Finance and Productivity: The Effects of Enforceability Constraints on Factor Misallocation *

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Abstract

The paper studies the contribution of the heterogeneity in firm-level balance sheet conditions in explaining the intra-industry productivity dispersion observed in the U.S. firm level data. I develop a model where the interplay between capital and financial market frictions endogenously determine firm-level capital-labor choice. Firms can internalize the cost of capital by borrowing in the financial market. However, borrowing is constrained by a firm's financial characteristics (namely; financial market reputation, leverage and asset liquidity). In equilibrium, firms with weak financial conditions become relatively more labor intensive which generates a sectoral misallocation of capital and labor. To study the quantitative properties of the model, I choose seven major industries from the U.S. economy, and for these industries, I show that industry-wide improvements in firm-level financial conditions mitigate factor misallocation and decrease intra-industry productivity dispersion while increasing industry total factor productivity by quantitatively important proportions. However, there are differential effects of the changes in financial reputation, leverage and asset liquidity on aggregate industry performance. This result suggests that the way sectors benefit from financial sector development depends on sector specific characteristics.

Keywords: Misallocation, Enforceability, Pledgeability, Asset Liquidity, and Total Factor Productivity.

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1 Introduction

Cross-country per-capita output differences are mostly accounted for by differences in total factor productivity[1] (TFP). Therefore, an important question concerning economic development is what

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[1]Prescott (1997)

accounts for the large disparity in aggregate productivity across nations? An important prevailing theory to explain cross-country total factor productivity differences suggests that TFP differences are not simply differences in the level of firm level technology but mainly differences in the efficiency of the resource distribution across its users. Recent studies have documented that misallocation of production factors can have sizeable quantitative effects for the aggregate total factor productivity in a society. Particularly Banerjee and Duflo (2005), Jeong and Townsend (2007), Restuccia and Rogerson (2008), Hsieh and Klenow (2009), Bartelsman, Haltiwanger and Scarpetta (2008), Alfaro, Charlton, and Kanczuk (2008), and Buera, Kaboski, and Shin (2008) show that the mis-allocation of resources in less developed economies is large enough to explain a big portion of TFP differences between rich and poor countries.

Different conjectures are brought up to attention to explain why misallocation of resources occurs. Distortionary taxes[2], labor market frictions which hinder the mobility of workforce [3], and credit market imperfections[4] are some of the popular theories in explaining misallocation of production factors.

Different from other studies in the literature, this essay provides an empirical as well as quantitative investigation for how firm level financial characteristics can affect the efficiency in firm level capital-labor ratio choice across heterogenous production plants and which type of firm level financial characteristics prevail as important in explaining industry-wide productivity dispersion and as a result aggregate industry TFP. The argument of the paper is that credit market imperfections which allow firms to borrow only a limited amount against their financial market reputation (pledgeability) and against their liquid financial assets (collateral) can lead to the misallocation of capital and labor across different production units by generating labor intensive production for financially constrained firms and hence increase intra-industry productivity variance. As it has been pointed out by recent studies such as Bartelsman, Haltiwanger and Scarpetta (2008), Restuccia and Rogerson (2008), and Hsieh and Klenow (2009) intra-industry productivity dispersion is important in explaining industry TFP. Also, different from many other studies in the literature instead of only concentrating on manufacturing

[2]Restuccia and Rogerson (2008) and Hsieh and Klenow (2009)

[3]Lagos (2006)

[4]Banerjee and Duflo (2005), Jeong and Townsend (2007), and Buera and Shin (2008)

sector, in this study I analyze productivity dispersion in a variety of sectors including service sectors such as finance, insurance and real estate services.

Specifically, in section 3, I study an economic model where production plants are owned by entrepreneurs who are heterogeneous in terms of intrinsic productive quality, financial market reputation (pledgeability), liquid financial assets holdings, as well as the rates at which they rent capital. In this economy capital is costly to rent for some entrepreneurs due to investment related moral hazard (capital market distortions). Therefore, capital rental rates are not homogeneous among entrepreneurs. Entrepreneurs who face relatively high capital rental rates can internalize external capital costs by purchasing the capital good instead of renting it. Entrepreneurs have the option to internalize the cost of capital by borrowing against their internal funds (collateralizable financial assets) and against their financial market reputation (pledgeability) in the financial market, and use the amount borrowed and their internal funds to purchase the capital good. In the model the contract enforceability is limited in the sense that the amount an entrepreneur can borrow in the financial market is constrained by his entrepreneurial financial pledgeability and his liquid financial assets. The equilibrium analysis shows that for a given level of capital rental rate, entrepreneurs with low financial pledgeability and/or weak liquid financial asset positions operate relatively labor intensive production plants compared to entrepreneurs with high financial pledgeability and/or large asset liquidity to shift away from high capital rental rates. The results are more pronounced for firms that face larger capital market distortions. In this setting, the lack of financial market development augments the sensitivity of firm level capital-labor choice to financial pledgeability.

In section 4, the analytical results are tested in a panel data analysis. I use the analytical model developed in section 3 to derive a measure for "labor intensive production". I use proxies for financial market reputation (pledgeability) and asset liquidity of an individual firm. Applying these proxies and controlling for other firm level characteristics, for a sample of U.S. firms from Compustat North America I show that low financial pledgeability and asset liquidity are associated with high labor intensive production and low capital-labor ratio.

Finally, in section 5, I conduct a quantitative exercise to study the effects of financial market reputation and firm's financial asset liquidity on observed firm level capital-labor ratio distortions and productivity dispersion at the industry level for seven major industry clusters[5] of the U.S. economy. In this exercise, I isolate the contribution of firm level financial market reputation and financial asset liquidity in explaining intra-industry productivity dispersion. The counterfactual policy analysis shows that the presence of both firm level financial pledgeability and also financial asset liquidity mitigate the misallocation of capital and the productivity dispersion in analyzed industry clusters and affect industry total factor productivity. However, which type of financial characteristic has a stronger effect on aggregate industry performance differs across sectors with different types of financial market needs. Therefore, the policy implications suggest that financial development matters for the aggregate productivity but how the financial markets are ought to develop is sensitive on sector specific characteristics.

2 Misallocation of Capital, Financial Market Imperfections, and Capital-Labor Choice

Banerjee and Moll (2009) and Buera and Shin (2008) point out that focusing on financial market development would be consistent with Restuccia-Rogerson and Hsieh-Klenow results that a big fraction of TFP gains would accrue from reallocating capital across production plants. Financial markets play a key role in reallocating capital across the producers of goods and services in an efficient way. Therefore, financial market imperfections is a strong candidate for explaining misallocation of factors of production both at extensive and intensive margins across production plants.

Financial funds and physical capital are two key assets that any firm needs, existence of which might reinforce each other in the presence of financial and capital market imperfections. That is, the existence of liquid financial assets at a firm can increase a firm's ability to obtain physical capital, and vice versa the availability of physical capital is expected to allow a firm to have access to financial funds through a so-called collateral effect (Kiyotaki and Moore (1997)). Another asset which a firm might need to be able to stay in operation is his financial market reputation. Relative to financial funds and physical capital reputation has a more intangible nature. In the face of financial market

[5]Financial-Insurance-Retail-Real Estate, Information Technologies, Textiles and Fabrics, Food and Beverages, Minerals and Metal Manufacturing, Chemicals and Petroleum, Transportation Equipment.

imperfections, if capital is too costly to rent for certain firms, financial market reputation as well as financial assets liquidity might become important in determining the labor management policies at the firm level. Garmaise (2008) documents that small firms, which on average are expected to face less favorable financial market conditions compared to average large firms, are much more labor intensive in their production processes compared to large scale establishments. According to Garmaise (2008) large firms in the Compustat database in 1998 had a median total assets-employee ratio of \$189,628 while the median ratio for the small firms in 1998 Survey of Small Business Finance was \$18,520.

This paper argues that distortionary capital rental rates in the presence of financial constraints can lead to the misallocation of capital across producers and generate labor intensive production units which can be important in explaining the intra-industry productivity dispersion and industry total factor productivity.

The next section develops a simple analytical model which I apply to derive a disciplined measure of firm level capital-labor distortions. Section 4 presents an empirical analysis, and shows that firm level financial market pledgeability and liquidity of financial assets positions can be important in determining the "labor intensity" at production plants. Section 5 quantifies the importance of financial pledgeability and financial asset liquidity for explaining intra-industry productivity dispersion and industry total factor productivity. Section 6 discusses the findings concludes the paper.

3 The Theoretical Model

In this section, I develop a model of monopolistic competition with heterogeneous entrepreneurs in line with Hsieh and Klenow (2009) to illustrate how the interactive effect between financial constraints and capital market distortions can lead to inefficiencies at firm-level capital-labor management. Specifically, I consider an open economy which is populated by risk-neutral agents with a unit measure. There is a representative final good producer firm and 3 types of agents in the economy: entrepreneurs, workers, and capital owners, with measures μ^e, μ^w and $1 - \mu^e - \mu^w$ respectively. The characteristics of each agent is described as the following:

3.1 Entrepreneurs and Production

The production side of the economy largely resembles Hsieh and Klenow (2009). Different from their model though, in the current setting heterogenous entrepreneurs are not endowed with any physical capital holdings. Instead they have to rent or purchase the capital good in order to become operational. Entrepreneurs differ from each other in terms of the efficiency of the production units they have access to, financial pledgeability (financial market reputation), collateralizable financial assets, the liquidity of their financial asset position, and also rates at which they rent the capital good.

Specifically, I assume that there is a single numeraire composite consumption good Y produced by a representative firm in a perfectly competitive market. The output of this consumption good Y is a CES aggregator of the differentiated intermediate products Y_i, where each intermediate good is produced by a single entrepreneur $i \in e$:

$$Y = \left(\int_{i \in e} Y_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma-1}{\sigma}}$$

Denote L as the labor, and K as the capital good obtained from capital owners. Y in this model can be thought as an aggregate industry product, and Y_i's as products of sub-sectors.

The production function of each differentiated good producer is given as:

$$Y_i = A_i K^{\alpha} L^{1-\alpha} \tag{1}$$

A_i measures productive efficiency, which is distributed independently and identically across entrepreneurs with the cumulative distribution function $F(A)$ with support $[0, \bar{A}]$. Letting P_i be the price of each differentiated good, an entrepreneur receives P_i units of the consumption good in return for a unit intermediate good supplied to the final good production sector.

3.2 Workers and the Labor Market

Workers supply the labor force to the entrepreneurial sector which is essential for the production of intermediate goods. In this analysis I abstract from the labor-leisure choice of the households. In the current setting, each worker is endowed with a unit indivisible labor which he inelastically supplies to the entrepreneurial intermediate good production. Labor market is frictionless with a prevailing wage rate at w. The wage rate gets determined exogenously. Abstracting labor market frictions allows the modeling of relative capital-labor distortions in an analytically tractable fashion.

3.3 Capital Owners and the Capital Market

Capital owners provide the capital good necessary for the intermediate good production. Each capital owner is endowed with a unit divisible capital good which can be either rented or sold to entrepreneurs. Rental and purchase rates are denominated in terms of the consumption good. When capital is leased, entrepreneurs make an ex-post (after the production) transfer to capital owners, whereas when it is purchased they have to make an ex-ante transfer (before the production). Ex-post transfer of funds is costly for some entrepreneurs due to exogenously determined (e.g. due investment specific moral hazard problems) capital rental distortions. Capital market distortions create heterogeneity in capital rental prices. The capital rental rate charged to entrepreneur i is $r^c(1 + \tau_i)$, where r^c is the exogenously given world capital rental rate, and τ_i is independently and identically distributed rental distortion with the cumulative distribution function $G(\tau)$ and support $[0, \bar{\tau}]$, where $\bar{\tau} \in \Re^+$. τ captures entrepreneur-specific capital market distortions. If capital is purchased, entrepreneurs transfer R^c units of the composite consumption good to capital owners for each unit of the capital good without facing capital market distortions. Entrepreneurs borrow the composite consumption good from financiers by participating in the credit market.

3.4 The interpretation of relative capital-labor distortions

Suppliers of labor learn about the firm in the course of production while capital good suppliers do not receive information until the production is finalized. Also, the labor-force gets paid much more frequently compared to the capital good owners. Therefore, suppliers of capital good may ask the entrepreneur an up-front transfer, or relatively higher rental rates. In that case the availability of internal funds ability to finance externally becomes an important determinant for whether an entrepreneur faces distortions to his capital-labor management policies.

3.5 The Financial Market

An entrepreneur i holds the Ω_i units of the composite consumption good to begin with, which he can either consume, lend to other entrepreneurs at a rate r^f which is exogenously determined in the world loan market, or can use the consumption good to purchase the capital good from the capital owners. There is a market incompleteness in the sense that entrepreneur's total borrowing, B, is constrained by his financial pledgeability in the following way:

$$B = (K - S_i) \leq \theta_i R^c K \tag{2}$$

where K is the total capital investment into the entrepreneurial project. S_i is the liquid net worth position of an entrepreneur. θ_i represents entrepreneur i's "financial market reputation" or his "financial pledgeability". Basically a χ_i fraction of an entrepreneur's net worth Ω_i consists of liquid financial assets. Only ϕ fraction of the illiquid portion can be converted into liquid assets before the investment takes place. ϕ is an economy-wide parameter which measures the efficiency of financial markets in the society in converting illiquid financial assets into liquid ones. The liquid net worth position of an entrepreneur which can be used to internalize the cost of capital is:

$$S_i = (\chi_i + (1 - \chi_i)\phi)\Omega_i \tag{3}$$

Ω_i, χ_i and θ_i have a joint cumulative distribution function $J(\Omega, \chi, \theta)$ across the entrepreneurs. Inequality (2) implies that an entrepreneur can internalize only a fraction of his total capital cost by using his internal funds and borrowing in the financial market to purchase the capital good.

3.6 Optimal Behavior and Equilibrium

I assume $r^f = r^c$, such that entrepreneurs prefer to borrow in the credit market and internalize the cost of capital up to their borrowing limits. In equilibrium $R^c = r^c = R$ holds due to no-arbitrage and pins down the general equilibrium of the economy. Define K^E as the amount of capital investment financed externally, whereas K^I is the amount of capital financed internally, with $K = K^E + K^I$. Taking the enforceability constraint (2) into consideration, the optimization problem of an entrepreneur i can be written as:

$$\max_{K^E,K^I,L} \{P_iA_i(K^E+K^I)^\alpha L^{1-\alpha} - wL - R[(1+\tau_i)(1-\theta_i)+\theta_i]K^E - RK^I\} \tag{4}$$

subject to

$$K^I \leq S_i \tag{5}$$

Define $\lambda_i = \min\{\frac{S_i}{K^*}, 1\}$ with K^* as the optimal capital investment level. Then, $1-\lambda_i$ can be interpreted as the external finance dependency of an entrepreneurial firm i.

Profit maximization yields the standard condition that the firm's price is a fixed mark-up over its marginal cost. That is

$$P_i = \frac{\sigma}{1-\sigma}\left(\frac{R}{\alpha}\right)^\alpha \left(\frac{w}{1-\alpha}\right)^{1-\alpha} \frac{[\lambda_i + (1-\lambda_i)[(1+\tau_i)(1-\theta_i)+\theta_i]]^\alpha}{A_i}. \tag{6}$$

Similarly, the optimum capital-labor ratio (K_i^*/L_i^*) for entrepreneur i can be derived as:

$$\frac{K_i^*}{L_i^*} = \frac{\alpha}{1-\alpha}\frac{w}{R}\frac{1}{[\lambda_i + (1-\lambda_i)[(1+\tau_i)(1-\theta_i)+\theta_i]]} \tag{7}$$

Henceforth, the allocation of resources, as well as the marginal productivity across plants not only depends on productivity levels but also on capital and credit market distortions,

$$\begin{aligned} MRPL_i &= w\frac{1}{\lambda_i + (1-\lambda_i)[(1+\tau_i)(1-\theta_i)+\theta_i]} \\ MRPK_i &= R[\lambda_i + (1-\lambda_i)[(1+\tau_i)(1-\theta_i)+\theta_i]] \end{aligned}$$

Using equality (7), we can infer distortions to capital-labor ratio and firm level productivity for each intermediate good producer as:

$$1 + \underbrace{\tau_i(1-\theta_i)(1-\lambda_i)}_{\gamma_i} = \frac{\alpha}{1-\alpha}\frac{w}{R}\frac{L_i^*}{K_i^*} \tag{8}$$

3.7 Comparative Statics

The term on the left hand side of the equality (8) $(1 + \gamma_i)$ captures the deviations from the optimal capital-labor ratio: The higher γ_i the more labor intensive the entrepreneurial production is. Straightforward application of comparative-statics yields the following properties of γ_i. γ_i increases in capital rental rate distortions faced by an entrepreneurial firm i (τ_i), and decreases by the amount of internal liquid financing the firm can provide (λ_i and χ_i) as well as by an entrepreneur's financial pledgeability (θ_i). Also, cross-partial derivatives provide the following observation:

$$\frac{\partial}{\partial \tau_i}\frac{\partial \gamma_i}{\partial \theta_i} < 0 \qquad (9)$$

$$\frac{\partial}{\partial \tau_i}\frac{\partial \gamma_i}{\partial \lambda_i} < 0 \qquad (10)$$

$$\frac{\partial}{\partial \tau_i}\frac{\partial \gamma_i}{\partial \chi_i} < 0 \qquad (11)$$

These analytical results show that low financial pledgeability, and/or low financial asset liquidity, and high capital market distortions are associated with labor intensive production. Cross-partials show that the effects of financial pledgeability and financial asset liquidity on capital-labor ratio is greater for entrepreneurs who face larger capital market distortions.

Equality (8) shows that distortions to capital-labor ratio has three components. The first component (τ_i) generates the heterogeneity in capital rental rates. Antunes et. al (2007) interpret this distortion as the *financial repression.* The second component (θ_i) is associated with the ability to borrow against investment returns which Matsuyama (2007) defines as individual *financial pledgeability.* Finally, the third component (λ_i) is associated with the (in)ability to finance investment projects using internal *liquidity.* $1-\lambda_i$ represents the external finance dependency of an entrepreneur as in Rajan and Zingales (1998).

In the next section, I propose a methodology to measure each of these components using U.S. firm level balance sheet data, and I test the contribution of financial pledgeability and financial asset liquidity in explaining firm level distortions to capital-labor choice in a panel data analysis.

4 Empirical Study

In this section, using a sample of U.S. manufacturing firms from Compustat North America, I test the analytical predictions of the model developed in the previous section[6]. The hypothesis to be tested are:

- Poor financial pledgeability is associated with labor intensive production.
- Poor financial liquidity is associated with labor intensive production.

4.1 The Data

The panel data is extracted from Compustat North America. The firms contained in the dataset are active firms as of 2006. The time series dimension of the sample covers the time period 1990-2006. The firms in the sample are chosen in such a way that as of 2006 each firm has spent at least 5 years in the database. There are 725 firms in the sample. The summary statistics about the sample distribution of the firms can be found in table Table 1.

4.2 Estimation

I estimate the following reduced form regression equations with time varying industry fixed effects γ_{st} to study the sensitivity of capital-labor distortions to firm level financial pledgeability and financial liquidity[7]:

$$\begin{aligned} KLDistort_{it} &= \gamma_{st} \\ &+\eta_1 * Fin.\ Liquidity_{it} * EFD_i \\ &+\beta * Controls_{it} + \epsilon_{it} \qquad (12) \\ KLDistort_{it} &= \gamma_{st} \\ &+\eta_2 * Fin.\ Pledgeability_{it} * EFD_i \\ &+\beta * Controls_{it} + \epsilon_{it} \qquad (13) \end{aligned}$$

[6]The data used in this analysis will be available by the author upon request.
[7]I use 3-digit NAICS codes.

$KLDistort_{it}$ represents deviations from optimal capital-labor ratio respectively for firm i in period t. $KLDist_{it}$ is generated using the γ_i variable derived in section 3. That is:

$$KLDist_{it} = \gamma_{it} = \frac{\alpha_s}{1-\alpha_s}\frac{w}{R}\frac{L_{it}}{K_{it}} - 1$$

α_s is the 3-digit industry specific capital share. wL_i, "compensation of employees", is available in Compustat as "Labor and Related expenses", K_i, capital stock, is derived from "Property, Plant and Equipment" and "Capital Expenditures" data items in Compustat using the methodology developed in Chirinko, Fazzari and Meyer (2004). R, the return to capital, is taken as 10% as in Hsieh and Klenow (2009). A high value of $KLDist_{it}$ means high distortions to the capital costs, and more labor intensive production.

The right hand side variables included in the regression analysis are as the following:

- $Fin.\ Liquidity_{it}$ captures firm level financial liquidity. Financial liquidity is measured as

$$(Current\ Assets - Current\ Liabilities)/(Current\ Liabilities)_{it}.$$

- $Fin.\ Pledeability_{it}$ captures financial pledgeability of firm i in year t. Financial pledgeability is proxied with two different measures:

  1. *Credit Rating*; measured as $log(Long\ Term\ Domestic\ Credit\ Issuer\ Rating)$ reported by Standard and Poor's in Compustat Database. Firm credit ratings in the sample range from $C = 2$ to $AAA = 24$, with $C = 2$ being the worst credit rating and $AAA = 24$ being the best credit rating. The mean (and also median) rating the sample is $B- = 12$.
  2. The interactive term *log(Net Worth)*log(Credit Rating)*, where *Net Worth* is measured as $(log(1+Total\ Assets - Total\ Debt))$ both total assets and total debt variables are reported in the Compustat North America Database.

The purpose of having these two different degrees of financial pledgeability is as the following: Firms which receive low credit ratings ex ante due to repayment problems, if continue to borrow and choose to operate with low financial net worth are expected to face higher cost of external financing due to the moral hazard problem associated with high borrowing and low probability of repayment of the amount borrowed.

- I test the sensitivity of K/L distortions to financial characteristics with respect to the interactive effect of industry external finance dependency. As it has been shown in the analytical section, firms with high external finance needs are expected to be more labor intensive in the face low financial pledgeability. Therefore, it is crucial to consider the presence of external finance dependency heterogeneity across industries while studying the sensitivity of capital-labor ratio distortions with respect to financial pledgeability. To serve this purpose, using 3-digit NAICS codes, I group industries according to their external finance dependency levels and create an "external finance dependency" (EFD) dummy variable:

  As in Rajan and Zingales (1998), I define the average external finance dependency ($AEFD$) of industry j as:

  $AEFD_j = (Avg\{(Cash\ Flow\ From\ Operations - Cap\ Exp)/(Cap\ Exp)_i)\}_{i=1}^{N_j}$, where $i \in \{1, .., N_j\}$ are firms operating in industry j.

  $(External\ Finance\ Dependency)_2 = 1$ and 0 otherwise if $0.3 < AEFD_j < 0.6$

  $(External\ Finance\ Dependency)_3 = 1$ and 0 otherwise if $AEFD_j > 0.6$

  Hence, firms operating in industries with low external finance dependency have:

  $(External\ Finance\ Dependency)_2 = (External\ Finance\ Dependency)_3 = 0$, firms in industries with intermediate levels of external finance dependency have

  $(External\ Finance\ Dependency)_2 = 1$ and $(External\ Finance\ Dependency)_3 = 0$, and firms in industries with high levels of external finance dependency have

  $(External\ Finance\ Dependency)_2 = 0,\ (External\ Finance\ Dependency)_3 = 1.$

Other control variables included in the regression analysis are as the following:

- $Size_{it}$ refers to the employee size of the firm in year t.
- $Profitability_{it}$ captures the effects of firm profitability and it is proxied with $((Total\ Sales - Total\ Cost\ of\ Goods\ Sold)/Size)$.
- $FirmAge_{it}$ refers to the total number of years the firm i spent in the database until year t.
- $LiabStr_{it}$ refers to the debt structure as $Total\ Long\ Term\ Debt/Total\ Debt$ of a particular firm i in year t.
- $R\&DInt_{it}$ is the Research and Development intensity of a firm i in year t, and is computed as $R\&D\ Expenditures/Total\ Sales$.

To control for outlier effects I trim upper and lower 1% tails of each distribution.

4.3 Estimation Results

I estimate the model for the full sample, as well as for large, medium size, and small firms separately. Small firms refer to those firms which have less than 500 employees in their establishments, medium-size firms have a total number of employees between 500 and 5000, and large firms have more than 5000 employees. Tables 2-9 report estimation results.

Firms with low levels of capital are expected to have relatively high levels of asset/liability ratio due to insufficient amounts of collateral to back-up their borrowing. In order to control for this possible endogeneity problem, I estimate the model using the 2-stage least squares estimation methodology by using one period lagged values of net worth and credit rating as instrumental variables. Tables 6-9 report the estimation results with the 2SLS estimation technique, whereas tables 2-5 report the results from panel ordinary least squares estimation.

Tables 2 and table 6 provide empirical results which are in line with the predictions of the analytical model. Financial pledgeability is important for determining the firm level capital-labor ratio distortions from the optimum benchmark levels. Coefficient estimates associated with credit ratings and the interactive term between credit ratings and net worth enter regression equations with expected signs; that is the better the financial pledgeability of a firm the smaller are the distortions to the choice of capital-labor ratio, and hence the production units are relatively more capital intensive. The interactive term between net worth and credit ratings in fact not only enter regression equation with the expected sign but also much more significantly. The results are robust to the 2SLS estimation methodology as well. Also, the results are relatively more significant for those firms which operate in relatively more external finance dependent sectors.

Similarly, financial asset liquidity enters regression equations as a significant explanatory variable especially for those firms which operate in highly external finance dependent industries.

Profitability and firm age are not significant determinants of capital-labor ratio distortions. Firm size and liability structure on the other hand are significant determinants of capital-labor ratio distortions because these two variables are expected to contain information regarding the financial characteristics of an individual firm.

The effects of financial asset liquidity on capital-labor ratio distortions does not vary across firm size classes. However, as tables 3-5 and tables 7-9 show that the effects of financial pledgeability on capital-labor ratio distortions are much more pronounced for firms with smaller scale. A plausible explanation for this outcome is that size does influence the effects of financial characteristics on real performance. Size by itself could have an implicit reputation effect which makes the observed "financial reputation" matter more for firms which are smaller in size. As analytical results presented in section 3 suggest, the effects financial pledgeability on capital-labor ratio distortions are higher the larger the capital market distortions are.

5 Quantitative Analysis

I conduct quantitative exercises to study the effects of capital rental rate distortions, financial pledgeability and asset liquidity on capital-labor management, and productivity at the firm level, and in turn the implications of ability to borrow against financial pledgeability (reputation) and against asset liquidity (collateral) for the productivity dispersion and aggregate total factor productivity observed at the industry level.

In order to stress the importance of firm level financial characteristic, namely the capital rental distortions (τ_i), financial pledgeability (θ_i) and asset liquidity (λ_i) for firm performance and industry-wide total factor productivity we can employ the concepts "physical productivity" and "revenue productivity" which Foster, Haltiwanger and Syverson (2008) call as TFPQ and TFPR respectively. Firm level physical and revenue productivity in our setting can be defined as in Hsieh and Klenow (2009). Namely, for a firm i operating in sector s:

$$TFPR_{si} \equiv P_{si}A_{si} = \frac{P_{si}Y_{si}}{K^{\alpha_{si}}(wL)^{1-\alpha_{si}}},$$

and

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K^{\alpha_{si}}(wL)^{1-\alpha_{si}}}.$$

with

$$A_{si} = \omega^{1-\alpha}\frac{(PY)^{-\frac{1}{\sigma-1}}}{P}\frac{(P_iY_i)^{\frac{\sigma}{\sigma-1}}}{K_i^*L_i^*}$$

ω is a constant which equals to $w^{1-\alpha_s}(P_sY_s)^{-\frac{1}{\sigma_1}}/P_s$.

In this model, as in Hsieh and Klenow (2009), TFPR is constant across plants within an industry unless plants face distortionary capital rental rates, or have differential financial pledgeability or asset liquidity levels. In the absence of financial characteristic heterogeneity, more capital and also labor should be allocated to plants with high levels of TFPQ. Using $MPRK_{si}$ and $MPRK_{si}$, one can show that plant TFPR is proportional to a geometric average of a plant's (operating in industry s) marginal revenue products of capital and labor as:

$$TFPR_{si} \propto (MRPK_{si})^{\alpha_s}(MRPL_{si})^{1-\alpha_s} \propto (1+\tau_i(1-\theta_i)(1-\lambda_i))^{\alpha_s} \tag{14}$$

$TFPR_{si}$ is increasing in capital rental rate distortions, but decreasing in financial pledgeability and in financial asset liquidity or the inverse of external finance dependency of a particular firm. High plant TFPR signals that the plant confronts capital market barriers which raises firm level marginal products. In my model, financial pledgeability and asset liquidity mitigate the capital market barriers an individual plant owner faces.

We can develop the industry-wide aggregate TFP formula as the following:

$$TFP_s = \left(\sum_{i=1}^{M_s}\left(A_{si}\frac{\overline{TFPR_s}}{TFPR_si}\right)^{\sigma-1}\right)^{\frac{1}{\sigma-1}} \tag{15}$$

with

$$\overline{TFPR_s} = \left[\frac{R}{\alpha_s}\sum_{i=1}^{M_s}(1+\tau_i(1-\theta_i)(1-\lambda_i))\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)\right]^{\alpha_s}\left[\frac{1}{1-\alpha_s}\sum_{i=1}^{M_s}\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)\right]^{1-\alpha_s} \tag{16}$$

and

$$TFPR_{si} = \left(\frac{R}{\alpha_s})^{\alpha_s}\right)\left(\frac{1}{1-\alpha_s}\right)^{1-\alpha_s}(1+\tau_i(1-\theta_i)(1-\lambda_i)). \tag{17}$$

When TFPQ and TFPR are jointly log-normally distributed, as Hsieh and Klenow (2009) has shown, there is a simple closed form expression for industry-wide aggregate TFP as:

$$\log TFP_s = \frac{1}{1-\sigma}\log\left(\sum_{i=1}^{M_s} A_{si}^{\sigma-1}\right) - \frac{\sigma}{2}var(logTFPR_{si}) \tag{18}$$

In the next section, using Compustat data, we will run counterfactual policy experiments to study the effects of (1) capital rental rate distortions (τ_i), (2) financial pledgeability (θ_i), and (3) asset liquidity (λ_i) on firm productivity dispersion (TFPR dispersion) in seven major U.S. industry clusters.

5.1 Data and Counterfactual Experiments

I use the same Compustat sample from the empirical analysis for the computational exercise[8]. I use data from 725 firms which were active between 2003-2006 time period; however concentrate on seven major industry groups in the policy analysis. Each firm level observation is taken as a time-series average over 2003-2006 data observations. Each firm was active with reported necessary balance sheet data for the 2003-2006 time period.

I apply the proxies for financial pledgeability (θ_i) and asset liquidity (λ_i) developed in the previous section to back out firm level distortions to capital rental rates (τ_i) which firms would have faced if they didn't have any financial pledgeability or asset liquidity to support their financial market transactions.

The analytical model developed in section 3 provided

$$1 + \underbrace{\tau_i(1-\theta_i)(1-\lambda_i)}_{\gamma_i} = \frac{\alpha}{1-\alpha}\frac{w}{R}\frac{L_i^*}{K_i^*}$$

[8]The data used in this analysis will be available by the author upon request.

as a disciplined measure of observed firm level capital-labor distortions which we can compute using balance sheet data from Compustat database. In order to derive τ_i for each firm using the observed capital-labor distortions γ_i, I map financial pledgeability and asset liquidity level of each firm observed in the data to an index between $[0,1]$ where I apply the following functional forms for this transformation:

- For financial pledgeability:

  $$M(Credit\ Rating)^{\zeta_p}$$

  where Credit Rating is the S&P Long Term Domestic Issuer Credit Rating of an individual firm from the Compustat database,

- For asset liquidity:

  $$N(B + Financial\ Liquidity)^{\zeta_\ell}$$

  where Financial Liquidity is (Current Assets-Current Liabilities)/Current Liabilities for a firm.

In these functional forms the parameters M, ζ_p, N, ζ_ℓ, and B are chosen in such a way that the transformed distributions mimic the observed distributions as closely as possible in terms of the mean/standard deviation ratio as well as the skewness. The values assigned to functional form parameters are: $M = (1/28)^{0.84}$, $\zeta_p = 0.84$, $N = (1/15)^{0.68}$, $\zeta_\ell = 0.68$, and $B = 5$.

Using λ_i and θ_i we can derive capital rental distortions for each firm i τ_i as:

$$\tau_i = \frac{\gamma_i}{(1-\lambda_i)(1-\theta_i)} \tag{19}$$

We can derive $A_{si} = TFPQ$ for each firm using

$$A_{si} = \omega^{1-\alpha} \frac{(PY)^{-\frac{1}{\sigma-1}}}{P} \frac{(P_i Y_i)^{\frac{\sigma}{\sigma-1}}}{K_i^* L_i^*}$$

where $\omega = w^{1-\alpha_s}(P_s Y_s)^{-\frac{1}{\sigma_1}}/P_s$. Since in Compustat data only values are observable and not the prices, as in Hsieh and Klenow (2009) I assume $\omega = 1$. Also, as in Hsieh and Klenow (2009), I take $\sigma = 1$.

To derive firm level TFPR I use:

$$TFPR_{si} \equiv P_{si} A_{si} = \frac{P_{si} Y_{si}}{K^{\alpha_{si}} (wL)^{1-\alpha_{si}}}.$$

Figures 1-24 show distributions of observed capital-labor distortions (γ_i), capital-rental distortions τ_i, observed financial pledgeability (long term credit ratings), implied financial pledgeability transformation θ_i, observed asset liquidity, implied asset liquidity transformation λ_i, and finally TFPQ and TFPRS at the firm level for the full sample, as well as for firms with less than 2200 employees and for firms with more than 2200 employees separately, where 2200 is the mean employment size of the sample.

Sample distributions show that, as Foster Haltiwanger and Syverson (2008) has documented, firms face heterogeneous capital rental distortions which implies dispersion in firm productivity levels. In figures 2-3 and 5-6, we can observe that although large firms's distribution first order stochastically dominates that of small firm's, both large and small firms do face distortionary capital rental rates which affect their capital-labor choice. As a result we observe a TFPR dispersion for both small and large firms.

We can derive industry TFPRS and TFP using equations (16) and (18). Table 10 lists the industry-wide properties of TFP, TFPR, as well as capital-labor ratio distortions. Figure 25 plots ln(TFPRS) vs ln(TFPS). The table 10 and the figure 25 show that there is big heterogeneity in terms of the level of industry TFPS as well as industry $\overline{TFPRS}$ across 3-digit NAICS industries. Therefore, in order to study the contribution of financial characteristics (financial pledgeability and financial asset liquidity) to aggregate performance it is crucial to concentrate on major 3-digit NAICS industries.

For this purpose I conduct the counterfactual experiments for 7 major industry branches as listed in tables 11 and 12. The industry clusters in hand are

1. Information Technology (IT): Machinery Manufacturing; Computer and Electronic Product Manufacturing.

2. FIRE: Credit Intermediation and Related Services; Securities, Commodity Contracts, and other Financial Investments and Related Activities; Insurance Carriers and Related Activities; Retail

Trade; Real Estate.

3. Food and Beverages (FB): Food and Kindred Products; Beverages and Tobacco Products.

4. Textiles and Fabrics (TX): Textiles and Fabrics.

5. Chem and Petroleum (CP): Petroleum and Coal Products Manufacturing; Chemical Manufacturing.

6. Metal and Mineral (MM): Nonmetallic Mineral Product Manufacturing; Primary Metal Manufacturing.

7. Transportation Equipment (TE): Transportation Equipment Manufacturing.

For these seven major industry clusters, I study the following two experiments:

(1) How does the presence of financial pledgeability mitigate the capital-labor rental distortions at the firm level, and affect the industry-wide aggregate TFPR, and TFPR dispersion, and as a result the industry-wide TFP.

(2) How does the presence of asset liquidity mitigate the capital-labor rental distortions at the firm level, and affect the industry-wide aggregate TFPR, and TFPR dispersion, and as a result the industry-wide TFP.

To conduct the the first exercise, I hypothetically change the financial pledgeability level of each firm to zero. In this case each firm face higher levels of capital market barriers. Basically each firm's capital-labor ratio choice gets distorted by $\hat{\gamma}_i$ instead of γ_i, where $\gamma_i = \tau_i(1-\theta_i)(1-\lambda_i)$ and $\hat{\gamma}_i = \tau_i(1-\lambda_i)$.

Similarly, for the second exercise, I hypothetically change the asset liqudity level of each firm to zero. In this case, each firm would face $\hat{\hat{\gamma}}_i$ instead of γ_i, where $\gamma_i = \tau_i(1-\theta_i)(1-\lambda_i)$ and $\tilde{\gamma}_i = \tau_i(1-\theta_i)$.

Tables 13 and 14, lists for seven major industry clusters, the effects of these hypothetical changes on average capital-labor distortions, and implied TFPR dispersion for each industry, and also the implications of the presence of financial pledgeability and asset liquidity for the aggregate industry TFP[9].

[9] I also study the implications of decreasing both the level financial pledgeability and the level of asset liquidity to zero for aggregate industry TFP. The results can be found in table 15.

Both financial pledgeability and asset liquidity are quantitatively important for the industry-wide TFPR dispersion. However, the results show that the mitigating effects of financial pledgeability and asset liquidity on capital rental distortions are not uniform across clusters. In especially IT, Textile Fabrics and Food and Beverages reduction of financial pledgeability to level zero for all firms increases the intra-industry TFPR dispersion by 200, 239 and 116 percents respectively. In FIRE and Metal-Mineral industry clusters the effects of financial pledgeability are quite substantial as well. The standard deviation of TFPR increases by 23% in FIRE and by 46% in Metal-Mineral as a response to the counterfactual experiment. In Chemicals and Petroleum and Transportation Equipment the changes in TFPR dispersion as a response to the counterfactual experiment are relatively mild with a decrease in dispersion by 15% in Chemicals and Petroleum industry and an increase in dispersion by 7% in Transportation Equipment industry. The effects of financial pledgeability on intra-industry TFPR dispersion has quantitatively important implications for the aggregate TFPS as well. As a response to the large dispersion increase, IT, Textiles and Fabrics and FB sectors experience TFP losses at significant proportions. In IT the industry TFP decreases by 83%, in Textile Fabrics the TFPS decreases by 133%, and finally in Food and Beverages the TFP drops by 47% as we suppress the mitigating effects of firm level financial pledgeability. For the remaining industry clusters the TFP losses are: For FIRE 21%, For Metal and Mineral 34%, and for Transportation Equipment 7%. Although at rather a small ratio, TFP increases in Chemicals and Petroleum industry as a response to shutting down the ability to borrow against financial pledgeability. The rise in TFP is by 8%.

The quantitatively important effects of financial pledgeability on Total Factor Productivity for 6 out 7 industry clusters show that the ability to borrow in financial markets against financial market reputation matters for the performance of an industry. The sensitivity of the aggregate performance with respect to the firms' ability to borrow against their market reputation matters more for industries such as IT and Textiles and Fabrics in which production highly depends on innovative activity as oppose to industries such Chemicals and Petroleum and Transportation Equipment.

Similarly dropping each firm's financial asset liquidity level to zero has quantitatively important implications for the intra-industry TFPR variance as well as for the industry TFP. Suppressing financing against internal assets increases the industry TFPR dispersion for the Chemicals and Petroleum by 455 %, for the Textiles and Fabrics by 79 %, for Food and Beverages by 59%, for IT by 48%, for FIRE by 37 %, for Transportation Equipment by 14%. Dropping financial asset liquidity to zero decreases the TFPR variance by 43 % for the Metal and Minerals industry. As a response to the large dispersion increase, the Chemicals and Petroleum industry experiences large TFP losses by %113. For the remaining industry clusters: in IT the industry TFP decreases by 62%, in Textile Fabrics the TFPS decreases by 75%, in Food and Beverages the TFP drops by 22%, for Metal and Mineral 34%, and for Transportation Equipment 4%. TFP increases in Minerals and Metalindustry as a response to shutting down the ability to borrow against financial pledgeability by 57%.

The large effects of financial asset liquidity and almost no-effects of financial pledgeability on the TFPR dispersion and aggregate industry performance in Chemicals and Petroleum industry suggests the importance of self financing for this sector and hence the mitigating effects of financial asset liquidity against distortionary capital rental rates. Shutting down the asset liquidity channel has significant effects for the IT and Textiles and Fabrics industries as does financial pledgeability. Minor effects of pledgeability and liquidity on TFPR dispersion in FIRE industry cluster suggests an important Lucas's "span of control effect" associated with the industries included in FIRE which was not modeled in this current setting.

These key results suggest that ability to borrow against reputation (pledgeability) as well as against liquid assets matter for capital-labor misallocation in industries with high innovation intensity such as IT and Textile and Fabrics, whereas ability to borrow against liquid assets matters for the observed misallocation and productivity dispersion in industries with relatively lower innovation intnsity such as Chemicals and Petroleum as it has been pointed out by Kamien and Schwartz (1978).

Policy implications one can draw upon this quantitative are: (i) improving the ability to borrow against financial market reputation and improving the ability to borrow against liquid financial assets have differential effects for the aggregate industry performance across industries, (ii) financial development matters for the aggregate productivity. However, how financial sector development should take place highly depends on sector specific characteristics.

6 Conclusion

This paper studies the sensitivity of capital-labor ratio distortions at the firm level to firm financial characteristics and the implications of this sensitivity for industry-wide firm productivity dispersion and aggregate industry TFP. Basically, in this paper I have studied the effects of financial pledgeability and asset liquidity on capital-labor choice when there are capital market distortions in terms of heterogeneity in capital rental rates.

The analytical results show that financial pledgeability and asset liquidity can mitigate the effects of distortionary capital rental rates. Empirical findings show that the mitigating effect of financial pledgeability on capital-labor ratio distortions is relatively high for small firms, whereas asset liquidity is important for all firm-size classes.

Finally quantitative analysis shows that the ability to borrow against financial pledgeability and financial asset liquidity matters for intra-industry TFPR dispersion and aggregate TFPS. However, which type of financial characteristic has a stronger effect on aggregate industry performance differs across sectors with different types of financial market needs. Therefore, the policy implications suggest that financial development matters for the aggregate productivity but how the financial markets are ought to develop is sensitive on sector specific characteristics.

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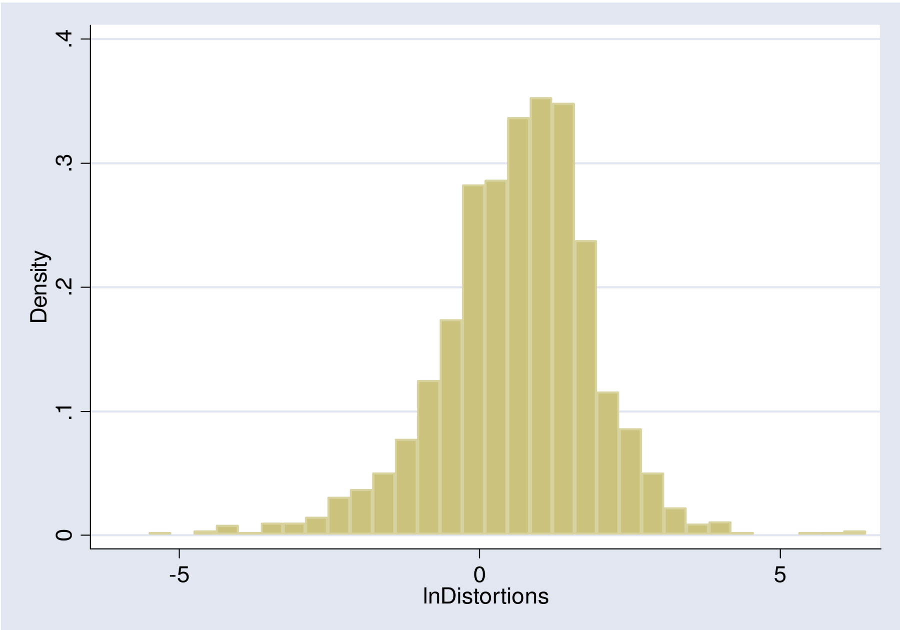


Figure 1. Sample Distribution of lnDistortions

lnDistortions is the natural log of oberved K/L distortions in the Compustat data which are derived using the deviations from the optimum K/L ratio. The data is cross-sectional. Each firm level observation is derived using time series K/L distortion averages over 2003-2006.

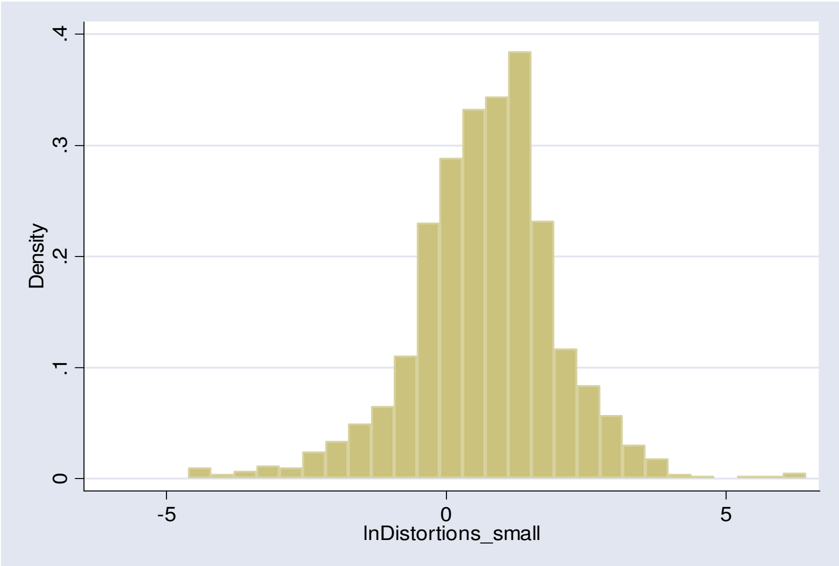


Figure 2. Sample Distribution of lnDistortions_small

lnDistortions for small firms. Small firms are production plants with less than 2200 employees. 2200 employees is the mean employment size of the sample firms.

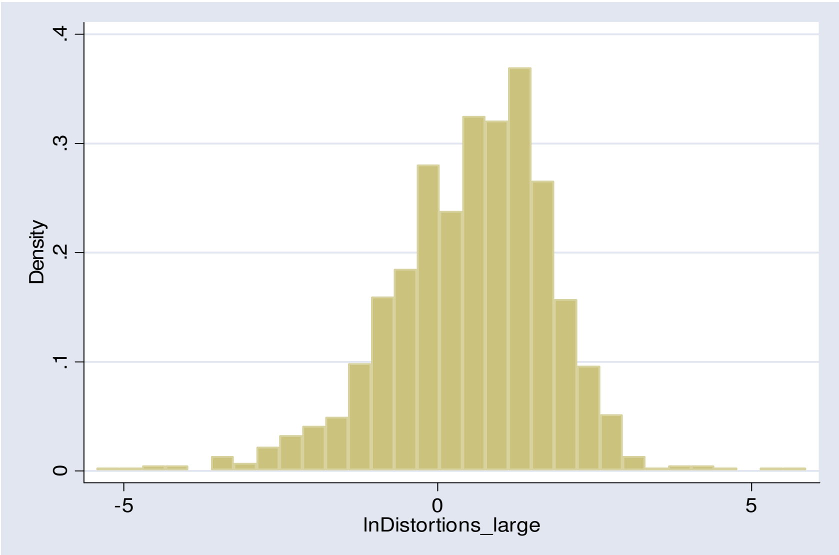


Figure 3. Sample Distribution of lnDistortions_large

lnDistortions for large firms. Large firms are production plants with more than 2200 employees. 2200 employees is the mean employment size of the sample firms.

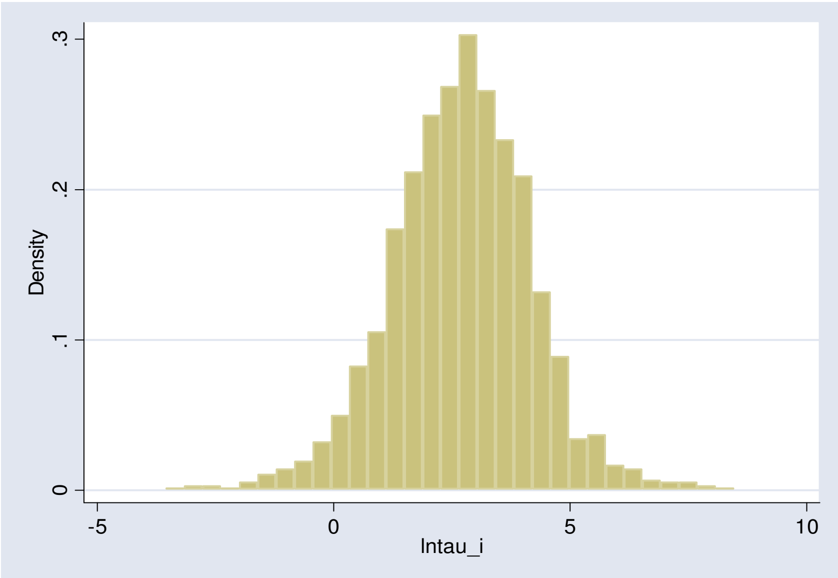


Figure 4. Sample Distribution of lntau

lntau is the natural log of firm level capital rental rate distortions which are backed-out using K/L distortions, financial pledegability and asset liquidity index.

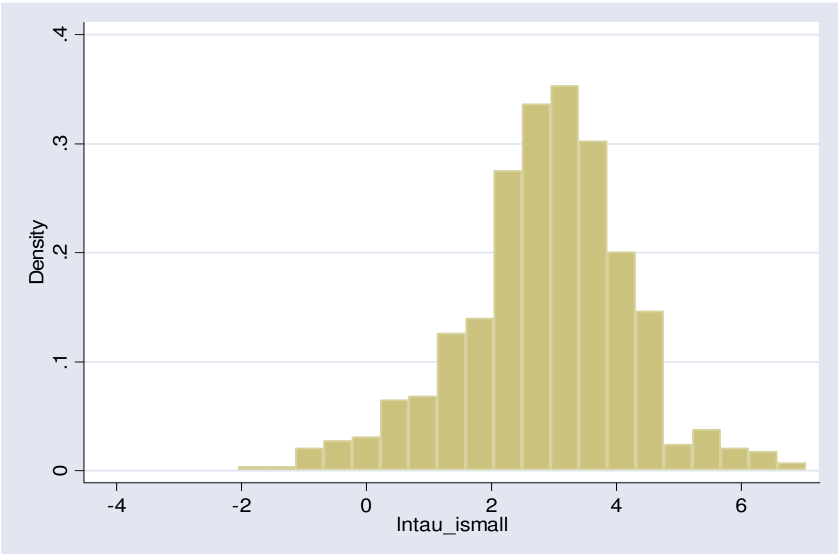


Figure 5. Sample Distribution of lntau_small

lntau_small is the natural log of firm level capital rental rate distortions for firms wih less than 2200 employees.

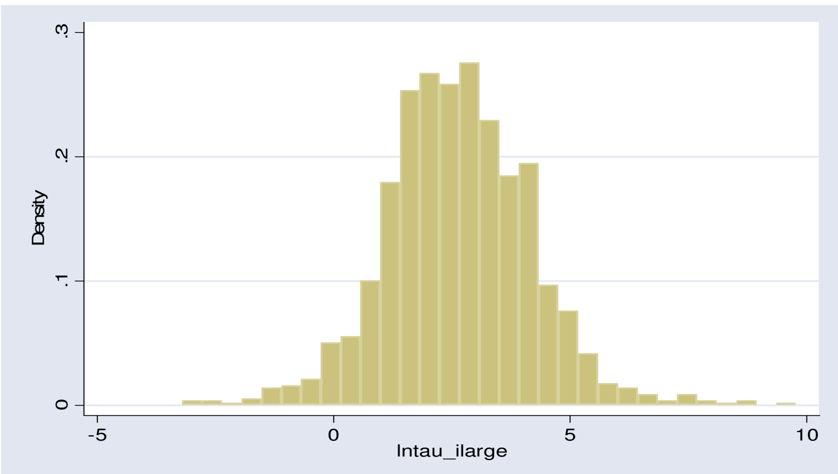


Figure 6. Sample Distribution of lntau_large

lntau_large is the natural log of firm level capital rental rate distortions for firms wih more than 2200 employees.

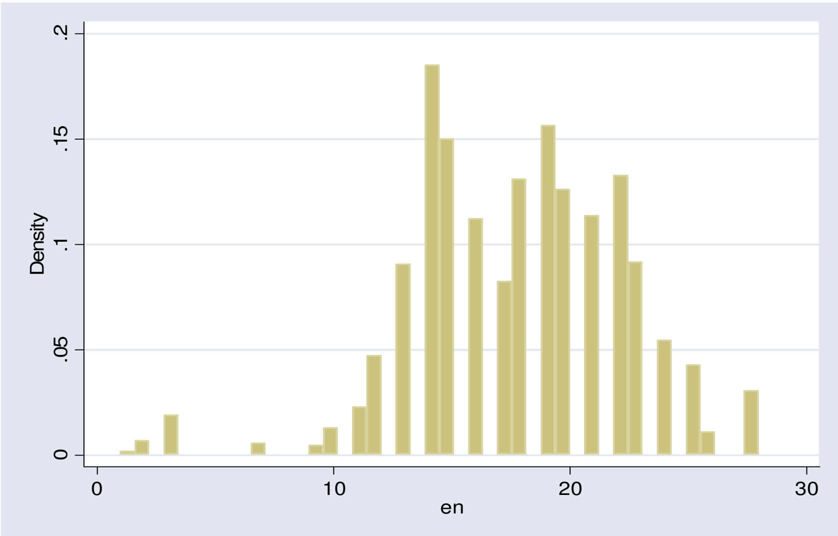


Figure 7. Sample Distribution of pledgeability

en is the S&P domestic issuer long term credit rating. In the sample the lowest rating is 1 whereas the highest is 28.

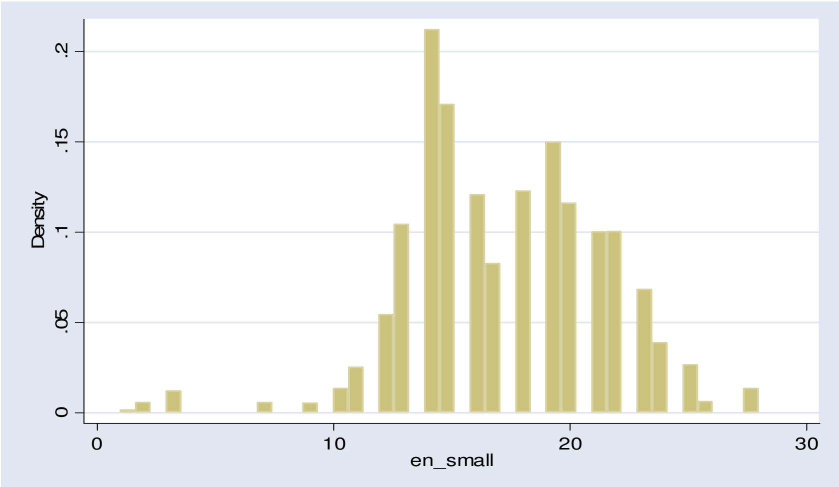


Figure 8. Sample Distribution of pledgeability_small

en_small is the S&P domestic issuer long term credit rating for firms with less than 2200 employees.

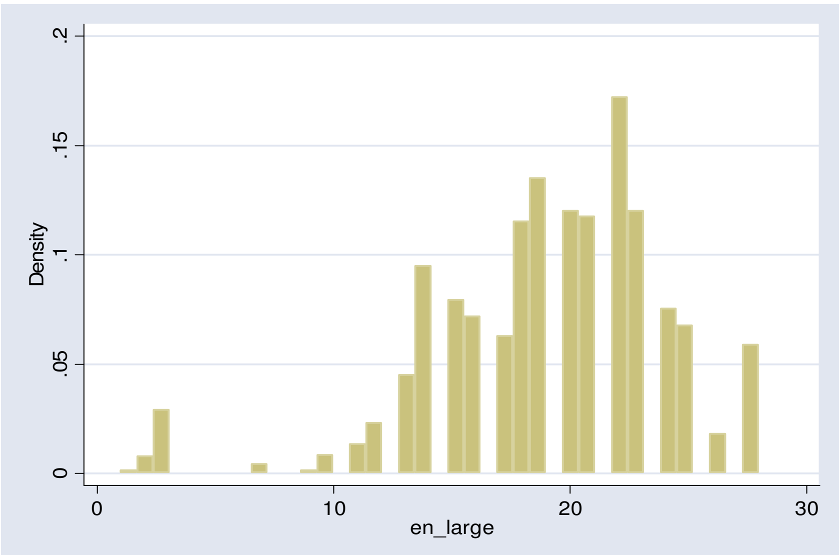


Figure 9. Sample Distribution of pledgeability_large

en_large is the S&P domestic issuer long term credit rating for firms with more than 2200 employees.

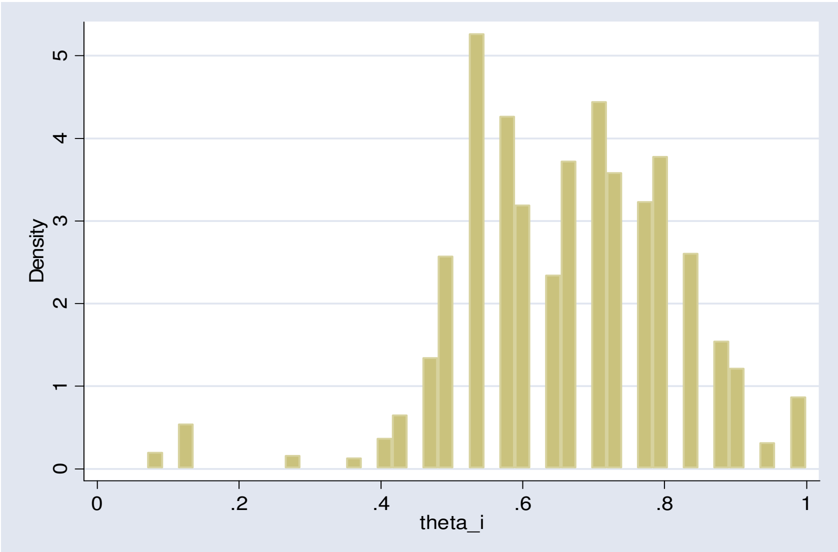


Figure 10. Sample Distribution of theta

theta is the transformation of long term credit rating oberved in the data into an index number between 0 and 1 as discussed in section 5.

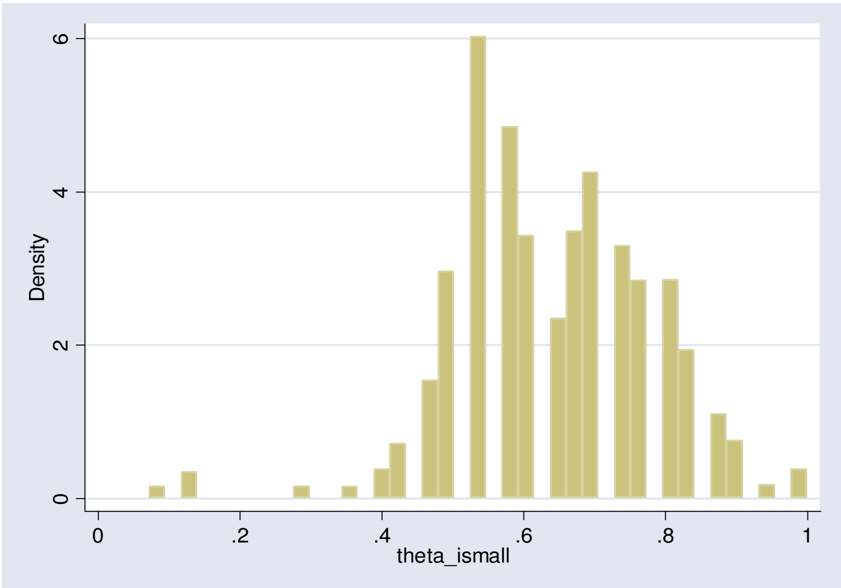


Figure 11. Sample Distribution of theta_small

theta_small is the transformation of long term credit rating oberved in the data into an index number between 0 and 1 as discussed in section 5 for firms with less than 220 employees.

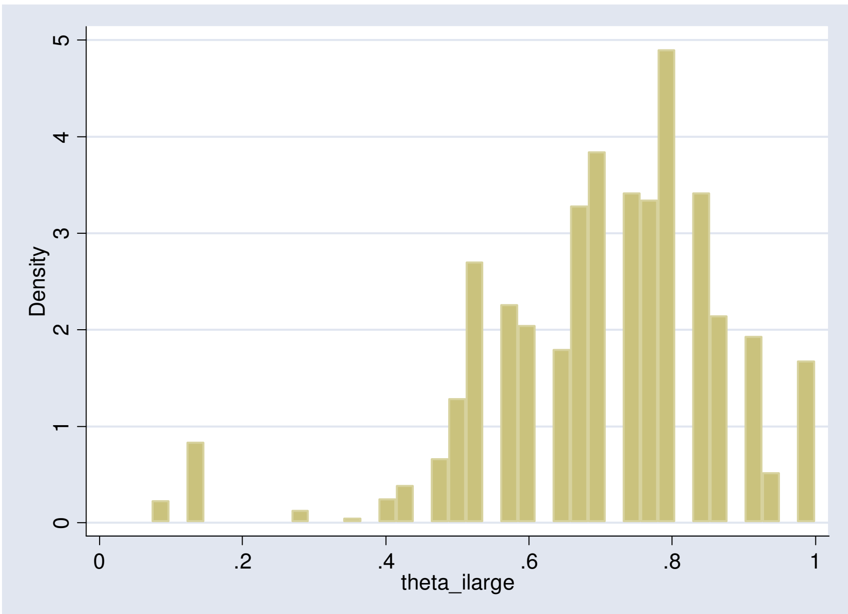


Figure 12. Sample Distribution of theta_large

theta_large is the transformation of long term credit rating oberved in the data into an index number between 0 and 1 as discussed in section 5 for firms with more than 220 employees.

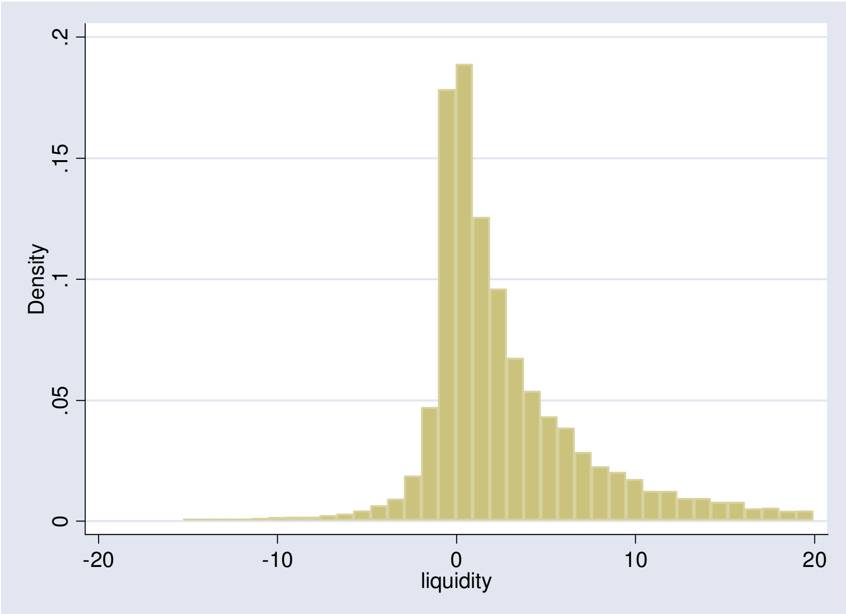


Figure 13. Sample Distribution of liquidity

liqudity is the measure of the financial asset liquidity of a firm proxied as

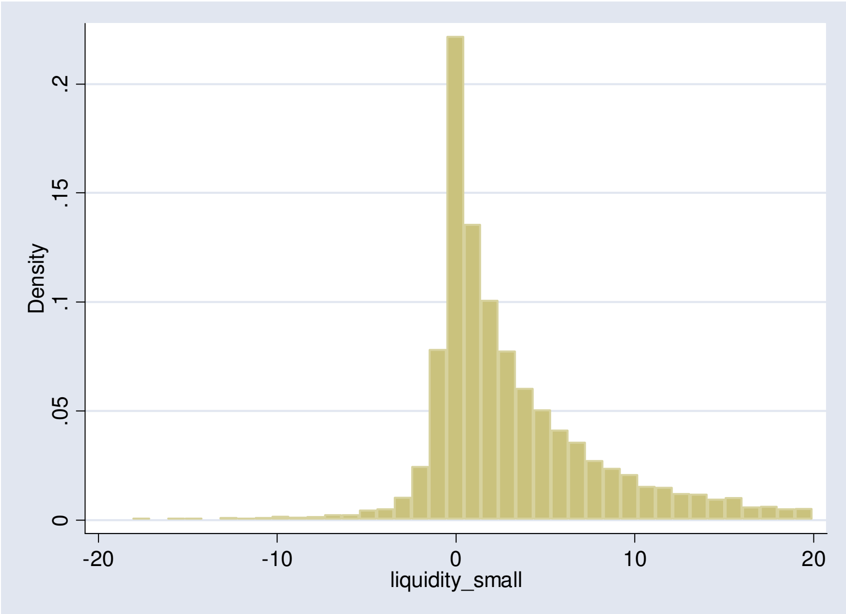


Figure 14. Sample Distribution of liquidity_small

liquidity_small is the asset liquidity of firms with less than 2200 firms.

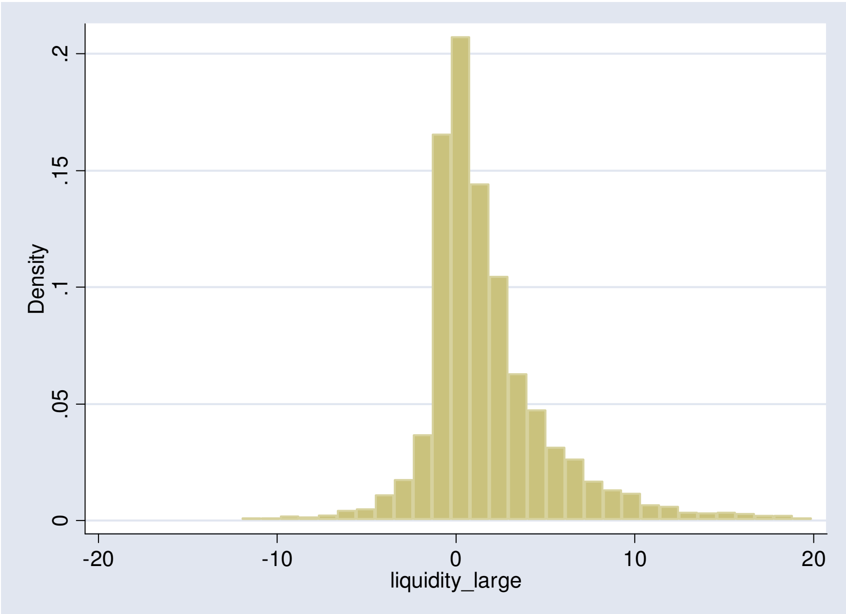


Figure 15. Sample Distribution of liquidity_large

liqudity_large is the asset liquidity of firms with more than 2200 firms.

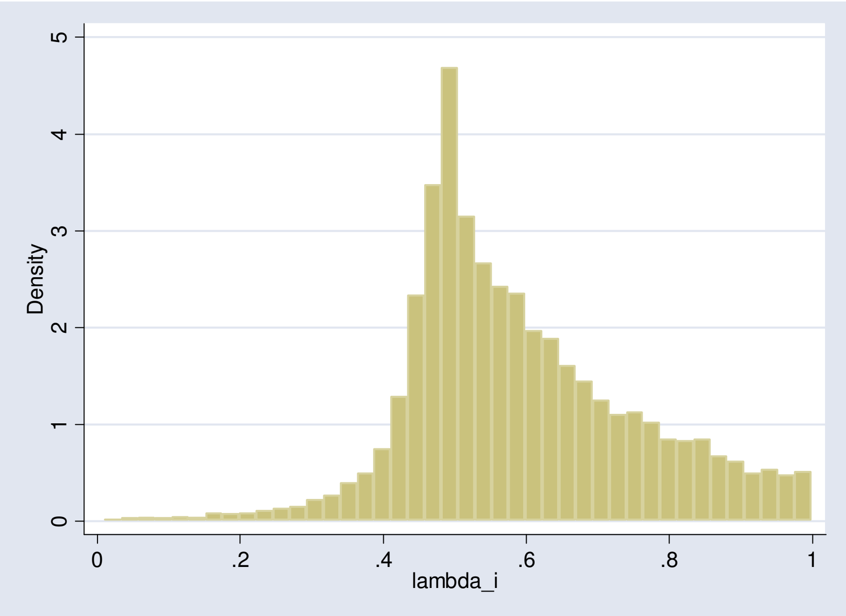


Figure 16. Sample Distribution of lambda

lambda is the transformation of asset liquidity oberved in the data into an index number between 0 and 1 as discussed in section 5.

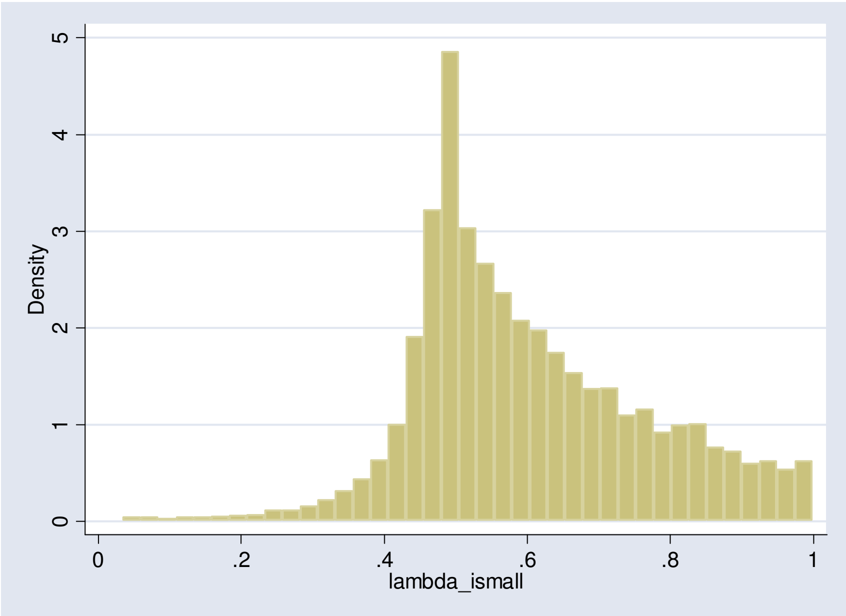


Figure 17. Sample Distribution of lambda_small

lambda_small is the transformation of asset liquidity oberved in the data into an index number between 0 and 1 as discussed in section 5 for firms with less than 2200 employees.

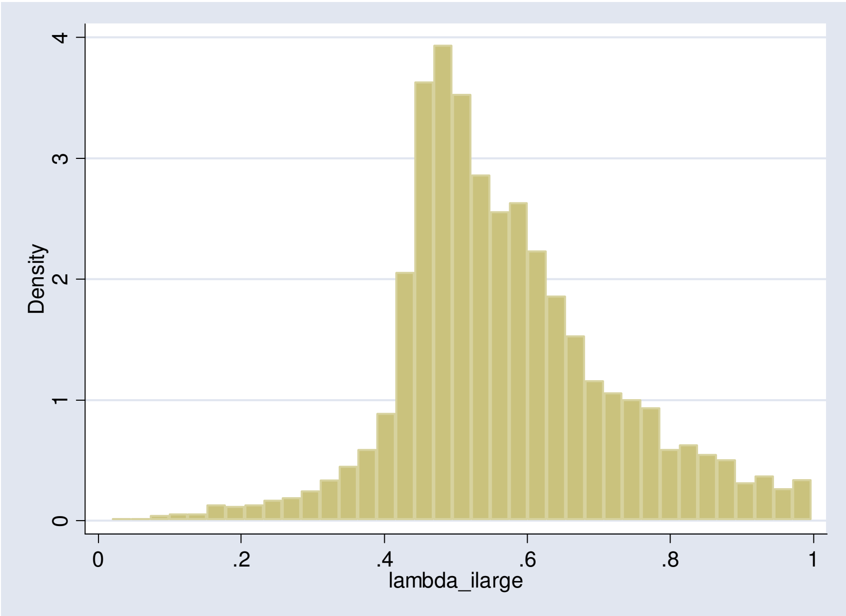


Figure 18. Sample Distribution of lambda_large

lambda_large is the transformation of asset liquidity oberved in the data into an index number between 0 and 1 as discussed in section 5 for firms with more than 2200 employees.

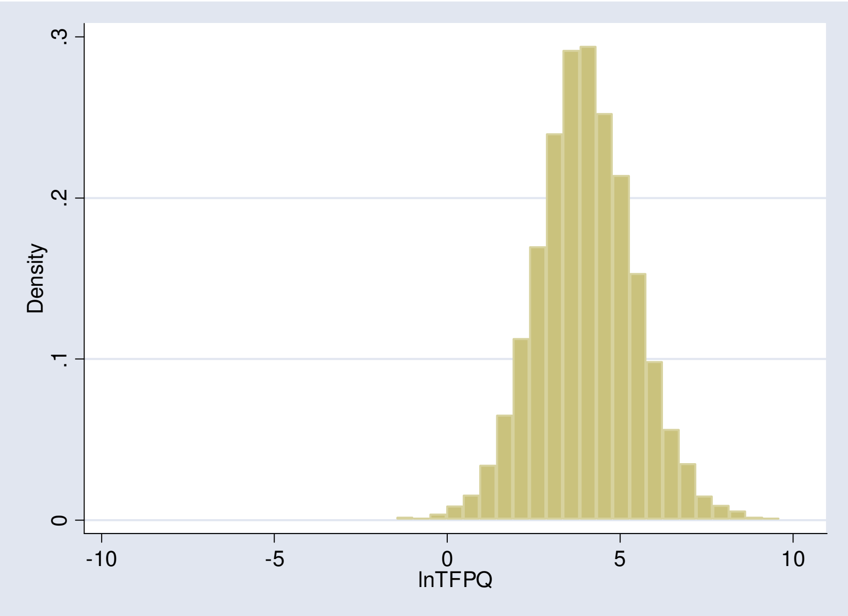


Figure 19. Sample Distribution of lnTFPQ

lnTFPQ is the natural log of firm level total factor productivity quality.

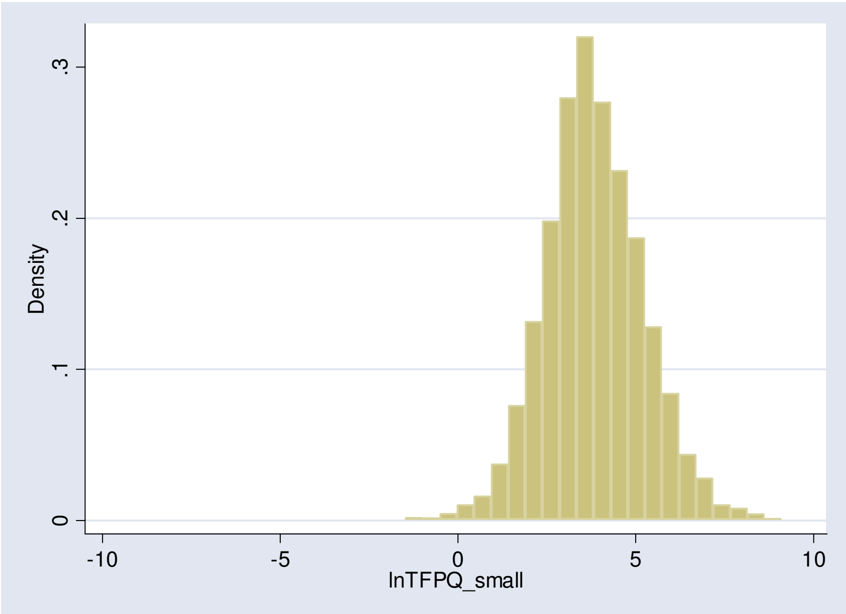


Figure 20. Sample Distribution of lnTFPQ_small

lnTFPQ_small is the natural log of firm level total factor productivity quality for firms with less than 2200 employees.

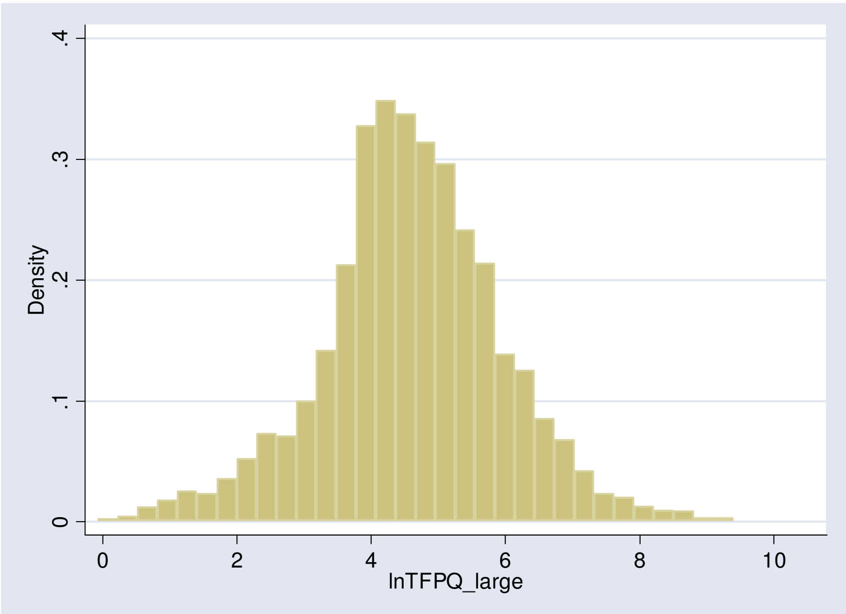


Figure 21. Sample Distribution of lnTFPQ_large

lnTFPQ_large is the natural log of firm level total factor productivity quality for firms with more than 2200 employees.

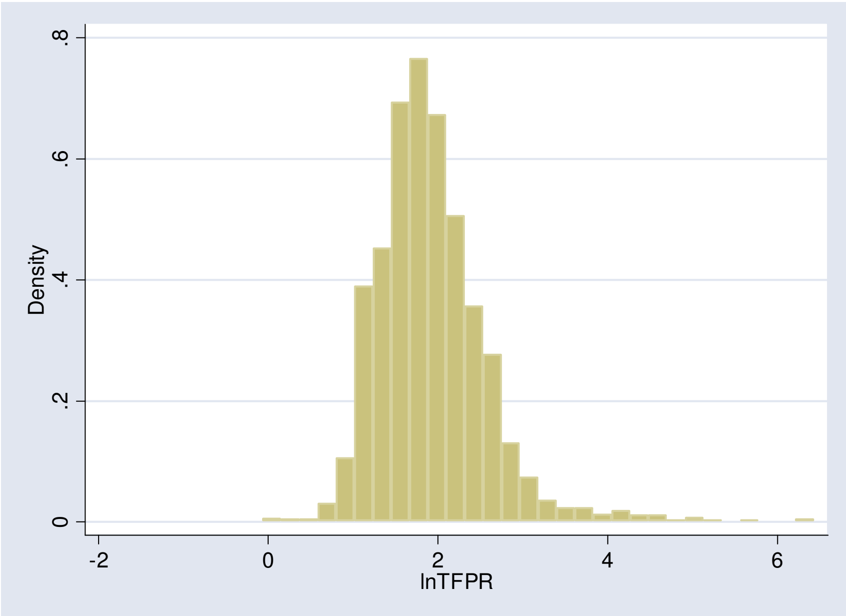


Figure 22. Sample Distribution of lnTFPR

lnTFPR is the natural log of firm level total factor productivity revenue.

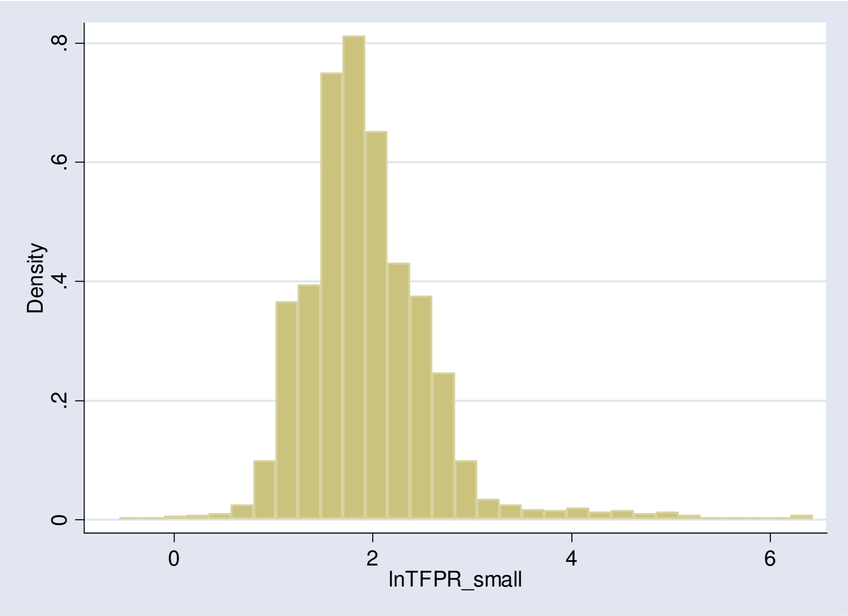


Figure 23. Sample Distribution of lnTFPR_small

lnTFPR_small is the natural log of firm level total factor productivity revenue for firms with less than 2200 employees.

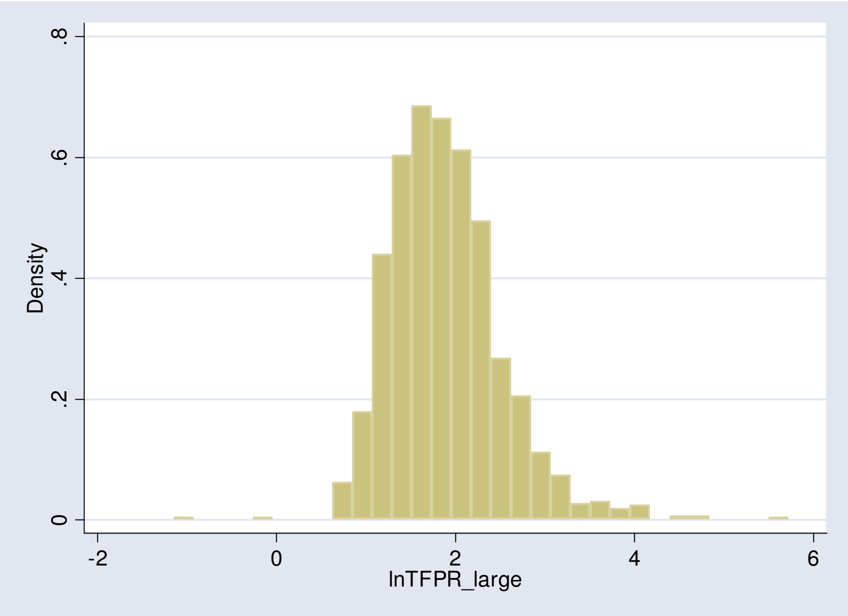


Figure 24. Sample Distribution of lnTFPR_large

lnTFPR_large is the natural log of firm level total factor productivity revenue for firms with more than 2200 employees.

Table 10. Industry Productivity and Capital Rental Distortions

Industry Name	lnTFPRS	lnTFPS	Tau (Mean)	Tau (St Dev)
Utilities	2.15	3.07	7.41	5.50
Construction	2.62	2.26	4.78	6.23
Wholesale Trade	3.21	2.75	10.06	8.29
Retail Trade	2.53	2.20	5.25	4.64
Retail Trade	2.65	2.08	4.54	6.58
Warehousing	1.38	1.62	4.27	3.19
Oil and Gas	1.59	2.20	1.51	4.10
Minerals and Ores	2.30	1.74	2.51	3.88
Food and Kindred Products	2.60	2.37	7.69	4.04
Beverages and Tobacco Products	2.66	2.42	4.03	3.60
Textiles and Fabrics	1.66	1.13	2.77	0.82
Paper	2.51	1.82	1.69	2.32
Petroleum and Coal Products Manufacturing	2.67	3.10	2.48	3.69
Chemical Manufacturing	2.28	2.36	7.39	4.37
Plastics and Rubber Products Manufacturing	1.93	1.70	4.54	2.92
Nonmetallic Mineral Product Manufacturing	2.28	1.90	4.60	3.78
Primary Metal Manufacturing	2.19	1.80	3.69	2.98
Fabricated Metal Product Manufacturing	1.85	1.63	3.76	1.97
Machinery Manufacturing	1.81	1.67	2.36	3.00
Computer and Electronic Product Manufacturing	1.60	1.39	-0.55	1.27
Electrical Equipment, Appliance, and Component Manufacturing	1.90	1.85	8.93	1.59
Transportation Equipment Manufacturing	2.12	1.76	3.96	5.82
Air Transportation	1.99	1.75	2.34	5.49
Rail Transportation	1.43	1.71	2.52	2.49
Water Transportation	1.83	2.02	0.20	2.43
Truck Transportation	1.87	1.61	9.74	8.11
Publishing Industries	2.00	1.84	10.05	5.93
Credit Intermediation and Related Activities	3.02	2.06	4.70	7.21
Securities, Commodity Contracts, and Other Financial Investments and Related Activities	1.75	2.19	3.55	4.77
Insurance Carriers and Related Activities	3.14	2.70	19.75	3.01
Rental and Leasing Services	2.59	2.07	5.83	3.60
Insurance Carriers and Related Activities	5.72	3.93	26.31	5.13
Ambulatory Health Care Services	1.81	1.81	5.66	6.32
Hospitals	1.09	0.94	-0.64	1.14
Nursing and Residential Care Facilities	0.87	0.42	1.76	3.72
Accommodation	1.75	1.45	2.53	3.17
Food Services and Drinking Places	1.82	1.12	6.76	7.17
Accounting and bookkeeping services	1.72	1.41	9.51	1.83
Architectural and engineering services	1.65	1.53	2.34	2.27
Advertising and related services	1.62	1.61	18.61	1.93

TFPRS is the industry aggregate revenue productivity which is calculated using the equation 3.17 whereas TFPS is the aggregate industry TFP which is calculated using equation 3.19.

Table 11. Productivity and Capital Rental Distortions, Pledegability and Asset Liquidity

Sector	# of Firms	Capital Rental Dists in S (Mean Tau)	St Dev Tau	Observed Pledgeablity (Mean)	Observed As. Liquid. (Mean)
IT	105	27.19	58.83	0.62	0.75
FIRE	113	452.49	1855.48	0.74	0.61
Food and Beverages	34	60.65	116.43	0.68	0.58
Textiles and Fabrics	52	30.23	24.47	0.57	0.71
Chem and Petroleum	65	77.90	386.31	0.72	0.65
Metal and Mineral	32	64.06	209.97	0.60	0.64
Transportation Equipment	17	36.76	93.70	0.65	0.63

IT stands for Information Technology whereas FIRE stands for Finance-Insurance-Retail Trade-and-Real Estate. Capital distortions are computed using observed K/L distortions and the oberved financial pledgeability and observed asset liquidity.

Table 12. Observed K/L Distortions and TFPRS

Sector	Obsv. KL Dists in S (Mean gamma)	St Dev Gamma	Observed TFPRS	Observed TFPRS (St. Dev.)
IT	**1.325066**	**1.72**	**6.08**	**1.20**
FIRE	9.123698	46.41	14.94	23.65
Food and Beverages	3.117286	2.12	13.42	5.48
Textiles and Fabrics	**1.560131**	**0.61**	**5.28**	**0.38**
Chem and Petroleum	**3.526251**	**10.72**	**11.71**	**15.89**
Metal and Mineral	2.157464	2.45	9.09	7.04
Transportation Equipment	1.479764	3.43	8.35	3.70

IT stands for Information Technology whereas FIRE stands for Finance-Insurance-Retail Trade-and- Real Estate. TFPRS is computed using equation 3.17.

Table 13. Counterfactual Experiment 1: Decrasing the level of financial pledgeability to zero for all firms

Sector	Hypothetical TFPRS	% Change in TFPRS	Hypothetical TFPRS (St. Dev.)	% Change in TFPRS (St. Dev.)	%TFPS Losses
IT	7.98	31	3.59	200	83
FIRE	20.85	40	29.14	23	21
Food and Beverages	19.48	45	11.85	116	47
Textiles and Fabrics	7.04	33	1.29	239	133
Chem and Petroleum	17.74	51	13.40	-15	-8
Metal and Mineral	12.84	41	10.28	46	34
Transportation Equipment	8.63	3	4.04	9	7

IT stands for Information Technology whereas FIRE stands for Finance-Insurance-Retail Trade-and- Real Estate. TFPS change is computed using equation 3.19. In this exercise all firms financial pledgeability hypothetically decreased to the lowest possible level in the set.

Table 14. Counterfactual Experimnet 2: Decrasing the level of financial asset liquidity to zero for all firms

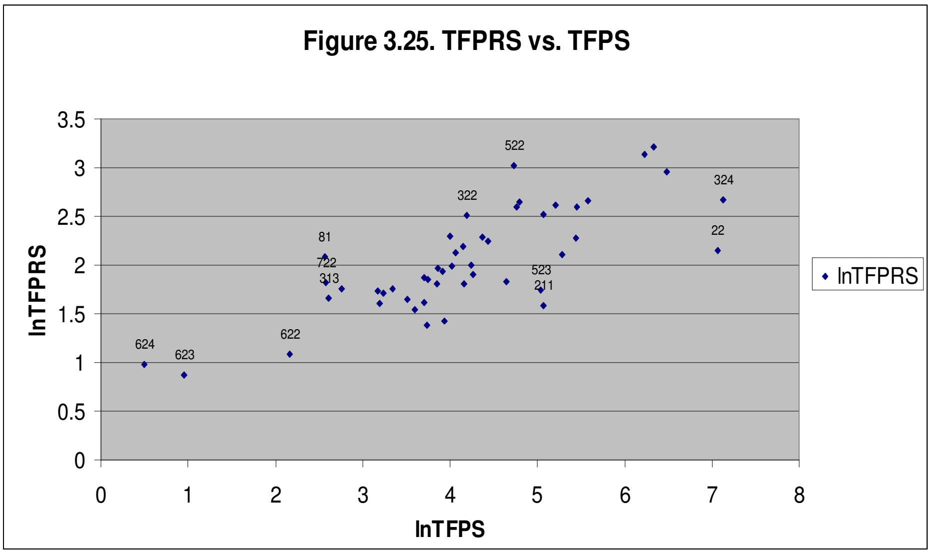
Sector	Hypothetical TFPRS	% Change in TFPRS	Hypothetical TFPRS (St. Dev.)	% Change in TFPRS (St. Dev.)	%TFPS Losses
IT	**7.39**	**22**	**1.78**	**48**	**62**
FIRE	21.20	42	32.48	37	29
Food and Beverages	28.76	114	8.70	59	22
Textiles and Fabrics	**6.81**	**0.29**	**0.68**	**79**	**75**
Chem and Petroleum	**30.85**	**163**	**88.22**	**455**	**113**
Metal and Mineral	10.33	137	4.028	-43	-57
Transportation Equipment	9.69	160	4.21	14	10

IT stands for Information Technology whereas FIRE stands for Finance-Insurance-Retail Trade-and- Real Estate. TFPS change is computed using equation 3.19. In this exercise all firms financial asset liquidity hypothetically decreased to the lowest possible level in the set.

Table 15. Counterfactual Experimnet 3: Decrasing the level of financial pledgeability and the level of financial asset liquidity to zero for all firms

Sector	Hypothetical TFPRS	% Change in TFPRS	Hypothetical TFPRS (St. Dev.)	% Change in TFPRS (St. Dev.)	%TFPS Losses
IT	8.51	39	4.05	238	94
FIRE	23.19	55	37.83	60	46
Food and Beverages	32.11	140	14.19	159	61
Textiles and Fabrics	6.92	31	1.53	302	158
Chem and Petroleum	34.21	192	65.93	315	103
Metal and Mineral	13.59	50	6.78	-7	-5
Transportation Equipment	11.21	34	4.30	16	13

IT stands for Information Technology whereas FIRE stands for Finance-Insurance-Retail Trade-and- Real Estate. TFPS change is computed using equation 3.19. In this exercise all firms financial asset liquidity hypothetically decreased to the lowest possible level in the set.



lnTFPS vs. ln TFPRS. Industries with low TFPS, and/or high TFRPS are labeled. 22: Utilities, 81: Other Services, 211: Oil and Gas, 313: Textiles and Fabrics, 322: Paper, 324: Petroleum and Coal Products Manufacturing, 522: Credit Intermediation and Related Activities, 523: Securities, Commodity Contracts, and Other Financial Investments and Related Activities, 622: Hospitals, 623: Nursing and Residential Care Facilities, 624: Social Assistance, 722: Food Services and Drinking Places. ln(Mean(TFPS))=2.19, ln(Mean(TFPRS))=2.17.

Table 1. Summary Statistics

Variable	Mean	Standard Deviation	Median
Size (#(Employees))	1926	576	349
Capt-Lab Distortions	8.82	2.11	5.81
Credit Rating	12.1(=B-)	4.4	12(=B-)
Net Worth (Millions of $'s)	121.11	591.22	191.12
Financial Liquidity	0.39	0.12	0.18
Profitability (Millions of $'s)	1.45	1.10	0.85
Firm Age	18.2	5.1	12.9
Liability Structure	0.23	0.09	0.18
Research and Development Intensity	0.08	0.04	0.06

Compustat Industrial Annual, Average of 1990-2006. Firm size is derived using the total number of employees at an establishment. Capital-Labor distortions are derived using the model presented in section 3. Credit rating is the S&P long term domestic credit issuer rating. Net worth is computed as $Total\ Assets - Total\ Debt$. Financial Liquidity is computed as $(Current\ Assets - Current\ Liabilities)/Current\ Liabilities$. Profitability is $(Total\ Sales - Total\ Cost\ of\ Goods\ Sold)/Size$, firm age proxied using the total number of years an establishment has spent in the database. Liability structure refers to the debt structure $TotalLongTermDebt/TotalDebt$ of a particular firm i in year t. Research and Development intensity of a firm i in year t, and is computed as $R\&DExpenditures/TotalSales$.

Table 2. Coefficient Estimates (OLS (Panel) Full Sample)

Indep. Var.	Dist to L/K Ratio	Dist to L/K Ratio	Dist to L/K Ratio
Fin Liquidity$_{lowEF}$	-0.218 (-1.05)	-	-
Fin Liquidity$_{midEF}$	-0.241* (-1.99)	-	-
Fin Liquidity$_{hiEF}$	-0.267* (-2.03)	-	-
ln(CrRat)$_{lowEF}$	-	-0.219 (-0.98)	-
ln(CrRat)$_{midEF}$	-	-0.276 (-0.76)	-
ln(CrRat)$_{hiEF}$	-	-0.398 (-1.61)	-
ln(1+NWorth)*ln(CrRat)$_{lowEF}$	-	-	-0.522(-1.23)
ln(1+NWorth)*ln(CrRat)$_{midEF}$	-	-	-0.601**(-3.65)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.721**(-4.21)
ln(Size)	-0.425** (-5.34)	-0.441** (-5.67)	-0.493** (-3.71)
Profitability	-0.063 (-0.34)	-0.071 (-0.45)	-0.064 (-0.61)
ln(1+FirmAge)	-0.581 (-1.16)	-0.574 (-0.96)	-0.576 (-0.91)
LiabStr	0.712** (3.46)	0.721** (3.91)	0.732* (2.11)
R&DInt	0.754** (2.34)	0.729** (3.01)	0.741** (3.13)
R^2	0.367	0.389	0.312

The values in parentheses are robust t-statistics. * and ** indicate significance at 10% and 5% respectively. Subscripts (loEF), (miEF), (hiEF) refer to the sensitivity of capital labor distortions with respect to financial pledgeability for firms operating in industries with low, medium, and high level external finance dependency sector respectively. FirmAge is proxied using the total number of years an establishment has spent in the database. See the notes to table 1.

Table 3. Coefficient Estimates (OLS (Panel) Large Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.143 (-0.79)	-	-
Fin Liquidity$_{miEF}$	-0.201 (-1.82)	-	-
Fin Liquidity$_{hiEF}$	-0.232* (-2.11)	-	-
ln(CrRat)$_{loEF}$	-	0.984 (0.78)	-
ln(CrRat)$_{miEF}$	-	1.381 (0.88)	-
ln(CrRat)$_{hiEF}$	-	1.255 (0.87)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.671(-1.23)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.912(-1.47)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.985(-1.65)
ln(Size)	1.198* (2.01)	1.231* (2.42)	1.019* (2.22)
Profitability	-0.009 (-0.19)	-0.042 (-0.22)	-0.101 (-0.17)
ln(1+Firm Age)	1.112 (0.76)	1.231 (0.32)	0.981 (0.78)
LiabStr	1.891* (2.12)	2.011* (1.99)	1.982* (2.07)
R&DInt	0.912 (1.54)	1.104 (1.82)	1.184 (1.63)
R^2	0.391	0.384	0.389

Large firms are those establishments with more than 5000 employees. See also the notes to table 2.

Table 4. Coefficient Estimates (OLS (Panel) Medium Size Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.021 (-1.71)	-	-
Fin Liquidity$_{miEF}$	-0.191** (-2.51)	-	-
Fin Liquidity$_{hiEF}$	-0.381** (-2.69)	-	-
ln(CrRat)$_{loEF}$	-	-0.113 (-1.05)	-
ln(CrRat)$_{miEF}$	-	-0.179 (-1.67)	-
ln(CrRat)$_{hiEF}$	-	-0.175* (-1.98)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.665**(-2.78)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.781**(-4.69)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.759**(-5.81)
ln(Size)	-0.231** (-6.11)	-0.314** (-6.71)	-0.367** (-6.01)
Profitability	-0.098 (-0.11)	-0.182 (-0.18)	-0.241 (-0.21)
ln(1+Firm Age)	-0.212 (-1.01)	-0.174 (-1.02)	-0.161 (-0.89)
LiabStr	0.681** (4.12)	0.711** (4.64)	0.981** (4.91)
R&DInt	0.661** (3.43)	0.771** (3.72)	0.712** (3.65)
R^2	0.345	0.351	0.342

Medium size firms are those establishments with more 500 and less than 5000 employees. See also the notes to table 2.

Table 5. Coefficient Estimates (OLS (Panel) Small Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.113 (-1.43)	-	-
Fin Liquidity$_{miEF}$	-0.234** (-3.11)	-	-
Fin Liquidity$_{hiEF}$	-0.461** (-3.91)	-	-
ln(CrRat)$_{loEF}$	-	-0.126 (-1.45)	-
ln(CrRat)$_{miEF}$	-	-0.191 (-1.63)	-
ln(CrRat)$_{hiEF}$	-	-0.211 (-1.84)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.4 31*(-2.04)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.749**(-5.13)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.912**(-6.74)
ln(Size)	-0.321** (-5.67)	-0.378** (-5.99)	-0.441** (-5.61)
Profitability	-0.121 (-0.21)	-0.212 (-0.23)	-0.211 (-0.29)
ln(1+Firm Age)	-0.301 (-1.21)	-0.281 (-1.11)	-0.291 (-1.22)
LiabStr	0.731** (5.32)	0.792** (5.41)	0.873* (5.36)
R&DInt	0.701** (3.91)	0.785* (3.89)	0.816** (3.84)
R^2	0.310	0.293	0.296

Small firms are those establishments with less than 500 employees. See also the notes to table 2.

Table 6. Coefficient Estimates (2SLS Full Sample)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.155 (-1.42)	-	-
Fin Liquidity$_{miEF}$	-0.242 (-1.90)	-	-
Fin Liquidity$_{hiEF}$	-0.392** (-2.21)	-	-
ln(CrRat)$_{loEF}$	-	-0.104 (-0.87)	-
ln(CrRat)$_{miEF}$	-	-0.213 (-1.49)	-
ln(CrRat)$_{hiEF}$	-	-0.225 (-1.75)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.634*(-2.09)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.761**(-4.17)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.793**(-4.49)
ln(Size)	-0.651** (-4.10)	-0.644** (-4.87)	-0.593** (-4.11)
Profitability	-0.121 (-0.11)	-0.133 (-0.14)	-0.143(-0.11)
ln(1+Firm Age)	-0.421 (-1.34)	-0.448 (-1.56)	-0.394 (-1.01)
LiabStr	0.733** (4.71)	0.741** (4.82)	0.736** (3.92)
R&DInt	0.830* (2.03)	0.871** (3.23)	0.845** (3.49)
R^2			

See the notes to table 2.

Table 7. Coefficient Estimates (2SLS Large Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.059 (-1.04)	-	-
Fin Liquidity$_{miEF}$	-0.193 (-1.36)	-	-
Fin Liquidity$_{hiEF}$	-0.431** (-2.69)	-	-
ln(CrRat)$_{loEF}$	-	0.913 (0.46)	-
ln(CrRat)$_{miEF}$	-	1.239 (0.67)	-
ln(CrRat)$_{hiEF}$	-	1.192 (0.65)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.619(-0.78)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.861(-0.89)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.924(-1.32)
ln(Size)	2.012* (2.12)	1.856** (2.76)	1.921* (2.34)
Profitability	-0.011 (-0.19)	-0.052 (-0.16)	-0.021 (-0.30)
ln(1+Firm Age)	1.011 (0.86)	1.129 (0.42)	0.971 (0.66)
LiabStr	1.498** (3.62)	2.108** (2.93)	2.223* (2.98)
R&DInt	1.251 (1.19)	1.522 (1.49)	1.234 (1.23)
R^2			

See the notes to table 2.

Table 8. Coefficient Estimates (2SLS Medium Size Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.135 (-1.31)	-	-
Fin Liquidity$_{miEF}$	-0.193* (-1.96)	-	-
Fin Liquidity$_{hiEF}$	-0.341** (-2.91)	-	-
ln(CrRat)$_{loEF}$	-	-0.187 (-1.21)	-
ln(CrRat)$_{miEF}$	-	-0.223 (-1.54)	-
ln(CrRat)$_{hiEF}$	-	-0.239 (-1.69)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.691**(-2.61)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.799**(-4.41)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-0.813**(-4.83)
ln(Size)	-0.378** (-5.98)	-0.412** (-5.61)	-0.422** (-5.64)
Profitability	-0.120 (-0.23)	-0.141 (-0.21)	-0.134 (-0.24)
ln(1+Firm Age)	-0.320 (-1.13)	-0.291 (-1.34)	-0.315 (-1.03)
LiabStr	0.824** (4.66)	0.898** (4.79)	1.012** (5.02)
R&DInt	0.981** (3.57)	1.023** (4.12)	1.078** (4.39)
R^2			

See the notes to table 2.

Table 9. Coefficient Estimates (2SLS Small Firms)

Indep. Var.	Dist to L/K	Dist to L/K	Dist to L/K
Fin Liquidity$_{loEF}$	-0.065 (-1.01)	-	-
Fin Liquidity$_{miEF}$	-0.281 (-1.86)	-	-
Fin Liquidity$_{hiEF}$	-0.457** (-3.39)	-	-
ln(CrRat)$_{loEF}$	-	-0.098 (-1.51)	-
ln(CrRat)$_{miEF}$	-	-0.198 (-1.77)	-
ln(CrRat)$_{hiEF}$	-	-0.393 (-1.71)	-
ln(1+NWorth)*ln(CrRat)$_{loEF}$	-	-	-0.573**(-4.32)
ln(1+NWorth)*ln(CrRat)$_{miEF}$	-	-	-0.711**(-4.14)
ln(1+NWorth)*ln(CrRat)$_{hiEF}$	-	-	-1.253**(-6.52)
ln(Size)	-0.541** (-5.71)	-0.552** (-5.85)	-0.573** (-5.94)
Profitability	-0.232 (-0.29)	-0.243 (-0.34)	-0.219 (-0.31)
ln(1+Firm Age)	-0.411 (-1.13)	-0.467 (-1.09)	-0.451 (-1.19)
LiabStr	0.698** (4.37)	0.706** (4.91)	0.734** (4.98)
R&DInt	0.745** (4.17)	0.795** (4.11)	0.921** (3.87)
R^2			

See the notes to table 2.