Financial markets and Firm Size: The role of employment protection laws and barriers to entrepreneurship

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Abstract: This paper provides evidence on the institutional determinants of firm size for the period 1980-1998. Using a comprehensive longitudinal database across 29 industrial sectors in 15 OECD countries, we study how labor regulations and barriers to entrepreneurship affect industrial organization in the presence of capital market frictions. We show that strict employment protection laws and higher barriers to entrepreneurship negatively affect firm size in sectors that are more dependent on external funds. Our findings show the interaction between market regulations and financial market imperfections that help to explain some of the differences in firm structure across countries.

JEL classification codes: J21, G2, C33
Key words: institutions, firm size, financial imperfections, labor costs, entrepreneurship costs

I. Introduction

Much attention has been devoted to the study of market structure and firm size differences. Evidence shows that firm size differs considerably across countries and within country over time and sectors. For instance, Poschke (2014) shows that firm size is larger in richer countries. Similar evidence is found for Europe; further, the degree of variability is different across sectors suggesting more than country-wide differences in firm size (Figure 1). Classical studies about size differences have concentrated on technical factors (Pagano and Schivardi, 2003). More recently a growing body of research focuses on firm size and firm financial constraints to analyze whether firm growth varies along firm size distribution (see Cabral and Mata, 2003; Angelini and Generale, 2008 and Didier et al., 2015 among others).

[Insert Figure 1 here]

In addition, a large literature has shown the relevance of institutions in shaping countries' economic differences such as in economic growth, per capita income or financial development, Engerman and Sokoloff (2008). Despite the growing academic interest on institutions, papers analyze the effects of institutions on firm size in order to study different economic problems. For instance, several papers analyze the effects of regulations on job creation and employment (Boeri and Garibaldi, 2007, Charlot *et al*, 2011 and Yin and Lenain, 2015). Others show the regulation effects on investment and firm productivity (Bassanini et al. 2009, Cingano et al, 2010 and Cingano et al., 2014). This paper, although related to, has a different objective. First of all, we focus on explaining differences in firm size and not on other firm dimensions such as productivity, investment or job rotations. Second, the paper tries to reconcile the two separate body of

research by analyzing interactions between financial constraints and institutional environment. In particular, we analyze the interaction between product market regulations (PMR), employment protection laws (EPL) and financial development. This is an interesting question since small firms account for large percentage of gdp and employment falta completar cita con la importancia de las empresas pequeñas

We find strong evidence of an interaction effect between EPL/PMR and financial development. We show that both EPL and PMR tend to decrease the marginal effect of financial development on the average firm size, particularly in sectors that are more dependent on external funds. Our results support the view that financial market development is not enough to cause increments in firm size unless interactions with other regulations are taken into account, in particular those with labor and product market institutions.

The paper is structured as follows: Section 2 describes the institutional factors analyzed. Section 3 presents the data used in our empirical application. Section 4 explains the identification strategy. Section 5 presents the main results while Section 6 is dedicated to economic assessment of our results and policy implications. Finally, Section 7 concludes.

II. Firm size, financial development and institutions

Firms interact with banks every day to finance their current operations and future investments. They are, therefore, directly affected by financial development. Economic research has long argued s strong relation between financial markets and real activity (Auer et al, 2008). In particular, financial development can facilitate incumbent growth by reducing financial constraints to finance investment opportunities (Rajan and

Zingales, 1998). However a market-oriented economic environment such as a developed financial market is only a necessary condition, since other regulations can reinforce or stifle the positive effects of easier access to credit (Nicoletti et al. 2000). Regulations as competitive rules or labor market laws condition firm activity and therefore interplay with financial development.

Both barriers to entrepreneurship and bureocratic procedures are considered as product market regulations (PMR). Barriers to entrepreneurship PMR not only shape market competition but also may prevent the growth of existing firms as well as the development of new ones (Davidsson and Henrekson, 2002, European Commission 2002) Similarly, procedures, waiting periods and other bureaucratic barriers may result in disincentives to invest by creating confusion and uncertainty for investors (Klapper et al. (2004), Fonseca et al. (2001)). Hence, the effect of PMR on average firm size may PMR negative.

Related to labor regulation, strict employment protection laws (EPL) can discourage the development of high turnover industries or sectors at the technological frontier (Saint-Paul (2002), Samaniego (2006)). With higher EPL, firms may face higher external costs to finance their investment opportunities as projects may either PMR less profitable or become more risky as a result of higher costs derived from labor regulation; i.e. firms subject to strict EPL may choose low risk although less profitable projects (Glazer and Kanniainen, 2002). Henrekson and Johansson (1999) argue that large firms can better adapt to labor regulations because they have more bargaining power over trade unions and are more able to reallocate labor within the firm. They also argue that new startups may PMR less attractive particularly because the lack of flexibility to hire and fire

workers may induce more risk for new business ventures.[1]

According to Blanchard and Tirole (2003) labor market regulation costs, by raising investment risk and raising the cost of external funds, may prevent firms from investing in more efficient ventures. Further, when financial markets are more developed firms have easier access to external finance; hence the impact of increasing labor market regulation may PMR even larger in less developed financial markets than in more developed ones. Conversely, technology shocks that increase the reliance of firms on external funds may have larger effects on firm size when EPL is flexible. It has been argued that strict EPL may actually emerge as policy response to the lack of financial development, providing workers with insurance against idiosyncratic shocks (Pissarides, 2001; Bertola, 2004). Related to PMR, the delays caused by procedures and bureaucratic barriers also increase the cost of external capital and can therefore PMR more harmful in less developed financial markets. These interactions are the basis of our empirical tests.

II. Dataset and Descriptive Statistics

We use the UNIDO Industrial Statistics Database that contains highly disaggregated data on the manufacturing sector. It comprises detailed data on business structure and statistics on major indicators of industrial performance by country in the historical time series[2]. Our analysis is realized for the period 1981-1998. The reason to

[1] Other studies investigating the role of EPL or/and PMR across sectors focusing on firm growth and job reallocation are Fonseca and Utrero (2004, 2005), Pages-Serra and Mico (2008), Bassanini et al.(2009), Cingano et al. (2010) and Haltiwanger et al. (2014).

[2] We study 15 countries and 29 sectors which are classified using US classification.

analyze this time span is because it is a period when in general terms there are no radical labor regulation reforms for the countries analyzed, as described in Boeri and Garibaldi (2007). During the late 1990s and early 2000s, many important reforms to introduce labor market flexibility have generally been passed whose main objective was to reduce frictions and promote job creation. However, these reforms have not produced job creation growth, Boeri and Garibaldi (2007). Accordingly, Freeman (2010) shows that labor market rigidity does not cause adverse effects on growth. Therefore we consider interesting to analyze this period 1981-1998 characterized by more labor rigidity (OCDE, 2004) to shed additional evidence on the effects that labor protection can have when taken together with product market regulation and financial development.

What is firm size?

We first define firm size and present some descriptive statistics on its variation across countries, industries and time. We then discuss the construction of institutional measures. Table 1 collects the main variable definitions. Finally, we present the correlations between the variables.

[Insert Table 1 here]

Firm size can be measured in terms of value added, sales, output or the number of employees. Value added is clearly preferable to output or sales, because the complexity of an organization is related to the value of its contribution and not necessarily to the

value of the quantity sold. However, as pointed out by Kumar et al. (2001), coordination costs are not included in measures based on value added. It is also argued that for some countries, particularly in Europe, value added per employee is fairly stable across firms of different size. This implies that a measure of firm size based on the number of employees is likely to be very similar to a measure based on value added. Hence, we use a measure of size in terms of number of employees.

The number of employees is defined as the total number of individuals who worked for the establishment during the reference year. The number of employees includes all persons engaged other than working proprietors, active business partners and unpaid family workers. Following Davis and Henrekson (1999) we use the coworker mean as a measure of size to emphasize the number of employees at the average worker's place of employment. The average firm size in each sector is calculated by dividing the number of employees by the number of firms (establishments) in the sector times the proportion of total employment in that sector. This measure gives more weight to larger sectors.[3]

Table 2 presents average firm size across countries for each sector in 1981, 1990 and 1998. Over the period, average firm size tends to increase in some sectors such as petroleum refineries (1981: 390.3, 1998: 444.5) as well as industrial chemicals (1981: 102, 1998: 170.5). However there is a general downward trend in other sectors, particularly so in the primary and manufacturing sectors such as iron and steel (1981: 225.6, 1998: 107.4) or textile (1981: 58.0, 1998: 29.8). This is likely to reflect, for the

[3] Our main conclusions are robust if we use the traditional natural logarithm of the ratio between the number of employees by the number of establishments in the sector. In the paper, we interchangeably use firms and establishments although we always measure the latter.

most part, the restructuring of the global economy from labor and capital intensive sectors to service sectors in OECD countries.

[Insert Table 2 here]

Table 2 also shows that the general trend over time tends to PMR dominated by the much larger variance in firm size across sectors. Table 3 helps to better judge this variation. In this table, we compute both the mean and the standard deviation of average firm size across sectors within each country over time. First, one can see that variation across countries again seems dominated by sector variation. Differences in average firm size across sectors are much larger than differences in average firm size across countries (Table 3). Still some important differences remain. For example average firm size is 188.1 in Germany and 195.3 in the Netherlands, compared to 72.9 in the United Kingdom. Since German firms have access to the same technology as the UK firms and the industrial structure of both countries is relatively similar, there is ample room for institutions to play a role.

[Insert Table 3 here]

The 2nd to 4th columns of Table 3 emphasize again that there is much more variation across sectors than across time. However, it is interesting to note that the country-level standard-deviation of firm size over time is quite different across countries, both in levels and expressed as a fraction of the mean. This means that variation over time is not simply reflecting a common downward trend in firm size across all countries.

Measures of Institutions

To assess the effect of institutions on firm size, we use a set of measures that reflect both financial development at sector level as well as EPL and PMR at country-level. After presenting each measure we analyze cross-country variation as well as correlations between measures.

Financial Development measure at sector level

We use three different measures in particular: stock market capitalization to GDP in 1990, domestic credit to GDP in 1990 and accounting standards that measure the transparency of annual reports. We use all three measures for robustness.

To find industry-specific financial development effects over time, we start from the measure developed by Rajan and Zingales (1998). This measure is composed of two variable interactions: US industry external financial dependence, $EXTD_j$, and financial development of a country k, $DEFIN_k$. The intuition is that if the U.S. has the highest financial development, then the amount of external finance used in the U.S. industry is a proxy to measure the industry demand for external finance (i.e. industry-country that depend most on external capital are likely to have lower financial development). The interaction allows us to capture an industry-specific effect of financial development. Following Kumar et al (2001), this variable is weighed by the investment per worker. In this way we find the amount per worker that has to be raised from external sources each year, therefore showing the time variability necessary to panel data estimation.

The ranking of OCDE countries is well documented.[4] Countries in Southern Europe tend to have less financial development than countries in continental Europe. Table 4 shows spearman correlations for these measures. For example, accounting

[4] See Claessens and Laeven (2003).

standards are not correlated with stock market development or domestic credit. This suggests that accounting standards index measures different dimensions of financial market development.[5]

[Insert Table 4 here]

EPL/PMR Regulation

Employment Protection Laws: As proxies for the level of EPL, we use three broad indexes of EPL constructed by Botero et al. (2004). These measures are firing costs, dismissals procedures and labor union power. The first two refer to legal provisions while the third allows us to analyze other kinds of labor market rigidities. Our main EPL measure is that of dismissals procedures. This variable is an indicator of how employers should act when dismissing workers and the degree of protection granted by collective agreements. For robustness, we also use the cost of firing a worker as well as labor union power. The former is similar to dismissals but is computed differently. The cost of firing is calculated as the sum of the notice period, severance pay, and any mandatory penalties established by law or mandatory collective agreements for a worker with three years of tenure with the firm. The latter variable measures the statutory protection and power of unions using collective bargaining and union laws.[6]

Product Market Regulations: Data for PMR is taken from the LOGOTECH, S.A. (1997) study for the European Commission. This data provides information about administrative burdens on the creation of corporate and sole proprietor businesses. These measures account for barriers to entrepreneurial activity (including administrative procedures) and

[5] See Rajan and Zingales (1998) to find various explanations of the causes of these different correlations.

[6] For more detail of how measures are computed, see Botero et al. (2004).

they are divided as follows: (i) number of procedures to set up a firm, *procedures*, (ii) number of weeks to establish a firm, *weeks* and (iii) start-up index, combining the number of procedures and the number of weeks needed to establish a new firm, *start-up index.*[7] Therefore we use measures based on LOGOTECH data (1997). In particular, our main measure for PMR is *procedures.*

For EPL, it is easiest in Anglo-saxon countries, as well as in Japan, to fire workers. Not surprisingly Continental European countries score highest on these indexes. However, some of these countries have high financial development. A similar picture emerges for PMR, although one exception is Sweden, which has high EPL but relatively low PMR. Union power does not strongly correlate with other measures of EPL, therefore it captures different aspects of EPL. On the other hand, all measures of PMR correlate strongly (Table 4).

Average Firm Size and Sector-specific Financial Development

Over the period 1981-1998, Figure 2 shows that there is a strong positive relationship between the Rajan and Zingales sector-specific financial development measure and average firm size. These descriptive statistics indicate some positive relationship between both measures. We expect that the interaction with rigidities in other institutions should depress this positive relationship, in particular in countries with high PMR or EPL.

[Insert Figure 2 here]

III. Identification Strategy

[7] Fonseca et al (2001) and Nicoletti et al. (2000) used Logotech data. In particular the start-up index is taken from Fonseca et al. (2001), Start-up costs index = no. of weeks + no. of procedures/average procedures per *week)/2.

In order to show how important EPL and PMR regulations are when interacting with financial development on firm size, we adapt and extend the identification strategy used by Rajan and Zingales (1998):

$$SIZE_{j,k} = \alpha_k + \alpha_j + \alpha_M X_{j,k} + \alpha_F EXTD_j \times DEFIN_k + \varepsilon_{j,k}. \quad (1)$$

α_k and α_j account for country and industry effects respectively. The inclusion of country and industry fixed effects captures other unobserved differences across countries and industries. Provided there is sufficient variation in either one of the variables composing $EXTD_j \times DEFIN_k$, we can use panel data estimation to identify α_F the industry-specific effect of financial development on firm size. A panel data version of the specification equation (1) is given by

$$SIZE_{j,k,t} = \alpha_{j,k} + \lambda_t + \alpha_M X_{j,k,t} + \alpha_F EXTD_{j,t} \times DEFIN_k + \varepsilon_{j,k,t} \quad (2)$$

where fixed effects can now be industry-country specific because of the calendar time variation. The identifying assumption in equation (2) is a common trend at the industry-country level, λ_t, rather than a common intercept.

Our main hypothesis is that EPL and PMR interact with financial development. To study these interactions, we augment equation (2) by introducing country *k*'s measure of EPL (or PMR). Although most measures of EPL/PMR do not vary much over the period considered (17 years), the new interaction term will vary over time. Hence,

although it is impossible to plausibly identify the effect of EPL on its own, it is possible to identify the interaction effect due to the variation over time in industry-specific financial development. For the EPL interaction, this leads to a modified version of equation (2) given by

$$SIZE_{j,k,t} = \alpha_{j,k} + \lambda_t + \alpha_M X_{j,k,t} + \alpha_F FINDE_{j,k,t} + \alpha_E FINDE_{j,k,t} \times EPL_k + \varepsilon_{j,k,t} \quad (3)$$

where we replaced $EXTD_j \times DEFIN_{k,t}$ by $FINDE_{j,k,t}$ to denote the industry-specific proxy of financial development. Finding a positive coefficient α_F means that more financial development tends to increase firm size. Hence, when we interact $FINDE_{j,k,t}$ and EPL_k, α_E measures the differential effect of financial development in countries with different levels of EPL(PMR).[8] Frictions in labor and product markets may hinder the effect of financial development on firm size, especially on those sectors more externally financially dependent (Blanchard and Tirole (2003)). Similar interpretation should hold true for the interaction with PMR.

Firm size is likely to be dynamic for several reasons, such as entry and investment adjustment. Introducing dynamics helps to capture the dynamic effects of institutions that affect both level and growth of firm size across sectors. Hence for EPL (as well as PMR) we augment equation (3) to include an autoregressive term. The estimating equation becomes

[8] This interpretation results from the order by which variables are included in equation (3).

$$SIZE_{j,k,t} = \alpha_{j,k} + \lambda_t + \alpha_S SIZE_{j,k,t-1} + \alpha_M X_{j,k,t} + \alpha_F FINDE_{j,k,t} + \alpha_E FINDE_{j,k,t} \times EPL_k + \varepsilon_{j,k,t}. \quad (4)$$

Contrary to static models, equation (4) implies that changes in external financial dependence can have both contemporaneous as well as dynamic effects. Unlike equation (3), using standard linear regression after first-differencing, equation (4) does not yield consistent estimates (Arellano and Bond, 1991). The problem is that $\varepsilon_{j,k,t-1}$ in $\Delta\varepsilon_{j,k,t}$ is correlated with $\Delta SIZE_{j,k,t-1} = SIZE_{j,k,t} - SIZE_{j,k,t-1}$ by construction leading to a downward bias in the estimate of α_S, and as a consequence in other parameters as well. Hence we use a Generalized Method of Moments (GMM) approach, which uses lags of levels to instrument first differences (Arellano and Bond, 1991). [9] [10]

Since we have more moments than parameters, we guide our specification search by using the Sargan test for over-identification. For the variables of interest, i.e. financial development, EPL and PMR, we assume both predetermined and strict exogeneity conditional on the industry-specific fixed effect.[11] We use two-step estimates, where the second step constructs the optimal weighting matrix based on first step estimates. Two-step estimates are correct for heteroscedasticity but are known to have poor finite sample

[9] In practice we use between 8 and 10 lags as instruments to minimize the risk of weak instruments. We test the adequacy of including only one lag of average firm size in the conditional mean by looking at the second order serial correlation test as is customary.

[10] Furthermore, since average firm size is likely to be quite persistent, we augment the set of moments with moments that impose mean stationarity on these outcomes. Blundell and Bond (1998) show how this improves on the efficiency of the "crude" Arellano and Bond estimator.

[11] We keep the hypothesis of predetermined variables even if coefficients do not differ too much considering institutions exogenous or predetermined.

properties when it comes to estimating standard errors. Hence, we use the correction proposed by Windmeijer (2000). Further, we look at both fixed effect estimators (within estimates) and random effect estimators (GLS) to discard that the finite-sample bias due to weak instruments is large.[12]

IV. Results

Preliminary Regressions and Specification Tests

We first present parameter estimates of equation (1), using cross-sectional regressions of average firm size using the within country and sector variation in firm size and financial development. We augment this regression with the interaction of financial development and EPL. We take stock market capitalization and dismissals as the benchmark measure for financial development and EPL respectively. Robustness tests follow afterwards. We perform this regression for the years 1982, 1992 and 1998. We include sector and country fixed effects so as to mimic the identification strategy used by Rajan and Zingales. The first 3 columns of Table 5 give parameter estimates along with t-statistics using robust standard errors. The coefficient of the financial development interaction term is positive and statistically significant in 1982 and 1992. This interaction term is akin to a second derivative. The interpretation is that in countries with more financial developed markets, more externally financially dependent firms are on average larger. This is generally in-line with results in Rajan and Zingales. However the parameter estimates are unstable over time, potentially because of small sample size in the 1998 regression. The second

[12] When the autorregresive component estimate is bounded from above by the GLS estimate and from below by the fixed effect estimate, it is likely that the finite-sample bias in GMM estimators is weak (Bond, 2002).

interaction term (with EPL) is not statistically significant at any conventional level for any year.

Second, we estimate the specification outlined in the static panel equation (3) using two assumptions about sector-country specific unobserved heterogeneity. One imposes that this heterogeneity is strictly exogenous to institutions and market size leading to a random effects or (generalized-least square) GLS specification. If correct, using this assumption should improve on the efficiency of the OLS regressions without leading to large changes in the parameter estimates. The other assumption is weaker; it assumes individual specific effects, commonly known as fixed effects, estimated from within sector-country deviations.[13]

[Insert Table 5 here]

Results in the 4th and 5th column of Table 5 show that the effect of market size is considerably different across both specifications. Both interaction terms (of financial development and its interaction with EPL) are now statistically significant and similar across specifications. Higher financial development is associated with larger firms, especially those more externally dependent, but this positive effect of financial development will be lower in those countries which have rigid employment protection laws. This result is coherent with Blanchard and Tirole's predictions (2003). However, the different estimated coefficients for market size across specifications suggest some misspecification. In particular, when looking closely at the within estimates, they imply relatively large changes in firm average size following changes in market size. We

[13] In the GLS specification, we still include both country and sector specific fixed effects.

perform a Hausman test to check whether the random effect assumptions for the GLS estimates hold in the data. This test overwhelmingly rejects the null of equality between the two sets of estimates and therefore gives reason to believe that the random effects assumption may not hold on this data.[14]

One possible explanation is that market size is itself endogenous to firm size. Further, sector-specific dynamics are not static and it is likely that the serial correlation in average firm size is correlated with market size. To better understand this possibility before moving to GMM estimates, we estimate equation (4), including lagged firm size but ignoring the pre-determinedness of lagged firm size for current firm size.[15] Results in the last 2 columns of Table 6 show that the GLS autoregressive component is much larger (0.94) than the within estimate (0.811). The financial development coefficient and its interaction with institutions also differ considerably across these two specifications. Hence, this shows that the estimates are sensitive to the dynamic specification.

[Insert Table 6 here]

Generalized Method of Moments Results

[14] For market size, the difference in coefficients (b_fixed effect – b_random effects) is -0.18 with a standard error of 0.01148 using the assumption that the GLS estimator is efficient under the null. The difference for financial development is 0.069 and -0.076 for the interaction with EPL. In both cases, standard errors are low (0.012 and 0.013 respectively) such that we can reject the null of random effects. When looking closely at the within estimates, they imply relatively large changes in average size of firms following changes in market size. The estimated elasticity is close to unity.

[15] In the GLS specification, this will lead to an upward bias in the estimate of α_S and in consequence. In the within case inclusion of the lagged average firm size should bias downward the estimate of α_S. Both situations could also affect other estimates.

Table 5 shows a positive relationship between financial development and firm size over time and a dampening of that relationship in countries with higher EPL, in particular in those sectors more financially dependent. However, the estimates were quite sensitive to assumptions made about unobserved heterogeneity at the sector-country level and how the dynamics in average firm size were modeled.

In Table 6, we present two set of estimates, one that assumes that measures of institutions are strictly exogenous and one that relaxes that assumption and assumes that institutions are predetermined.[16] We also present both the Sargan-Hansen test of overidentification, and Arellano-Bond AR(1) and AR(2) tests for autocorrelation.

None of the over-identification test statistics provide strong evidence against the set of moments used, whether we consider institutions as predetermined or as strictly exogenous. Furthermore, there is no evidence against the null of no autocorrelation. Interestingly, the autoregressive parameter on lagged firm size falls between the bounds defined by the within and GLS estimates in Table 5 implying that weak instruments are not likely to be an important issue. That said, the dynamic component implies strong persistence in firm size and dynamic multiplier effects created by any change in market size and/or changes in institutions.[17] The coefficient of the financial development interaction term is positive and statistically significant in all specifications.[18]

[16] The current firm size does not affect the current financial development and labor regulations, but could affect future values of financial development and labor regulations.

[17] The effect of market size is much smaller than in any of the specification in Table 5, but it is statistically significant. It implies a much lower elasticity of approximately 0.07.

[18] The effect is however much lower than those estimated in Table 5.

Table 6 shows that the introduction of EPL has a detrimental effect on the relationship between financial development and firm size.[19] As explained above, this can be interpreted as additional external costs that firms face, being more relevant when firms depend strongly on external funds. Even if financial development increases by the same amount in two countries with identical financial development at the beginning of the sample period, a firm in the country with lower EPL will be able to raise more capital to finance investment projects than a firm in the country with higher EPL. Therefore, tight employment protection regulations offset part of the positive effects that financial development has on the average size of more externally financially dependent sectors. The presence of financing constraints may deter hiring (Caggese and Cuñat, 2008). Therefore, financing constraints are an important determinant of employment. Further, with strict EPL, externally dependent sectors may show more cautions about adjusting their workforce (Bertola, 2004). Additionally, when hiring costs are not translated into lower wages, total labor costs for the firms increase and this may lead to a lower level of employment (Boeri et al., 2000).

This negative coefficient is in line with Nickell and Layard (1999) who document a detrimental effect of strict EPL in employment ratio. It can also be interpreted as evidence that the net effect of EPL is stronger in existing firms than in new entrants. If disincentive effects are present for both groups, having fewer new entrants should increase firm size while smaller existing firms decrease average firm size.

[19] Regressions results with other institutions variables (Financial development, EPL and PMR) will PMR showed in the summary Table 7 and all regressions in Appendix section in Tables A1 and A2.

Table 7 shows that results are robust to the introduction of alternative measures for financial development, EPL and PMR. In particular, the negative interaction also holds if we use alternative measures of PMR instead of EPL.[20] Since all indicators of PMR are highly correlated, they tend to reveal the same effects. Looking at alternative measures of financial development, for all measures of PMR as for EPL, results maintain significance for domestic credit but are less conclusive when accounting standards are introduced. Detailed results are in Table A1 and A2 of Appendix.

[Insert Table 7 here]

Economic Assessment

To see whether the effects found in Table 6 and 7 are economically significant, we compute a country-specific effect from these estimates. This effect will depend on EPL or PMR. Grouping the terms that include sector-specific financial development in equation (4), the contemporaneous sector specific effect of financial development is

$$\alpha_{F,k} = \alpha_F + \alpha_E EPL_k .$$

Table 8 gives such estimates by country using the estimates in Column 2 of Table 6. Although we can see some variation and such variation is statistically significant, it is doubtful whether such difference helps to explain the variation in firm size across countries.

[Insert Table 8 here]

[20] These measures, although widely used in the literature are invariant over time. We have tried other institutional variables and robustness that other studies use without any large differences in the results. Nickell et al. (2003) collect EPL variables that vary along the period; however they do not vary much. Further, the correlation between them is very high. For PMR data, we have also done robustness with Djankov et al. (2002) variables with similar results. (Results are available upon request).

To address this, we consider two countries that had different social and economic evolutions in the period studied: the case of Portugal and Ireland. Ireland has followed a very different social and economic regime from other European countries in the 90s, making it a good case study. In isolation, neglecting differences in fixed effects and market size as well as in dynamics, average firm size at the country level (averaged over sector) is given by

$$SIZE_p = \alpha_{x,p} + \alpha_{F,p} FINDE_p$$
$$SIZE_i = \alpha_{x,i} + \alpha_{F,i} FINDE_i$$

where α_x denotes the mean of other characteristics and p denotes Portugal while i denotes Ireland. Hence, differences in average firm size (A) can be decomposed into

$$\underbrace{SIZE_i - SIZE_p}_{A} = \underbrace{(\alpha_{F,i} - \alpha_{F,p}) FINDE_p}_{B} + \underbrace{(FINDE_i - FINDE_p)\alpha_{F,i}}_{C} + \underbrace{(\alpha_{x,i} - \alpha_{x,p})}_{D}.$$
$$(0.074) \qquad (0.09) \qquad (0.02072) \qquad (-0.03672)$$

The first term (B) reflects the difference arising from national in EPL differences times the sector-specific financial development on firm size. The second term (C) reflects differences in financial development across countries. The raw difference in log firm size is 0.074, meaning that the average firm size is roughly 7.4% higher in Ireland than in Portugal. Using the decomposition above 28% of that difference is due to differences in average financial development across both countries (C/ A). Part B is 9%, which implies that the proportion due to EPL (B/A) could explain all the difference in firm size across the two countries on it's own. This would mean that other characteristics are actually

favorable to Portugal compared to Ireland (D). Hence, for those two countries the economic significance of our results is non-trivial.

V. Conclusions

Our results can be summarized as follows. We show that the positive effect of financial development on firm size varies across countries and depends on other institutions such as EPL and PMR. Using longitudinal data at the sector-country level, we gauge the effect of labor and product market institutions on firm size across countries. In particular, we show that frictions in labor and product markets hinder the positive effect of financial development on firm size, especially on those sectors more externally financially dependent. These results imply that for some countries, differences in firm size at the country level can be entirely explained by these other institutional factors. Further, results show the importance of developing a complete reform plan that includes financial, labor and product markets and relationships among them in order to foster increases in firm size. This evidence could provide a complementary reason to limited job creation derived from labor reforms in the 2000s; more attention should be paid to other institution reforms such as product market regulations and particularly to financial market development. Further, the impact of 2008 financial crises on credit availability and its effects on unemployment (Auer et al. 2008) is in line with this explanation.

However, although institutions play a relevant role for explaining empirical differences, the present data does not allow us to disentangle all the differences observed across countries. Future research should address this issue and develop sector-specific measures of institutions. This would enable the measurement of firm reactions to global-wide technology shocks and show how these reactions depend on institutional evolution.

This is a relevant question since firm adaptation to their institutional environment is likely to have important consequences for firm size and indirect consequences for employment and economic growth.

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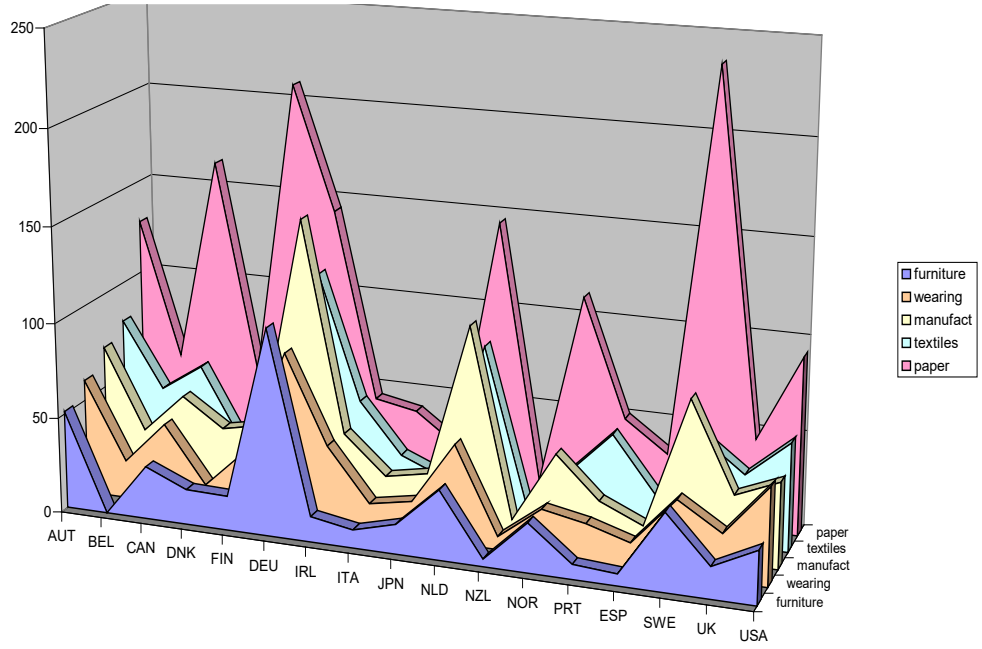
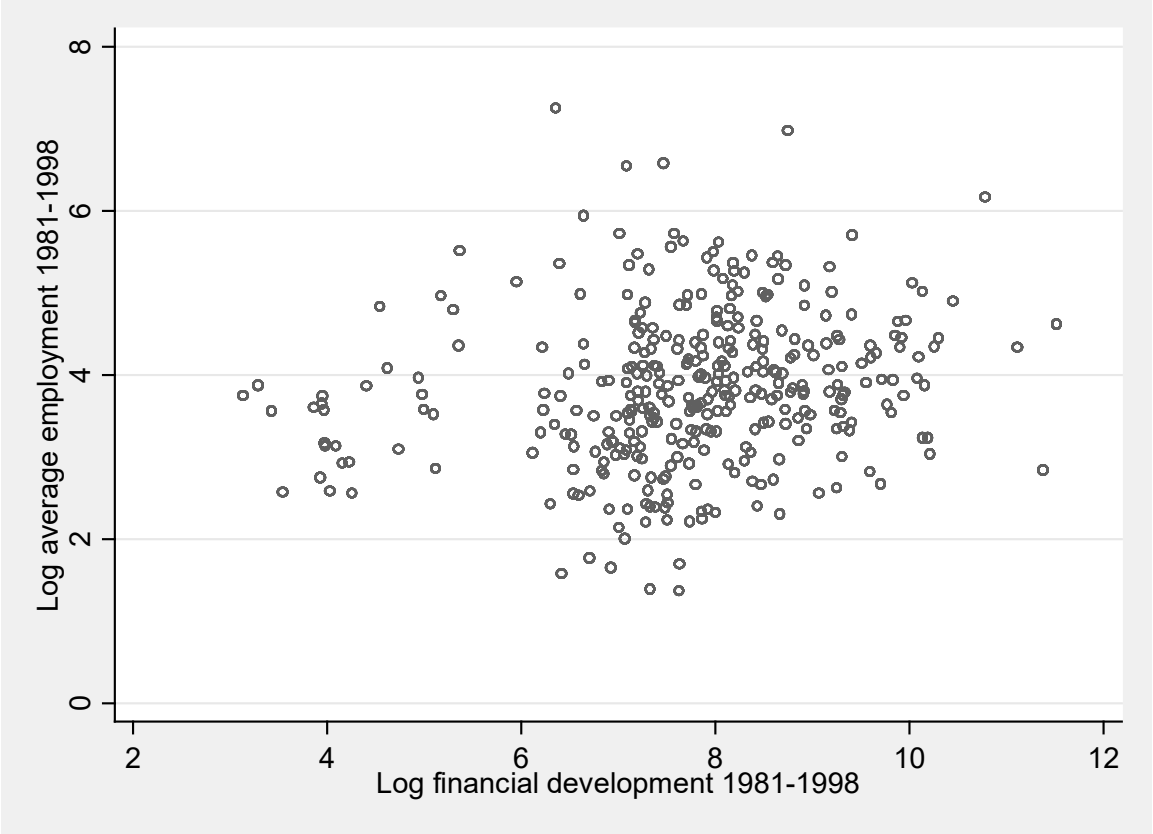
Figures

Figure 1: Average Firm Size (in terms of Employment) by Industry and Country



Notes: Own Calculations from Unido Industrial Data average 1982-1998. Average firm size is plotted by industry and country.

Figure 2 Average Firm Size and Financial Development over the Period 1981-1998



Notes: Sector-country observations averaged across the period 1981-1998. Axis is in logs.

Tables

Table 1: Variable Definitions

Variable	Description	industry (j) vs. country (k)	Variation over time
1. Firm size	Logarithm of Average employment/establishment size. A particular sector by ISIC corrected by the proportion of total employment in that sector in a particular country over the period 1981 – 1998. Source: UNIDO Database on Industrial Statistics and Davis and Henrekson (1999). Dependent variable.	(j,k)	YES
Financial Development Variables			
2. Financial Dependence	External financial dependence of U.S. firms by ISIC sector averaged over the period 1980 - 1989. Weighted by investment per worker. Sources: COMPUSTAT, Business Segment File, OECD: Industrial Structure Statistics (ISIS) (1997) and Rajan and Zingales (1998). Investment per worker from UNIDO Database on Industrial Statistics.	(j,k)	YES
3. Stock market development	Stock market capitalization to GDP. Center for International Financial Analysis and Rajan and Zingales (1998).	(k)	NO
4. Accounting	Proxied by a measure of accounting standards. This variable measures the transparency of annual reports. Accounting standards in 1983 (on a scale from 0 to 90). Higher scores indicate more disclosure. Source: Center for international Financial Analysis and Research and Rajan and Zingales (1998).	(k)	NO
5. Domestic credit	Domestic credit divided by GDP in 1980. Source: International Financial Statistics of the International Monetary Fund.	(k)	NO
Employment Protection Laws (EPL) Botero et al.(2004)			
6. Dismissals	Dismissal procedures. Measures worker protection granted by law or mandatory.	(k)	NO
7. Firing costs	Cost of firing workers. Measures the cost of firing 20 percent of the firm's workers (10% are fired for redundancy and 10% without cause). Collective agreements against dismissal.	(k)	NO
8. Trade Union power	Labor union power. Measures the statutory protection and power of unions as the average	(k)	NO
Barriers to Entrepreneurship			
9. Procedures	Number of procedures to set up a firm. Source: LOGOTECH, S.A. (1997)	(k)	NO
10. Weeks	Number of weeks to set up a firm. Source: LOGOTECH, S.A. (1997)	(k)	NO
11. Index of barriers to Entrepreneurship	The index is defined as (no. of weeks + no. of procedures/average procedures per week)/2 Source: Fonseca et al. (2001)	(k)	NO
Other			
12. Market size	Logarithm of total employment in that NACE three-digit industry in a country. Source: UNIDO Database on Industrial Statistics.	(j,k)	YES

Table 2 Average Firm Size by Sector for Selected Years

Sector	1981	1990	1998
manufacture	54.9	47.8	55.0
food products	50.5	50.0	36.9
beverages	89.7	98.1	70.4
tobacco	359.1	286.1	247.2
textiles	58.0	45.1	29.8
wearing apparel	43.3	32.4	26.0
leather products	30.4	24.7	16.1
footwear except rubber or plastic	62.3	43.1	37.6
wood products, except furniture	25.2	23.9	21.1
furniture, except metal	27.0	24.4	27.1
paper and products	111.5	105.2	71.6
printing and publishing	38.9	36.7	23.3
industrial chemicals	102.0	128.2	170.5
other chemicals	71.7	83.3	70.7
petroleum refineries	390.3	358.8	444.5
misc. Petroleum and coal products	60.8	41.9	11.5
rubber products	111.3	83.3	74.1
plastic products	39.7	39.4	36.9
pottery, chine earthenware	87.1	57.6	42.4
glass and products	76.5	73.6	44.1
other non metallic mineral products	30.0	34.7	25.0
iron and steel	225.6	166.3	107.4
non-ferrous metals	110.6	94.9	82.0
fabricated metal products	38.5	34.6	22.3
machinery, except electrical	60.4	47.2	45.4
machinery electrical	119.6	96.8	59.0
transport equipment	168.6	127.2	141.0
professional and scientific equipment	58.2	50.3	30.0
other manufactured products	34.7	29.7	21.0

Notes: the number of countries is not constant within each cell, ranging from 10 to 15.

Table 3 Sources of Variation in Average Firm Size Within Countries

		Stand. Dev.						
	Mean	overall	between (over sectors)	within (over time)	Min	Max	# sectors	#sector - year
Austria	109.7	85.4	67.0	53.3	1.0	1030.8	29	414
Belgium	63.0	77.1	87.0	14.9	4.9	378.9	25	252
Canada	86.4	76.0	74.9	18.4	14.9	375.0	29	518
Denmark	53.4	44.0	36.4	25.0	2.8	210.2	29	505
Finland	115.7	189.2	163.9	94.4	2.4	1450.0	29	502
Germany	188.1	151.0	158.9	37.1	39.1	884.5	29	218
Ireland	51.2	40.0	39.7	9.1	9.1	244.4	27	297
Italy	104.4	126.2	103.5	70.1	2.0	862.3	29	487
Japan	40.9	50.3	55.2	7.4	9.7	361.7	29	518
The Netherlands	185.3	332.3	247.1	224.4	27.2	4944.0	28	301
New Zeland	26.3	37.4	32.8	20.5	1.4	290.0	29	433
Norway	74.0	80.0	76.1	32.9	8.8	400.0	29	480
Portugal	105.9	378.4	334.5	219.8	4.4	3727.0	29	499
Spain	60.7	145.9	147.0	37.0	3.1	1000.0	29	429
Sweden	111.6	93.9	89.5	32.4	25.4	562.1	29	406
United Kingdom	72.9	121.8	118.3	52.5	6.5	1111.1	29	502

Notes: average firm size by sector 1981-1998, 29 sectors

Table 4 Correlations of Institutional Measures Across Countries

	Financial development			Employment Protection Laws (EPL)			Barriers to Entrepreneurship (BE)		
	Stock M.D.	Account. Stand.	Domestic Credits	Firing costs	Dismissals	Trade Union power	Procedures	Weeks	Index
Stock Markets dev.	1								
Account. Stand.	-0.1994	1							
Domestic Credits	0.7884*	-0.3533	1						
Firing costs	-0.3686	-0.0304	-0.0166	1					
Dismissals	-0.0084	0.099	0.0678	0.5872*	1				
Trade Union power	0.4643	-0.068	0.4367	-0.1379	0.3241	1			
Procedures	0.7872*	-0.3636	0.6257*	-0.2278	0.1477	0.2967	1		
Weeks	0.4653	-0.2123	0.3347	-0.0444	0.5901*	0.2993	0.5806*	1	
Index	0.6800*	-0.319	0.5014	-0.0854	0.4522	0.2943	0.8301*	0.9207*	1

Notes: Spearman correlations on 13 country observations. * denotes statistical significance at the 5% level. Canada, New Zealand and Norway have missing information on BE measures.

Table 5 Cross-Sectional, Within and GLS Estimates of the Effect of Institutions on Average Firm Size

	Cross-sectional OLS in Levels			Static Panel		Dynamic Panel	
Variable	1982	1992	1998	GLS	within	GLS	within
Firm size (t-1)						0.940	0.811
						0	76.63
Market size	0.344	0.247	0.382	-0.195	-0.378	0.004	-0.181
	6	4.27	3.82	-8.23	-14.38	0.55	-10
Financial Development							
FINDE (ext. dep. X	0.127	0.259	0.073	0.334	0.403	0.012	0.121
stock market capitalization)	1.83	3.09	0.57	11.51	12.69	0.177	5.63
Interaction with Institutions							
FINDE*EPL	-0.0397	0.012	0.017	-0.323	-0.398	-0.010	-0.123
(EPL is Dismissals)	-0.66	0.19	0.24	-11.45	-12.72	0.149	-5.83
Cons	-1.096	-1.876	-2.428	6.220	7.020	0.100	2.319
	-1.21	-1.8	-1.59	16.99	23.69	0.84	10.86
n.obs.	283	245	145	4591	4591	4196	4196

Notes: T-statistics presented below point estimates using robust standard errors in the case of Cross-sectional OLS in levels. For GLS estimates, we included both time and sector fixed effects. Within estimates include time fixed effects.

Table 6 Generalized Method of Moments Estimates of the Effect of Institutions on Average Firm Size

	Institutions exogeneous		Institutions predetermined	
	no interaction	interaction	no interaction	interaction
Firm size (t-1)	0.899	0.901	0.902	0.907
	53.22	51.55	55.03	56.52
Market size	-0.076	-0.090	-0.073	-0.085
	-3.31	-3.8	-3.31	-3.64
Financial Development				
FINDE	0.032	0.052	0.045	0.076
(stock market capitalization)	3.66	4.2	2.92	3.62
Interaction with Institutions				
FINDE*EPL	.	-0.029	.	-0.039
(EPL is Dismissals)		-3.15		-3.37
cons	0.809	0.946	0.653	0.745
	3.8	4.17	3.01	3.45
n. obs. (sector-year)	4196	4196	4196	4196
Sargen-Hansen test	293 (256)	294.44 (256)	304.04(266)	308.54(276)
p-value	0.052	0.056	0.047	0.087
AR(1)	-8.74	-8.73	-8.76	-8.76
p-value	<0.001	<0.001	<0.001	<0.001
AR(2)	-0.09	-0.04	-0.15	-0.09
p-value	0.928	0.964	0.882	0.925

Notes: GMM two-step point estimates with t-statistics below using corrected standard errors (Windmeijer, 2000).

Table 7 Additional GMM Estimates using Alternative Institutional Measures

	GMM Parameter Estimate on variable FINDE X Measure of Institution					
	Employment Protection in Law Measures			Barrier to Entrepreneurship Measures		
FINDE: External financial development multiplied by	Dismissals	Firing costs	Trade Unions	Procedures	Weeks	Index
Stock market capitalization	-0.039	-0.12	-0.094	-0.064	-0.047	-0.055
	-3.37	-3.53	-0.23	-2.67	-2.33	-2.44
Accounting Standards	-0.03	-0.129	-0.07	-0.01	-0.01	-0.01
	-1.19	-3.58	-1.5	-0.52	-0.08	-0.52
Domestic Credit	-0.071	-0.121	-0.066	-0.037	-0.031	-0.043
	-4	-3.66	-1.17	-2.34	-2.47	-2.46

Notes: Two step GMM estimates as in Table 5 column 4 with t-statistics below using corrected standard errors (Windmeijer, 2000). Institutional measures defined in Table 1.

Table 8 Country Specific Financial Development Effects

Country estimate	Dismissal Index	value of interaction	country effect	Financial development measure	log of average firm size
Austria	0.286	-0.009	0.043	8.185	4.465
Belgium	0.143	-0.004	0.047	7.627	3.597
Canada	0.286	-0.009	0.043	7.797	4.133
Denmark	0.286	-0.009	0.043	7.209	3.655
Finland	0.571	-0.017	0.035	7.475	4.172
Irland	0.286	-0.009	0.043	7.593	3.721
Italy	0.452	-0.014	0.038	8.319	4.069
Japan	0.000	0.000	0.052	8.696	3.364
the Netherlands	0.717	-0.022	0.030	8.526	4.759
New Zeland	0.143	-0.004	0.047	7.713	2.797
Norway	0.714	-0.022	0.030	7.646	3.884
Portugal	0.714	-0.022	0.030	7.099	3.646
Spain	0.714	-0.022	0.030	7.611	3.160
Sweden	0.714	-0.022	0.030	7.574	4.440
UK	0.143	-0.004	0.047	7.515	3.791
Total	0.412	-0.012	0.039	7.784	3.867

Notes:effects estimated using estimates in the second column on Table 7. Refer to text for details on the computation of the country specific effects

Appendix
A1 Generalized Method of Moments Estimates of the Effect of Institutions on Average Firm Size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Firm size (t-1)	0.902	0.913	0.929	0.907	0.863	0.869	0.913	0.907	0.914	0.907	0.893	0.907
	55.03	58.84	70.47	56.52	35.6	37.51	45.07	40.57	45.81	53	44.69	54.5
Market size	-0.073	-0.068	-0.063	-0.085	-0.117	-0.124	-0.106	-0.117	-0.101	-0.07	-0.956	-0.068
	-3.31	-3.92	-4.12	-3.64	-4.06	-4.05	-3.53	-4.23	-3.79	-3.13	-3.49	-3.03
Financial Development												
FINDE: External financial development proxied by												
Stock market capitalization	0.045			0.076			0.165			0.049		
	2.92			3.62			4.32			1.11		
Accounting Standards		0.025			0.075			0.178			0.124	
		2.58			2.64			4.26			2.16	
Domestic Credit			0.017			0.106			0.161			0.039
			2.71			4.43			4.39			0.88
Employment Protection Law Measure												
FINDE*EPL												
Dismissals				-0.039	-0.03	-0.071						
				-3.37	-1.19	-4						
Firing costs							-0.12	-0.129	-0.121			
							-3.53	-3.58	-3.66			
Trade Unions										-0.0094	-0.07	-0.066
										-0.23	-1.5	-1.17
Cons	0.653	0.651	0.737	0.745	0.924	0.721	0.908	0.794	0.911	0.729	0.621	0.746
	3.01	3.75	4.41	3.45	3.69	2.67	3.07	2.53	3.11	3.2	2.61	3.3
n. obs. (sector-year)	4196	4196	4196	4196	4196	4196	4196	4196	4196	4196	4196	4196
Sargen-Hansen test	304.04(266)	268.13(241)	264.21(232)	308.54(276)	293.34(258)	304(259)	296.73(258)	290.56(258)	297.54(258)	304.48(258)	295.81(258)	311.64(275)
p-value	0.047	0.111	0.072	0.087	0.064	0.027	0.049	0.08	0.046	0.025	0.053	0.064
AR(1)	-8.76	-8.62	-8.66	-8.76	-8.62	-8.66	-8.65	-8.62	-8.64	-8.74	-8.74	-8.74
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AR(2)	-0.15	-0.03	-0.01	-0.09	-0.81	-0.06	-0.04	-0.04	-0.07	-0.11	-0.18	-0.07
p-value	0.882	0.974	0.974	0.993	0.754	0.949	0.965	0.971	0.948	0.909	0.855	0.943

A2 Generalized Method of Moments Estimates of the Effect of Institutions on Average Firm Size

	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Firm size (t-1)	0.936	0.942	0.95	0.936	0.944	0.943	0.936	0.942	0.947
	57.44	61.82	120.03	57.44	62.16	113.31	58.16	61.74	116.6
Market size	-0.053	-0.032	-0.02	-0.059	-0.034	-0.027	-0.056	-0.034	-0.026
	-2.93	-1.84	-1.43	-2.8	-2.13	-1.96	-2.89	-2.11	-1.99
Financial Development									
FINDE: External financial development proxied by									
Stock market capitalization	0.126			0.105			0.117		
	4.51			4.48			4.32		
Accounting Standards		0.050			0.052			0.049	
		2.670			3.52			2.95	
Domestic Credit			0.0369			0.035			0.048
			2.07			2.08			2.41
Barrier to Entrepreneurship Measure									
FINDE*PMR									
Procedures	-0.064	-0.01	-0.037						
	-2.67	-0.52	-2.34						
Weeks				-0.047	-0.010	-0.031			
				-2.33	-0.8	-2.47			
Index							-0.055	-0.01	-0.043
							-2.44	-0.52	-2.46
cons	0.289	0.235	0.247	0.321	0.242	0.487	0.275	0.234	0.479
	1.28	1.1	1.3	1.3	1.1	2.97	1.2	1.09	3
n. obs. (sector-year)	3478	3478	3478	3478	3478	3478	3478	3478	3478
Sargen-Hansen test	258.49(240)	246.38(219)	224.67 (208)	248.54(219)	246.56(219)	225.45(202)	255.65(231)	246.47(219)	222.48(202)
p-value	0.197	0.099	0.204	0.083	0.097	0.124	0.127	0.098	0.154
AR(1)	-8.37	-8.34	-8.26	-8.36	-8.34	-8.27	-8.36	-8.34	-8.28
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AR(2)	-0.82	-0.74	-0.54	-0.8	-0.74	-0.51	-0.82	-0.74	-0.52
p-value	0.413	0.461	0.589	0.423	0.456	0.611	0.414	0.458	0.601