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Finance and Employment Formalization: Evidence from Mexico's ENIGH, 2000-2016*

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Abstract: We study the relationship between financial constraints and employment formalization by exploiting heterogeneity in the industry-level degree of financial dependence, in the spirit of Rajan and Zingales (1998). This dependence, and variation in aggregate credit, lets us measure industry-level financial slack, and estimate its effects on employment formality. We find formality among young workers increases, which is consistent with a model of informal firms that grow and formalize with financial resources, thus becoming more productive. However, we find that financial slack, apparently, decreases formality among older, experienced workers, which is consistent with a model of capital-constrained formal employees that turn into entrepreneurs when financial conditions improve. Descriptive statistics on formality, as well as regression estimates conditioning by age and schooling provide a detailed map of the differential effects of finance on formality.

Keywords: Self-Employment, Entrepreneurship, Financial Constraints, Employment Formality, Financial Dependence

JEL Classification: G2, J46, O11, O12, O16

Resumen: Estudiamos la relación entre las restricciones financieras y la formalidad del empleo, utilizando heterogeneidad entre industrias en el grado de dependencia financiera, al estilo de Rajan y Zingales (1988). Esta dependencia, y cambios en el nivel de crédito agregado, nos permiten medir la relajación financiera por industria, y estimar sus efectos en la formalización. Encontramos que la formalidad aumenta entre los jóvenes, lo cual es consistente con modelo de empresas informales que crecen y se formalizan para acceder a mayor financiamiento, aumentando así su productividad. Encontramos que, aparentemente, la formalidad disminuye entre los trabajadores mayores, lo cual es consistente con un modelo de trabajadores sin acceso a capital, que se vuelven emprendedores. Estadísticas descriptivas sobre formalidad y estimaciones lineales, condicionando por edad y educación, generan un mapa de los efectos diferenciales del financiamiento sobre la formalidad.

Palabras Clave: Autoempleo, Emprendimiento, Restricciones Financieras, Formalización del Empleo, Dependencia Financiera

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1 Introduction

One of the distinct features of emerging market economies is the large fraction of economic activity that is informal. At the same time, emerging markets are characterized by low financial market participation, low levels of capitalization in public financial asset markets and generally underdeveloped financial markets. Following Catao, Pages and Rosales (2009), in this paper we take a look at a question lying at the intersection of these two issues: what is the effect on economic formality of changes in the availability of financial resources?

To address that question, we explore whether, for the case of Mexico, the change in the formality of employment in an industry between 2000 and 2016 is related to the availability in that industry of financial resources. Although financial development and availability of financial resources are typically observable only as economy-wide variables, this paper uses heterogeneity across industries' financial dependence as in Rajan and Zingales (1998) to derive industry-level measures of these variables. The intuition of that paper and the subsequent literature¹ is that some industries are more affected by aggregate financial development or financial slackening than others. Based on that idea, aggregate financial data such as interest rates or total credit can be used to create industry-level financial slack indicators. We then use those indicators to estimate the effect of changes in financial slack on employment formality.

We relate the empirical results to two different models of formality and finance. In the first model, firms are capital-constrained and use labor very intensely as an input for production. In that situation, labor has low productivity and therefore the firm will be reluctant to formalize and pay high labor formality costs. However, if increased financial slack makes capital more easily available, the firm will find it profitable to get more capital, thus making its laborers more productive, even at the expense of having to pay the costs of formality.

In the second model, workers in large, formal firms are those that do not have enough capital or enough skills to work independently. In this model an inflow of capital allows formal workers to become independent, and thus informal. Despite their informal, small firm condition, they obtain higher earnings than by being laborers. Financial slack thus gener-

¹For example Beck, (2003), Kroszner, Laeven and Klingebiel (2007), and Claessens and Laeven (2010).

ates informality in the sense of moving some formal workers into entrepreneurship, albeit informal.

For the whole sample, using a broad definition of informality², our estimates imply that there is a significant formalizing effect among younger workers, i.e. financial slack appears to lead to greater formality in this group. This result is consistent with the first model described above, where firms are incentivized to formalize in order to access an improved financial market. However, there are differential effects across the population. Among older workers, financial slack is apparently associated with *lower* industry formality. Moreover, workers with more education also seem to reduce their average formality as financial slack increases. These effects are consistent with the second model described above, where older or experienced workers are potential entrepreneurs, and increased financial slack allows them to obtain enough capital to become micro-entrepreneurs, but in an institutional context where such establishments have little incentives to formalize.

Calculations of average formality across age reinforces this view: beyond a certain age threshold, older workers are less formal than younger workers which suggests that workers leave formal employment once they have enough experience or capital to do so. These results are in contrast to the traditional Harris and Todaro (1970) view that informal employment is not a form of entrepreneurship but is instead a precarious labor state available to those whose productivity is too low to be part of the formal labor market.

The paper also describes a set of potential alternative explanations for the fact that the aggregate formalization result contrasts with the findings of Catao, Pages and Rosales (2009) and briefly considers the merit of each of them. Foremost among these are, first, that the absolute increase in credit for Mexico during this period was relatively small, and second, that the recent introduction of a health insurance program (the Seguro Popular program) without the formal workforce participation requirement of most other health service programs, further reduced formalization incentives. However, we also consider the changing price of capital over this period, the institutional issues that surround the formal/informal decision

²We use several measures of informality but generally consider both informal laborers and informal entrepreneurs in our measures.

in Mexico that imply large difficulties in the formalizing of firms, and the distinct form of credit expansion in Mexico that during this period was more focused towards consumption credit rather than entrepreneurship, and consisted in part of micro-credit lending which is often devoid of formalization requirements. This last fact is also suggestive of the financing-for-entrepreneurship model sketched before.

We organize the paper as follows: Section 2 presents the two basic models of the formality/informality trade-off and how it relates to financial availability; Section 3 discusses the data sources and definitions and presents descriptive statistics of formality indicators and credit; Section 4 shows the results of estimating the linear relationship between the industry-level financial deepening measures on the changes in industry formality; Section 5 discusses the potential alternative explanations of the different estimates found for Mexico relative to other Latin-American countries. Section 6 concludes, highlighting the apparent differential effect of finance on formality as a function of age and education heterogeneity among workers. We also provide an appendix with robustness tests, descriptive statistics and with a decomposition of the change in formality over time into within-industries changes and changes in the industry composition of the sample.

Related work

There is a large literature on finance and growth. King and Levine (1993) used cross sectional studies to argue that financial development is important for economic growth. Rajan and Zingales (1998) improves upon the King and Levine (1993) econometric methodology, creating an index of financial dependence, to arrive at the same conclusion. Levine (1999) and Levine, Loayza and Beck (2000) use cross country data to show that legal systems affect financial development which in turn affects growth. Bekaert, Harvey and Lundblat (2005) relate financial market liberalization to economic growth by studying a cross-country database of equity market liberalization events and find that they increased growth by up to 1 % of GDP. Allen, Quian and Quian (2005) study law, finance and growth in China to find that in contrast to the standard findings, it is the poorly regulated, ad-hoc institution private sector that grows

the fastest. They claim among other things that Confucianism rather than working public institutions plays a role in sustaining a functional reputation-based equilibrium. Claessens and Laeven (2003) compare the effects of financial development with those of functional property rights on growth and find that there is evidence for both channels at work and that the magnitude of their effect is similar. Recent work in this area includes Demiguc-Kunt, Klapper and Panos (2011) who study financial constraints and entrepreneurship in post-conflict regions, and find that indeed financial constraints stifle entrepreneurship. Also Beck, Demirguc-Kunt, Laeven and Levine (2008) use cross-industry, cross-country data to study the effect of financial development on the size distribution of firms, finding that financial deepening benefits small firms particularly. A survey of this general literature is available in Levine (2005). At that stage of the literature, he concludes that although there are numerous issues with cross country data, it is hard to conclude that financial availability has no impact on economic growth. Our paper contributes one particular measurement of the effect of changes in financial slack on employment formality, long thought to be related to low growth potential and fiscal instability in developing economies.

There's also a large literature directly focused on the formality of employment in developing economies. Castells and Portes (1989) and Portes and Schauffler (1993) provide a wide-ranging view of the phenomenon of labor informality, suggesting it's origin are associated with population growth and urbanization rates higher too high for formal employment to develop, as well as by efficiency concerns and by lack of law enforcement, and that it implies an important setback of the gains achieved by the unionized labor movement. Loayza (1996) discusses firm's formalization decision and relates informality to growth in an endogenous growth model. It then relates data on informality across Latin America with institutional features of the different countries such as taxation and quality of government. It then shows that informality affects growth negatively. Yamada (1996) describes a model of informality by choice. Workers choose formal employment if they lack the entrepreneurial skills to be informal. It also presents data from Perú that is consistent with the model. Maloney (2004) directly addresses the issue of whether informality in Latin America is a sector of inferior jobs where people not productive enough to access the formal labor market take refuge. He focuses on

self-employed informal workers as the ‘core’ of the informal sector. He concludes that, instead, informal self-employment should be seen as a voluntary micro-entrepreneurial choice. He cites the fact that 60% of the informal self employed claim they had voluntarily quit a formal job. Straub (2005) studies a model of how a firm’s choice of formal vs. informal arrangements interact with the relative efficiency of formal and informal finance. Dabla-Norris et al.(2008) present a model and estimates suggesting the quality of the legal framework is the main determinant of the degree of informality in a country and that establishment size and formality are closely related. Also, Gasparini and Tornarolli (2009) summarize a wealth of cross country informality data for Latin America. Among other things, they conclude that the data is consistent with the voluntary self-employment view of informality. Also, Fiess, Fugazza and Maloney (2010) describes the cyclical properties of informal self-employment in the context of a two sector macro model. They find some support in the data for non-segmentation of labor markets. Finally, McKenzie and Sakho (2010) measure the impact of formality on firm’s profits and find heterogeneity across size and entrepreneurial ability: as in this paper they find evidence of a negative relationship between skill and formality. Overall this paper contributes to this literature by studying informality and how it depends on financial slack, and by providing two simple models, related to those in Dabla-Norris et al.(2008) and Yamada (1996), with which to interpret the different pieces of evidence.

With respect to Mexico, in particular, Levy (2008) describes the impact of changes in social protection government programs on the incentives for formalization over the period. His analysis of Mexico’s social programs suggests that there has been a dramatic change in the economic incentives to work in the formal or in the informal sector over the sample period. In particular he argues that the large increase in non-labor-linked public health insurance has implied that formalization provides only a small health benefit advantage for workers relative to informality and thus that these social programs have discouraged formalization. Maloney (1999) studies labor transitions in Mexico and finds that the border between formality and informality is very porous, with workers switching in and out of formality, thus suggesting ‘duality ’ is not a key feature of that market. Also Alcaraz (2009) studies the degree of wage flexibility in formal and informal labor markets in Mexico and finds informal labor has more

flexible wages in the sense of responding more to cyclical macroeconomic fluctuations. Alcaraz, Chiquiar and Ramos-Francia (2008) also focus on the Mexican case and find that there are productivity differences between informal and formal labor which potentially implies that informality drives down aggregate productivity. They also find that informality differences across industries does not seem to be explained by characteristics intrinsic to different productive processes but through regulatory frictions instead. Alcaraz, Chiquiar and Salcedo (2015) also study the case of Mexico, estimating a model where there are some barriers to entry into the formal labor market but also some workers that self-select into informality. They find only between 10 and 20 percent of informal workers would rather have a formal job. Also Leal (2014) estimates a model where taxes affect firm's decision to become informal. Calibrated to Mexican data, it predicts a very large increase in output if labor allocation was not distorted towards informality.

Finally, this paper is closely related to that in Catao, Pages and Rosales (2009). In that paper, Brazilian data from the IBGE is used to measure the fraction of employment in different industries that is formal and the change in the measure in formality is found to be related to changes in the availability of finance, particularly in finance-dependent industries.³

2 Theory

This section describes two basic models of formality and finance that help us interpret the statistical results described further below.

2.1 Model 1: Credit-Constrained Firms

This model describes the basic intuition for the idea that finance can bring about formality by incentivizing firms to hire workers formally. In it a firm obtains the benefit of access to credit in exchange for complying fully with employment regulation.

³A comprehensive survey of the finance and growth literature is Levine (2004).

Firms maximize a profit function

$$\pi = k \cdot (w - r) - W \quad (1)$$

where k is capital and $k \in \{K_1, K_2\}$, with $K_2 = K_1 + \delta$, w is the workers' productivity per unit of capital and r is the rental cost of capital. The firm pays the worker $W = w$ if the firm keeps employment informal, but must pay $W = w + F$ if it formalizes its employees, where $F > 0$ is a formality premium. The firm starts out as a credit constrained entity with $k = K_1$, unable to borrow δ to get to $k = K_2$. In that situation the firm's profits will be $\pi = K_1 \cdot (w - r) - W$ and there will be no reason to formalize its workers. The firm's industry then receives an inflow of capital so that the firm is now allowed to borrow δ and set $K = K_2$ at the cost of formalizing its employees. With $k = K_2$ the firm's profits are $\pi = (K_1 + \delta)(w - r) - (w + F)$.

The model predicts that in the case that $F < \delta * (w - r)$ the firm chooses to formalize the workers in order to obtain credit. In other words, we expect to observe formalization when the increases in profitability from a larger capital stock is enough to compensate the firm for the formality premia it will pay. Firms choose to be formal if they can get access to credit (δ is large), if the cost of formalization is low (F is small), or if the productivity of its workers is high relative to the cost of capital ($w - r$ is large).

2.2 Model 2: Credit-Constrained Worker-Entrepreneurs

This model describes the idea that financial slack can 'allow' formal workers to become independent entrepreneurs. In it, formal employment is optimal either for high productivity workers or for low productivity workers that have no access to capital. While it is costly to be formally employed, this cost is offset for high productivity workers by the large capital pool available in formal employment firms. For low productivity workers formal employment is always worse than being an independent worker. However, workers need to accumulate assets or borrow them before they can become independent.

Workers maximize a utility function as follows:

$$U(W) = \begin{cases} (w - F) * K^{dep} + B^{dep} & \text{if he works for a firm (is dependent)} \\ w * K^{ind} + B^{ind} & \text{if he is independent} \end{cases} \quad (2)$$

where w is the workers productivity and F is the cost of being a formal employee. Here K^{dep} is the capital the worker can use as a dependent worker in a formal firm and K^{ind} with $K^{ind} \in \{K_1, K_2\}$ is the capital he has access to as an independent worker. Also, B^{dep} and B^{ind} are the utility, beyond that of consumption, that workers derive from working as a dependent or as an independent.

Assuming a worker has access to more capital within the firm than he would have as an independent ($K^{dep} > K^{ind}$), workers with high productivity are more likely to be formally employed since the formality cost is relatively less important for them. Also a worker that only has access to a small amount of capital as an independent, $K^{ind} = K_1$, is more likely to find it optimal to work as a dependent. However if increased access to capital in an industry allows workers to obtain or rent more capital (through trade credit for example) and lets them choose $K^{ind} = K_2 > K_1$ then it can be optimal for them to become independent.

Assuming the benefits of formal and informal employment are equal we can see that the worker will optimally choose to be dependent if $w > F K^{dep} / (K^{dep} - K^{ind})$

Therefore the model predicts that workers will be formal if K^{ind} is small enough (credit constrained) or if w is high (high productivity workers), and it predicts that workers will be informal if w is very small (productivity below the cost of being formally employed) or if K^i is large enough(credit constraints lifted).

The effects of B^{ind} and B^{dep} can readily be seen: they change the thresholds for w and K^{ind} at which the workers optimally choose to be formally employed or to be independent.

Crucially, the two models predict different effects of financial slackening. The first one predicts firms will accept to formalize in order to obtain credit, increasing overall labor formality. The second one predicts that some entrepreneurs will react by becoming independent entrepreneurs thus decreasing formality.

3 Data and Descriptive Statistics

The following subsections describe the construction of the micro and macro data and present a range of descriptive statistics about these data.⁴

3.1 Data Definitions and Sources

The formality data in this paper comes from Mexico's ENIGH⁵ survey, produced by the INEGI⁶. The main conclusions of the paper are based on the 2000 - 2016 samples. While some data is available from 1989 on, the industry classification changed substantially between 1998 and 2000 and therefore we choose 2000 as the beginning of the sample. We use this survey because it asks detailed questions about employment status, the kind of employment, the industry of employment, the size of the firm, etc.

Independent Workers

An important distinction that has to be made when studying informality is the difference between informal salaried workers and informal entrepreneurs or 'independent workers'. Independent workers are informal in the sense that their economic activity is not registered with the authorities, and they might or might not be illegal in terms of income tax compliance, however, being an unregistered independent worker in itself is not illegal from the point of view of the labor laws. Indeed, many independent workers potentially own large formal firms which are registered and pay taxes. Moreover, the existence of independent workers by itself is not related to the same welfare issues related to informal but salaried work, in the sense that it is unclear how many of them are poor, prone to abuse by their employer. Also, a fraction of these independent workers will be successful entrepreneurs / business owners and therefore they are likely to be relatively well off. These are also likely to purchase health

⁴Source data, processed data, and processing and analysis files (in Stata) are available online at <http://www.tc.umn.edu/santiago/P41-Informality/> or upon request.

⁵Encuesta Nacional de Ingreso y Gasto de los Hogares (National Survey on Households' Income and Expenditure)

⁶Instituto Nacional de Estadística, Geografía e Informática (National Institute for Statistics, Geography and Information Technology)

services or insurance directly and also able to access sophisticated financial services and save for retirement directly.

From the point of view of economic growth, the standard view is that the existence of unregistered independent workers is not an obvious constraint on growth in the same way that informal salaried work. It does not imply that firms are trading off employment informality and size in order to avoid detection and prosecution because there is nothing illegal in being an independent unregistered worker. However, independent employment can also be the extreme case of the size and informality trade-off. Regardless of their compliance with labor laws, large firms have a lot at stake reputationally and legally from breaking any other law. However, independent workers have very little at stake because they own only a small amount of capital and relatedly, because they are unlikely to be the focus of prosecution.

In general, informal employees are difficult to distinguish from independent workers. Unfortunately, this is the case in our data set: there is not a consistent measure of worker independence across the sample. For our purposes we classify workers as independent as follows: for the years 2000-2006 we took the variable “position” which asks workers about their position at work and took “works on his own”, “employer” and “member of a cooperative” as implying the worker is independent; for the years 2008 and 2010 we use the workers self-classification as an “independent worker” as codified in the variable “indep” with 0 for not independent and 1 for independent. According to this classification 26% of employed individuals are independent.

Formality Data

This paper identifies five survey topics that are related to formality: the existence of a signed contract with an employer; the worker’s own job description as salaried or ‘helping out’; the benefits received from the employer; the worker’s union membership; and finally the regularity of labor income (sporadic/irregular vs. regular). The paper focuses on the first three topics for our main analysis since for these topics the information appears to be consistent

over the 2000-2016 period.⁷.

F^{SC}: Fraction of workers with a signed contract

Individuals are asked whether they work with a permanent contract, a temporary contract or whether there is no contract at all. We classify workers as formal if they state that they are under a permanent or a temporary contract under the assumption that workers and employers that expect to be able to use a contract in a court of law, presumably realize they need to have a legal relationship for the contract to be meaningful. Therefore the first measure of informality is the fraction among respondents that answer that they possess jobs in said industry, that also answers they have a signed contract of some kind with their employer during the past year. This variable is potentially biased in that we don't observe the contract signing and therefore workers might be misreporting it, or firms where they work might be simulating the signing of a contract.

F^{DW}: Fraction of workers with well defined wage

Individuals are asked whether their work is in exchange for a wage or whether they are 'helping out' somebody else. The term 'helping out' reflects an informal relationship with their employer. Therefore the second measure is the fraction among respondents that answer that they possess jobs in said industry, that also answers they work for a set wage, as opposed to describing their status as 'helping out'. The potential biases in these variables as a measure of formality are in that defined wage agreements might well be an optimal market outcome regardless of the formality of the relationship and in that sense firms will often set defined wage agreements with their workers regardless of whether they are formal or informal workers. Furthermore, workers might have a formal relationship in which the wage is contingent on productivity or profits. In that case workers might report that they do not have a defined wage as a way to describe such a contingent pay arrangement despite being in a formal employment relationship.

F^{SB}: Fraction of workers with social benefits

Individuals are asked what kinds of benefits they receive from the employers: health insurance, paid

⁷The questions and the coding details in the databases are nevertheless slightly different from year to year. The variable-definition files (in STATA) are available upon request.

vacations, retirement savings, access to sporting facilities, food coupons, etc. Therefore the third measure of formality is the fraction among respondents that answer that they possess jobs in said industry, that also answers positively to any of the work-related social benefit questions. This measure is potentially biased in the sense that workers might not correctly identify the relationship between their rights and their employer. Workers could report that they are receiving social benefits from the employer when in reality these benefits are publicly available as in the case of Seguro Popular.

Table 1 shows that the correlations across these variables are high and most importantly they are stable throughout the sample, a finding consistent with the assumption throughout the paper that the characteristics proxied for by these formality indicators remain constant through time.

Table 1: Correlations Across Formality Indicators Over Time

Panel 1 presents Pearson correlation coefficients for different formality measures across individuals that report being employed. Panel 2 presents Pearson correlation coefficients for different formality measures across NAICS two-digit industry formality averages. The first column reports the pooled sample correlation. columns 2 to 11 represent within year correlations. Data: Authors' computations with INEGI's ENIGH data.

Panel 1: Correlation of Formality Measures Across Workers											
Correlation, Year	2000-2016	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016
F^{SC}, F^{DW}	-	-	-	-	-	-	-	-	-	-	-
F^{SC}, F^{SB}	0.67	0.74	0.75	0.58	0.60	0.61	0.67	0.69	0.67	0.70	0.70
F^{DW}, F^{SB}	-	-	-	-	-	-	-	-	-	-	-
Panel 2: Correlation of Formality Measures Across Industries											
Correlation, Year	2000-2016	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016
F^{SC}, F^{DW}	0.61	0.69	0.71	0.67	0.67	0.61	0.71	0.72	0.64	0.63	0.64
F^{SC}, F^{SB}	0.92	0.96	0.95	0.96	0.91	0.77	0.95	0.94	0.88	0.95	0.96
F^{DW}, F^{SB}	0.68	0.65	0.63	0.70	0.70	0.68	0.84	0.85	0.83	0.79	0.76

Firm Size Data

The ENIGH survey contains information about the total employment of the establishment that an employed individual is working in. The survey asks workers how many other workers work in the same establishment as they do. Depending on the year, the answers are given either directly as a natural number or as within one of the following bins: '0', '1', '2-4', '5-15', '16 or more'. Here we use this information as a measure of the size of the firm. We define four size classes based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and

15; Medium+, 16 or more. These figures give us a distribution across classes that is close to even. Also, they loosely correspond to international standards that typically describe a ‘Micro’ firms as a firm with 10 workers or less and ‘Small’ firms as firms with 50 workers or less. For simplicity, we denote these numbers as referring to *firm size* although they more accurately reflect establishment size in many cases.

Industry and Financial Dependence

As a measure of financial dependence (FD_i) we use the index built for the same purposes by Catao, Pages-Serra and Rosales (2009) (henceforth CPR)⁸. The index constructed in CPR is an extension to the whole economy of the one built by Rajan and Zingales (1998) for manufacturing firms alone.

The index is constructed by computing the average ratio of firm’s external finance as a fraction of their capital expenditures, where external finance consists of capital expenditures net of internal finance. The index is calculated by aggregating external finance for all firms in an industry, and dividing it by the sum of capital expenditures for that industry over several years. The index is meant to convey the ratio of investment that is typically financed from external sources for an industry, as a way to measure the tendency of an industry, potentially because of technological differences in their production processes, or because of the stage of maturity of the industry, to finance investment from external sources. As originally calculated, it is defined over two digit ISIC industries.

In order to assign workers in the ENIGH survey to ISIC industries we use the NAICS assignments contained in the survey. The survey asks employed individuals open questions about the nature of their work and what the entity they work at produces in order to establish which sector of economic activity they are involved in. After the surveys are gathered the answers are codified into NAICS industry codes. To ‘translate’ these codes to ISIC codes we use the correspondence tables available at the UN⁹ to the extent possible. Many of the entries in the ENIGH however are not found in the correspondence tables or in the stan-

⁸We use the revised version of this index, CPR (2011)

⁹Correspondence Tables, UN Classification Registry, UN Statistics Division

standard definitions of the NAICS codes. Of the missing codes, some are instead part of the Household-wise-NAICS created by INEGI for this purpose. We use these to assign some of the workers to ISIC industries manually. Finally, some of the NAICS codes reported by INEGI are not identified in any of the NAICS catalogs. We assign employees in these categories to the ‘closest’ well-defined category in the sense of the immediately preceding code for which we have found a definition¹⁰

Aggregate Financial Slack

We use two kinds of financial slack data. First, we use quantity measures: economy wide aggregates of credit to the private sector. Second, we use price measures: nominal and real interest rates. These data are obtained from the Bank of Mexico.

As a measure of aggregate credit (C) we use two series ‘Total Commercial Bank Credit to the Private Sector’¹¹ and ‘Total Commercial Bank Credit to Firms and Entrepreneurs’¹². In order to measure the impact of credit on the degree of employment formality in the economy this paper focuses on these measures of credit in relation to GDP¹³ which we denote Y_t . In particular the definition of aggregate credit used in the paper is c_t , aggregate credit as fraction of contemporaneous nominal GDP:

$$c_t = C_t/Y_t \quad (3)$$

The price indicators that we use are also obtained from the Bank of Mexico. We use the TIEE91¹⁴ the annualized 91 day inter-bank loan rate, as a nominal interest rate. We then subtract the current year-over-year inflation rate (calculated from the INPC, a Consumer Prices

¹⁰Correspondence tables (in Stata) to assign NAICS based ENIGH industry data to ISIC3-r1 codes are available upon request.

¹¹ SF40859 ‘Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances, Total current portfolio.’

¹² SF40915: ‘Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances in thousands of millions of pesos, Total effective portfolio destined to Enterprises and persons with enterprise activity’

¹³ CR114: ‘Gross Domestic Product, at current prices.’

¹⁴ SF43878 ‘Inter-bank equilibrium interest rate, annual percent, 91 days’

index¹⁵) to obtain a measure of the expected real interest rate.

Industry Level Financial Slack

Finally as in CPR we measure the financial slack FS_{it}^C in an industry i during a given period t as the aggregate financial slack during that period multiplied by the estimated financial dependence of said industry. In other words $FS_{it} = FD_i \cdot c_t$ for the case of credit aggregates and $FS_{it}^I = FD_i \cdot i_t$ for the case of interest rates. Note that we consider an increase in FS^C to be a sign of greater financial slack, while the opposite is true for FS^I for which an increase is a sign of *less* financial slack.

3.2 Descriptive Statistics

This section presents descriptive statistics for the main data used in the analysis. The formality and firm size data by industry consists of pseudo-panels of data, where we have formed industry-year averages for each of the relevant variables. The ENIGH survey *does not* follow individuals over time and therefore we cannot distinguish what has happened to individual workers. Instead we describe what has happened to the average value of each of the variables for each industry. The survey-based descriptive statistics and estimators that we describe are calculated using the expansion factors that accompany the ENIGH database.

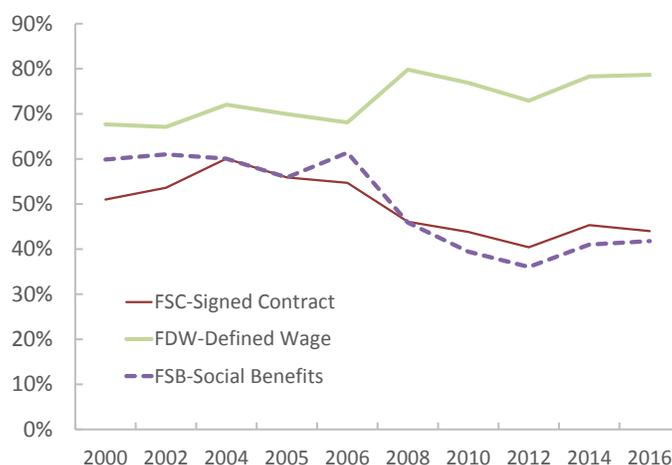
Formality

Figure 1 and table 2 describe the evolution of average formality from 2000 to 2016 according to our three measures. The fraction of formal employment in total employment has had only small variations over this period of time.

According to the F^{SC} measure formality increased from 2000 to 2004 and then declined in 2006, 2010 and 2012, but increased again since then. According to the F^{SB} and the F^{DW} measures formality increased from 2000 to 2004, declined until 2006, increased again until 2008, decreased again in 2010 and went back up after that. Interestingly although two

¹⁵ *SPI 'Consumer Price Index, National*

Figure 1: Formality Indicators



This figure describes the fraction of employment that is formal employment according to our three measures of formality: The first series represents the variable ‘Signed Contract’: the fraction of employed individuals answering that they have signed a contract with their employer. The second series represents the variable ‘Defined Wage’: the fraction of employed individuals answering that they are paid for their work rather than helping out at somebody’s business. The third series represents the variable ‘Social Benefits’: the fraction of employed individuals that have access to social benefits as a result of their employment. Data: Authors’ computations with INEGI’s ENIGH data.

thirds of employed people report a fixed wage, reflecting a well defined contractual-type relationship with their employers, only 30% to 40% of employed individuals report having signed a contract. Similarly only between 30% and 40% of workers report having any social benefits despite the fact that formal labor in Mexico is entitled to a set of social benefits.

Table 2 also presents formality grouped by the reported size of the firm. As expected, the degree of formality is closely linked to the size of the firm: Almost all workers working in establishments with 16 or more employees have a defined wage, while only 30% of those working for firms where they are the single employee or one of two employees have a defined wage. A similar range is in display across firm sizes for the other two formality measures.

Table 3 presents the same data but for different industries, averaged over the whole sample. It shows that according to the benefits measure, the private industries with the highest fraction of formal employment are utilities, mineral extraction, finance and education. These

Table 2: Formality by Firm Size Classes and Firm Size Composition of the Sample, over time

This table presents the fraction of employment that is formal employment according to our three measures of formality. F^{SC} is the fraction of employed individuals answering that they have signed a contract with their employer. F^{DW} is the fraction of employed individuals answering that they receive a defined wage for their work rather than ‘helping’ at somebody’s business. F^{SB} is the fraction of employed individuals that have access to social benefits as a result of their employment. Economy-wide average formality corresponds to the sample periods 2000-2016. The firm size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, 16 or larger. In this table there is no distinction between dependent and independent workers. Data: Authors’ computations with INEGI’s ENIGH data.

Size	Year										Average
	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016	
F^{SC} : Signed Contract											
Medium+	0.81	0.78	0.84	0.80	0.80	0.76	0.76	0.73	0.76	0.76	0.78
Small	0.44	0.44	0.56	0.52	0.52	0.44	0.44	0.41	0.45	0.42	0.46
Micro	0.16	0.18	0.29	0.29	0.26	0.15	0.14	0.13	0.15	0.14	0.19
Tiny	0.09	0.08	0.19	0.13	0.14	0.04	0.06	0.06	0.05	0.06	0.09
Average	0.51	0.45	0.60	0.56	0.55	0.45	0.43	0.40	0.44	0.43	0.48
F^{DW} : Defined Wage											
Medium+	0.99	0.99	0.98	0.99	0.98	0.99	0.99	0.99	1.00	1.00	0.99
Small	0.89	0.90	0.90	0.90	0.89	0.95	0.95	0.94	0.96	0.95	0.92
Micro	0.56	0.55	0.62	0.59	0.57	0.77	0.74	0.71	0.75	0.76	0.66
Tiny	0.21	0.23	0.28	0.22	0.24	0.31	0.31	0.28	0.33	0.34	0.28
Average	0.68	0.62	0.72	0.70	0.68	0.79	0.76	0.73	0.78	0.78	0.72
F^{SB} : Social Benefits											
Medium+	0.86	0.85	0.85	0.82	0.85	0.86	0.82	0.81	0.83	0.84	0.84
Small	0.57	0.57	0.59	0.53	0.63	0.57	0.55	0.50	0.55	0.54	0.56
Micro	0.27	0.27	0.29	0.26	0.32	0.21	0.17	0.16	0.17	0.18	0.23
Tiny	0.19	0.15	0.15	0.11	0.21	0.07	0.06	0.06	0.05	0.07	0.11
Average	0.60	0.54	0.60	0.56	0.61	0.45	0.38	0.36	0.40	0.41	0.49
Employed Workers by Size of Firm											
Medium+	35 %	25 %	36 %	35 %	34 %	30 %	29 %	26 %	31 %	30 %	31 %
Small	15 %	14 %	14 %	16 %	13 %	17 %	17 %	17 %	16 %	16 %	16 %
Micro	32 %	38 %	30 %	32 %	33 %	36 %	36 %	37 %	34 %	35 %	34 %
Tiny	18 %	23 %	20 %	18 %	20 %	17 %	18 %	19 %	18 %	19 %	19 %

figures are consistent with casual intuition about industries dominated by large enterprises that will necessarily be part of the formal economy and will be hiring their employees formally. The industries with the lowest formality are household employment as well as fishing and agriculture, again consistent with casual intuition that firms or individuals providing personal services and small rural enterprises are unlikely to formalize.

Table 4 describes formality as a function of different demographic characteristics. The first set of columns focus on the whole sample of employed individuals, the second set focuses only on those workers that are employed but not independent.

The first two rows in each panel describe formality across the worker’s gender. F^{SC} and F^{SB} are virtually identical for men and women in the sample, however F^{DW} is not, suggesting that women are more likely to be working without a defined wage. A potential

Table 3: Fraction of Formal Employment by Industry

This table presents the fraction of employment that is formal employment according to our three measures of formality. F^{SC} is the fraction of employed individuals answering that they have signed a contract with their employer. F^{DW} is the fraction of employed individuals answering that they receive a defined wage for their work rather than ‘helping’ at somebody’s business. F^{SB} is the fraction of employed individuals that have access to social benefits as a result of their employment. Economy-wide average formality corresponds to the sample periods 2000-2016. Industries correspond to the one digit ISIC3r1 definition. Assignment of workers to industries is described in section 3.1. In this table there is no distinction between independent and non-independent workers. Data: Authors’ computations with INEGI’s ENIGH data.

Industry	F^{SC}	F^{DW}	F^{SB}	% of the Sample
A- Agriculture, hunting and forestry	0.15	0.54	0.13	15.12
B- Fishing	0.16	0.52	0.17	0.42
C- Mining and quarrying	0.81	0.96	0.86	0.64
D- Manufacturing	0.63	0.81	0.63	17.03
E- Electricity, gas and water supply	0.86	0.99	0.90	0.49
F- Construction	0.23	0.87	0.29	8.76
G- Wholesale and retail trade; vehicle repair	0.45	0.63	0.40	19.06
H- Hotels and restaurants	0.35	0.68	0.36	7.1
I- Transport, storage and communications	0.44	0.84	0.48	4.45
J- Financial intermediation	0.86	0.97	0.85	0.82
K- Real estate, renting and business activities	0.59	0.76	0.56	5.6
L- Public administration, defence, social security	0.84	1.00	0.88	4.77
M- Education	0.87	0.98	0.86	5.44
N- Health and social work	0.79	0.87	0.75	2.95
O- Community, social and service activities	0.38	0.67	0.34	2.74
P- Household employment and production	0.04	0.96	0.20	4.63
Average	0.48	0.75	0.47	
Total				100

explanation for this is that women are more often working as sales clerks under a contract that allows for sales commissions and this makes them informal workers despite having a steady employment.

The next set of rows describes formality across age groups. Age-based sub-samples provide a very good tool to analyze the data in the sense that age is not chosen by individuals, but is completely exogenous. The data on the first three columns suggests that very early in a workers life some workers move from formal to informal employment. That is, in contrast to what model 1 above predicts individuals do not formalize as their productivity increases with experience. Instead, workers de-formalize as their productivity increases with experience. This table is suggestive of a formality model such as model 2 above where workers leave formal employment when they can. The relationship with age can be interpreted as saying that this happens either because they’ve accumulated capital on their own or because they have enough experience to be independent workers or when both conditions are met. Columns 4-6 confirm this view in the sense that they show that the age-wise pattern is weaker when we

Table 4: Formality Status of Workers, by Demographic Characteristic

This table describes the average demographic characteristics of the workers described as formal according to our three definitions or classified as informal according to the three of them. F^{SC} is the fraction of employed individuals answering that they have signed a contract with their employer. F^{DW} is the fraction of employed individuals answering that they receive a defined wage for their work rather than ‘helping’ at somebody’s business. F^{SB} is the fraction of employed individuals that have access to social benefits as a result of their employment. Economy-wide average formality corresponds to the sample periods 2000-2016. Columns 1-3 describe the results for the whole sample, Columns 4-6 describe the results for the non-independent workers alone. Data: Authors’ computations with INEGI’s ENIGH data.

Variable	Benchmark Sample			Non-Independent Sample		
	F^{SC}	F^{DW}	F^{SB}	F^{SC}	F^{DW}	F^{SB}
Gender						
Female	0.36	0.65	0.40	0.51	0.94	0.58
Male	0.36	0.74	0.41	0.48	0.97	0.53
Age Group						
15-25	0.33	0.81	0.38	0.39	0.93	0.44
26-35	0.42	0.76	0.48	0.54	0.97	0.61
36-45	0.38	0.69	0.43	0.55	0.97	0.61
46-55	0.33	0.60	0.37	0.53	0.97	0.59
56-65	0.21	0.47	0.24	0.42	0.95	0.48
Education						
Elementary (or less)	0.17	0.60	0.22	0.28	0.95	0.35
High School (or less)	0.41	0.76	0.46	0.51	0.96	0.58
More than High School	0.62	0.79	0.65	0.77	0.98	0.80
Location						
Rural	0.15	0.55	0.18	0.25	0.91	0.29
Urban	0.41	0.74	0.47	0.54	0.97	0.60
Average	0.36	0.70	0.41	0.49	0.96	0.55

eliminate workers classified as independent from the sample.

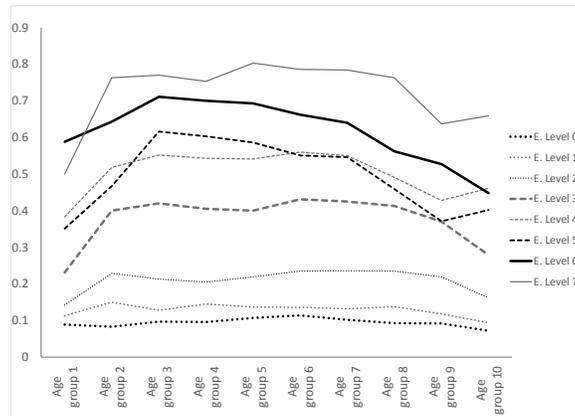
The third set of rows split the data by education and show that as expected more educated workers are more likely to be formal. Both the full sample and the non-independent worker sample show a substantial fraction of the individuals with schooling, those that have at least finished high-school, in the informal sector. This is also suggestive of a model where formal employment is not unambiguously better for workers.

Finally, the fourth set of rows are consistent with our intuition about the employment formality of agricultural workers: workers in urban settings are more likely to be formal workers.

The last figure of descriptive statistics is figure 2. It characterizes formality across education and age jointly in order to explore the support for model 1 or model 2 with these variables. It shows that formality first increases and then decreases with age for all education groups. This is an important fact in terms of distinguishing between the two models posed above. The fact that more experienced workers appear to drop out of the formal workforce

suggests that to some extent workers in the informal sector could have jobs in the formal sector but decide not to. This in turn implies that informal work is to some workers more desirable than formal work, corresponding to model 2 above.

Figure 2: Descriptive Statistics: Formality by Age and Education, F^{SC}



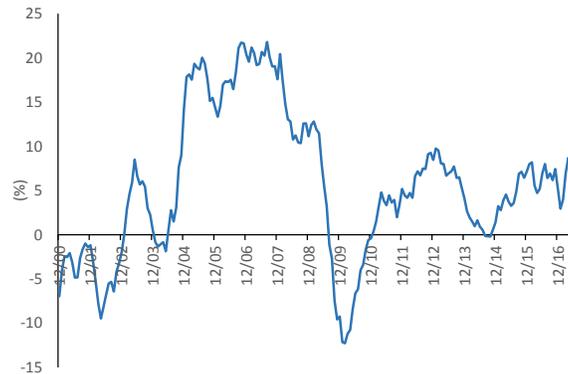
This figure presents the fraction of employment that is formal employment according to our three measures of formality, but for different levels of education and for different ages. Education groups numbers correspond to formal education level achieved: 0: No elementary ; 1: Incomplete Elementary; 2:Elementary; 3:Incomplete Secondary; 4:Secondary; 5:Incomplete Higher; 6:Higher; 7:Post-Graduate;. Age groups correspond to 1:age<=20; 2:20< age <=25; 3:25< age <=30; 4:30< age <=35; 5:35< age <=40; 6:40< age <=45; 7:45< age <=50; 8:50< age <=55; 9:55< age <=60; 10:60< age <=65. In this table there is no distinction between independent and non-independent workers. Data: Authors' computations with INEGI's ENIGH data.

Among others, two salient alternative explanations for the pattern presented above are, first, that workers lose their strength to work as they age and, second, that there are older cohorts of firms and employees that have on average less employment than recently formed ones. However, the fact that for every education group formality starts declining between the groups 3(30 to 35) and 4(35 to 40), which is typically thought to be a period well within the prime age of a workers life, and yet where experience has already been accumulated, suggests that it is not declining strength or ability that explains the age-formality pattern. Also the fact that the level of formality within education groups is relatively constant compared to the variation across groups, and the fact that the formality of the first few age groups is low suggests that it is not a cohort effect that causes the age/formality pattern.

Aggregate Credit

Figures 3 and 4 describe the credit to the private sector as a fraction of GDP. They show that after stagnating from 2000 to 2004, credit grew at a large average rate of about 6% from 2005 to 2016, consistent with the experience of other countries over this same period of time. Despite the high growth rate, the maximum level as a fraction of GDP was only 15% of GDP, which is small relative to corresponding figures for Brazil for example which reached levels of about 35% (Credit to the Private Sector) and of 22% (Credit to Private Firms) by 2008.

Figure 3: Rate of Growth of Commercial Bank Credit to the Private Sector

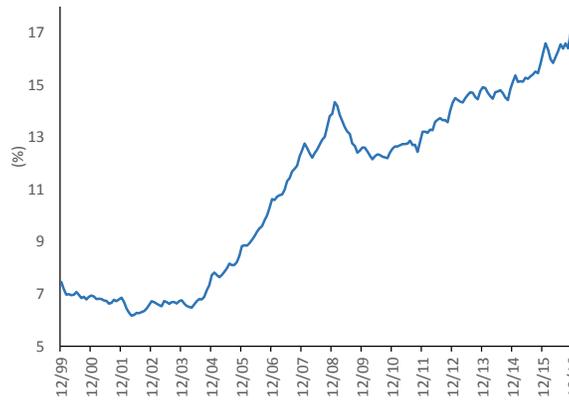


Year over year rate of growth of total credit to the private sector from commercial banks as a fraction of contemporaneous (to the trimester) nominal GDP. As a measure of credit we used series SF40859: 'Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances, Total current portfolio.' For GDP we used series CR114: 'Gross Domestic Product, at current prices.' Data: Bank of Mexico.

Figures 6 and 5 describe an alternative measure of credit, credit to entrepreneurs and businesses as a fraction of GDP, as well as the evolution of its growth rate. They show that this type of credit followed a similar pattern to that of total credit to the private sector.

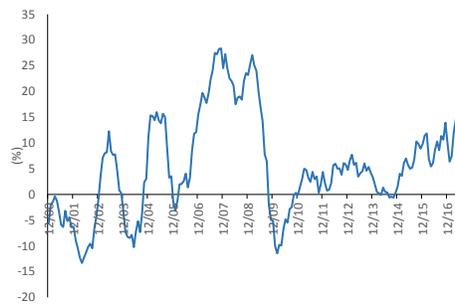
Finally, figure 7 describes an alternative measure of the availability of credit: short term interest rates.

Figure 4: Commercial Bank Credit to the Private Sector as a Fraction of GDP



Total credit to the private sector from commercial banks as a fraction of contemporaneous (to the trimester) nominal GDP. As a measure of credit we used series SF40859: 'Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances, Total current portfolio.' For GDP we used series CR114: 'Gross Domestic Product, at current prices.' Data: Bank of Mexico.

Figure 5: Rate of Growth of Commercial Bank Credit to Corporations and Entrepreneurs



Year over year rate of growth of total credit to corporations and entrepreneurs from commercial banks as a fraction of contemporaneous (to the trimester) nominal GDP. As a measure of credit we used series SF40915: 'Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances, Total current portfolio.' For GDP we used series CR114: 'Gross Domestic Product, at current prices.'

Figure 6: Commercial Bank Credit to Corporations and Entrepreneurs as a Fraction of GDP



Total credit to corporations and entrepreneurs from commercial banks as a fraction of contemporaneous (to the trimester) nominal GDP. As a measure of credit we used series SF40915: 'Portfolio of total effective credit granted by the commercial bank, to the private sector, Nominal balances, Total current portfolio.' For GDP we used series CR114: 'Gross Domestic Product, at current prices.' Data: Bank of Mexico.

Figure 7: Level of Short Term Interest Rates

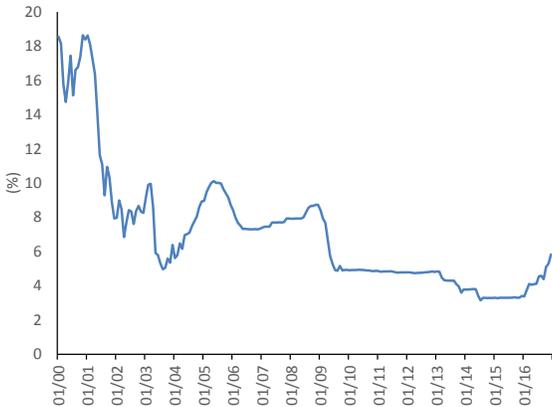


Figure represents weekly, end of period data on the one month inter-bank equilibrium rate or TIEE in pesos from January 2000 to December 2016. Data is from Bank of Mexico's Money Market Statistics & IDC ONLINE.

4 Regression Analysis

We follow CPR in performing statistical analysis on the data by testing whether there is evidence of a relationship between the evolution of formality in each industry and the amount of financial slack it faces. From this point on we concentrate on two definitions of formality alone, F^{SB} and F^{SC} .

4.1 Estimation of a Linear Relationship Between Formality and Finance

The second analysis we perform is to estimate panel data regressions over the sample on our three formality measures. We test whether there is a statistical relationship between formality and our measure of financial deepening. First we look at whether, within industries, the deepness of financial markets is related to an industry's formality.

The panel regressions correspond to an estimation of the following equation:

$$F_t^I = \beta_0 + \sum_t d_t \delta_t + \sum_I d^I \delta^I + \gamma(FD_t^I) + \epsilon_t^I \quad (4)$$

where F_t^I corresponds to one of the measures of formality, the terms d^I and d_t correspond to time and industry dummies, the terms δ^I and δ_t correspond to the coefficients on these time and industry dummies, FD_t^I is a financial slack measure and γ represents the coefficient on financial slack that is the focus of this section.

Tables 5 through 6 describe the main results of this paper. These tables describe a heterogeneous effect of financial deepening on formality. For the three measures of formality and for the two measures of aggregate financial slack, the regression results suggest a significant negative relationship between these two variables. However, although the results are not statistically significant, we find a positive effect of finance on formalization for medium firms using either credit measures or interest rate measures.

Table 5: Coefficients on Industry-Level Financial Slack, Credit Measures

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. P values in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

Credit to the Private Sector					
Definition	All	Tiny	Micro	Small	Medium+
F^{SC} : Signed Contract	-0.074** (-0.04)	-0.021 (-0.88)	-0.018 (-0.77)	-0.165** (-0.03)	-0.073 (-0.12)
F^{DW} : Defined Wage	-0.033 (-0.3)	-0.277 (-0.11)	-0.077 (-0.32)	0.008 (-0.87)	0.023 (-0.28)
F^{SB} : Social Benefits	-0.105*** (0)	-0.132 (-0.31)	-0.096 (-0.14)	-0.079 (-0.32)	-0.127*** (0)
Groups	209	36	43	44	48
Obs	1439	246	327	346	423
Credit to Firms and Entrepreneurs					
Definition	All	Tiny	Micro	Small	Medium+
F^{SC} : Signed Contract	-0.153** (-0.03)	-0.048 (-0.85)	-0.073 (-0.54)	-0.300** (-0.05)	-0.151 (-0.11)
F^{DW} : Defined Wage	-0.064 (-0.29)	-0.416 (-0.23)	-0.182 (-0.22)	0.031 (-0.76)	0.04 (-0.35)
F^{SB} : Social Benefits	-0.193*** (0)	-0.261 (-0.31)	-0.171 (-0.17)	-0.132 (-0.4)	-0.250*** (0)
Groups	209	36	43	44	48
Obs	1439	246	327	346	423

Table 6: Coefficients on Industry-Level Financial Slack, Interest Rates

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. P values in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

Real Interest Rates					
Definition	All	Tiny	Micro	Small	Medium+
F^{SC} : Signed Contract	0.078 (0.13)	0.171 (0.38)	-0.005 (0.96)	0.151 (0.23)	0.100* (0.1)
F^{DW} : Defined Wage	0.021 (0.65)	0.519** (0.04)	0.073 (0.55)	-0.049 (0.56)	-0.012 (0.67)
F^{SB} : Social Benefits	0.134*** (0.01)	0.204 (0.28)	0.093 (0.37)	0.024 (0.85)	0.207*** (0)
Groups	209	36	43	44	48
Obs	1439	246	327	346	423
Nominal Interest Rates					
Definition	All	Tiny	Micro	Small	Medium+
F^{SC} : Signed Contract	0.046 (0.19)	0.13 (0.3)	0.004 (0.96)	0.103 (0.27)	0.049 (0.21)
F^{DW} : Defined Wage	0.015 (0.64)	0.370** (0.03)	0.029 (0.75)	-0.008 (0.9)	-0.01 (0.56)
F^{SB} : Social Benefits	0.094*** (0.01)	0.136 (0.27)	0.095 (0.23)	0.048 (0.62)	0.112*** (0)
Groups	209	36	43	44	48
Obs	1439	246	327	346	423

4.2 Conditional Results

The large sample of data as well as the many demographic characteristics let us analyze the patterns in the data conditioning along several dimensions. In this section we discuss the results of estimating the models described above but focusing on different subsets of the sample, across gender, age and education.

Table 7: Conditional Regression Coefficients, Credit Measures, F^{SC}

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. P values in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium+
ALL	-0.074** (-0.04)	-0.021 (-0.88)	-0.018 (-0.77)	-0.165** (-0.03)	-0.073 (-0.12)
Male	0.025 (0.64)	-0.018 (0.92)	0.232 (0.04)	0.073 (0.57)	-0.097 (0.13)
Female	0.090 (0.23)	-0.385 (0.31)	0.426 (0.04)	0.297 (0.30)	0.046 (0.56)
Urban	-0.037 (0.38)	-0.219 (0.21)	0.078 (0.36)	-0.189 (0.05)	-0.025 (0.64)
Rural	-0.065 (0.60)	0.074 (0.76)	-0.124 (0.52)	-0.584 (0.19)	0.132 (0.54)
Elementary Only	0.105 (0.26)	-0.005 (0.98)	0.095 (0.57)	0.080 (0.76)	0.095 (0.53)
Highschool	0.052 (0.39)	0.132 (0.57)	0.320 (0.01)	-0.156 (0.31)	0.014 (0.85)
More than HS	-0.025 (0.72)	-0.501 (0.09)	0.281 (0.14)	-0.145 (0.40)	-0.018 (0.78)
15 to 25	0.199 (0.01)	0.018 (0.95)	0.597 (0.00)	0.095 (0.62)	0.130 (0.18)
25 o 35	0.043 (0.53)	-0.056 (0.82)	0.172 (0.32)	0.049 (0.79)	0.021 (0.80)
35 to 45	-0.156 (0.04)	-0.090 (0.75)	-0.041 (0.83)	-0.097 (0.72)	-0.176 (0.02)
45 to 55	-0.072 (0.45)	0.049 (0.85)	-0.347 (0.11)	-0.306 (0.47)	0.030 (0.79)
55 to 65	0.316 (0.09)	-0.172 (0.52)	0.304 (0.31)	1.824 (0.02)	0.126 (0.74)

Tables 7 through 8 show these results. For both the F^{SC} and the F^{SB} measures, financial slackening, calculated with credit measures, has differential formalizing effects on the population. In general, most coefficients are consistent with an interpretation where financial slackening is related to increased formality among young workers and lower formality among older workers, increase formality among workers with elementary level education, but decreased formality with those with more education, and increased formality across women, but decreased formality among men. The appendix contains similar sets of tables for the

Table 8: Conditional Regression Coefficients, Credit Measures, F^{SB}
 Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. P values in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium+
All	-0.105*** (0)	-0.132 (-0.31)	-0.096 (-0.14)	-0.079 (-0.32)	-0.127*** (0)
Male	-0.072 (0.19)	-0.095 (0.56)	0.047 (0.68)	0.096 (0.49)	-0.189 (0.01)
Female	0.064 (0.40)	-0.390 (0.29)	0.145 (0.55)	0.420 (0.15)	0.020 (0.79)
Urban	-0.068 (0.11)	-0.276 (0.09)	0.060 (0.50)	-0.057 (0.55)	-0.118 (0.03)
Rural	-0.034 (0.79)	0.019 (0.92)	-0.381 (0.08)	0.370 (0.45)	0.054 (0.80)
Elementary Only	0.254 (0.01)	0.018 (0.91)	-0.079 (0.65)	0.183 (0.55)	0.491 (0.00)
Highschool	-0.020 (0.73)	-0.098 (0.66)	0.227 (0.07)	-0.126 (0.43)	-0.060 (0.37)
More than HS	-0.086 (0.22)	-0.483 (0.08)	-0.116 (0.56)	-0.052 (0.78)	-0.084 (0.26)
15 to 25	0.175 (0.02)	-0.237 (0.31)	0.548 (0.00)	0.460 (0.05)	0.006 (0.95)
25 o 35	-0.030 (0.67)	-0.137 (0.55)	-0.007 (0.97)	0.061 (0.78)	-0.062 (0.42)
35 to 45	-0.127 (0.08)	-0.113 (0.66)	-0.143 (0.42)	0.188 (0.51)	-0.160 (0.04)
45 to 55	-0.061 (0.52)	-0.155 (0.51)	-0.096 (0.69)	-0.038 (0.93)	-0.013 (0.90)
55 to 65	0.112 (0.53)	-0.116 (0.63)	0.012 (0.97)	0.467 (0.49)	0.135 (0.76)

other aggregate credit measures.

These results are consistent with heterogeneity across workers. The behavior of younger workers is as in CPR, and consistent with model 1: more financial slack increases formality. However, the behavior of older, more experienced workers, seems to be closer to the predictions of model 2 above: higher financial slack in an industry allows workers that are experienced enough or have enough capital to become independent. This seems to be the dominant effect on the full sample. Although there is a positive effect higher financial availability on formality, this effect is mostly true for young, uneducated workers and for women.

4.3 Robustness Results

Tables 9 thorough 12 describe the results of alternative empirical specifications of the most significant results shown above. Each table focuses on a measure of formality and a measure

Table 9: Robustness tests, F^{SB} , Commercial Bank Credit to Firms and Entrepreneurs

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. One two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium +
Whole Sample	-0.193***	-0.261	-0.171	-0.132	-0.250***
No Independent Workers	-0.14	0.43	0.025	-0.06	-0.27**
No Agricultural Workers	-0.14	0.49	0.032	-0.046	-0.27**
Logistic Regression	-1.62	-13.98*	-0.71	-1.01	0.92
{-1, +1} Transform of R&Z Index	-0.12	-0.29	-0.079	-0.003	-0.22*

of financial slack. Each table contains five different specifications. The first specification is one where we use the whole sample as in the rest of the paper. The second specification is one where we limit the sample to non-independent workers. Consideration of non-independent workers only is essential to interpret our results as those of informal laborers versus those of workers that have become independent and have their own small business. Informal laborers are those that do the same type of jobs than formal ones, but without being officially registered. Independent workers manage their own small firm, becoming contractors for example. In the third specification we limit the sample to non-agricultural and non-independent workers. In the fourth we instead estimate the regressions as ‘Logit’ regressions which is consistent with the bounded nature of the formality variable. In other words we transform the fraction of formal employees variables from a $[0, 1]$ range to a $(-\infty, \infty)$ range so that they are amenable to regression analysis with normally distributed errors. In the fifth specification we use the Rajan and Zingales (R&Z) index as a directional indicator only by substituting it with -1 or +1 when it's original value is below or above the weighted average of the index itself.

The results across all specifications are broadly equivalent to those described above. While there is some loss of significance, particularly for the transformed R&Z index specification, it is still the case that the relationship between formality and aggregate credit is negative and significant for some of the individual firm size groups, specially for “Small” and for “Medium and larger” firms. This is true for example for Small firms for the case of the Social Benefits measure when using aggregate credit as an indicator of financial slack.

Table 10: Robustness tests, F^{SB} , Commercial Bank Credit to the Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. One two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium +
Whole Sample	-0.105***	-0.132	-0.096	-0.079	-0.127***
No Independent Workers	-0.092*	0.35	-0.021	-0.039	-0.15***
No Agricultural Workers	-0.083*	0.39	9.019	-0.29	-0.15***
Logistic Regression	-2.98	-28.73*	-1.52	-1.72	-1.33
{-1, +1} Transform of R&Z Index	-0.06	-0.157	-0.046	0.006	-0.105*

Table 11: Robustness tests, F^{SC} , Real Interest Rate

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. One two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium +
Whole Sample	0.078	0.171	-0.005	0.151	0.100*
No Independent Workers	0.03	-0.57	-0.094	0.14	0.04
No Agricultural Workers	0.32	-0.82	-0.07	0.13	0.003
Logistic Regression	3.75	30.45*	2.59	3.85	1.78
{-1, +1} Transform of R&Z Index	0.080	0.20	-0.27	0.20	0.25*

Table 12: Robustness tests, F^{SC} , Nominal Interest Rate

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. One two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively.

	All	Tiny	Micro	Small	Medium +
Whole Sample	0.046	0.13	0.004	0.103	0.049
No Independent Workers	0.00	-0.058	-0.069	-0.05	-0.008
No Agricultural Workers	-0.019	-0.97	-0.05	-0.45	0.04
Logistic Regression	2.74	25.36*	1.78	2.30	1.01
{-1, +1} Transform of R&Z Index	0.049	0.17	-0.11	0.098	0.098

The relationship between interest rates and the signed contract measure of formality also follows the same patterns in each of the different specifications, whether one uses the nominal or the real interest rate. In contrast to the analysis with credit aggregates and social benefits, tables 11 and 12 show that it's the employment in Medium and larger firms that shows a positive relationship between formality and interest rates. The coefficients for tiny firms also reflect the same pattern described before: a mostly positive effect of credit aggregates on formality and a mostly negative effect of interest rates on formality, however individual coefficients are not statistically significant.

5 What Explains the Puzzle?

The contrasting results for Mexico and other Latin American countries over 2000-2010 are somewhat puzzling. While there was a credit boom in all of them, in Mexico the average formality of employment did not change very much. In fact according to some measures, it decreased from 2005-2010. Also, employment in firms in more financially dependent sectors seem to have become *less* formal in relative terms instead of more formal in response to increasing credit and falling interest rates. Although the existence of some sectors of the population that behave according to model #2 as described earlier, it does not explain why Mexico is different than other LatAm countries. Some potential explanations for the different overall trends are the following ones:

5.1 Effects of Seguro Popular

The predominant topic in the recent literature about formality in Mexico has to do with the effects of the introduction and expansion of the Seguro Popular social protection program. In contrast to the traditional social security program provided by IMSS, the Seguro Popular is not linked to employment and is available (at means-tested rates) for anybody without access to IMSS. The argument is that existence of this program reduces the incentive for individuals to formalize. In a context of large taxation inequality, where formal employees/employers pay large IMSS related contributions on top of general labor income taxes, the program is seen by some as promoting informality. In particular Santiago Levy has argued that the introduction of Seguro Popular program has made it harder for the poorest Mexicans to escape poverty despite the continued existence of the anti-poverty program “Progres-Oportunidades” because it makes it very costly for any medium-skilled workers to join the formal labor force. However, there is controversy on the extent to which this is happening: Aterido, Hallward and Pagés (2008) find Seguro Popular has led to a small reduction in the formality of employment of between 0.4 and 0.7 percentage points of the labor force, Campos-Vazquez and Knox (2009) find no effect on formality in their sample which is restricted to the two lowest deciles of income of the population, Barros (2008) finds no significant effect on formality, or

on wages and Aguilera (2010) finds no effect on formality or on the probability of joining or leaving the formal workforce. Duval Hernandez and Smith Ramirez (2011) also find a relatively small effect, despite assuming that the markets are segmented and distinguishing effects on formality from effects on formal job search. On the other hand Bosch and Campos-Vazquez(2014) find a larger effect, estimating that from 2002 to 2009 up to 4% more firms would have formalized their employment relationships without the introduction of the Seguro Popular.

The introduction and expansion of Seguro Popular could help explain the lower overall trend in employment formalization in Mexico compared to other Latin American countries. However, it does not explain why employment in the more financial dependent sectors seems to have become relatively less formal as the documented credit expansion took place.

5.2 Significance of Credit Boom

While Mexico did have a credit boom in terms of rates of growth of credit, the overall level of credit in Mexico is very low and therefore the credit boom has been less significant as a fraction of the total economy. Total credit in Mexico is calculated to be around 27% of GDP, smaller than that for Chile, (71%), Brazil (45%), Colombia (35%) and other Latin American countries, although not very different from that of Argentina (23.5%) or Uruguay (26.5%).

Similarly, the credit expansion documented above is a private credit expansion. A potential explanation for the puzzle is that public sources of credit, closely associated with the credit boom in Brazil for example, behaved differently than overall credit. Indeed, public credit is calculated to be about 40% of total credit and therefore its behavior is very important for total credit. However, while the expansion in private bank credit and that in public bank or development bank credit are not strongly correlated over time, it turns out that the trend during the period 2000 to 2010 is similar across both credit types. Therefore, plugging in private credit or public credit indicators in the calculations above should not make a difference.

5.3 Costs of Formalization

One potential explanation for the lack of a positive effect of financial slack on worker formality for the case of Mexico could be the finding that the costs of formalization are particularly large in Mexico. If that is the case then we wouldn't expect small changes in financial slack to generate a change in formality. This idea does not explain why we find a *negative* coefficient on financial slack for the case of Mexico for some types of firms and individuals, but it would explain a different behavior than that of other countries.

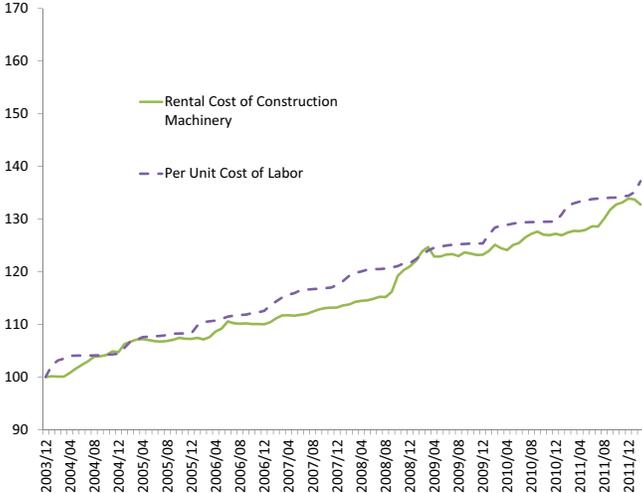
There are some important costs for firms in going from an informal employer to a formal employer. Among these, for example, is registration of the physical location where work is performed. As described by Levy (2008) this implies either obtaining a license as a small business or registering the firm's property altogether with the National Property Registry. There are also ongoing costs of being formal: social security contributions by workers and firms are large as a fraction of the wage (around 20%) and, assuming firms that are registered as formal employees will have a harder time avoiding the fiscal authority, it also implies higher corporate income taxes. Moreover labor protection laws are stringent in the sense of requiring vacations, severance pay, profit sharing, among other things which could increase direct labor costs or expected labor litigation costs.

5.4 Capital-Labor Substitution

One possible channel for interaction between labor formalization and financial slack is that of the substitution of labor for capital. If relaxation of financial constraints allows firms to substitute labor for capital then industries that are more financially constrained will see employment affected negatively. This could in turn affect the formality of employment by turning the previously formal workers into informal workers within the same industry, as they move to temporary, non-contractual work, or try self-employment. Additionally, the change in financial availability observed through the 2000-2010 period can be interpreted as a decrease in the rental cost of financial capital. Here we test whether there is evidence of a change in the rental cost of capital by looking directly at the price index for the rental cost of

machinery for construction and contrasting it with the price index for unit labor costs in the construction industry. Figure 8 describes these indexes from 2003- 2011. Unfortunately the evolution of these indexes does not support the capital-labor substitution hypothesis because the two are closely aligned.

Figure 8: Price Indexes of Rental Cost of Machinery and Unit Cost of Labor in the Construction Industry



This figure describes the evolution of two price indexes in the residential construction industry at a national level: a) the rental cost of construction machinery and b) the cost of labor. Both are available from INEGI, since 2003.

In contrast to other Latin-American countries, México did not experience an important real exchange rate appreciation over the 2000-2010 period. This suggests instead that, perhaps, the increase in financial slack interacts with the lower cost of capital goods in Brazil to generate the formalization observed there. Indeed, according to model #1 described earlier, the incentive to formalize and get access to credit is further magnified if the cost of capital goods has declined. Furthermore the increase in labor productivity from the added capital would make the tax-costs of formal labor smaller relative to the total surplus generated by the worker-firm relationship.

5.5 Non-Formalizing Credit Arrangements and Micro-Credit

Another potential explanation for the different results is in the fraction of the credit expansion in Mexico that has happened through channels where the link to formality is less stringent, such as consumer credit or micro-credit. Mexico has indeed been a success story for micro-credit over the period 2000-2010. The for-profit and publicly-listed “Compartamos Bank” is one of the largest and most profitable micro-credit institutions in the world with about 1 million borrowers in Mexico in 2011. The overall penetration of micro-credit in Mexico is also relatively large at 22.6% (measured as the number of micro credit clients as a fraction of the employed population that reports to be working on their own or to be owners of their businesses)¹⁶, while Brazil has a penetration of only 5%, Argentina has one of 0.6%, Uruguay’s is 2.3% and Colombia’s is 16.0%. Perú also boasts a high penetration level of 28.8% of the independent worker population. A comparison across countries of the number of micro-credit loans as a fraction of the total population produces equivalent contrasts.

¹⁶Pedroza, 2010

6 Conclusion

An important policy problem in developing economies is labor informality. It is possible that this problem is in part related to the low financial development of developing economies. In this paper we have tried to examine the relationship between changes in the availability of financial resources and changes in labor formality.

We have found that, for the case of Mexico, there is formalization effect of financial slack on young workers. The results for younger workers are consistent with what we call model 1, that there are firms that would rather be formal and have higher capital levels, making their workers more productive, if only they could finance their capital cheaply. Thus, financial slackening moves some firms into formality. This empirical result is also consistent with the findings for Brasil by Catao, Pages and Rosales (2009). However, the paper finds heterogeneous effect of financial development on formality across ages and education levels for workers. The evidence suggests that older workers and educated workers in the most finance dependent sectors of the economy formalize *less* than those in the least financial dependent ones, when there is a credit boom. The results for older workers are consistent with what we call model 2, a which describes a financing-for-entrepreneurship type of channel. In that model there are some formal, experienced workers that would rather become entrepreneurs, and would do so if they got enough capital to become independent. In that model financial slackening moves some of these workers to become entrepreneurs, albeit informal ones. More generally these results are consistent with the self employment by choice theories of Maloney (2004), Yamada (1996), Dabla-Norris et al. (2008) and with the interpretation given by Gasparini and Tornarolli (2009) to their data.

The findings above are robust to different sub-periods and different methods of estimation, as well as to different indicators of aggregate credit slackness. When we split the sample across gender, across firm size, across rural/urban settings we find broadly the same results.

Overall, while we find that the formality-finance relationship was different in Mexico for the period 2000-2016 than in Brazil during a similar period, our results suggest the formalization mechanism of finance is present for young, inexperienced workers and for female

workers as well, but that there is some evidence of a mechanism working in the opposite direction for those with a decade or more of work experience or with more than elementary education.

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A Robustness Tests: Aggregate Credit Measures

This part of the appendix describes the results of estimating the relationship between the fraction of employment that is formal and alternative measures of aggregate credit. It describes the coefficient on the measure of financial slack for firms in different size bins, and for different measures of the formality of employment. The alternative measures of aggregate credit that it uses are banking and non banking credit, to the whole economy and to the private sector and used as a contemporaneous variable and as a lagged variable. Allowing for market credit on top of banking credit lets us eliminate any a change in the composition of credit from these two sources. Also allowing for lending to the public sector along with the private sector allows for the possibility that access to credit by the public sector relaxes financial constraints on private firms by letting it get paid in advance or at least quickly for sales to the public sector for example. Lastly, including lagged values of the credit variables allows for the notion that there might be a delayed effect between credit expansion and employment formality.

The results from these tables are consistent with the ones in the main text. In all cases, significant coefficients point to a negative relationship between credit and employment formalization.

Table 13: Coefficients on Industry-Level Financial Slack, Total Bank Credit to the Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.371*	-0.162	-0.178	-0.566	-0.472*
pval	(0.013)	(0.457)	(0.568)	(0.108)	(0.042)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.360**	-0.538	-0.638	-0.354	0.073
pval	(0.008)	(0.129)	(0.071)	(0.139)	(0.203)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.442**	-0.153	-0.399	-0.585	-0.486*
pval	(0.005)	(0.491)	(0.226)	(0.152)	(0.03)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 14: Coefficients on Industry-Level Financial Slack, Lagged Total Bank Credit to the Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.318	-0.222	-0.037	-0.353	-0.555*
pval	(0.06)	(0.363)	(0.918)	(0.379)	(0.035)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.275	-0.486	-0.486	-0.204	0.067
pval	(0.075)	(0.223)	(0.232)	(0.453)	(0.3)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.367*	-0.235	-0.248	-0.341	-0.511*
pval	(0.039)	(0.345)	(0.511)	(0.462)	(0.044)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 15: Coefficients on Industry-Level Financial Slack, Total Credit to Public and Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.322	-0.277	-0.046	-0.29	-0.568*
pval	(0.082)	(0.299)	(0.906)	(0.511)	(0.049)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.287	-0.522	-0.512	-0.177	0.061
pval	(0.089)	(0.232)	(0.25)	(0.553)	(0.393)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.361	-0.278	-0.257	-0.26	-0.516
pval	(0.064)	(0.308)	(0.534)	(0.61)	(0.064)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 16: Coefficients on Industry-Level Financial Slack, Lagged Total Credit to Public and Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.067	-0.199	0.219	0.259	-0.465
pval	(0.753)	(0.53)	(0.627)	(0.606)	(0.159)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.01	-0.181	-0.041	0.183	0.036
pval	(0.961)	(0.726)	(0.937)	(0.592)	(0.661)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.066	-0.229	0.102	0.3	-0.351
pval	(0.769)	(0.477)	(0.831)	(0.606)	(0.271)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 17: Coefficients on Industry-Level Financial Slack, Total Bank and Market Credit to Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.241	-0.185	-0.062	-0.281	-0.386
pval	(0.058)	(0.315)	(0.817)	(0.353)	(0.051)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.223	-0.373	-0.432	-0.146	0.039
pval	(0.054)	(0.215)	(0.157)	(0.478)	(0.425)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.275*	-0.178	-0.218	-0.255	-0.372
pval	(0.04)	(0.343)	(0.443)	(0.466)	(0.051)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 18: Coefficients on Industry-Level Financial Slack, Lagged Total Bank and Market Credit to Private Sector

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.248	-0.391	0.179	-0.11	-0.585*
pval	(0.126)	(0.082)	(0.609)	(0.769)	(0.021)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.207	-0.65	-0.265	-0.033	0.051
pval	(0.157)	(0.1)	(0.504)	(0.88)	(0.416)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.286	-0.489	-0.031	-0.069	-0.485*
pval	(0.076)	(0.052)	(0.928)	(0.86)	(0.044)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 19: Coefficients on Industry-Level Financial Slack, Total Bank and Market Credit to Private and Public Sectors

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.258**	-0.147	-0.026	-0.42	-0.398**
pval	(0.005)	(0.275)	(0.891)	(0.051)	(0.005)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.182*	-0.304	-0.307	-0.214	0.047
pval	(0.029)	(0.168)	(0.163)	(0.142)	(0.183)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.284**	-0.158	-0.146	-0.399	-0.370**
pval	(0.003)	(0.25)	(0.476)	(0.109)	(0.007)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 20: Coefficients on Industry-Level Financial Slack, Lagged Total Bank and Market Credit to Private and Public Sectors

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.063	-0.083	0.245	-0.023	-0.319
pval	(0.597)	(0.606)	(0.341)	(0.933)	(0.087)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.015	-0.246	0.08	0.033	0.046
pval	(0.885)	(0.385)	(0.785)	(0.837)	(0.317)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.11	-0.207	0.115	-0.053	-0.251
pval	(0.348)	(0.252)	(0.648)	(0.855)	(0.156)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

Table 21: Coefficients on Industry-Level Financial Slack, Active-Passive Intermediation Spreads

Fixed-effects (industry) panel regression of the fraction of formal employment in an industry, on that industry's financial slack, with year dummies. Columns describe independent regressions run for industry-year-firm size formal employment fractions for each firm size group. The size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15. Standard errors in parenthesis, one two and three stars represent the 5%, 1% and 0.1% significance (different from 0) levels respectively. Each panel describes the regression using a different formality indicator.

F1					
	All	Tiny	Micro	Small	Medium+
FSL	-0.001	-0.005	0.001	0.001	-0.005
pval	(0.376)	(0.055)	(0.674)	(0.721)	(0.082)
F2					
	All	Tiny	Micro	Small	Medium+
FSL	-0.001	-0.004	-0.001	0.001	0
pval	(0.567)	(0.328)	(0.731)	(0.615)	(0.933)
F3					
	All	Tiny	Micro	Small	Medium+
FSL	-0.001	-0.005	0.001	0.003	-0.003
pval	(0.542)	(0.053)	(0.866)	(0.545)	(0.188)
Groups	125	26	30	33	36
Obs	754	142	180	196	236

B Changes in Formality: Within Firm Size Effects vs. Firm Size Composition Effects

The regressions above focus on the degree of employment formality *within* firm size groups. While this is standard, it is important to look at whether there have been important changes in the composition of the sample, that is changes in firm's sizes. This section performs that analysis by breaking apart the overall changes in formality that were observed from 2000-2010 into changes in formality within groups and changes in the composition of the sample.

Here we analyze the data above through a decomposition of the changes in each of our formality measures over time into changes within industries and within size classes and in the changing composition of the sample into different industries and different size classes.

The fraction F of employed workers that are formally employed in any given period is the number of formally employed workers divided by the total number of employed people. For any partition of the sample, for example by industry or by size, it can also be expressed as an interior product. This interior product is the sum of the products of the weight of a particular element of the partition and the formal employment fraction within that element. In other words,

$$F^t = \left(\sum_{j,I} F_t^{j,I} \right) / N = \sum_I \left(\frac{\sum_{j=1}^{N_I} F_t^{j,I}}{N_I} \right) \left(\frac{N_I}{N} \right) = \sum_{I=1}^M f_t^I n_t^I = f_t * n_t \quad (5)$$

where $f_t * n_t$ denotes the interior product between f_t and n_t and n_t is the vector of weights of each element of the partition and f_t is the vector of formal employment proportions in each of the elements.

From this we can see that the change in the fraction of formal employment from one period to another can be written as

$$\begin{aligned} \Delta(f_t n_t) &= f_t * n_t - f_{t-1} * n_{t-1} \\ &= (\Delta f_t) * n_t + (\Delta n_t) * f_t - (\Delta f_t) * (\Delta n_t) \end{aligned} \quad (6)$$

where $\Delta f_t = f_t - f_{t-1}$, and $\Delta n_t = n_t - n_{t-1}$.

Table 22: Decomposition of Formalization Changes by Firm Size, Period; F^{SC}

This table presents the decomposition of changes in formality over periods of time into changes within industries and changes in the industry composition of the employed workforce in the sample. The rows reflect different periods over which the decomposition is taken and the columns reflect which firm size bin the change refers to and which part of the change corresponds to each type of change: $(\Delta f_t)*n_t$ refers changes in formality within industry and $(\Delta n_t)*f_t$ reflects changes in the composition of the sample. The firm size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15.

Years	Change	Total Change							
		Tiny		Micro		Small		Medium+	
Start End		$(\Delta f_t)*n_t$	$(\Delta n_t)*f_t$						
2000 - 2002	-6%	0%	0%	0%	0%	0%	-1%	-1%	-6%
2002 - 2004	16%	1%	0%	3%	-1%	2%	0%	1%	9%
2004 - 2006	-7%	0%	0%	-1%	1%	0%	0%	-1%	-4%
2006 - 2008	-1%	0%	0%	-2%	0%	-1%	1%	-1%	1%
2008 - 2010	-2%	0%	0%	0%	0%	0%	0%	0%	-2%
2000 - 2005	6%	0%	0%	3%	0%	1%	0%	0%	2%
2005 - 2010	-6%	0%	0%	-3%	0%	-1%	1%	-1%	-2%
2000 - 2010	0%	0%	0%	0%	0%	1%	1%	-1%	-1%

Table 23: Decomposition of Formalization Changes by Firm Size, Period; F^{SB}

This table presents the decomposition of changes in formality over periods of time into changes within industries and changes in the industry composition of the employed workforce in the sample. The rows reflect different periods over which the decomposition is taken and the columns reflect which firm size bin the change refers to and which part of the change corresponds to each type of change: $(\Delta f_t)*n_t$ refers changes in formality within industry and $(\Delta n_t)*f_t$ reflects changes in the composition of the sample. The firm size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15.

Years	Change	Total Change							
		Tiny		Micro		Small		Medium+	
Start End		$(\Delta f_t)*n_t$	$(\Delta n_t)*f_t$						
2000 - 2002	-7%	0%	0%	0%	1%	0%	-1%	0%	-6%
2002 - 2004	11%	0%	0%	0%	-1%	0%	0%	0%	10%
2004 - 2006	-2%	0%	0%	0%	1%	0%	0%	0%	-4%
2006 - 2008	5%	0%	0%	1%	0%	0%	2%	0%	2%
2008 - 2010	-5%	0%	0%	-1%	0%	0%	0%	-1%	-3%
2000 - 2005	1%	0%	0%	1%	0%	0%	0%	-1%	2%
2005 - 2010	1%	1%	0%	0%	0%	1%	1%	0%	-2%
2000 - 2010	2%	0%	0%	1%	0%	1%	1%	-1%	-1%

Tables 22 and 23 describe the decomposition of the change in formality between 2000 and 2010. Very broadly this data describe a situation where employment formality increased until 2004, declined in 2005-2006, increased until 2008 and then declines into 2010. At the same time the three aggregate financial indicators suggest that financial slack increased during 2005 and during 2007 and 2008. Over this period of time a fraction of changes in

formality that take place in this sample come from changes within each of the industries and the rest of the change can be traced to a change in the composition of the sample across industries. Table 22 shows for example that from 2000 to 2005 there was an increase in the formality of micro and small firms and an increase in large firms as a fraction of the sample. The opposite happened from 2005 to 2010. There was less formality within tiny and small firms and there were also less large firms.

C Descriptive Statistics

C.1 Characteristics of Formal vs. Informal Workers

Table 24 describes the average characteristics of individuals that fit different definitions of formality and informality. The key observations from this data are that informal workers are relatively more likely to be female, are relatively older, relatively less educated, and are relatively more likely to live in rural settings. The characteristics are essentially unchanged from one type of formality to another except in that formal workers according to the defined wage variable are more likely to be rural workers than those that are formal according to the other two definitions.

Table 24: Demographic Characteristics of Workers by Formality Status

This table presents the fraction of formal employees according to each of the three measures that have a particular demographic. The first two rows describe the formal employee's gender. the second set of rows describes their age. The third set describes their education and the fourth set describes whether they live in a Rural or an Urban setting (as proxied by the size of the community they live in). the last column of the table describes the demographic characteristics of those working people deemed informal according to all the three formality indicators. F^{SC} is the fraction of employed individuals answering that they have signed a contract with their employer. F^{DW} is the fraction of employed individuals answering that they receive a defined wage for their work rather than 'helping' at somebody's business. F^{SB} is the fraction of employed individuals that have access to social benefits as a result of their employment. Data corresponds to the sample periods 2000, 2002, 2004, 2005, 2006, 2008 and 2010.

	Whole Sample	F^{SC}	F^{DW}	F^{SB}	Informal
Gender					
Male	0.62	0.62	0.65	0.62	0.55
Female	0.38	0.38	0.35	0.38	0.45
Age Group					
15-25	0.25	0.23	0.28	0.23	0.16
26-35	0.27	0.32	0.29	0.32	0.21
36-45	0.24	0.26	0.24	0.26	0.26
45-55	0.16	0.15	0.14	0.15	0.22
56-65	0.08	0.05	0.06	0.05	0.15
Education					
Elementary (or less)	0.37	0.18	0.32	0.20	0.51
High School (or less)	0.44	0.49	0.47	0.50	0.36
More than High School	0.19	0.33	0.21	0.30	0.13
Location					
Rural	0.21	0.09	0.17	0.09	0.32
Urban	0.79	0.91	0.84	0.91	0.68
N	236,198	82,237	165,575	92,251	71,053

C.2 Formality by Age and Education, by Firm Size and by Year

Table 25: Descriptive Statistics: Formality by Age and Education, F^{DW}

This table presents the fraction of employment that is formal employment according to our three measures of formality, but for different levels of education and for different ages. Education groups numbers correspond to formal education level achieved: 0: No elementary; 1: Incomplete Elementary; 2:Elementary; 3:Incomplete Secondary; 4:Secondary; 5:Incomplete Higher; 6:Higher; 7:Post-Graduate;. Age groups correspond to 1:age ≤ 20 ; 2:20 < age ≤ 25 ; 3:25 < age ≤ 30 ; 4:30 < age ≤ 35 ; 5:35 < age ≤ 40 ; 6:40 < age ≤ 45 ; 7:45 < age ≤ 50 ; 8:50 < age ≤ 55 ; 9:55 < age ≤ 60 ; 10:60 < age ≤ 65 . In this table there is no distinction between independent and non-independent workers. Rows labeled 'N' correspond to number of observations.

Education Group	Age Group										Average
	1	2	3	4	5	6	7	8	9	10	
0	0.572	0.599	0.579	0.574	0.532	0.505	0.478	0.422	0.396	0.330	0.469
N	538	641	961	1038	1448	1656	2013	2008	2281	1866	14450
1	0.735	0.719	0.664	0.632	0.594	0.553	0.517	0.480	0.456	0.379	0.558
N	2026	2317	3070	3525	4221	4308	4723	4362	3906	2836	35294
2	0.728	0.759	0.712	0.675	0.642	0.605	0.570	0.547	0.511	0.439	0.640
N	4406	4141	4827	5044	5397	4746	4593	3468	2464	1322	40408
3	0.764	0.843	0.795	0.747	0.718	0.709	0.674	0.656	0.602	0.506	0.750
N	16455	12805	12200	12029	11315	7974	5535	3299	1914	883	84409
4	0.832	0.849	0.819	0.773	0.754	0.744	0.737	0.680	0.595	0.649	0.789
N	3303	5228	4275	3660	3439	2598	1703	850	395	154	25605
5	0.771	0.831	0.824	0.794	0.745	0.716	0.690	0.614	0.538	0.543	0.772
N	881	2577	1402	958	943	871	617	355	186	92	8882
6	0.882	0.874	0.873	0.827	0.803	0.768	0.742	0.676	0.630	0.552	0.799
N	34	2939	4639	3823	3717	3283	2619	1585	899	375	23913
7	0.750	0.892	0.892	0.845	0.867	0.842	0.830	0.800	0.739	0.725	0.836
N	4	93	361	498	547	518	524	375	226	91	3237
Average	0.761	0.821	0.780	0.732	0.697	0.665	0.619	0.562	0.502	0.412	0.697
	27647	30741	31735	30575	31027	25954	22327	16302	12271	7619	236198

Table 26: Descriptive Statistics: Formality by Age and Education, F^{SB}

This table presents the fraction of employment that is formal employment according to our three measures of formality, but for different levels of education and for different ages. Education groups numbers correspond to formal education level achieved: 0: No elementary ; 1: Incomplete Elementary; 2:Elementary; 3:Incomplete Secondary; 4:Secondary; 5:Incomplete Higher; 6:Higher; 7:Post-Graduate;. Age groups correspond to 1:age \leq 20; 2:20; age \leq 25; 3:25; age \leq 30; 4:30; age \leq 35; 5:35; age \leq 40; 6:40; age \leq 45; 7:45; age \leq 50; 8:50; age \leq 55; 9:55; age \leq 60; 10:60; age \leq 65. In this table there is no distinction between independent and non-independent workers. Rows labeled 'N' correspond to number of observations.

Education Group	Age Group										Average
	1	2	3	4	5	6	7	8	9	10	
0	0.078	0.103	0.124	0.131	0.126	0.152	0.134	0.129	0.123	0.088	0.122
N	538	641	961	1038	1448	1656	2013	2008	2281	1866	14450
1	0.153	0.203	0.182	0.200	0.187	0.186	0.178	0.185	0.172	0.127	0.179
N	2026	2317	3070	3525	4221	4308	4723	4362	3906	2836	35294
2	0.204	0.305	0.283	0.278	0.282	0.291	0.292	0.295	0.276	0.197	0.276
N	4406	4141	4827	5044	5397	4746	4593	3468	2464	1322	40408
3	0.277	0.496	0.498	0.479	0.467	0.500	0.483	0.476	0.423	0.324	0.442
N	16455	12805	12200	12029	11315	7974	5535	3299	1914	883	84409
4	0.420	0.581	0.618	0.603	0.593	0.611	0.608	0.546	0.453	0.500	0.572
N	3303	5228	4275	3660	3439	2598	1703	850	395	154	25605
5	0.377	0.499	0.649	0.644	0.616	0.587	0.575	0.496	0.414	0.380	0.549
N	881	2577	1402	958	943	871	617	355	186	92	8882
6	0.500	0.660	0.733	0.740	0.731	0.695	0.672	0.587	0.555	0.480	0.692
N	34	2939	4639	3823	3717	3283	2619	1585	899	375	23913
7	0.750	0.763	0.792	0.777	0.852	0.840	0.811	0.784	0.681	0.714	0.799
N	4	93	361	498	547	518	524	375	226	91	3237
Average	0.273	0.471	0.484	0.459	0.437	0.433	0.389	0.339	0.273	0.188	0.403
	27647	30741	31735	30575	31027	25954	22327	16302	12271	7619	236198

Table 27: Fraction of Formal Employment by Firm Size

The numbers below represent the fraction of employment that is formal employment according to our three measures of formality: The first series (F^{SC}) represents the data corresponding to the 'signed contract' topic: the fraction of employed individuals answering that they have signed a contract with their employer. The second series (F^{DW}) represents the variable 'defined wage': the fraction of employed individuals answering that they receive a defined wage for their work rather than 'helping' at somebody's business. The third series (F^{SB}) represents the variable 'benefits': the fraction of employed individuals that have access to social benefits as a result of their employment. Economy-wide average formality corresponds to the sample periods 2000, 2002, 2004, 2005, 2006, 2008 and 2010. The firm size classes are defined based on the reported number of other employees working at the same location as follows: Tiny, 0 or 1; Micro, between 2 and 5; Small, between 6 and 15; Medium+, larger than 15.

Source: ENIGH survey produced by Mexico's INEGI.

Size	F^{SC}	F^{DW}	F^{SB}
Medium+	0.79	0.99	0.83
Small	0.42	0.91	0.52
Micro	0.12	0.61	0.16
Tiny	0.02	0.26	0.04
Average	0.36	0.70	0.41

Table 28: Fraction of Formal Employment by Year

The figures below represent the fraction of employment that is formal employment according to our three measures of formality: The first series (F^{SC}) represents the data corresponding to the ‘signed contract’ topic: the fraction of employed individuals answering that they have signed a contract with their employer. The second series (F^{DW}) represents the variable ‘defined wage’: the fraction of employed individuals answering that they receive a defined wage for their work rather than ‘helping’ at somebody’s business. The third series (F^{SB}) represents the variable ‘benefits’: the fraction of employed individuals that have access to social benefits as a result of their employment. Economy-wide average formality corresponds to the sample periods 2000, 2002, 2004, 2005, 2006 and 2008.

Source: ENIGH survey produced by Mexico’s INEGI.’

Year	F^{SC}	F^{DW}	F^{SB}
2000	0.35	0.68	0.40
2002	0.29	0.63	0.33
2004	0.41	0.72	0.41
2005	0.40	0.71	0.41
2006	0.38	0.69	0.43
2008	0.34	0.74	0.44
2010	0.34	0.75	0.41
Average	0.36	0.70	0.41

C.3 Firm Size by Industry

Table 29: Size by Industry

ISIC3-r1	mean	p50	sd
A- Agriculture, hunting and forestry	14.2	5	28.8
B- Fishing	26.9	5	40.4
C- Mining and quarrying	76.7	100	40
D- Manufacturing	52.6	15	47.2
E- Electricity, gas and water supply	82.3	100	36.1
F- Construction	29.5	5	40.5
G- Wholesale and retail trade; vehicle repair	21.9	5	36.7
H- Hotels and restaurants	22.5	5	36.3
I- Transport, storage and communications	42.4	10	46.3
J- Financial intermediation	60.3	100	45.1
K- Real estate, renting and business activities	34.3	5	43.7
L- Public administration, defence, social security	79.5	100	38.1
M- Education	63.1	100	44.6
N- Health and social work	60.6	100	46.5
O- Community, social and service activities	25.1	5	39.3
P- Household employment and production	2.3	1	7
Total	34.5	5	43.9

Approximate firm size data by one-digit ISIC3-r1 industry.