2.

Our theory can also provide some insights about the low real investment rates in poor countries. Hsieh and Klenow (2002) argue that poor countries have low real investment rates because they are plagued with low efficiency in the production of investment goods, which leads to a high relative price of capital and a low real investment rate. If we extended our model to include an investment sector that relies heavily on external financing, then the *relative* price of investment would be high in poor countries.[14] Interestingly, Rajan and Zingales (1998) find that Machinery ranks among the industries most highly dependent on external financing.

6 Conclusion

The contribution of this paper is to build a general equilibrium theory with endogenously motivated financial intermediation that provides an explanation for the following observations characterizing poor countries: *i*) use of inefficient technologies, *ii*) low aggregate TFP, *iii*) large productivity differences across industries, *iv*) large employment shares of low productivity sectors, and *v*) relative prices that differ from those in rich countries. The theory also suggests that entrepreneurs have a vested interest in maintaining a status quo with low enforcement since it allows them to extract economic rents from the factors that they hire.

We view our theory to be related to Parente and Prescott's (1999, 2000) theory of monopoly unions of specialized input suppliers. Since economic rents provide incentives to workers to organize themselves as a union, capital-market imperfections may be an important element in understanding in which industries the forces emphasized by Parente and Prescott are more important.

It would be interesting to study the issues addressed in this paper in a framework with dynamic contracts. In this way, we can study how capital-market imperfections affect entrepreneurial selection and firm growth across industries. It would also be interesting to study the consequences of capital-market imperfections for international trade. We conjecture that capital-market institutions are an important determinant of industry specialization across countries. We leave these issues for future research.

[14] We emphasize that our theory only pins down relative prices. If we assume that investment goods are tradable, then low productivity in the tradable sector will imply a low wage rate and a low price of non-tradable goods (such as hair cuts and other non-tradable services). In a recent paper, Castro et al. (2005) develop a theory in which countries with weaker investor protection also face a higher relative price of investment goods. In their theory, firms producing capital goods face a higher level of indiosyncratic risk than their counterparts producing consumption goods.

7 References

ACEMOGLU, D., JOHNSON, S., and ROBINSON, J. (2001). "The Colonial Origins of Comparative Development: An Empirical Study," *American Economic Review* 91, 1369-1401.

BENCIVENGA, V.R., and SMITH, D. (1991). "Financial Intermediation and Endogenous Growth," *Review of Economics Studies*, 58, 195-209.

BOYD, J., and PRESCOTT, E.C. (1986). "Financial Intermediary-Coalitions," *Journal of Economic Theory*, 38(2), April 1986, 211-232.

CASTRO, R., CLEMENTI, G. L., and MACDONALD, G. (2004). "Investor Protection, Optimal Incentives, and Economic Growth," *Quarterly Journal of Economics*, Vol. 119 (3), pp. 1131-1175, August 2004.

CASTRO, R., CLEMENTI, G. L., and MACDONALD, G. (2005). "Legal Institutions, Sectoral Heterogeneity, and Economic Development," mimeo, University of Montreal.

ENGERMAN, S. and SOKOLOFF, L. (1997), "Factor Endowments, Institutions, and Differential Paths of Growth among New World Economies: A View from Economic Historians of the United States", in *How Latin America Fell Behind*. Stephen Harber, ed. Stanford: Stanford University Press.

EROSA, A. (2001). "Financial Intermediation and Occupational Choice in Development," *Review of Economic Dynamics*, 4, 303-334.

GOLLIN, D., PARENTE S., and ROGERSON, R (2002). "The Role of Agriculture in Development," *American Economic Review,* 92(2),160-164.

GREENWOOD, J. and JOVANOVIC, B. (1990). "Financial Development, Growth and the Distribution of Income," *Journal of Political Economy,* 98, 1067-1107.

HALL, R.E. and JONES, C.I. (1999). "Why Do Some Countries Produce So Much More Output per Worker than Others," *Quarterly Journal of Economics*, 114, 83-116.

HERRENDORF, B. and TEIXEIRA, A. (2003). "Monopoly Rights Can Reduce Income Big Time," mimeo. Universidad Carlos III.

HOLMES, T. and SCHMITZ, J. (2001). "A Gain from Trade: From Unproductive to

Productive Entrepreneurship," *Journal of Monetary Economics* 47, 417-446.

HSIEH, C-T., and KLENOW, P.J. (2002). "Relative Prices and Relative Prosperity," mimeo.

IMROHOROGLU, A., and KUMAR, K. (2004). "Capital Flows," *Review of Economic Dynamics,* 7(3), 586-612.

KOCHERLAKOTTA, N. (2001). "Building Blocks for Barriers to Riches," Research Department Staff Report 288, Federal Reserve Bank of Minneapolis.

KRUSELL, P. and RIOS-RULL, J-V. (1996). "Vested Interest in a Positive Theory of Stagnation and Growth," *Review of Economic Studies*, 63, April 1996, 301-331.

KUZNETS, S. (1966). *Modern Economic Growth.* New Heaven, CT: Yale University Press.

LA PORTA, R., LOPEZ-DE-SILANES, F., SHLEIFER, A., and VISHNY, R. (1998). "Law and Finance," *Journal of Political Economy*, 106, 1113-1155.

LEVINE, R. (1997). "Financial Development and Economic Growth: Views and Agenda," *Journal of Economic Literature*, 35, June 1997, 688-726.

NORTH, D. (1988). "Institutions, Economic Growth, and Freedom: An Historical Introduction," in *Freedom, Democracy, and Economic Welfare.* Michael A. Walker, ed., Vancouver: Fraser Institute.

PARENTE, S., and PRESCOTT, E. (1999). "Monopoly Rights: A Barrier to Riches," *American Economic Review*, 89, 1216-1233.

PARENTE, S., and PRESCOTT, E. (2000). *Barrier to Riches.* Third Walras-Pareto Lecture. University of Lausanne. MIT Press.

PRESCOTT, E. (1998). "Needed a Theory of Total Factor Productivity," *International Economic Review*, 39, 525-552.

PRESCOTT, E., and TOWNSEND, R. (1984). "Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard," *Econometrica,* 52, 21-45

RAJAN, R.G., and ZINGALES, L. (1998), "Financial Dependence and Growth," *American Economic Review*, 88, 559-586.

RAJAN, R.G., and ZINGALES, L. (2003). *Saving Capitalism from the Capitalists: Un-*

leashing the Power of Financial Markets to Create Wealth and Spread Opportunity, New York: Crown Business.

RESTUCCIA, D., and URRUTIA, C. (2001). "Relative Prices and Investment Rates," *Journal of Monetary Economics*, 47, 93-121.

RESTUCCIA, D., YANG, T., and ZHU, X. (2003). "Agriculture and Aggregate Productivity: A Quantitative Cross-Country Analysis," mimeo,University of Toronto.

SOKOLOFF, L., and ENGERMAN, S. (2000). "History Lessons: Institutions, Factor Endowments, and Paths of Development in the New World," *Journal of Economic Perspectives*, 14(3), 217-232.

TOWNSEND, R. (1978). "Intermediation with Costly Bilateral Exchange," *American Economic Review*, 73,417-425.

VAN BIESEBROECK, J. (2005). "Firm Size Matters: Growth and Productivity Growth in African Manufacturing," *Economic Development and Cultural Change*, 53 (3), 545-84.

8 Appendix

Proof of Lemma 1. We assume, as a way of finding a contradiction, that there exists an optimal contract $(Z_h^1, L_h^1, e_h^1, Z_l^1, L_l^1, e_l^1)$ with $Z_h^1 < \widehat{Z}$. Then, we set an alternative contract with $Z_h^2 = \widehat{Z}, e_h^2 = \frac{Z_h^1 e_h^1}{\widehat{Z}} < e_h^1, L_h^2 = \frac{L_h^1 e_h^1}{e_h^2}$ (notice that the allocation for low-types is not changed). Notice that enforceability of contract 1 implies enforceability of contract 2. To see this, multiply the enforcement constraint of the first contract by the ratio $\frac{e_h^1}{e_h^2}$ in order to obtain

$$\frac{L_h^1 e_h^1}{e_h^2} = L_h^2 \leq \phi q_z Z_h^1 \frac{e_h^1}{e_h^2} = \phi q_z \widehat{Z}.$$

Similarly, contract 2 is resource feasible since it requires the same amount of aggregate expenditure in variable inputs, external financing, and payments as contract 1 but less expenditure in fixed inputs (since $e_h^2 < e_h^1$). Moreover, contract 2 is incentive-compatible for low-productivity entrepreneurs since their payoff for lying is lower under contract 2 than under contract 1 (the decrease in e_h relaxes the incentive-compatibility constraint for low-types). However, contract 2 gives higher utility to high-type entrepreneurs since $c_h^2 - c_h^1 =$

$(e_h^1 - e_h^2)(w+f) > 0$ since $e_h^1 > e_h^2$, contradicting the optimality of contract 1. Using a similar type of argument, it is easy to show that $e_l > 0$ implies $Z_l = \widehat{Z}$. Q.E.D.

Proof of Lemma 2. By Lemma 1 we can set $Z_l = Z_h = \widehat{Z}$. By multiplying the enforcement constraint of agent i by e_i and by defining $\widetilde{L}_i = e_i L_i$ we can express the optimal problem of the intermediary as a linear programming problem in $(\widetilde{L}_l, \widetilde{L}_h, e_l, e_h)$:

$$\max \nu \left\{ q_z \widehat{Z} e_l - \widetilde{L}_l + (1-e_l)w \right\} + (1-\nu) \left\{ q_z \widehat{Z} e_h - \widetilde{L}_h + (1-e_h)w \right\}$$

$s.t.$

$$\begin{aligned}
\widetilde{L}_i &\leq \phi q_z \widehat{Z} e_i \\
q_z \widehat{Z} e_i - \widetilde{L}_i + (1-e_i)w &\geq q_z \frac{A_i}{A_j}(1-\phi)\widehat{Z} e_j + (1-e_j)w \\
v(y_l \widehat{Z} + f)e_l + (1-\nu)(y_h \widehat{Z} + f)e_h &\leq \nu \widetilde{L}_l + (1-\nu)\widetilde{L}_h + \eta. \\
0 &\leq e_i \leq 1, \widetilde{L}_i \geq 0.
\end{aligned}$$

Notice that $e_l > 0$ only if the incentive compatibility of low-types binds. The enforcement constraint of high-type and the feasibility constraint also bind (since $q_z > y_h$). As a result, we have three equations to be satisfied. The linearity of the constraints and objective function implies that either $\widetilde{L}_l = 0$ or $\phi q_z \widehat{Z} e_l$. We then have four linear equations in four unknowns. Q.E.D.

Proof of Proposition 1. As we previously showed, when the incentive-compatibility constraint of low-quality entrepreneurs binds, $e_l(\chi)$ is given by equation 9 and $e_h(\chi)$ is obtained from combining equations 8 and 9, where χ is the fraction of output that low-types contract to repay at the end of the period. By Lemma 2 we know that χ is either equal to 0 or ϕ in an optimal contract. Denote by $c^e(\chi)$ the entrepreneurs' consumption as a function of χ:

$$c^e(\chi) \equiv \nu[e_l(\chi) q_z \widehat{Z}(1-\chi) + (1-e_l(\chi))w] + (1-\nu)[e_h(\chi) q_z (1-\phi)\widehat{Z} + (1-e_h(\chi))w].$$

Then $\chi = \phi$ is optimal if and only if $c^e(\phi) \geq c^e(0)$. Using the expressions derived for $e_l(\chi)$ and $e_h(\chi)$ we obtain

$$c^e(\chi) = \frac{\eta\nu[q_z\widehat{Z}(1-\chi) - w] + \eta(1-\nu)[q_z\widehat{Z}(1-\phi) - w]\left(\frac{(1-\chi)q_z\widehat{Z}-w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z}-w}\right)}{\nu\{(y_l - \chi q_z)\widehat{Z} + f\} + (1-\nu)\{(y_h - \phi q_z)\widehat{Z} + f\}\left(\frac{(1-\chi)q_z\widehat{Z}-w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z}-w}\right)} + w \tag{15}$$

Defining $M \equiv \nu\{(y_l - \phi q_z)\widehat{Z} + f\} + (1-\nu)\{(y_h - \phi q_z)\widehat{Z} + f\}\left(\frac{(1-\phi)q_z\widehat{Z}-w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z}-w}\right)$ and $N \equiv \nu\{y_l\widehat{Z} + f\} + (1-\nu)\{(y_h - \phi q_z)\widehat{Z} + f\}\left(\frac{q_z\widehat{Z}-w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z}-w}\right)$, we obtain that $c^e(0) \leq c^e(\phi))$ if and only if

$$\begin{aligned}&\left\{\nu(q_z\widehat{Z} - w) + (1-\nu)(q_z\widehat{Z}(1-\phi) - w)\left(\frac{q_z\widehat{Z} - w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z} - w}\right)\right\} M \\ &- \left\{[q_z\widehat{Z}(1-\phi) - w]\left[\nu + (1-\nu)\left(\frac{(1-\phi)q_z\widehat{Z} - w}{(1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z} - w}\right)\right]\right\} N \leq 0,\end{aligned} \tag{16}$$

which is equivalent to

$$\left[(q_z\widehat{Z} - w)M - (q_z\widehat{Z}(1-\phi) - w)N\right]\left[\nu + (1-\nu)\frac{(q_z\widehat{Z}(1-\phi) - w)}{((1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z} - w)}\right] \leq 0. \tag{17}$$

Since $(q_z\widehat{Z} - w)M - (q_z\widehat{Z}(1-\phi) - w)N\} = \nu q_z\phi[\widehat{Z}(-q_z + y_l) + f + w]$, the previous inequality can be written as

$$\nu q_z\phi\left[\widehat{Z}(-q_z + y_l) + f + w\right]\left\{\nu + (1-\nu)\frac{(q_z\widehat{Z}(1-\phi) - w)}{((1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z} - w)}\right\} \leq 0. \tag{18}$$

The sign of expression on the LHS of the above inequality is determined by the sign of the two terms in brackets. The second term in brackets is positive since $w < (1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z} < (1-\phi)q_z\widehat{Z}$ (the first inequality follows from the assumption that the incentive compatibility of low-quality entrepreneurs binds). It then follows that $c^e(0) \leq c^e(\phi)$ if and only if

$$\widehat{Z}(q_z - y_l) - w - f \geq 0. \tag{19}$$

This condition says that the revenue from operating low-quality projects (net of operating costs) should be higher than the opportunity cost of entrepreneurs' time. We thus conclude that it is optimal to set $\chi = \phi$ if it is profitable for the financial intermediary to operate low-quality projects. On the other hand, if $w > \widehat{Z}(q_z - y_l) - f$, it is optimal to set $\chi = 0$. Thus, when the parameter region is such that $\widehat{Z}(q_z - y_l) - f < w < (1-\phi)\ q_z\ \frac{A_l}{A_h}\widehat{Z}$ is optimal to set $e_l = e_l(0) > 0$ and $\chi = 0$. Q.E.D.

Proof of Proposition 2. We start by writing the intermediary's problem. The intermediary maximizes expected consumption of entrepreneurs c^e. Using 2, 3, 4, and Lemma 1 we obtain

$$c^e = \nu e_l \left\{ q_z\widehat{Z} - (\widehat{Z}\ y_l + f + w) \right\} + (1-\nu) e_h \left\{ q_z\widehat{Z} - (\widehat{Z}\ y_h + f + w) \right\} - \eta + w.$$

This maximization is subject to the intermediary's budget constraint

$$\nu\ e_l\ (\widehat{Z}\ y_l + f) + (1-\nu)\ e_h\ (\widehat{Z}\ y_h + f) = \nu\ e_l \chi_l q_z \widehat{Z} + (1-\nu)\ e_h \chi_h q_z \widehat{Z} + \eta, \tag{20}$$

enforcement constraints $\chi_j \leq \phi$ for $j = l, j$, and the incentive compatibility constraint

$$e_l\ (1-\chi_l) q_z \widehat{Z} + (1-e_l) w \geq e_h\ (1-\phi) q_z \widehat{Z}\frac{A_l}{A_h} + (1-e_h) w. \tag{21}$$

The F.O.C. with respect to $\{e_l, e_h, \chi_l, \chi_h\}$ are

$$e_l \ :\ \nu \left\{ q_z\widehat{Z} - (\widehat{Z}\ y_l + f + w) \right\} + \lambda\nu\ \{\chi q_z \widehat{Z} - (\widehat{Z}\ y_l + f)\} + \gamma\{(1-\chi) q_z \widehat{Z} - w\} \leq 0, = 0 \text{ if } e_l > 0 \tag{22}$$

$$e_h \ :\ (1-\nu) \left\{ q_z\widehat{Z} - (\widehat{Z}\ y_h + f + w) \right\} + \lambda(1-\nu)\{\ \chi_h q_z \widehat{Z} - (\widehat{Z}\ y_h + f)\} - \gamma\{(1-\phi) q_z \widehat{Z}\frac{A_l}{A_h} - w\} = 0 \tag{23}$$

$$\chi_l \ :\ \lambda\nu\ e_l q_z \widehat{Z} + \gamma e_l\ (-1) q_z \widehat{Z} \begin{cases} = 0 \text{ if } \chi_l \in (0,\phi), \\ \leq 0 \text{ if } \chi_l = 0, \\ \geq 0 \text{ if } \chi_l = \phi. \end{cases} \tag{24}$$

$$\chi_h \ :\ \lambda(1-\nu)\ e_h q_z \widehat{Z} \begin{cases} = 0 \text{ if } \chi_h \in (0,\phi), \\ \leq 0 \text{ if } \chi_h = 0, \\ \geq 0 \text{ if } \chi_h = \phi, \end{cases} \tag{25}$$

where λ and ν are the multipliers associated to the constraints (20) and (21) for the case $j = l$.

Multiply (22) by e_l and (23) by e_h to obtain

$$\begin{aligned} e_l\pi_l + e_h\pi_h \ &= \ \lambda \left\{ \nu e_l \left(\widehat{Z}\ y_l + f - \chi_l q_z \widehat{Z} \right) + (1-\nu) e_h \left(\widehat{Z}\ y_h + f - \ \chi_h q_z \widehat{Z} \right) \right\} \\ &\quad + \gamma \left(e_h\{(1-\phi) q_z \widehat{Z}\frac{A_l}{A_h} - w\} - e_l\{(1-\chi_l) q_z \widehat{Z} - w\} \right). \end{aligned} \tag{26}$$

From (25) we know that $\lambda > 0$ implies $\chi_h = \phi$. Moreover, $0 < \chi_h < \phi$ only if $\lambda = 0$. Using (20), (21), (26), and the Kuhn-Tucker complementary slackness conditions we obtain $e_l \pi_l + e_h \pi_h = \lambda \eta$. Thus, profits are positive if and only if $\lambda > 0$. We conclude that profits are positive if and only if the enforcements-constraint for high types binds ($\lambda > 0$ and $\chi_h = \phi$). QED.

Proof of Proposition 3.

Proof of Part *i)*.We first show that assumption A1 implies that profits (π_j) are equal to 0 in all intermediate-goods industries when $\phi = 1$. Consider an economy with the fixed cost $f_j = 0$, for $j = 1, ..., n$. We use this economy to find an upper bound to the quantity of intermediate goods produced in the equilibrium of the economy with $\phi = 1$ and $f_j \geq 0$. When $f_j = 0$ for all j, profits are 0 in industry j (and $e_{j,h} < 1$) only if equilibrium prices satisfy $w = (q_j - y_h)\widehat{Z}$, for $j = 1, ..., n$. Note that q_j does not depend on j when $f_j = 0$ for all j (all sectors are identical) so that we can neglect the index j from the above equation and write $w = (q - y_h)\widehat{Z}$. Using firms' FOC and the consumers' Euler equation (together with $\delta = 1$), we can express this equation as a single equation in the ratio of intermediate goods to labor in the final-goods sector sector.[15] Denote by z^* the solution to this equation (corresponding to the economy with $\phi = 1$ and $f_j = 0$ for all j). The quantity of intermediate goods is bounded above by $Z^* = z^*(1 + 2\epsilon)$ (since aggregate labor in the economy is less than $1 + 2\epsilon$).

Now consider an economy with $f_j \geq 0$ (now f_j is not necessarily equal to zero). We show that if $\widehat{Z}$ is such that $(1 - \nu)\epsilon\widehat{Z} > Z^*$, then in equilibrium prices are such that $w = (q_j - y_h)\widehat{Z} - f_j$. To this end, note that a necessary condition for positive production is that $w \leq (q_j - y_h)\widehat{Z} - f_j$ (otherwise output in the economy would be 0). Moreover, if prices satisfy $w < (q_j - y_h)\widehat{Z} - f_j$, then the aggregate supply of intermediate good j would be at least $\epsilon(1 - \nu)\widehat{Z}$ (and even higher if low-quality entrepreneurs choose to operate their technology),

[15] Using firms' FOC and households' Euler equation we can obtain $w = \frac{(1-\alpha)}{\alpha\beta}k$, $q_z = \frac{k\mu}{\beta\alpha(1-\mu)z}$, $r = 1/\beta = \alpha(1-\mu)k^{\alpha(1-\mu)-1}z^{\mu}$, where k and z denote the capital-to-labor and the intermediate goods to labor ratios in the final-goods sector. Then, y_h can be written as $y_h = \frac{1}{\alpha A_h \beta}k^{1-\alpha}$. Combining the expressions just obtained for w,q_z, and y_h, the equation $w = (q_z - y_h)\widehat{Z}$ can be expressed as an equation in a single unknown (z).

so that $(1-\nu)\epsilon\widehat{Z} > Z^*$ implies that the market for intermediate good j would not clear. Then, for the market to clear it is necessary that $w = (q_j - y_h)\widehat{Z} - f_j$. In this case, only a fraction less than one of high-quality entrepreneurs operate their technology in equilibrium. By continuity, the above argument holds for ϕ close to 1. When ϕ is close to 1, enforcement and incentive-compatibility constraints do not bind (for all industries). Therefore, a decrease in enforcement ϕ around 1 does not affect equilibrium allocations and prices, and value added per worker is constant across industries (as in the economy with $\phi = 1$).

Proof of Part *ii*). Denote the equilibrium prices of the economy with $\phi = 1$ by $(w^*, q_1^*, ...q_n^*)$. When $\phi = 1$, a small decrease in the level of enforcement does not affect equilibrium allocations and prices. Denote by ϕ^e the treshold value of enforcement for which the enforcement constraint binds for the first time for some industry in the economy. Denote by j this industry. We now show how to determine ϕ^e under the assumption that $e_{lj} = 0$ when $\phi = \phi^e$.[16] The results that follow can also be derived when parameters are such that $e_{lj} > 0$ when $\phi = \phi^e$, and are omitted for brevity.

The threshold value of enforcement ϕ^e is obtained by solving for ϕ from the intermediary's budget constraint at equality (setting $e_{lj} = L_{lj} = 0$ and $L_h = \phi q_j \widehat{Z}$)

$$m_j\ (\widehat{Z}\ y_h^* + f_j) =\ m_j \phi q_j^* \widehat{Z} + \eta^*,$$

where $m_j = (1-\nu)\ e_{hj}$ is the number of projects operated. Because the enforcement constraint starts binding at $\phi = \phi^e$, we know that profits of industry j are $\pi_j = q_j^* \widehat{Z} - (\widehat{Z}\ y_h^* + f_j + w^*) = 0$. Since, in equilibrium, $\eta^* = w^*/\beta$, we obtain

$$m_j\ (\widehat{Z}\ y_h^* + f_j) - w^*/\beta = m_j(\widehat{Z}\ y_h^* + f_j + w^*)\phi,$$

so that enforcement constraint in industry j binds for ϕ equal to

$$\phi^e = \frac{(\widehat{Z}\ y_h^* + f_j)}{\widehat{Z}\ y_h^* + f_j + w^*} - \frac{w^*}{m_j(\widehat{Z}\ y_h^* + f_j + w^*)\beta}.$$

[16] A sufficient condition for this to be true is that $1 + \frac{1}{\beta(1-\nu)e_{hn}^*} < \frac{A_h}{A_l}$, where e_{hn}^* denotes the equilibrium value of e_{hn} in the economy with $\phi = 1$. Note that e_{hn}^* does not depend on A_l for $A_l < A_h$ since low-productivity projects are not operated when $\phi = 1$. As a result, the condition holds in economies with A_l sufficiently small.

Under assumption $A1$, optimality by firms in the final-goods sector implies that $m_j q_j \widehat{Z} = \mu Y/n$, which using $\pi_j = 0$ implies $m_j = \frac{\mu Y/n}{\widehat{Z}\ y_h + f_j + w}$. Plugging this expression into the above formula for ϕ^e, we obtain

$$\phi^e = \frac{(\widehat{Z}\ y_h^* + f_j)}{\widehat{Z}\ y_h^* + f_j + w^*} - \frac{w^*}{\mu(Y/n)\beta}. \tag{27}$$

Note that ϕ^e only depends on j through the term f_j. It follows from (27) that ϕ^e is an increasing function of f_j. Thus, as ϕ decreases below 1, the enforcement constraint binds first in the industry with the highest fixed cost ($j = n$). Note that we have impose that the incentive compatibility constraints do not bind for $\phi \geq \phi_j^e$ (otherwise prices would change with ϕ). We now find conditions so that this holds true. Given prices of the economy with $\phi = 1$, the treshold level of enforcement at which the incentive-compatibility constraint binds is given by

$$\phi_j^{ic} = 1 - \frac{w^*}{q_j^* \widehat{Z}} \frac{A_h}{A_l} = 1 - \frac{w^*}{\widehat{Z}\ y_h^* + f_j + w^*} \frac{A_h}{A_l}. \tag{28}$$

Using *(27)* and *(28)*, it is easy to check that $\phi_j^{ic} < \phi_j^e$ if $1 + \frac{1}{\beta(1-\nu)e_h^*} < \frac{A_h}{A_l}$, which is true if A_l is chosen small enough (note that e_h^* does not depend on A_l for $A_l < A_h$ since $e_l^* = 0$).

We now show that when the enforcement constraint of an industry binds, its value added per worker is increasing in the fixed cost of the industry. We then study how changes in enforcement impact across industries that differ on f_j. We divide the analysis in two cases.

Case 1: Consider the case $e_{lj} = 0$ (low-productivity entrepreneurs do not operate their technology). In this case, the intermediary's budget constraint is given by $m_j(\widehat{Z}\ y_h + f_j) = \phi m_j q_j \widehat{Z} + \eta$, where the mass of firms in industry j is $m_j = (1-\nu)e_{hj}$. Under assumption $A2$, optimization by firms in the final-goods sector sector implies that the value of production in industry j, $q_j Y_j$, satisfies $q_j Y_j = q_j m_j \widehat{Z} = \mu Y/n$, where μ is the share of intermediate goods in the production of final goods. Combining the expressions just obtained, we can get $m_j = \frac{\phi\mu Y/n+\eta}{\widehat{Z}\ y_h + f_j}$. Profits in industry j are given by $\pi_j = q_j m_j \widehat{Z} - w\ (m_j\ + N_j) - rK_j - m_j\ \ f_j$, where K_j and N_j denote aggregate capital and labor in industry j. Note that the number of workers and capital hired per project is constant across industries (since the scale of operation $\widehat{Z}$ and the marginal cost of production is constant across industries) so that the ratios $\frac{K_j}{m_j} = K_I$ and $\frac{N_j}{m_j} = N_I$ are constant in j. We thus have $N_j = m_j N_I = \frac{\phi\mu Y/n+\eta}{\widehat{Z}\ y_h + f_j} N_I$. We can then write profit per worker in the industry as follows

$$\begin{aligned}\frac{\pi_j}{N_j} &= \frac{\mu Y}{nN_j} - \frac{w(m_j+N_j)}{N_j} - rk - \frac{f_j}{N_j/m_j} = \frac{\mu Y}{nN_j} - (w+f_j)\frac{m}{N} - w - rk \\ &= \frac{\mu Y}{n}\frac{(\widehat{Z}\ y_h + f_j)}{\phi\mu Y/n+\eta}\frac{1}{N_I} - (w+f_j)\frac{1}{N_I} - w - rk \\ &= \frac{\mu Y\ \widehat{Z}\ y_h}{\phi\mu Y + n\eta}\frac{1}{N_I} + f_j\left(\frac{\mu Y}{\phi\mu Y+n\eta} - 1\right)\frac{1}{N_I} - w - rk. \end{aligned} \tag{29}$$

Notice that the sign of the term multiplying f_j depends on the sign of $\frac{\mu Y}{\phi\mu Y+n\eta} - 1$, which can be expressed as $\frac{(1-\phi)\mu Y - n\eta}{\phi\mu Y+n\eta}$. The numerator of this term is given by the value of production by all intermediate-goods industries (μY), minus repayment of loans ($\phi\mu Y$), minus internal financing by entrepreneurs $n\eta$. When enforcement binds, profits of the industry are positive so that $\frac{(1-\phi)\mu Y - n\eta}{\phi\mu Y+n\eta} > 0$. Then, an increase in f_j implies an increase in profit per worker (notice that f_j is the only term in (29) that depends on j). Then, (14) implies that value added per worker increases with f_j.

To study the impact of a small change in ϕ across industries, consider industries $j1$ and $j2$, such that $f_{j1} < f_{j2}$ and $e_{lj2} = 0$ (which implies $e_{lj1} = 0$). Then, $\frac{m_{j2}}{mj1} = \frac{\widehat{Z}\ y_h + f_{j1}}{\widehat{Z}\ y_h + f_{j2}}$ implies $\frac{\partial\frac{m_{j2}}{mj1}}{\partial\phi} = \frac{f_{j2}-f_{j1}}{[\widehat{Z}\ y_h + f_{j2}]\hat{}2}\frac{\partial y_h}{\partial\phi} > 0$ (using $f_{j2} > f_{j1}$ and $\frac{\partial y_h}{\partial\phi} > 0$). Using $\frac{N_j}{m_j} = N_I$ and $\frac{Y_j}{m_j} = \widehat{Z}$ for $j = j1, j2$, we obtain $\frac{\partial\frac{m_{j2}}{mj1}}{\partial\phi} = \frac{\partial\frac{N_{j2}}{N_{j1}}}{\partial\phi} = \frac{\partial\frac{Y_{j2}}{Yj1}}{\partial\phi} > 0$. Since $\frac{q_{j1}Y_{j1}}{q_{j2}Y_{j2}} = 1$ we obtain that $\frac{\partial\frac{q_{j2}}{q_{j1}}}{\partial\phi} = -\frac{\partial\frac{Y_{j1}}{Y_{j2}}}{\partial\phi} < 0$. As a result, output, employment, and prices become more equal across industries $j1$ and $j2$ after a small increase in ϕ.

Proposition 2 shows that profits in industry j are positive when the enforcement constraint associated to this industry binds. In this case, capital and labor inputs have a higher marginal product in industry-j than in the final-goods sector sector. As a result, if there were a small increase in ϕ, both factors of production would move towards industry-j. As a result, industry-j's employment (N_j) and output (Y_j) increase.

Case 2: Assume that $e_{lj} > 0$. In this case, the intermediary's budget constraint is given by $\nu\ e_l\ (\widehat{Z}\ y_l + f) + (1-\nu)\ e_h\ (\widehat{Z}\ y_h + f) = \phi(\nu\ e_{lj} + (1-\nu)\ e_{hj})q_j\widehat{Z} + \eta = \phi\mu Y/n + \eta$, where for deriving the second equality we used $q_jY_j = \mu Y/n$. When $\widehat{Z}$ is large, (10) implies that the ratio $\frac{e_{hj}}{e_l j} \simeq \frac{A_h}{A_l}$for any industry such that $e_l > 0$. Substituting $e_{hj} = \frac{A_h}{A_l}e_{lj}$

into the enforcement constraint, and using $\frac{y_l}{y_h} = \frac{A_h}{A_l}$, we get $e_{lj} = \frac{\phi\mu Y/n + \eta.}{\widehat{Z}\ y_l\ +\ [\nu+(1-\nu)\frac{A_h}{A_l}]f_j}$ and $m_j = \frac{[\nu+(1-\nu)\frac{A_h}{A_l}](\phi\mu Y/n+\ \eta)}{\widehat{Z}\ y_l\ +\ [\nu+(1-\nu)\frac{A_h}{A_l}]f_j}$. Note that $\frac{N_i}{m_i} = N_I$ (since average productivity is constant across industries with $e_{lj} > 0$). We then have

$$\begin{aligned}\frac{\pi_j}{N_j} &= \frac{\mu Y}{nN_j} - \frac{w(m_j+N_j)}{N_j} - rk - \frac{f_j}{N_j/m_j} = \frac{\mu Y}{nN_j} - (w+f_j)\frac{m}{N} - rk \\ &= \frac{\mu Y}{n}\frac{\widehat{Z}\ y_l\ +\ [\nu+(1-\nu)\frac{A_h}{A_l}]f_j}{[\nu+(1-\nu)\frac{A_h}{A_l}](\phi\mu Y/n+\ \eta).}\frac{1}{N_I} - (w+f_j)\frac{1}{N_I} - rk \\ &= \text{constant} + f_j\left(\frac{\mu Y}{\phi\mu Y+n\eta} - 1\right)\frac{1}{N_I} - w - rk.\end{aligned}$$

As in case 1, $\frac{\mu Y}{\phi\mu Y+n\eta} - 1 > 0$. Then, an increase in f_j leads to an increase in $\frac{\pi_j}{N_j}$ and in value added per worker.

To study the impact of a small change in ϕ across industries, consider industries $j1$ and $j2$, such that $f_{j1} < f_{j2}$ and $e_{lj1} > 0$ (which implies $e_{lj2} > 0$). Then, using formulas derived above $\frac{e_{lj2}}{e_{lj1}} = \frac{m_{lj2}}{m_{lj1}} = \frac{Y_{lj2}}{Y_{lj1}} = \frac{\widehat{Z}\ y_l\ +\ [\nu+(1-\nu)\frac{A_h}{A_l}]f_{j1}}{\widehat{Z}\ y_l\ +\ [\nu+(1-\nu)\frac{A_h}{A_l}]f_{j2}}$. Note that $\frac{\partial y_l}{\partial\phi} > 0$ implies that both the numerator and denominator increase with ϕ. Moreover, $f_{j1} < f_{j2}$ implies that the numerator increases by a higher proportion with an increase in ϕ so that $\frac{\partial\frac{e_{lj2}}{e_{lj1}}}{\partial\phi} = \frac{\partial\frac{m_{j2}}{m_{j1}}}{\partial\phi} = \frac{\partial\frac{Y_{j2}}{Y_{j1}}}{\partial\phi} > 0$. Since $\frac{q_{j1}Y_{j1}}{q_{j2}Y_{j2}} = 1$ we obtain that $\frac{\partial\frac{q_{j2}}{q_{j1}}}{\partial\phi} = -\frac{\partial\frac{Y_{j1}}{Y_{j2}}}{\partial\phi} < 0$. As a result, output, employment, and prices become more equal across industries $j1$ and $j2$ after a small increase in ϕ.

Proof of Part *ii c*).

When $\phi = 0$, we note that $e_{lj} > 0$ if and only if $w < q_j\frac{A_l}{A_h}\widehat{Z}$. This condition is equivalent to (after using optimization by consumers and firms in the final good sector) $\frac{(1-\alpha)k}{\alpha\beta} < \frac{\mu\ k\ A_l\ \widehat{Z}}{\alpha\ \beta\ (1-\mu)\ n\ z_jA_h}$, where k and z_j denote the capital-to-labor ratio and the intermediate goods$-j$ -to-labor ratio in the final-goods sector. Using $z_j < \frac{\epsilon}{n}\frac{\widehat{Z}}{1}$, we obtain (after simple algebra) that a sufficient condition for $e_{lj} > 0$ (for all j) is $\mu > \frac{(1-\alpha)\epsilon A_h}{A_l\ +(1-\alpha)\epsilon A_h} = \mu^*$. By continuity, we can extend this argument to ϕ close to 0.

When $e_{lj} > 0$ the average productivity of projects being operated increases with the ratio e_{hj}/e_{lj},which is given by *(10).* Differentiating *(10) w.r.t.* ϕ we obtain that

$$\frac{\partial(e_{hj}/e_{lj})}{\partial\phi} = \frac{(-\widehat{Z} - \frac{\partial R_j}{\partial\phi})[(1-\phi)\frac{A_l}{A_h}\widehat{Z} - R_j] - [(1-\phi)\widehat{Z} - R_j](-\frac{A_l}{A_h}\widehat{Z} - \frac{\partial R_j}{\partial\phi})}{((1-\phi)\frac{A_l}{A_h}\widehat{Z} - R_j)^2},$$

where $R_j = \frac{w}{q_j}$.

$$\frac{\partial(e_{hj}/e_{lj})}{\partial\phi} = \frac{\widehat{Z}\left(R_j + \frac{\partial R_j}{\partial\phi}(1-\phi)\right)(1 - \frac{A_l}{A_h})}{((1-\phi)\frac{A_l}{A_h}\widehat{Z} - R_j)^2} > 0$$

if $\frac{\partial R_j}{\partial \phi} = \frac{\partial \frac{w}{q_j}}{\partial \phi} > 0$. To see that $\frac{\partial R_j}{\partial \phi} > 0$, note that equations *(10) and (11)* imply that the number of businesses operated increases with ϕ (for fixed prices). As a result, for fixed prices, the supply of good-j increases and the demand for labor increases. In order for the markets to clear, q_j should decrease and w should increase, that is, R should increase.

QED.

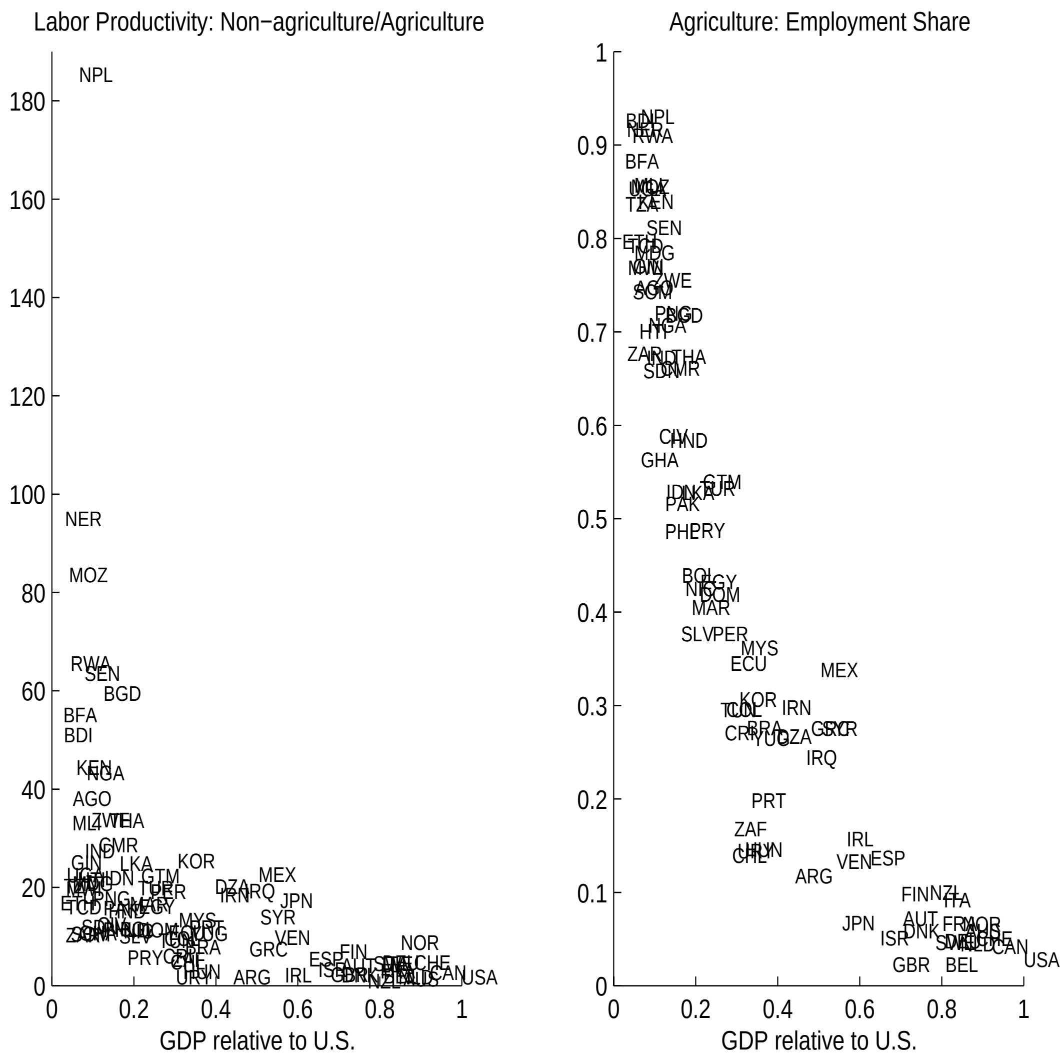

Figure 1: Labor Productivity and Employment in Agriculture and Non Agriculture - 1985.

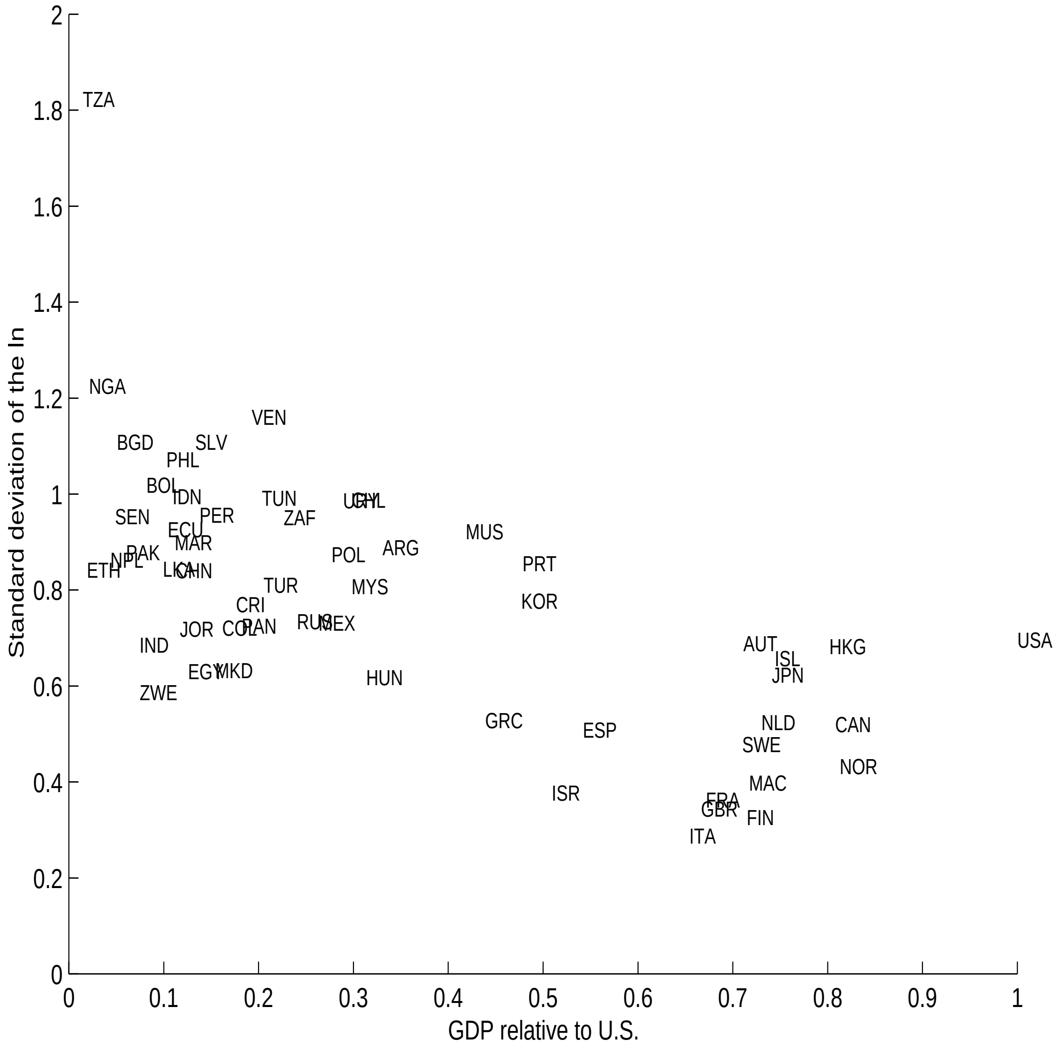

Figure 2: Standard Deviation of Ln Labor Productivity Across Industries -(1996-2000).

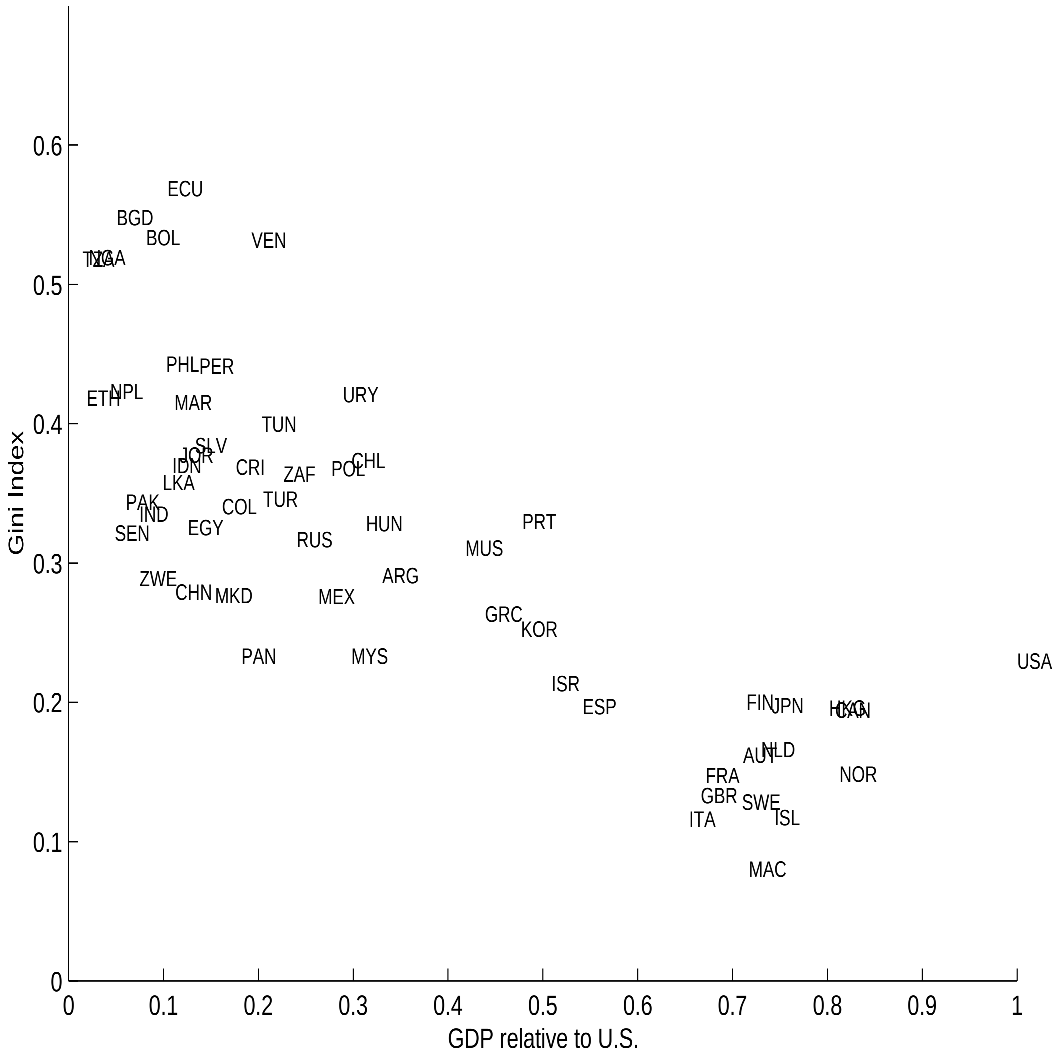

Figure 3: Gini Index of Labor Productivity Across Industries-(1996-2000).

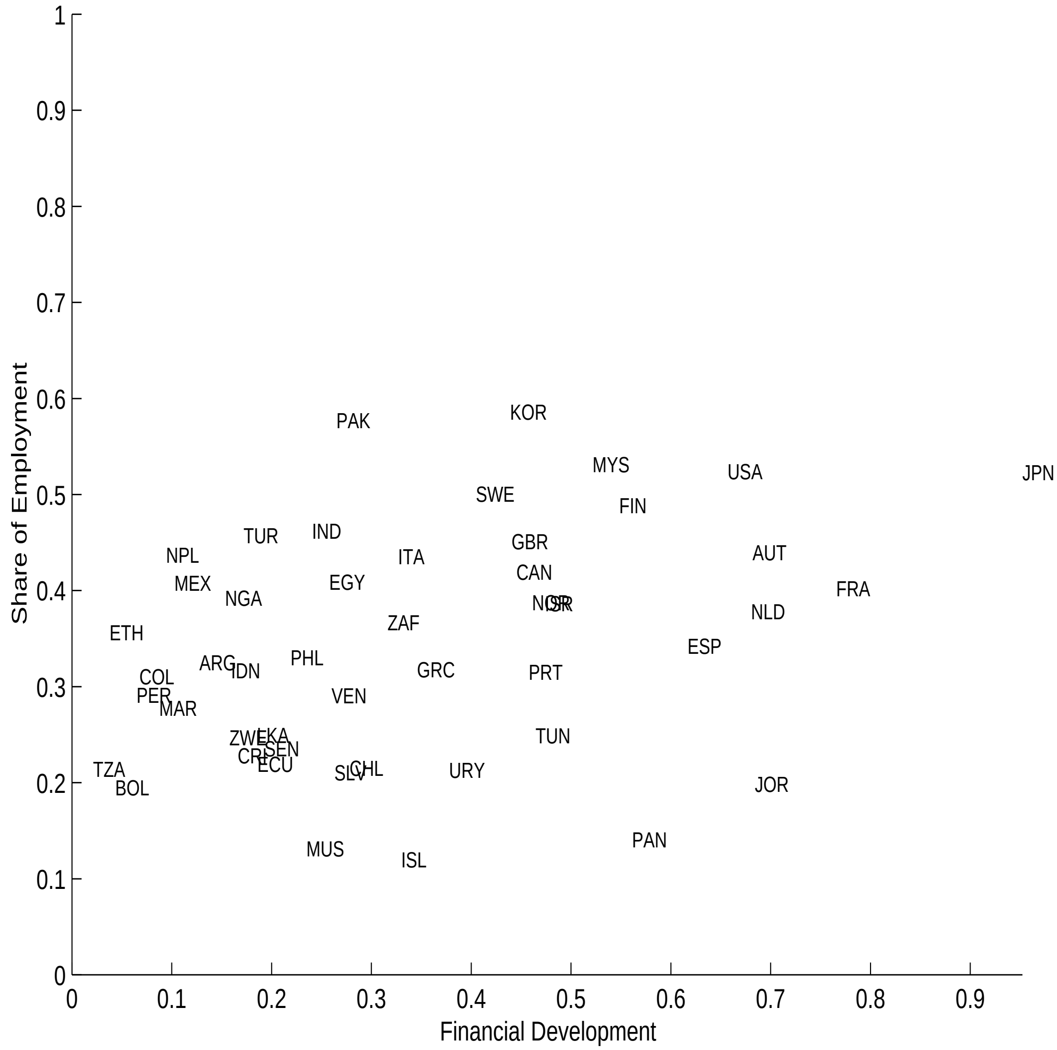

Figure 4: Employment in Industries with High External Dependence-(1996-2000).

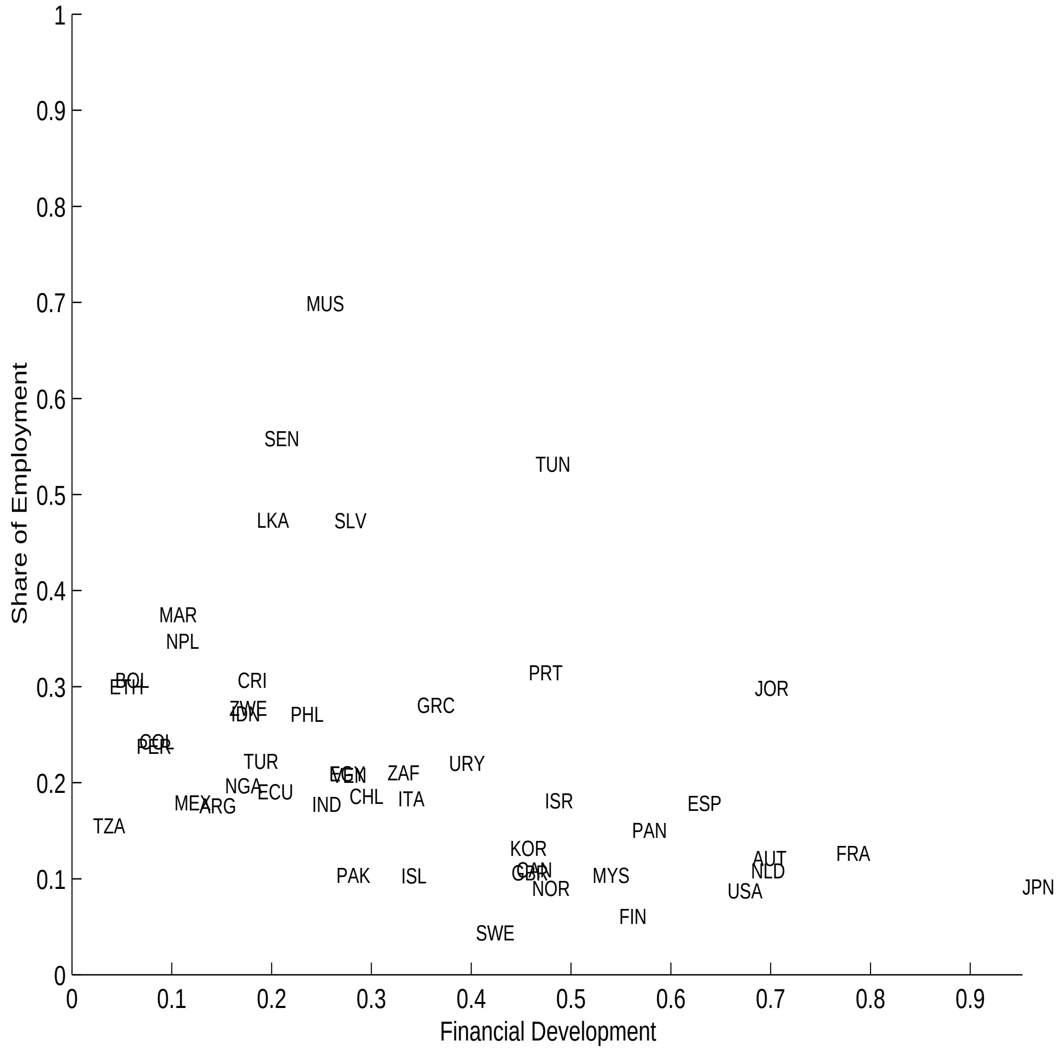

Figure 5: Employment in Industries with Low External Dependence-(1996-2000).