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Evidence from Peruvian Household Data

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Abstract[1]

This paper examines the link between financial deepening and formalization in Peru. Using data from the National Household Survey, Bloomberg and the Central Bank of Peru Central Bank, the Catão, Pagés, and Rosales (2009) model is implemented at activity level (2-digits ISIC), and the Rajan and Zingales (1998) approach of sectors' dependence on external funds is followed. The sample is divided into three firm size categories, and two formality measures are assessed. Using the accounting books specification, robust results are obtained, supporting a significant and positive effect of credit growth on formalization only for the self-employment firms category. Alternatively, using the pension enrollment specification, the channel is found positively significant only for firms with more than 10 workers; there is a smaller effect for firms with 2-10 workers. There is also a significant between effect, explaining the transition from small firms to larger firms due to greater credit availability.

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1. Introduction

Although extensive literatures separately address the respective growth effects of informality and financial deepening, there is still a paucity of literature on the relationship between the two.

The 2010 edition of the IDB's Development in the Americas report[2] shows that slow productivity growth has been at the root of Latin America's poor growth performance relative to other emerging markets, notably Asia. Both informality and highly imperfect financial markets share much of the blame for this poor performance, as it is well established in the economic literature that both greater formality and deeper financial markets underpin economic growth at the national level.[3]

Prominent arguments for the importance of the financial sector in economic growth include its roles in capital reallocation, risk management and technological innovation. The direction of the causal relationship between the financial sector and growth, however, has proven difficult to verify empirically. A useful approach to addressing this issue involves focusing on and documenting the details of theoretical mechanisms through which financial development affects economic growth, as in Rajan and Zingales (1998). More important, however, is the effect of credit availability on firm size: without appropriate development of financial markets the reallocation between savings and investment simply cannot take place. The investment decisions of a firm lacking access to financial markets will consequently depend on the economic cycle, i.e., there is no separation between investment and production decisions. This ultimately constrains firms' investment behavior (Aghion et al., 2005). Consequently, credit availability makes it possible for the firm to increase its productivity, which in the end is one of the triggering factors behind the transition from informality to formality.

In turn, informality is considered to have its own range of negative effects, reducing the national tax base and forcing governments to compensate by levying higher tax rates on formal businesses. This in turn undermines formal firms' competitiveness and creates disincentives to formalize, which tends to engender a vicious circle revolving around higher tax rates, tax collection systems with high levels of tax evasion, and finally modest growth rates. Thus, the claim by Hanson (2010) that some combination of poorly functioning credit markets and

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[2] See IDB (2010).
[3] For the informality and economic growth relationship see Loayza and Rigolini (2006). For the link between economic growth and financial development see Levine (1996).

perverse incentives for informality has created a drag on productivity growth in Mexico should hardly be surprising. Among various explanations for Mexico's lack of development, the author highlights those two factors as the most prominent. In particular, in a view shared by IDB (2010), Hanson points out:

> (…) informality keeps firms in existence that would be forced to exit, either because of poor management or outdated technology, if they had to compete for inputs with formal sector firms on a level playing field. One consequence of informality is, therefore, the survival of small, unproductive enterprises (p. 9).

In the Peruvian case, both formality and financial deepening have improved in recent years. Figure 4 shows the evolution of informal employment to be addressed in this paper. Both measures are the typical measures of informal employment utilized in the Peruvian case and are in line with the informality dimension pointed out by IDB (2010). Although the percentage remains high, it has shown a downward trend in recent years.

Figure 1 in turn shows that financial deepening resumed in 2003 after the 1998 crisis, although it has not reached its 1998 peak (29 percent of GDP). However, as Table 3 shows, financial deepening during the last decade has improved compared to the previous decade. This fact might suggest that the Peruvian financial system recovered faster than many others in Latin America following the turbulent period of 1998-2001.

Currently, credit growth in most of Latin America is recovering from the recent crisis. In some cases, this recovery has been very rapid, raising questions about its sustainability. It is within this context that the evaluation of how this new wave of credit has been acting upon firm growth deserves an evaluation.

In this line, the present paper will focus on the process through which firms face effective incentives from credit markets to undergo a formalization process. The mechanism of financial deepening lets firms increase their scale and therefore increase their productivity, which in turn allows firms to go formal—or more formal, ultimately fostering economic growth.

The model we implement in this paper draws from studying the relationship between credit and formalization for Brazil as in Catão, Pagés, and Rosales (2009). In particular, the methodology will consist of i) estimating whether and to what extent changes in financial deepening induce firms belonging to industries that are intrinsically more dependent on external

funds to increase their formality levels faster relative to the less financially dependent, and ii) decomposing that effect into two margins: intensive and extensive. On one hand, the intensive margin refers to improvements in formalization within the firm's size category due to the increase of credit supply. On the other hand, the extensive margin will examine whether those effects take place by changing the formal-informal labor composition between firm size categories.

To preview our empirical results, this paper finds evidence of both a within and a between channel operating in the impact of greater financial development on formalization. The within channel takes place in both measures of informality. Although the impact on the registration formality measure is focused on self-employed firms, for the pension formality measure the effect of credit deepening is focused on large firms. The between effect takes place mainly in the smallest firms. Thus, while self-employed firms reduce their share of total employment, the group of firms with 2-10 employees increases its share as a consequence of greater credit availability.

The rest of the paper is as follows: in Section 2 we review some of the literature focusing on informality and financial deepening applied to the Peruvian case. Section 3 presents the data sources used in the paper and discusses their suitability. Section 4 reviews some of the main stylized facts related to informality and credit deepening in Peru. Section 5 explains the econometric strategy undertaken in this paper to elucidate the effect of financial deepening on informality through both the intensive and extensive margin. Section 6 tests the robustness of our results, and finally, Section 7 concludes the analysis.

2. Literature Review

The lack of firm-level micro data appears to have constrained the study of credit supply and its effect on firms' performance in Peru. On the other hand, the availability of a national household survey (ENAHO) has motivated several studies of informality, an issue which has received much more attention. To the best of our knowledge, there is no study linking both dimensions for the Peruvian case.

In that sense, this paper represents the first attempt to understand the possible relationship between informality and financial deepening in Peru. This section reviews part of the literature on which this study is based.

On the informality front, one well-known study is that of Loayza (2008). In this work, Loayza first discusses a reliable measure of informality for Peru and then proceeds to find its determinants. Although the discussion is concerned with the Peruvian case, the estimation procedure relies on a cross-country estimation whose results are then revised for the Peruvian context. Consequently, no specific analysis is drawn from the Peruvian experience itself in a strict sense. However, the study is important in clearly establishing a definition of informality to be used in later literature. Four measures of informality are defined by the author. The first is the Schneider Index of Shadow Economies (Schneider and Dominik, 2000; Schneider, 2004) which measures the percentage of non-declared production in an economy. The second measure is the Heritage Foundation Index of Economic Freedom, which is based on subjective perceptions of the rule of law in the country. The other two indexes are more related to the labor market than the general economy: the third informality measure is the percentage of self-employed workers within the country, based on the estimations of Loayza and Rigolini (2006), and the final informality measured reviewed by Loayza is the percentage of workers not affiliated with the pension system. It is worth mentioning that the four indexes reviewed by Loayza rely on nationwide estimates rather than industry-specific measures. Besides, only the last informality measure covered by Loayza (2008) coincides with one of our measures, which is a consequence of our strategy. We attempt to exploit within-industry variation in informality to determine its relationship with credit availability, which in turn varies within industries due to differences in financial dependence. On the other hand, and different from Loayza, we intend to estimate informality even within the self-employment category instead of considering the whole category informal. Furthermore, the negative relationship between informality and economic growth is also highlighted by Loayza through a cross-country regression. Later in that paper the author tries to discern the theoretical determinants of informality, focusing on demographics, human capital and rule of law determinants; the relevance of the financial dimension is not assessed.

In a more recent study, Morón (2011) examines the relationship between informality and productivity using firm-level data from the National Economic Census of 2008. Although this study is still framed within the group of papers that study the effect of informality on economic growth (through productivity), it exploits this newly available dataset to address a variety of

issues related to productivity, formality among them. Data restrictions,[4] however, impede a better understanding of the causality between productivity and formality. It is nonetheless worth noting that the formality variable utilized in that study[5] maintains its positive correlation with productivity at different industry levels, which in the end enhances the close relationship between the functioning of labor markets and firm growth.

There is one more study worth mentioning on the formality side. In Tello (2010) the author explores the creation and destruction of jobs within a sample of firms from the manufacturing industry. Although the study does not address the informality issue and focuses only on formal firms, it is useful to understand the cyclical behavior of the manufacturing labor market. In particular, it is found that the change in labor demand is smaller compared to industry production. It is important to mention this study since part of our work focuses on the evolution of the formal-informal labor composition among firm size categories within industries. Then, we would expect a similar evolution for formal labor in our analysis due to aggregate changes in production. Thus, it will be important for our estimation not to misinterpret a recomposition of the formal-informal labor share among firm size categories as a consequence of financial deepening when it might solely be a consequence of an aggregate trend.

On the financial deepening side, the work of Aguilar (2011) assesses the relation between the availability of microcredit and economic growth at the regional level. Using regional-level production data to estimate the rate of economic growth and the provision of loans, also at the regional level, the author finds evidence that suggests a positive relationship between economic growth and the expansion of microcredit availability. Interestingly, using an alternative measure of financial deepening such as bank intermediation, the author does not consider any effect of this variable on economic growth at the regional level. As a simulation exercise, it is shown that if the provision of loans from rural banks, municipal banks and banks specialized in microcredit reaches 10 percent of GDP, that would imply a 4 percentage point increase in the GDP per capita growth rate. An important drawback of this study is the assumption of homogeneity of the relationship between credit expansion and the development of regions. While it seems likely that

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[4] See Section 3 for a detailed explanation of the limitations of the National Economic Census for exploring informality.
[5] A firm is considered formal if it is registered as a taxpayer, i.e., possesses a Unique Taxpayer Register (in Spanish, RUC) with the tax authority SUNAT.

certain activities with different credit requirements are concentrated in different regions, this possibility is not taken into account in the analysis.

Another interesting reference on the financial deepening side is the work of Paravisini et al. (2010), which offers an interesting approach for studying the credit supply elasticity of exports. Using firm-level customs data obtained from the Superintendency of Tax Administration (SUNAT) and bank data on loans obtained from the Peruvian bank regulator, the Superintendency of Banking, Insurance, and Pension Funds (SBS), the authors find that exports react strongly to changes in the supply of credit in the intensive margin (within), that is, firms tend to export more as a consequence of a positive credit shock. That reaction is similar across different firm sizes. An additional result suggests that in the extensive margin (between), the negative credit supply shock increases the probability of exiting a product-destination export market but does not significantly affect the number of firms entering an export market. The estimation strategy proposed by the authors utilizes the 2008 shock in credit supply due to the financial crisis as an instrument to estimate the elasticity of credit. Nevertheless, they do not distinguish between formal and informal firms. This is natural, since customs data are only available for firms currently exporting and thus registered with SUNAT. Moreover, although the authors make an attempt to differentiate by firm size, the average firm already registered as exporter has more than 30 workers and thus fits our classification of a large firm. A final interesting result from this study is closely related with our estimation purpose. Using the Rajan-Zingales measure of financial dependence (Rajan and Zingales, 1998), the authors find that the elasticity of exports to credit shocks is greater for firms less dependent on external financing. Moreover, the elasticity of the continuation and entry margins does not vary across sectors with different levels of external finance dependence. They conclude, then:

> [the] results suggest that the elasticities to short-term and long-term changes in financial conditions represent different aspects of the firm's usage of credit. The measure of external finance dependence may indicate the sensitivity of the firm to long term access to credit, which is potentially related to the presence of important fixed investments or entry costs. The elasticity of exports to credit shocks, on the other hand, is related to the short term needs of working capital (pp. 25-26).

In that sense, if we understand formality more as a long-term decision rather than a short-term strategy, we might expect that the transition to being a more formal entrepreneur will be more apparent among firms in industries more dependent on external funding. Or, to put it another way, the decision to become formal is generally associated with the decision to expand. Thus, the more financially dependent the industry in which the firm operates, the more likely formalization will be needed if the firm wants to undertake expansion.

3. Data Description

We rely on three sources of information. The first is the National Household Survey (ENAHO in Spanish and publicly available at www.inei.gob.pe), which includes information on the type of labor and the activity in which the worker is involved (categorized by the ISIC Rev. 3). More importantly, however, these surveys allow us to clearly identify informality based on information on the income data module (module 500). Subsequently, we adopt two informality measures. The first measure is closely related to firm registration, whereas the second is related to social security. Both measures are part of the general consensus[6] to identify formal-informal status of firm and labor relations. In particular, then, in the first measure a worker is considered informal if the firm he/she works for does not carry accounting books (henceforth registration informality). In the second measure, a worker is considered informal if he/she is not making contributions to any pension system; either public or private (henceforth pension informality).

Although the survey has been available since 1997, the informality questions have been asked only since 2001 for the first measure and only since 2002 for the second. Hence, for the sake of comparability we decided to restrict the sample to the 2002-2009 period. Additionally, that income module includes information for approximately 61,340 individuals distributed among 20,368 households for the 2002-2009 period. We will, however, focus our attention on respondents who report that they are of working age (i.e., between 16 and 64 years old) and effectively employed. As is usual in this kind of analysis, we exclude the agricultural and financial sectors. ENAHO also enables us to categorize the activity the worker is involved at a 2-digit level of the ISIC Rev. 3. In order to avoid outliers, we drop activities with fewer than 60

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[6] See Catão, Pagés and Rosales (2009) and Loayza (2008).

observations per year.[7] Additionally, we have opted for dropping industries that show a formalization rate constantly close or equal to 1. Some industries, moreover, currently have a high cost of entry, which makes the establishment of informal firms almost impossible.[8] Thus, including industries like these in the analysis would bias the results to non-impact of credit availability on formalization. Finally, it is also possible to categorize three firm size groups: i) self-employed (the worker is the owner); ii) firms with 2-10 workers; and iii) firms with more than 10 workers. Table 1 presents the average number of workers in each firm size category across industries. These averages are computed using the frequency weights provided in ENAHO.

Up to this point, it is worth noting that measuring informality by workers is more reliable than measuring it by firms. While the National Economic Census for 2008 (henceforth CENEC) is supposed to cover all firms in Peru, it clearly lacks access to very small businesses. The ENAHO, however, provides thorough coverage of informal labor markets. From CENEC it is possible to identify if the firm is registered as a taxpayer by the Unique Taxpayer Register (RUC). But ENAHO's comparable criterion for formality (accounting books) could help to disentangle whether a firm having RUC does not carry out formal practices as perceived by its workers.[9] In that sense, CENEC calculations could be seen as overestimating firms; formality. It could be argued, then that while our first informality measure is based on workers' perceptions, we are incorporating a quality component. As shown in Table 2, while ENAHO reports that formal establishments account for approximately 76 percent of total income and 24 percent of the total labor force, CENEC reports levels of 98 percent and 87 percent, respectively. Unfortunately, CENEC does not provide information about the contractual situation of workers. Therefore, there is no way to conduct a similar analysis for our second definition of formality based on CENEC data.

Moreover, it is uncertain how representative the two informality measures are at the industry level. In particular, while the first definition (accounting books holding) is computed as the proportion of workers working in firms which keep accounting books over the total number

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[7] Although ENAHO offers a rich dataset, increasing the cutoff to 80 observations as in Catão, Pagés, and Rosales (2009) would undermine the degrees of freedom we are left.
[8] For instance, extraction of crude petroleum and natural gas, which is industry 11 in the ISIC Rev. 3
[9] Although these are, strictly speaking, different formality measures, for the purpose of comparability we are assuming here that lacking a RUC is muck like lacking accounting books. The spirit of registration formality measure (lack of accounting books) is precisely the lack of registration in the tax system.

of workers in each industry, the second measure (social security) is computed as the ratio between respondents who report being enrolled in some pension system and the total of workers who report belonging to each activity. We argue that the sample is large enough to conduct an analysis at the industry level. In a similar vein, Yamada (2006) decomposes labor income by profession using ENAHO for the period 1997-2004, which enables us to expand his assertion: it is possible to find some level of representation at activity (not profession) level. Hence, the only assertion we can sustain is that, ENAHO being a representative sample of individuals at the national level, we can expect the national distribution of workers (and of firms) to be representative of their structure at the activity level.

The second source of information is Bloomberg. As in Catão, Pages, and Rosales (2009), we need to estimate rates of external financial dependence at the industry level. In that regard, we follow the Rajan and Zingales (1998) methodology but use information available from Bloomberg. The level of disaggregation considered is 2 digits of the ISIC Rev. 3. For its calculation, the usual procedure is to use firm-level data from the Standard and Poors 1500 index available at Bloomberg. The assumption underlying this choice is that firms in this sample are those that address the most frictionless credit market and, consequently, those that represent a clean estimation of requirements for external funds. Financial dependence is computed as the ratio of capital expenditures minus cash from operations to capital expenditures, that is, capital expenditures financed by flows from external agents. We obtain this index, for each firm in the sample, as the ratio between the sum of external finance over 2002 to 2006[10] and the sum of capital expenditures in the same period, and then the estimates are collapsed to the industry-level median.

Finally, we use macroeconomic data on financial deepening. For that purpose, the Central Bank of Peru provides the relevant country/year-level data for bank system credit to the private sector and the related interest rates at www.bcrp.gob.pe. In this estimation we only take into account depository financial corporations (i.e., bank, mutual and cooperative institutions). In Peru, and in most emerging markets, these organizations represent a substantial majority of the supply of credit to firms. So, this index is computed as credit from depository financial corporations to the private sector.

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[10] Although our period of analysis extends from 2002 to 2009, we avoided constructing a Financial Dependence measure using the financial crisis years. This facilitates comparison to the results of Catão, Pages, and Rosales (2009), who use the same period for the construction of the Rajan and Zingales measure.

4. Stylized Facts

Figure 4 shows the evolution of the two measures of informality we have adopted in this paper. As mentioned in Section 3, pension informality data is available from 2001, whereas we have data from 2002 for registration informality. Not surprisingly, both measures have a very close evolution; the correlation between them is 0.76 for the 2002-2009 period. The improvement in both measures is apparent, although that improvement seems to be smaller for registration informality: for the 2002-2009 period, it decreased by 0.94 percentage points. This, in the end, implies volatile behavior if not a slow improvement. The second measure has a more positive scenario: for the 2002-2009 period, pension informality decreased by 3.8 percentage points.[11]

However, as Table 6 suggests, the national informality measure is far from being homogeneous across sectors. Moreover, the improvement in pension formality outperforms the improvement in registration formality when we look at the detail. For instance, in the Manufacture of furniture sector, registration formality improved at a 0.1 percent annual rate, whereas pension formality did so at a 20.8 percent annual rate. It should be noticed that each measure departs from different initial values. Whereas at the beginning of the period registration formality in the aforementioned sector was 30.1 percent, pension formality was 6.1 percent; by the end of the period the respective measures were 30.4 percent and 21.8 percent. We seek to take advantage of precisely this cross-sector variability in the estimation undertaken in this paper: we argue that the different performance of each sector is related to its external dependence on finance, which ultimately represents a different exposure to greater credit availability.

Figure 1 presents the most general measure of financial deepening: the share of private domestic credit to GDP. As the figure shows, financial deepening increased after the 2001 crisis. Focusing on the 2002-2009 period, financial deepening has increased by 3 percentage points. This behavior follows a general pattern experienced in the Latin American region, as pointed out by Hanson (2010). Financial deepening for Peru averaged 21 percent for the 2001-2008 period, which is greater than the average in Argentina, Mexico or Venezuela (see Table 3) but still smaller than that of Brazil or Colombia within the region. Moreover, Figure 2 suggests that growth has been stronger for credit targeted to micro-firms: from 2002 to 2009 the annual

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[11] The informality estimation here implemented considered all the industries we are focusing on, but with no data trimming. The estimation procedure in the econometric estimation considers only activities with more than 60 observations

growth rate of domestic credit to micro-firms outperformed total credit, growth. This growth peaked in 2008 when micro-firms credit grew by 45.4 percent, whereas total credit did so by 33.8 percent. Even in the aftermath of the last financial crisis, microcredit kept growing by 19.4 percent, compared to 3.3 percent growth for total credit. Furthermore, the massive incursion of commercial banks into the microcredit sector during this period has driven this dynamic. Specifically, as shown in Figure 3, microcredit provided by commercial banks showed growth rates higher than those observed for the financial sector as a whole. Thus, Table 4 shows that credit for small and micro companies represents 8.4 percent and 16.8 percent, respectively, of total credit to business activities. In addition, commercial banking represents 62 percent and 30 percent of Peruvian small and micro companies' credit supply, respectively.

The parallel between trends in informality and credit motivates our analysis. In particular, as in the case of Brazil,[12] the trend of increasing private credit has taken place while the average interest rates charged by depository societies and the interest rate spread of banking intermediation have declined. The combination of these facts suggests that supply factors (e.g., rising intermediation efficiency, expansionary monetary policy, increasingly international liquidity) are driving the deepening of financial markets. Put differently, there are signs pointing to an exogenous rightward credit supply shift. Hence, matching trends experienced by the variables with exogenous condition of possible determinants gives us preliminary evidence of a causal relationship between credit access and formalization.

Assessing the importance of this mechanism with case studies, however, may face certain difficulties. One of such difficulties is the presence of threshold effects, that is, the possibility that the channel through which an expansion of credit supply encourages businesses to formalize their employees or their operations might have an area of non-response. In other words, companies will require the financial deepening incentive to exceed a certain threshold before they begin to implement improvements in their levels of formality. In terms of the present paper, something similar could be occurring if imbalances between costs of opening and closing a business or hiring and firing workers are linked to the status of formality. In fact, the World Bank's 2010 Doing Business Report suggested that two areas in which Peru has a relatively weak position are labor market flexibility and flexibility in the creation (formalization) and closing of businesses (see Table 5). If in practice becoming formal and leaving formality are not

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[12] See Catão, Pagés, and Rosales (2009).

symmetric, our estimates will be biased. Indeed, the increasing rate of formality may involve a complex combination of channels operating through sectors as well as across firm sizes (Catão, Pagés, and Rosales 2009). Then, in order to disentangle the channels through which this effect is operating, we decompose the total effect into two main effects: i) within firm size category and ii) between firm size categories. The within (or intensive) channel operates by encouraging formalization within the firm's size category. The idea is that access to credit requires compliance with tax and employment legislation. Thus, firms are more likely to incur such costs of formalization once bank credit is more widely available at a lower cost. On the other hand, the between (or extensive) channel operates through changing the composition of firms within the industry. Again, more widely available credit at a lower cost motivates firms to expand, thus migrating from one size category to another. Thus, it might not be surprising to find a negative impact of credit availability on formalization, since that impact could be a consequence of a change in the structure of firm size. This would imply that smaller firms obtaining credit are migrating to the bigger firms category, leaving the small category composed mainly of informal firms.

It is worth noting that the inference is at the industry-size category level. Using ENAHO we are able to evaluate the evolution of firms' composition, but we cannot infer what is driving the change. More explicitly, we cannot know if there is a life cycle effect driving the results. Firms' longevity, entry and exit remain important issues to be addressed in further research that will require the use of firm-level data.

We can thus now evaluate the importance of the within and between sizes effects as channels driving formalization during the period being studied. The hypothesis is that financial barriers have an impact on growth, and such repercussions are typically greater for smaller firms. Through ratios presented in equations (1) and (2) we implement a simple decomposition by firm size where E represents aggregate employment and F formal employment, and the subscripts $s = \{SE; S; L\}$ represent self-employment, small (2-10 workers) and large (more than 10 workers) categories of firm size.

$$\frac{F}{E} = \frac{F^{SE}}{E} + \frac{F^{S}}{E} + \frac{F^{L}}{E} \qquad\qquad (1)$$

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Then, dividing and multiplying each term of the right hand side by their respective employment size level and differentiating we obtain equation (2).

$$\Delta \left(\frac{F}{E}\right) = \Delta \left(\frac{F^{SE}}{E^{SE}}\right)\frac{E^{SE}}{E} + \Delta \left(\frac{E^{SE}}{E}\right)\frac{F^{SE}}{E^{SE}}$$
$$+\Delta \left(\frac{F^{S}}{E^{S}}\right)\frac{E^{S}}{E} + \Delta \left(\frac{E^{S}}{E}\right)\frac{F^{S}}{E^{S}} \tag{2}$$
$$+\Delta \left(\frac{F^{L}}{E^{L}}\right)\frac{E^{L}}{E} + \Delta \left(\frac{E^{L}}{E}\right)\frac{F^{L}}{E^{L}}$$

We have been hitherto referring to the informality rate in the above explanation. The analysis conducted in this section, however, addresses the informality issue by assessing the change in formality. Hence, making an analogy with our measures of informality, registration and pension, here we assign the same classification to formality: registration-formality and pension-formality. Thus, in equation (2) the change in the rate of formalization $\Delta \left(\frac{F}{E}\right)$ is decomposed into within and between changes through size categories. For each category (*SE*, *S* and *L*) we can see that the first component is the within effect: the change in formalization within the size category weighted by the share of that size category.

The second term for each category is the between effect: the change in the share of the employment of that size category over total employment, weighted by the share of formal employment over total employment within the size category. Table 8 presents the results for registration formality change, while Table 9 shows the same estimations for the change of pension formality. The first column in each table has been normalized to 1 in order to interpret the decomposition as the sum of within and between components across firm category sizes. Moreover, for the sub-periods that experienced a reduction in the rate of formality we opted for a negative sign in the interpretation. In general, changes in firm size category and channel are reported as a share of total change reported for the 2002-2009 period. As explained, the additional rows present the results for sub-periods within 2002 and 2009.

Looking at Table 8, we see that the rate of registration formality has increased from 2002 to 2009. Although the change seems small, there are interesting insights in the way it took place. We can see that the between effect is very strong for both small and large firms. Additionally,

the self-employment segment is experiencing an increase in the rate of formalization. At the same time, however, self-employment's share of total employment is decreasing, as is explicitly represented by the different signs of the within and between effect. For the second size category, small firms, the within effect shows a reduction in the rate of formalization, but, as explained above, it also has an important between effect, suggesting a greater level of formality due to a re-composition in employment. This is later evident when we look at the results for the large size category: there is a smaller within effect but a greater between effect. The likely explanation is that the rate of large firms already registered or carrying accounting books is very high, thus the increase in formalization is less explained by new large firms undertaking registration than by the increasing share of large formal firms in total employment. More interesting is the period differentiation. Two sub-periods were considered: 2001-2005/2006 and 2005/2006-2009. The first is related to the post-financial crisis period, whereas the second is related to the boom in the Peruvian economy due to high mineral prices. Although the Peruvian economy has displayed sustained growth since 2001, it is well known that this growth has been faster since the beginning of the boom in mineral prices (circa 2005-2006). Table 8 shows these two possible sub-periods. As explained above, to make the analysis more intuitive, the deterioration of formality is shown as a negative change. Interestingly, although the formality rate for the 2002-2009 period increased, that rate decreased in the first period, to later improve in the subsequent period. We can see that the within effect is even stronger for small firms, explaining to a greater extent the economy-wide decrease in formality, whereas large firms show a positive effect through both within and between channels. Not surprisingly, the category of self-employment showed a reduction in formality explained by the within and between channels.

Table 9 presents the decomposition for the pension formality rate. We conduct a similar analysis for registration formality. The change in the pension formality rate in the 2002-2009 period was more auspicious: it increased by 16.4 percentage points. At *prima facie* we argue that pension formality has been less volatile than registration formality, since undertaking an improvement in labor benefits within the firm implies a decision less likely to be reversed compared to the registration decision. Of course, in absolute terms registration formality is higher than pension formality. Interestingly, the within channel explains a greater share of the improvement in formalization. The good news is that the three categories are experiencing that improvement for the whole period. Even the self-employment category registered an increase in

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formalization. However, as in the previous case, large firms account for a larger share of the improvement in formalization through the within channel. The between estimations suggest that, again, large firms also explain the improvement in formalization as they increase their share of total employment. Decomposed into sub-periods, we observe that formalization growth has been apparent in both sub-periods, although large firms' growth has been stronger during the last sub-period.

Hence, so far we have shown that formality has experienced an important improvement, particularly in pension formality. Both within and between channels explain part of the transition, and large firms experienced the greatest formalization. The next section will test these stylized facts in greater detail.

5. Econometric Evidence

This section draws heavily from Catão, Pagés, and Rosales (2009). While the previous section noted that the credit supply available to firms in Peru has increased in recent years, there remains the question of whether this financial deepening has affected the formality of labor and firm relations. As explained previously, our approach follows the Rajan and Zingales (1998) methodology for the identification of financial dependence across industries, which in turn provides us with an interesting source of heterogeneity. The prior hypothesis is that greater credit availability induces greater formalization through the channels depicted above. We attempt to address this hypothesis by testing whether more financially dependent activities displayed relatively higher growth rates in their formality ratios compared to those activities less dependent on external financing. We also consider heterogeneity in the relationship depending on the firm's size category. If formalization is a key factor in gaining cheaper access to credit, firms are driven to formalize due to the newly available credit supply. Moreover, this is evident for the sectors technologically more dependent on external funds, since the nature of their activities compels to meet certain requirements, including formality, in order to gain access to credit. If we can demonstrate this, we can conclude that the credit channel is effective in inducing firms to formalize their activities.

It is important to note that this is an alternative approach and one that does not attempt to explain the behavior or performance of firms through the formalization process. Instead, it only seeks to determine the extent to which the aggregate shock of financial sector deepening

generates effective incentives to formalization. We will therefore try to isolate the influence of the credit channel on formalization and compare the performance of financially dependent and non-financially dependent activities. We thus treat the rest of the variables as controls without trying to understand their effective relation to formality. For this reason we introduce time and activities dummies as controls, which in turn encompass multiple possible explanations such as the minimum wage dynamics, labor system law and improvements in government agencies' monitoring efforts. Finally, the firm size dimension could be relevant for the interaction between access to credit and the formalization process. That is, if any effect is found, it might be concentrated in some firm category. Thus we implement a decomposition of the sample in the three categories explained categories: self-employment, small firms and large firms. This distinction also allows us to ensure that our estimates of financial dependence are not assimilating size effects (Catão, Pages, and Rosales 2009). The model we finally estimate is represented by equation (3).

$$f_{jt}^c = \beta_0^c + \delta_t^c + \delta_j^c + \gamma^c \left(\frac{Credit}{GDP} \right)_t * FD_j + \epsilon_{jt}^c \qquad (3)$$

Here we have as dependent variable f_{jt}^c, the formalization rate for industry j, during the period t, corresponding to the size category c. As control variables we have a set of time dummies represented by δ_t^c and activities dummies represented by δ_j^c. Finally we have the variable that represents the credit channel shock interacted with external financial dependence at the industry level, expressed by coefficient γ^c. It could be useful to interpret this multiplicative variable as a weighted shock where the shock component is represented by the dynamic of the credit deepening and the *weighting factor* is estimated by the external dependence of the corresponding activities. This is the equation for estimating the *within* effect of credit deepening on formality.

Additionally, as discussed above, we are also interested in estimating the *between* effect across firm size categories. It is possible that the formality rate increases due to the positive trend in credit supply, but this increase may also be a consequence of an employment transition from small to large firms, i.e., where employment is migrating from small to large firms and no improvement in formal labor is seen within the firm's size category. If between-size migration is in fact occurring, it would be expected to take place particularly in financially dependent sectors.

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We therefore estimate the model represented by equation (4) in which the dependent variable is the share of employment of the respective size category c for each activity j.

$$\left(\frac{E^c}{E}\right)_{jt} = \lambda_o^c + \delta_t^c + \delta_j^c + \gamma^c \left(\frac{Credit}{GDP}\right)_t * FD_j + \epsilon_{jt}^c \tag{4}$$

Up to this point, we have taken into account the typical endogeneity problem embedded in this kind of analysis. As discussed above, we should be able to uphold the necessary arguments supporting the assumption of exogeneity of the explanatory variable. This variable is constructed as the product of the activity-level financial dependence ratio and the national-level financial deepening measure. Since the ratio of external financial dependence is estimated from US data and is conceived as a structural measure, its exogeneity can be claimed without hesitation. On the other hand, for exogeneity of financial deepening it is sufficient to interpret the measure as an exogenous shock that is not particular to any firm or activity. The aggregate condition of the national year-level index ensures the non-endogeneity of the ratio. This can be understood more clearly by considering what would happen if we used credit deepening for each sector in the sample. Here, the directionality between particular financial deepening and formalization could be considered ambiguous. This does not happen when we consider a national deepening in which each sector is sufficiently small in relative terms. Finally, both models are estimated using Generalized Least Squares (GLS), allowing the standard error to follow a first-order autocorrelation specific to each sector.

Turning to the results, Tables 10 and 11 present the estimation results for equation (3) for the registration and pension formality rate, respectively. For each formality measure we have considered two additional measures of financial deepening: credit to private firms as a share of GDP and the interest rate. The share of credit to private firms is estimated using data on credit allocation to firms by banks and financial institutions obtained from the Superintendence of Banking, Insurance, and Pension Funds (SBS). Interest rate data also come from SBS, but we have considered two different measures: the interest rate for corporate credit, which we use in the estimation of effects on the large firm size category; and the interest rate for small and medium enterprises, which we use in the estimation of effects on the self-employed and small firm size category.

Table 10 shows a strong impact of credit deepening on formalization measured through registration (or the carrying of accounting books) for the self-employed category. This is

statistically significant only for the availability measures of financial deepening (not for the interest rate measure). By construction, the impact of greater financial deepening depends upon the industry's external financial dependence.[13] Hence, we have to assess the impact of financial deepening depending on the level of financial dependence. Two extreme industries relevant for the Peruvian sample can be considered: water transport, with the highest dependence on external funding, and publishing, printing and reproduction of recorded media, with the lowest.[14] An increase in aggregate domestic credit/GDP of one standard deviation (0.028) would increase formalization in the most financially dependent sector relative to the least financially dependent sector by 0.94 percentage points [=(-0.035 - (-4.304))*0.028*0.079].

If we replicate the example for the second measure of financial deepening, domestic credit to firms/GDP, we find that a one-standard deviation (0.025) increase in financial deepening measured by that variable would also increase formalization in the most financially dependent sector relative to the least financially dependent sector by 0.9 percentage points, or [=(-0.035 - (-4.304))*0.025*0.084]. However, if we measure financial deepening through the interest rate for small loans, we find that a one-standard deviation (0.0919) decrease in the interest rate would imply an increase in formalization in the most financially dependent sector relative to the least financially dependent sector of 1.3 percentage points, although this result is not statistically significant.

This interesting result suggests that the smallest firms, self-employed firms, benefit from greater credit availability. This result underpins the idea established by Karlan and Zinman (2007) that "even consumers making awed decisions may be better off when they can borrow from regulated financial institutions at 'excessive' rates."

And more precisely, the idea proposed by de Mel, McKenzie, and Woodruff (2007) is that, although small informal entrepreneurs face severe credit restrictions, once they have access to credit the return to capital of their projects is much higher than the cost of capital. The authors subsequently explain that this suggests that the reason for high returns to capital in small firms is missing credit markets rather than missing insurance markets.

The formalization story goes something differently when we assess formalization as the rate of workers making contributions to any pension system. Table 11 summarizes our results.

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[13] Since $\partial f / \partial (Credit/GDP) = \hat{\gamma} FD$ we must evaluate the impact of (Credit=GDP) depending on given value of $\overline{FD}$. This value is nothing more than the industry's external dependence on funding.
[14] See Table 7.

First of all, there is no significant effect for the self-employment category of firms. This result is not unexpected, since contributions to a pension system are more related to dependent workers. Although there are some independent (self-employed) workers making contributions to the pension system, greater availability of credit or a reduction of its cost does not have any impact on them.

Regarding the small category of firms, the three financial deepening measures have an inverse impact on formality by increasing it, although only the interest rate measure impact is statistically significant. Thus, at one standard deviation (0.091) decrease in interest rate charged for loans to small and micro-enterprisers reduces formality by 5.2 percentage points, as obtained by [=(-0.035 - (-4.304))*0.091*0.134]. This result, however, can be a consequence of a re-composition of employment through firm size categories. That is, if the share of formal firms over total firms within this category is decreasing, that could be due to an effective reduction of formal firms or the massive inflow of new firms into this category coming from a smaller category. The reduction of formal firms in the category could also be a consequence of firms migrating to the large firms category.

Finally, financial deepening does has an impact of pension formalization for the large firms category. This result is evident using both financial deepening measures related to domestic credit. A one-standard deviation increase in the rate of domestic credit to GDP increases formalization in the most financially dependent sector relative to the least financially dependent sector by 3.4 percentage points [=(-0.035 - (-4.304))*0.028*0.286]. Interestingly, the impact of financial deepening on pension formality is stronger than that estimated for registration formality. This suggests that larger firms have a greater capacity to undertake formalization through better credit availability.

Thus, the results hitherto presented suggest that pension formality is a large-firm issue, while registration formality is driven by self-employed firms and their access to credit. Therefore, the impact of greater credit availability is twofold: i) it increases the number of firms registered or carrying accounting books, and ii) it motivates the improvement of social security conditions in the labor market. It remains, then, to assess if greater availability of credit alters employment composition through the three categories defined.

Table 12 presents the results for equation (4). As explained above, we are trying to gauge the impact of greater financial deepening on employment composition through firm size

categories. The signs of the coefficients presented in this table suggest that greater financial deepening underpins a transition from small to large firms. For the self-employment category, the greater the financial deepening measured either as domestic credit/GDP or domestic credit to firms/GDP or interest rate decreases the employment share of self-employed firms. The impact of a standard deviation increase (or decrease in the case of interest rate) ranges from 1.9 percent, measured through domestic credit to firms, to 3.9 percent if we measure with domestic credit only. Thus, this result points to an evident transition from self-employment firms to larger firms due to better credit availability. The same table highlights the different result for the other two categories, reinforcing the previous result. Both small (2-10 employees) and large (more than 10 employees) firms increase their employment share as a consequence of greater credit availability. Nonetheless, that relationship is statistically significant only for the small firms (2-10 employees) category, and two coefficients for the large firm category do not have the expected sign. Thus for the small category, a one standard deviation increase in the rate of domestic credit increases small firms' share by 2.3 percentage points. In the case of domestic credit to firms, the impact is a 2.4 percentage point increase in small firms' share. Measured by the interest rate, the impact is a 4.7 percentage point increase in small firms' share.

More importantly, this last result should be read in line with the pension formality result found in Table 11 for the same size category. The inflow of new firms into the 2-10 employees category might be the cause of that increase in pension informality measure within the category. Hence, although results link an increase of informality to greater credit availability within the small firms category, this seems to be a result driven by the reallocation of employment from self-employment to small firms, further suggesting that greater credit availability is motivating firms to grow. This behavior seems to take place among large firms as well, although the effect is not statistically significant. In sum, we observe credit availability triggering a re-composition of firm size by prompting very small firms to grow, which ultimately reaffirms the link between financial deepening and growth.

6. Robustness

In this section we briefly conduct a robustness check in order to confirm the results presented so far. It is worth noticing that throughout the paper we have shown results on formality based on three different measures of financial development. In that sense, without explicitly stating as

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much, we have conducted a robustness check for each estimation, based on different measures of financial deepening. Thus, in this section we focus on the treatment of the interaction of financial deepening and dependence on external financing. As in the previous case, we conduct that robustness analysis for our three measures of financial development: domestic credit over GDP, domestic credit to firms over GDP and interest rate.

Following Catão, Pages, and Rosales (2009) we use a rough index of financial dependence based on a dummy variable. As the authors explain, one might conjecture that the Rajan-Zingales financial dependence ranking is highly demanding in terms of sectorial disaggregation and that the specifics of such a ranking of financial dependence may not be entirely appropriate for an economy such as Brazil or Peru, which are structurally quite distinct from the United States. With this potential criticism in mind, we re-run the regressions of Tables 10 to 12, replacing the financial dependence index with a dummy variable, defined as 1 if the sector has an above-average financial dependence index and zero otherwise. We then interact this dummy variable with our measures of financial development.

Tables 13 to 15 present the results for this new estimation. Table 13 suggests that the estimation of the effects on registration informality is high, with the wrong signs compared to previous results. One possible explanation for this lack of robustness might be seen in the between effect: since transition from self-employed firms to small firms is taking place within the labor market, it is very difficult to estimate the within effect for the self-employed category. Something different happens with the pension formality measure. Table 14 shows that the sign of the coefficients is the same for all financial development measures and firm size categories. Interestingly, the impact of financial deepening on pension formality is confirmed to the large firms category. The impact measured through domestic credit to firms increases the rate of formality in this category. It should be noted that, in contrast to what happened to the registration formality measure, the non-significance of the transition from small to large firms (in the between effect) allows us to identify the within effect of the pension formality measure.

The result for the between effect is robust if we measure with the interest rate. The estimation result (in terms of coefficient signs) of Table 12 is confirmed by Table 15. Greater availability of credit reduces the employment share of the self-employment category and increases the share of the 2-10 employees category, although the transition is statistically

significant only when measured with the interest rate. None of the estimated coefficients for the large firms category turned out to be statistically significant.

In sum, we are more confident in the results estimated for the effect of financial development on the rate of formality measured as affiliation to the pension system as well as in the estimation results of the between effect. Although we found a relationship between financial deepening and formalization expressed in carrying accounting books, this section finds that result less reliable than the others. Further research will be needed to clearly establish that relationship.

7. Conclusions

This paper has sought to identify the linkage between financial development and informality for the Peruvian case. Despite the massive literatures reviewing informality and financial development and their respective links to economic growth, there has been a gap in trying to empirically understand the relation between them.

The key hypothesis tested in this paper is whether the combination of financial dependence and greater availability of credit (financial deepening) increases firms' incentives to become formal. This hypothesis is based on the premise that formalization buys access to that expanded supply of formal credit and thus saves on the higher costs and legal insecurity of informal credit markets.

We have surveyed the related literature for the Peruvian case to the best of our knowledge and found the need to bridge the gap between the separate analyses of financial development and informality. In that line, some interesting results emerged from our assessment that allows us to depict some conclusions. Using the methodology proposed by Catão, Pagés, and Rosales (2009), we decomposed the impact of financial development into the within and between channels. The former operates through increasing formalization within the same firm size category, whereas the second takes place by altering the employment composition in each firm size category.

Our main conclusion points to the impact of greater credit availability on formalization through both within and between channels. The within channel operates by increasing the rate of formalization within the industry. We found that, depending on the formality measure, this impact is concentrated in some firm size categories.

Thus, for formality measured as the carrying of accounting books by the firm the worker works for, we find that the category of self-employed firms is experiencing an increase in the rate of formalization due to greater financial development. We do not find a statistically significant impact for the other two size categories: firms with 2-10 workers and firms with more than 10 workers.

Regarding the financial deepening measure, we find that registration formality has the greatest impact on very small (self-employed) firms. This suggests that the main problem faced by self-employed firms is lack of access to credit. Consequently, providing them credit alternatives (as the aggregate credit availability does) may be expected to motivate them to formalize as measured by registration. This result is consistent with the idea that poor entrepreneurs face high returns to capital due to missing credit markets (de Mel, McKenzie, and Woodruff 2007). As for formality measured as the percentage of workers enrolled in any pension system over the total number of workers within each industry, we find that greater credit availability is motivating formalization for the large firms category, and this result is robust for the measure of financial deepening related to domestic credit to firms. Interestingly, for this measure the formality rate of the small firm category (2-10 employees) decreases as a consequence of greater credit deepening in the form of cheaper credit. This suggests that there is a transition between categories which ultimately is altering employment composition between size categories.

The latter result is somewhat confirmed when we assess the impact of financial deepening on the employment composition of the three categories. The share of the self-employed firms category declines as a consequence of financial deepening, whereas the share of the small firm category (2-10 employees) in total employment increases.

Therefore, these results imply that greater financial deepening has evident and immediate effects on firms' level of formalization. This takes place by motivating firms to satisfy legal requirements in order to undertake investment decisions and then obtain access to credit. Moreover, financial development appears to have an impact on growth, as increased credit availability is triggering a re-composition of firm's size by prompting very small firms to grow, thus ultimately promoting economic growth.

The precise mechanisms by which this effect is taking place, however, have yet to be explained. Our data set does not allow us to identify whether that re-composition in employment

is a consequence of more firms entering the market or exiting it. In addition, we have explored the link between credit and formality under a linear relationship assumption. However, different definitions of formality have different levels of reversibility. Therefore, there might be reasons to assume that some sort of inaction band might be present in some sectors or economies. This inaction band will depend not only on their financial dependence on external funds but also on the characteristics of the labor market. If there are severe restrictions on hiring and firing formal employees, informal firms might require a major change in the credit market to change their formalization rate.

Moreover, it would be useful to investigate the life cycle for firms in the Peruvian case in order to understand if the market is functioning correctly by allowing more efficient firms to grow. The precise role of credit in this process can then be revisited. Of course, the availability of firm-level data for a certain span of time will considerably enrich the results presented in this paper.

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Figure 1. Financial Deepening: Domestic Credit to GDP
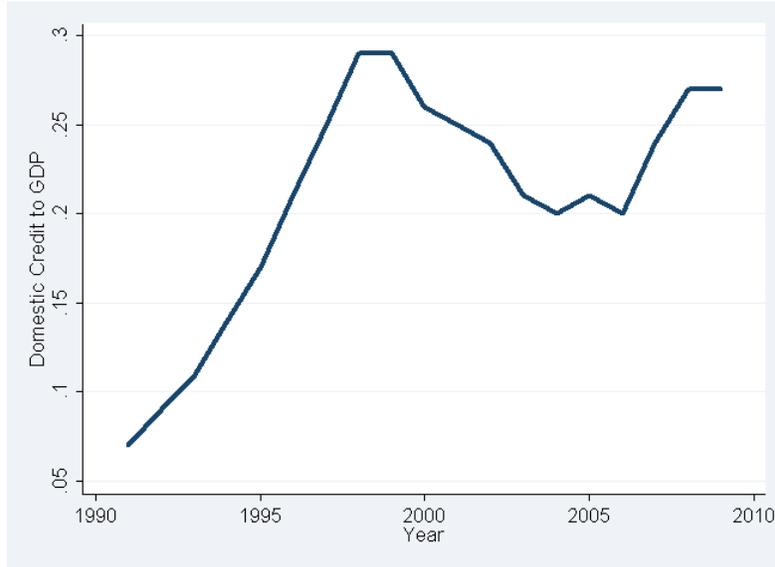
Source: Central Reserve Bank of Peru, 1991-2009. The vertical axis measures the total credit amount of credit (firms and households) in the country as a share of GDP. For the estimation of the share both measures were measured at 1994 constant prices.

Figure 2. Credit Dynamics in Entire Financial Sector (Growth Rate)
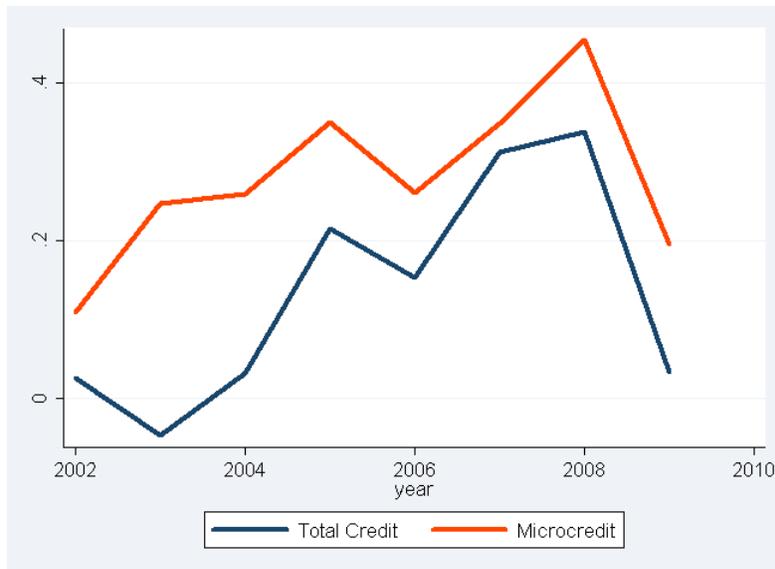
Source: Superintendency of Banking, Insurance, and Pension Funds, 2002-2009. The vertical axis measures the annual growth rate of total credit and microcredit.

Figure 3. Commercial Banks' Credit Dynamics (Growth Rate)
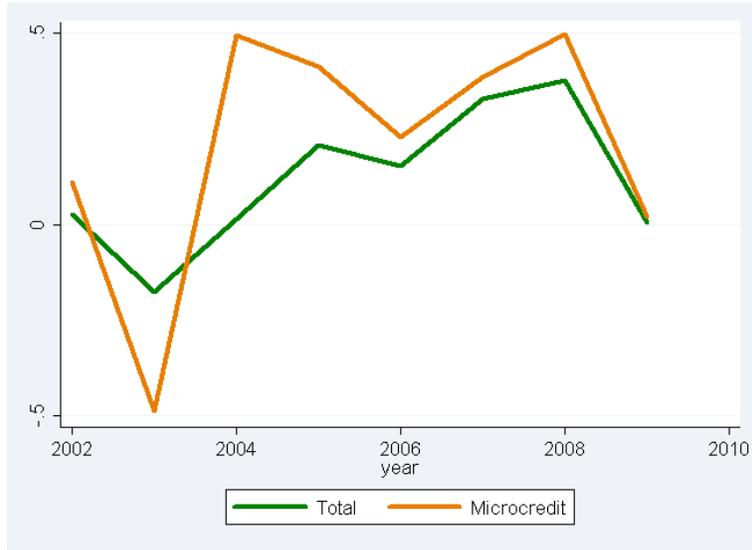
Source: Superintendency of Banking, Insurance, and Pension Funds, 2002-2009. The vertical axis measures the annual growth rate of total credit and microcredit.

Figure 4. Informality Measures
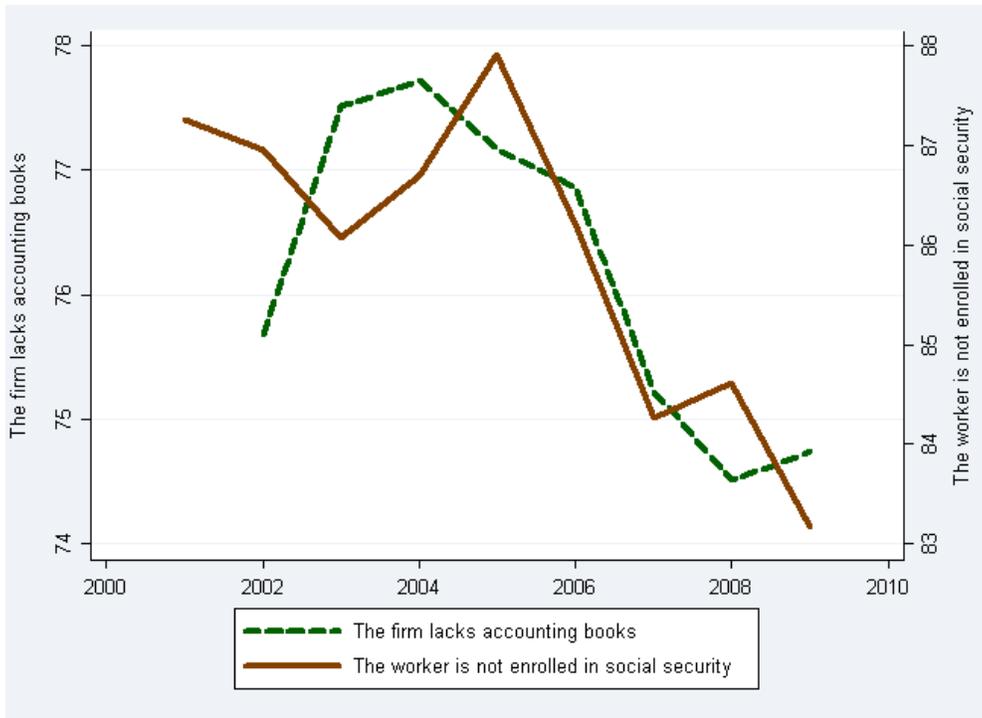
Source: ENAHO 2001-2009. The vertical axis measures the proportion of workers who report being informal workers according to the proposed measure over the total of workers. This figure presents nationwide informality.

**Table 1. Sample: Average Number of Workers in Each Industry
(Using Frequency Weights), 2002-2009**

| Industry	All	Self - Employment	2-10 Workers	More than 10 Workers
13	93661	7873	10431	75358
15	232367	20853	97376	114137
17	174694	97298	32236	45160
18	190957	57614	65624	67719
19	49679	5234	32150	12295
20	32196	8384	14330	9482
22	40973	2847	19004	19123
24	31416	1536	6030	23849
25	22290	422	4713	17155
26	44828	4929	26063	13835
28	78364	14883	40151	23330
29	26046	1860	10038	14149
36	154499	43778	89124	21597
45	472063	77092	285050	109921
50	165188	30182	102964	32041
51	249418	11675	133703	104040
52	1416520	698852	642670	74998
55	541874	138684	342692	60498
60	563788	325822	176362	61605
61	9153	2968	3265	2921
63	72337	35298	14893	22146
64	79401	4998	41724	32678
71	20925	4407	12210	4308
72	44508	23244	12869	8394
74	328096	69134	88178	170784
85	84816	21996	25658	37162
92	103274	17562	38302	47409
93	205010	148964	46657	9389

Source: ENAHO 2002-2009. This table shows the average number of workers utilized in each industry for the estimation of formality ratios at industry level. The average is estimated using the frequency weight provided by ENAHO and after getting rid of industries with fewer than 20 observations, i.e., every industry has at least 20 observations.

Table 2. Number of Workers, Value Added, Income and Informality

	ENAHO		CENEC	
	Total Income (Mill. of S/.)	Number of workers	Value Added (Mill. of S/.)	Number of workers
Formal	35,900	2,692,133	121,000	1,775,350
Informal	11,300	8,343,406	1,930	247,700
Total	**47,200**	**11,035,539**	**122,930**	**2,023,050**
Formal	0.76	0.24	0.98	0.88
Informal	0.24	0.76	0.02	0.12
Total	**1.00**	**1.00**	**1.00**	**1.00**

Source: CENEC 2008 and ENAHO 2008. CENEC considers a firm as informal if it does not possesses a Unique Taxpayer Register (RUC). For ENAHO the accounting books informality measure was used. For ENAHO estimation national weights at cluster level are considered.

Table 3. Domestic Credit to Private Sector (% of GDP)

Country	1991-2000	2001-2008
Argentina	20.16	13.79
Brazil	56.42	36.89
Colombia	32.72	27.03
Czech Republic	65.72	39.32
Hungary	27.82	49.22
Indonesia	45.73	24.24
Malaysia	163.44	130.94
Mexico	25.62	17.98
Peru	19.13	21.16
Philippines	42.09	33.58
Poland	21.73	32.80
Romania	9.33	20.95
Thailand	127.55	103.01
Turkey	19.90	21.90
Venezuela	16.93	14.63

Source: Hanson (2010), using data from the World Bank's World Development Indicators.

Table 4. Direct Loans by Credit Category and Supplier

	Commercial Banks	Other Private Financial Institutions	Public Financial Institutions	Total
Corporative	99.66%	0.33%		(18.18%)
Big Firms	99.05%	0.89%	0.05%	(15.83%)
Medium Firms	93.78%	6.13%	0.07%	(16.32%)
Small Firms	**61.86%**	**37.71%**	**0.42%**	**(11.29%)**
Micro Firms	**30%**	**68.71%**	**1.27%**	**(5.64%**
Consumer Credit	74.53%	15.60%	9.85%	19.76%
Mortgage Credit	96.26%	3.52%	0.20%	12.95%

Source: Superintendency of Banking, Insurance, and Pension Funds, Flow Data forAugust 2011. Percentages in parentheses refer to row's share of all direct loans.

Table 5. Doing Business Ranking for Peru

	Rank
Ease of doing business	56
Starting a business	**112**
Dealing with construction permits	116
Employing workers	**112**
Registering property	28
Getting credit	15
Protecting Investors	20
Paying taxes	87
Trading across borders	91
Enforcing contracts	114
Closing a business	**99**

Source: Doing Business 2010, World Bank.

Table 6. Formality Change by Industry and Formality Definition (2002-2009)

Industry	Description	Lack of accounting books	The worker is enrolled in pension system
15	Manufacture of food products and beverages	-0.8%	10.2%
17	Manufacture of textiles	-2.4%	4.1%
18	Manufacture of wearing apparel; dressing and dyeing of fur	1.3%	11.0%
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	2.1%	14.6%
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	9.0%	18.8%
22	Publishing, printing and reproduction of recorded media	-0.6%	10.9%
24	Manufacture of chemicals and chemical products	0.5%	6.3%
25	Manufacture of rubber and plastics products	-1.6%	8.5%
26	Manufacture of other non-metallic mineral products	-0.2%	14.4%
27	Manufacture of basic metals	1.9%	5.8%
28	Manufacture of fabricated metal products, except machinery and equipment	-0.6%	8.1%
29	Manufacture of machinery and equipment n.e.c.	-0.7%	10.4%
36	Manufacture of furniture; manufacturing n.e.c.	0.1%	20.8%
45	Construction	5.3%	14.6%
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	-4.6%	3.3%
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	2.4%	8.7%
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	1.1%	12.4%
55	Hotels and restaurants	-0.7%	9.0%
60	Land transport; transport via pipelines	-2.1%	21.6%
61	Water transport	-2.2%	-1.6%
63	Supporting and auxiliary transport activities; activities of travel agencies	0.0%	5.0%
64	Post and telecommunications	-7.9%	-7.0%
71	Renting of machinery and equipment without operator and of personal and household goods	12.1%	14.6%
72	Computer and related activities	3.5%	21.4%
74	Other business activities	-1.6%	5.6%
85	Health and social work	1.5%	7.2%
92	Recreational, cultural and sporting activities	-0.6%	9.7%
93	Other service activities	-1.4%	19.5%

Source: Authors' calculations based on ENAHO 2002-2009.

Table 7. Rajan-Zingales Financial Dependence (FD) Index

Industry	Description	Financial Dependence
13	Mining of metal ores	-1.650
15	Manufacture of food products and beverages	-2.221
17	Manufacture of textiles	-1.564
18	Manufacture of wearing apparel; dressing and dyeing of fur	-2.518
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	-2.966
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	-0.660
22	Publishing, printing and reproduction of recorded media	-4.304
24	Manufacture of chemicals and chemical products	-1.913
25	Manufacture of rubber and plastics products	-0.370
26	Manufacture of other non-metallic mineral products	-0.123
27	Manufacture of basic metals	-0.539
28	Manufacture of fabricated metal products, except machinery and equipment	-1.430
29	Manufacture of machinery and equipment n.e.c.	-1.615
36	Manufacture of furniture; manufacturing n.e.c.	-1.855
45	Construction	-0.632
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	-0.258
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	-2.009
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	-0.952
55	Hotels and restaurants	-0.230
60	Land transport; transport via pipelines	-0.118
61	Water transport	-0.035
63	Supporting and auxiliary transport activities; activities of travel agencies	-3.409
64	Post and telecommunications	-0.494
71	Renting of machinery and equipment without operator and of personal and household goods	-1.777
72	Computer and related activities	-2.964
74	Other business activities	-3.651
85	Health and social work	-1.728
92	Recreational, cultural and sporting activities	-0.854
93	Other service activities	-1.464

Source: Estimated using S&P 1500 Index data from Bloomberg. The financial dependence index is the ratio between the sum of external finance over 2002 to 2006 and the sum of capital expenditures in the same period collapsed to the industry level median.

Table 8. Formality Rate Decomposition, Accounting Books

		Within			Between		
		Self	Small	Large	Self	Small	Large
2006-2002	-1.000	-0.475	-3.028	0.431	-0.094	0.704	1.462
2009-2006	1.000	0.207	0.133	0.047	-0.018	-0.040	0.670
2005-2002	-1.000	-0.776	-2.315	0.808	-0.047	0.366	0.965
2009-2005	1.000	0.303	-0.069	-0.089	-0.027	0.059	0.823
2009-2002	**1.000**	**0.099**	**-1.223**	**0.276**	**-0.087**	**0.270**	**1.664**

Source: Authors' calculations based on ENAHO 2002-2009.
Note: The negative sign in the first column means, that instead of an increase in formality for that period, the economy experienced a reduction in formality rate.

Table 9. Formality Rate Decomposition. Social Security

		Within			Between		
		Self	Small	Large	Self	Small	Large
2006-2002	1.000	0.316	0.270	0.352	-0.025	0.018	0.069
2009-2006	1.000	0.261	0.270	0.329	-0.014	-0.032	0.186
2005-2002	1.000	0.355	0.345	0.264	-0.017	0.015	0.038
2009-2005	1.000	0.249	0.196	0.420	-0.033	-0.012	0.181
2009-2002	**1.000**	**0.299**	**0.266**	**0.349**	**-0.024**	**0.004**	**0.107**

Source: Authors' calculations based on ENAHO 2002-2009.

Table 10. Formality Rate, Accounting Books

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	0.0789***	0.967	0.181
Credit to Firms/GDP	0.0840***	0.673	0.276
Interest Rate	-0.0324	0.488	-0.308
Sectors	16	29	20
Obs.	128	232	160

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. Formality is measured as the percentage of workers who reported working for a firm that carries accounting books over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.

Table 11. Formality Rate, Social Security

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	0.0659	-0.459	0.286*
Credit to Firms/GDP	0.065	-0.481	0.286
Interest Rate	-0.0123	0.134***	0.435
Sectors	20	25	26
Obs.	160	200	208

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. Formality is measured as the percentage of workers who reported making contributions to any pension system over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.

Table 12. Between Effect

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	-0.328*	0.192*	-0.0283
Credit to Firms/GDP	-0.178*	0.227*	0.101
Interest Rate	0.0733***	-0.121***	0.241
Sectors	24	24	24
Obs.	192	192	192

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. The share of employment is measured as the number of workers working in a given category (self-employment, 20-10 workers and more than 10 workers) over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.

Table 13. Formality Rate, Accounting Books-Dummy Interaction

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	-0.303**	0.889	0.511
Credit to Firms/GDP	-0.425***	0.627	0.662*
Interest Rate	0.104*	0.559	-0.227
Sectors	16	29	20
Obs.	128	232	160

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. Formality is measured as the percentage of workers who reported working for a firm that carries accounting books over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.

Table 14. Formality Rate, Social Security-Dummy Interaction

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	0.331	-0.367	0.759*
Credit to Firms/GDP	0.334	-0.543	0.74
Interest Rate	-0.045	0.170**	0.634
Sectors	20	25	26
Obs.	160	200	208

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. Formality is measured as the percentage of workers who reported making contributions to any pension system over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.

Table 15. Between Effect-Dummy Interaction

	Self-employed	2-10 employees	More than 10 employees
Credit to Private Sector/GDP	-0.0758	0.255	0.0733
Credit to Firms/GDP	-0.172	0.291	0.0456
Interest Rate	0.0947	-0.190**	0.456
Sectors	24	24	24
Obs.	192	192	192

*,** and *** represent significance levels of 1%, 5% and 10%, respectively. The share of employment is measured as the number of workers working in a given category (self-employment, 20-10 workers and more than 10 workers) over the total number of workers by activity. There are three financial development measures: i) Domestic credit/GDP, ii) Domestic credit to firms/GDP, and iii) Interest rate. The interest rate relevant for both self-employed firms and 2-10 employees firms is the interest rate for loans to small businesses, whereas for the large firms category the corporate interest rate was used in the estimations.