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Abstract*

This paper examines the effect of bank credit on employment formalization in Uruguay. Using a difference-in-differences methodology proposed by Catão, Pagés and Rosales (2011), the paper finds that financial deepening decreases informality, especially in more financially dependent sectors. The effect is additionally found to be greater for women and younger workers. Despite the severe economic crisis and a sharp contraction of bank credit experienced by the economy in the period of analysis, no evidence is found that the effect of bank credit on employment formality has changed over time.

JEL classifications: E26, G21, O4, O16

Keywords: Credit market, Informality, Uruguay

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1. Introduction

There is a large academic literature studying the effects of financial development on economic growth.¹ The main reason why economists think financial development should foster growth is that the more developed financial markets are, the fewer firms will be financially constrained and the larger the number of investment projects undertaken. This in turn should foster economic growth. A similar line of reasoning is used to explain why informality hurts growth.² In order to avoid regulations while informal, firms decide not to undertake investment projects in order to remain small and undetected by government regulation. This leads to inefficient production scales and hurts economy growth.

Despite the similarities in arguments used, not many studies have looked at the interrelations between financial development and informality, and how these affect growth. Financial development might reduce informality by increasing the opportunity cost of being informal. To have access to credit from banks and other regulated agencies, firms typically have to be registered and disclose information. While deciding on whether to be formal, firm managers should take into account that informality limits access to finance. In less developed financial markets, the cost of being an informal firm should be lower, given that access to finance is limited and the cost of borrowing high. In more developed financial markets, access to finance tends to be relatively easier and the cost of borrowing lower. This should then increase the opportunity cost of being informal.

It is also possible that the extent of informality among firms affects financial market development. In economies with high levels of informality the cost of lending to an average firm tends to be higher, given the higher cost of monitoring informal firms. Due to the higher cost of providing financing, firms might decide not to participate in financial markets, which can be detrimental to the process of financial development.

This paper contributes to the literature on financial development, informality and economic growth by studying the effect of bank credit on informality in a developing country. To our knowledge, only the work of Catão, Pagés and Rosales (2011) has studied the relation

¹ Levine (1997); Beck, Levine, and Loayza (2000).

² Farrell (2006); Perry et al. (2008); Levy (2008); La Porta and Shleifer (2008); D'Erasmus and Moscoso Boedo (2009); Hsieh and Klenow (2009).

between access to credit and informality. Their work uses sectoral differences in financial needs to identify this relation. More specifically, if financial deepening affects formalization, easier access to credit should affect formalization relatively more in sectors that have a higher dependence on financing. Using Brazilian data from 2002 to 2007, they find that financial deepening led to higher employment formalization rates in sectors where firms are typically more dependent on external finance. We apply their methodology to study whether changes in financial deepening had an effect on formality in Uruguay in the years 2000 to 2010.

Uruguay is an interesting case study of the link between informality and credit access for two reasons. First, when compared to other Latin American countries, Uruguay stands out due to its low ratio of credit to GDP as well as for its low level of employment informality. In 2010, domestic credit provided by the banking sector in Uruguay reached only an equivalent of 30 percent of GDP, while the average for Latin American countries was 15 percentage points higher. In regard to employment informality, according to ILO Statistics (2011), 39.8 percent of employees in Uruguay are informal. This number is significantly lower than the average of 58.7 percent for the other 15 Latin American countries reported. Second, Uruguay is an interesting case study because in 2002 it experienced a deep economic and financial crisis, followed by a period of rapid economic growth. This allows the study of the effect of credit on informality in different phases of the business cycle.

Our results suggest that bank credit growth fostered formalization in Uruguay, especially in sectors that are more financially dependent. The positive effect found is consistent with that in Catão, Pagés and Rosales (2011), who use Brazilian data that only cover a period of economic expansion. We also find that for some groups of workers the effect of bank credit on informality is stronger. These groups include young workers and female workers. No evidence is found that the effect of bank credit on formality changed in the different phases of the business cycle.

The rest of this paper is organized as follows. In Section 2 we present the definitions of the main variables used in the analysis as well as the data sources. Section 3 discusses recent developments in the Uruguayan economy regarding the variables of interest. Section 4 presents the methodology used and discusses results, and Section 5 concludes.

2. Variable Definitions and Data Sources

To study the effect of bank credit on informality in Uruguay we construct a pseudo-panel dataset,³ given the lack of a dataset with information on informality or credit at the firm level. The pseudo-panel dataset consists of synthetic observations obtained from averaging observations for different groups with similar time-invariant characteristics, in a sequence of repeated cross-sectional datasets. In this paper we use repeated cross-sectional household surveys, which cover the years 2000 to 2010. To construct the dataset, observations from the household surveys are averaged across the economic sector and calendar year dimensions. We use the 2-digit ISIC Revision 3 for sector aggregation. The dataset created contains information on informality, credit and financial dependence. Definitions and data sources for each of these variables are indicated below.

2.1 Informality

Although related, employment informality and firm informality are not equivalent. Many established firms pay their workers below national minimum wages, leave their workers without social protection programs or simply do not declare them to the relevant public institutions. On the other hand, some formal employees may work in firms that are simply covering illegal or partially illegal activities (e.g., some importers may smuggle or not pay the required tariffs for all their imports). Given the lack of data on firm formality, the literature on informality in Uruguay has focused on employment informality as measured by household surveys.⁴

Researchers have tended to use three different approaches for measuring employment informality. Following International Labour Organization suggestions, informality can be defined according to sector, type of jobs and size of establishment.⁵ This methodology is easy to

³ There is vast literature regarding under which conditions parameters can be consistently estimated given the limitations that arise when working with pseudo-panel instead of real panel data. Part of that literature can be found in Deaton (1985), Moffitt (1993), Verbeek and Vella (2002) and Antman and McKenzie (2005), among others.

⁴ Assuming that informal activities have to be carried out in cash, some authors have measured the size of the informal sector from money demand in “excess” of fundamentals (see Graziani, 1988, and Brasca et al., 2009). These measures are controversial because of estimation issues, simplifying assumptions and some contradictions with other sources of information. Moreover, this is not an appropriate method for this project since it does not allow constructing sector-based measures of informality.

⁵ Diez de Medina and Gerstenfeld (1986) define informal employment as self-employed workers (excluding professionals), non-salary family workers and workers in establishments of four or less employees. Other authors make variations over this definition including for instance the domestic service and establishments of five or less

implement and to follow over time. A drawback of this approach, however, is that it does not truly capture informality but merely assumes that certain tasks and certain small firms are probably informal.

A second approach, following the work of Cassoni (2000), uses data from health coverage to build a measure of employment informality. As every formal worker in Uruguay has rights to health coverage at a private health maintenance organization (HMO), Cassoni measures employment informality as the percentage of active workers who do not have rights in any HMO. The strength of this approach is that workers are not likely to lie about their health coverage, which is in a separate section not related to the income or work sections of the questionnaire. On the other hand, this measure fails to capture workers at firms that for tax and social security reasons declare only a proportion of their current wage and informal workers who pay an HMO out-of-pocket.

The final approach to measuring employment informality looks at whether the worker has the right to an “aguinaldo” or the worker (or his employers) make in full the required payments to social security that would grant him rights to a pension in the future.⁶ These questions, which were incorporated into the household survey in 2001, capture the essence of employment informality. The main problem with them, though, is that they may suffer from significant misreporting.

Using data from Household Surveys (ECH)⁷ produced by Uruguay’s National Institute of Statistics (INE), we create three alternative measures of informality, based on the second and third approaches mentioned above. The first measure, which we call “health rights,” defines a worker as informal if he or she does not have an HMO, despite being employed. According to our second measure, a worker is considered informal if he or she does not receive a thirteenth salary. We call this measure “aguinaldo.” The third and last measure classifies a worker as informal if he or she does not pay social security taxes. We call this measure “social security.” The health right measure is available for the years 2000 through 2010, while the other two measures are available

employees. See Longhi (1999), Instituto Cuesta Duarte (2002), Filgueira and Gelber (2003) and Amarante and Arim (2005).

⁶ The *aguinaldo* is a thirteenth monthly bonus salary that Uruguayan workers receive by law, half of it in June and half in December.

⁷ The surveys cover every urban area (cities and towns) with more than 5,000 inhabitants. For each private household in the survey, the dataset has information on all people habitually living there.

starting in 2001. Once workers are classified as formal or informal according to the different measures, we construct the sector-level measure of informality by calculating the proportion of workers in a given sector and year who are informal. These proportions are calculated only for workers 14 years of age or older. Sectors with fewer than 50 observations in the household survey in a given year are dropped due to measurement error concerns.

Naturally, there are differences in the levels of informality reported in the three measures (see Figure 4 and Table A1 in the Appendix). For the last year in our sample, informality reached 35 percent according to the social security measure and about 41 percent according to the aguinaldo and health rights measures. For all years in the sample, the social security measure of informality was lower than the other two measures, which can be expected given the natural reporting bias. Despite the differences, all three measures of informality are highly correlated. Table 1 shows the correlations for the sector aggregates for the 40 sectors studied.

	Social Security	Aguinaldo	Health Rights
Social Security Tax	1.00 ^{***}	-	-
Aguinaldo	0.93 ^{***}	1.00 ^{***}	-
Health Rights	0.97 ^{***}	0.93 ^{***}	1.00 ^{***}

* Significant at 10%; ** significant at 5%; *** significant at 1%. Correlations are defined at the sector level and are estimated for the years 2001 to 2010.

Finally, it should be noted that informality in Uruguay differs greatly across sectors; Table A1 reports sector-level informality in three different years. Some sectors, such as manufacturing of furniture (ISIC sector 36) and construction (ISIC sector 45), display high levels of informality, exceeding 50 percent. On the other hand, sectors such as manufacturing of rubber and plastic products (ISIC sector 25) and manufacturing of chemicals and chemical products (ISIC sector 24) display informal employment of less than 15 percent. Dispersion is also observed along other breaks in the data. Table A2 reports informality measures according to various breaks that are considered in Section 4 below. Informality is larger among workers employed by smaller firms. Informality also seems to be higher for younger workers, although

this is not true when the aguinaldo definition of informality is used. Finally, in our sample, informality is greater among male workers than female workers.

2.2 Credit

In this paper we are interested in studying how bank credit affects informality levels. Measuring credit availability is difficult, however, since there are no data on firm-level credit access. Moreover, if this data were available, their utility for this study would be limited by their endogeneity. Given this problem, we follow Catão, Pagés and Rosales (2011) and use the ratio of credit to the private sector to GDP, measured at the country-year level, as a proxy for credit availability.

We focus on banking credit because it is the most important source of external funding for firms in Uruguay, as reported by various authors (e.g., Munyo 2005, de Brun et al 2003).⁸ To construct the credit measures, we use data from different sources. The data on credit to private sector, produced by the Superintendency of Financial Services of the Central Bank of Uruguay (BCU), include the lending of both private and public banks; these data are a time series with monthly observations. Given that we construct interannual informality results from the household surveys, we decided to construct our measure of credit in a given year as the annual average of the monthly stocks. The GDP measure also comes from the BCU.

2.3 External Financing Dependence

Some authors believe that technological factors make some industries more dependent than others on external finance. According to Rajan and Zingales (1998), such factors may include differences between industries in initial project scales, gestation and cash harvest periods and the requirement for continuing investment. Furthermore, they argue that these technological differences are likely to persist across countries, so an industry's dependence on external financing as identified in a given country could be used as a measure of its dependence in other countries. Following Rajan and Zingales (1998), Catão, Pagés and Rosales (2011) construct an

⁸ Munyo (2005) found that 60 percent of corporate financing needs were met through borrowing and 40 percent from retained earnings. Reliance on bank credit was on average as great as on trade credit, though larger companies with greater tangible assets tended to rely proportionally more on bank rather than trade financing, and had greater access to long-term financing.

external financing dependence index, using information from the sample of U.S. firms in the S&P 1500 index for the years 2000-2010. We use their measure in this paper.

The Catão, Pagés and Rosales (2011) external financing dependence index⁹ is defined as the ratio between capital expenditures minus cash from operations (use of external finance) and capital expenditures. For each firm the ratio is calculated as the sum of external financial use for the 2000-2010 period and the sum of capital expenditures for the same period. A sector's financial dependence is calculated as the median index for the firms in that sector. Using the index forces us to drop 10 sectors that have informality data but are not covered in the external financing dependence measure. Two of these sectors are important in terms of employment, each accounting for more than 10 percent of working adults: agriculture and domestic workers. Forestry and financial intermediation were also dropped, with each employing only 1 percent of the working population.¹⁰ Overall, our data cover the vast majority of workers. In 2010, the data covered 75 percent of all workers.

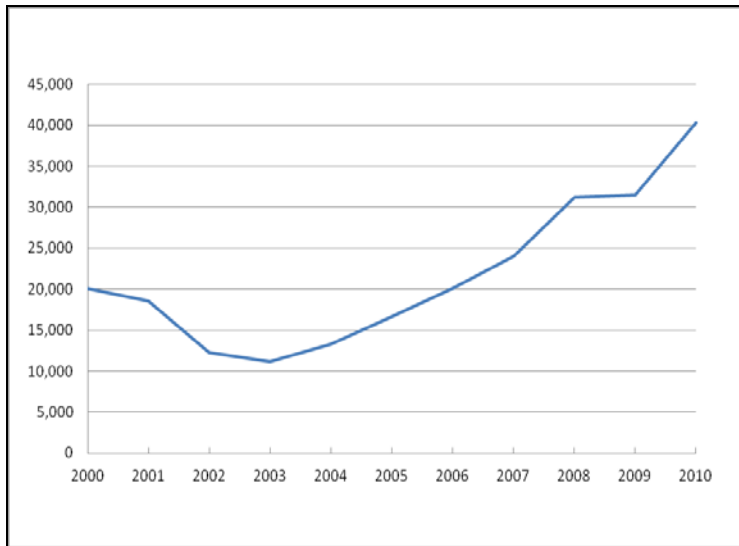
3. The Evolution of Credit and Informality in Uruguay during the Economic Crisis and Recovery

After growing by 3.9 percent a year on average between 1990 and 1998, in 1999 Uruguay entered a recession period that ended in a profound financial and economic crisis in the second quarter of 2002, a year in which GDP contracted by 7.7 percent. After the crisis, the Uruguayan economy entered a strong recovery period (see Figure 1), with an average growth rate of 6.2 percent between 2004 and 2010.

⁹ We thank Luis Catão for providing these data.

¹⁰ The other sectors are the following: fishing, operation of fish hatcheries and fish farms; insurance and pension funding; activities auxiliary to financial intermediation; research and development; compulsory social security and activities of membership organizations n.e.c.

Figure 1. Evolution of GDP (in million U\$S)



The 2002 financial crisis was triggered by a run on banks, a large currency devaluation and a default on sovereign debt in neighboring Argentina. Fear soon spread to the financial system in Uruguay, which had large deposits from Argentine citizens. In the first nine months of 2002, peso-denominated deposit in Uruguayan banks fell by 15.6 percent and dollar-denominated deposits by 56.5 percent. The Uruguayan government was forced to let the currency depreciate rapidly, financially support some financial institutions and intervening several failing private-sector banks.

3.1 Bank Credit

The loss of deposits during the crisis led banks to cut down on credit. In 2002 the stock of dollar-denominated credit (which accounted for about two-thirds of total credit) dropped by 16.1 percent. The stock of dollar credit continued falling until October 2006 and as of October 2011 had still not returned to its pre-crisis peak (see Figure 2). Meanwhile, the stock of peso-denominated credit dropped by 12.8 percent in 2002 and continued falling until February 2005, only returning to its pre-crisis peak in December 2007. Despite the recovery, credit growth tended to fall behind growth in activity. Credit to GDP fell every year between 2002 and 2007, and by the end of 2010 the ratio of credit to GDP stood at barely one third of its pre-crisis level (see Figure 3).

Figure 2. Average Credit Stock (in millions of US\$)

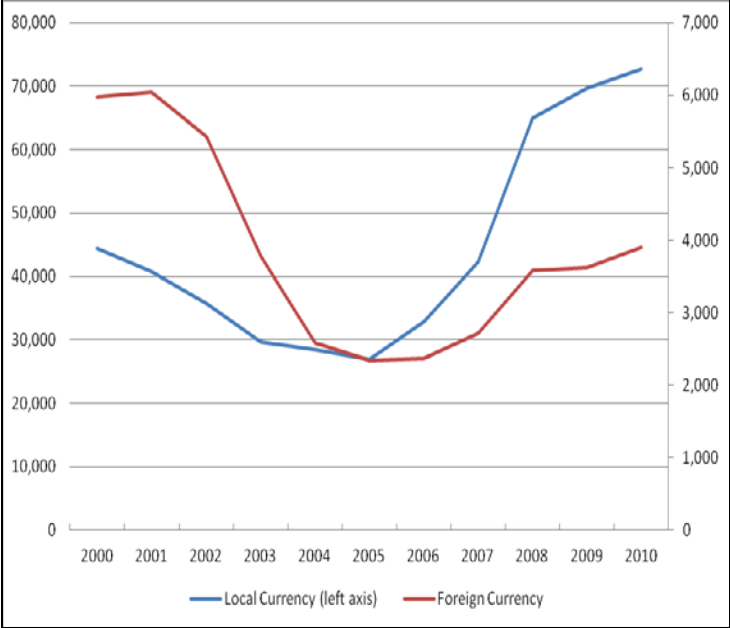
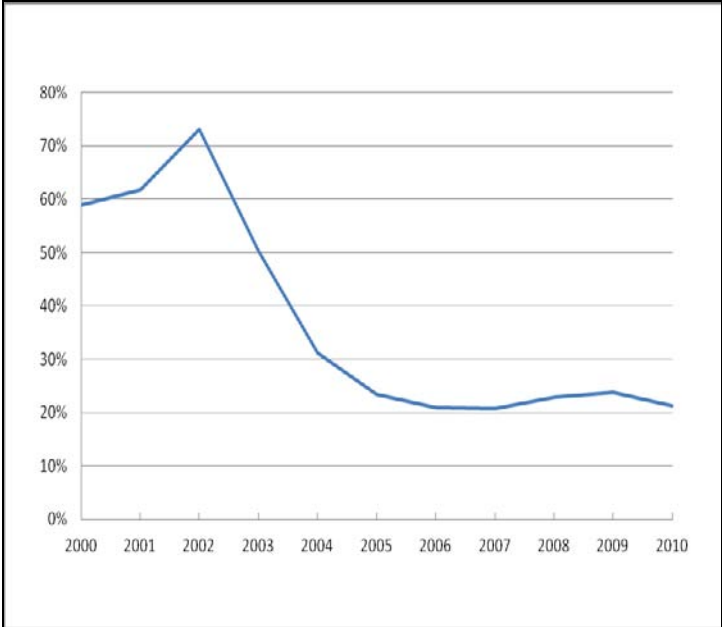


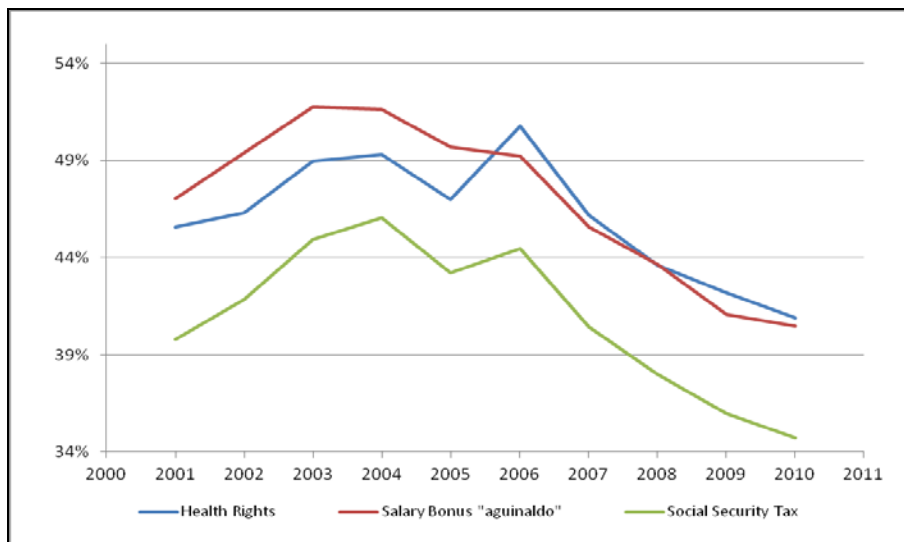
Figure 3. Evolution of Credit/GDP Ratio



3.2 Informality

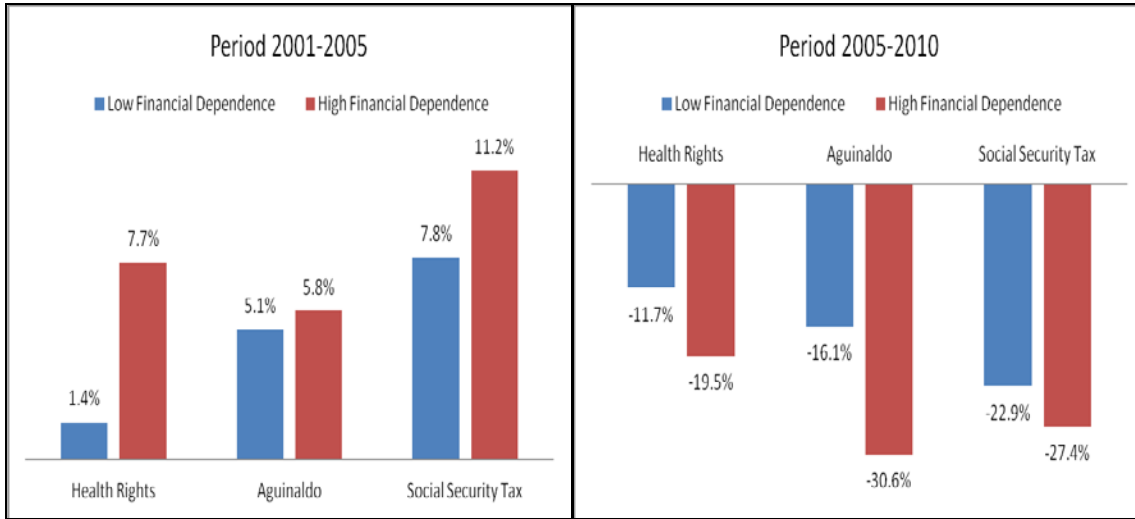
As could be expected, employment informality followed a countercyclical pattern during this period. Figure 4 shows the evolution of informality between 2000 and 2010. According to all three measures, informality rose during the economic crisis and decreased during most years of the subsequent recovery.

Figure 4. Evolution of Employment Informality



Even though informality in most sectors followed a similar trend during this period, there were important differences in the changes in sector-level informality. Given the goal of this paper, it is important to highlight differences in changes in informality according to the sector's dependence on external financing. Figure 5 plots the median of percentage changes in sector-level informality for sectors with high and low external financial dependence. The graph shows that between 2001 and 2005, when credit contracted sharply, informality rose in both types of sectors. But it increased relatively more in those sectors that are more dependent on external financing. Meanwhile, between 2005 and 2010, when credit grew, informality decreased in both types of sectors, but relatively more in sectors with high external financial dependence.

Figure 5. Median Percentage Changes in Informality



Note: Sectors are grouped into high and low financial dependence depending on whether their index of external financial dependence is above or below the average index for the sample of sectors considered.

4. Methodology and Results

4.1 Econometric Model

Following, we take advantage of sectoral differences in financial dependence to identify the effect of banking credit on formalization. The basic model to be estimated is:

$$f_{jt} = \beta_0 + \delta_t + \delta_j + \gamma FD_t EFD_j + \varepsilon_{jt} \quad (1)$$

where the dependent variable f_{jt} is the share of formal workers in sector j at time t . The deltas are year and sector dummies. FD_t is a measure of financial deepening and EFD_j is a measure of external financial dependence at time t . The regressions were estimated by Generalized Least Squares (GLS) assuming a heteroskedastic but uncorrelated error structure.

The coefficient of interest is γ . For the estimation strategy to identify γ one needs both FD and EFD to be exogenous. The baseline measure of FD is the ratio of credit to the private sector to GDP. Given that most sectors considered are relatively small compared to the Uruguayan economy, and that they also account for only a small share of total credit to the private sector, our measure of FD can be considered exogenous. The baseline measure of external financing (EFD) is computed on U.S. firms. Therefore, it should be exogenous for Uruguayan firms.

4.2 Baseline Results

In Table 2 we report the first set of estimations. The coefficient reported is γ in equation 1. The coefficient is significant at traditional statistical significance levels, implying that credit increases formality relatively more in sectors with higher financial dependence. The point estimates of the coefficient imply that a 10 percent increase in the ratio of credit to GDP increases formalization in the most financially dependent sector in the sample (Air transport) relative to the least financially dependent sector (Publishing, printing and reproduction of recorded media) by between 7.8 and 12.1 percentage points, depending on the definition of informality used. We also estimate γ via GLS, allowing the error term to follow a first-order autocorrelation process specific to each sector. The coefficients obtained are once again significant, and the point estimates are smaller than the ones obtained using panel GLS estimation with heteroskedastic but uncorrelated error. The point estimates imply that a 10 percent increase in the ratio of credit to GDP increases formalization in the most financially dependent sector in the sample relative to the least financially dependent sector by between 5.9 and 10.9 percentage points.¹¹

Table 2. Formal Employment and Financial Dependence					
Dependent variable: share of formal to total employment according to various definitions					
Independent variable: Credit to the private sector (as percentage of GDP) interacted with RZ					
Estimation method: various alternatives					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Panel GLS estimation with heteroskedastic but uncorrelated error	Health rights ^{/1}	28.972***	8.993	332	36
	Salary bonus “aguinaldo” ^{/2}	28.017***	8.518	305	36
	Social security taxes ^{/2}	18.553**	7.926	305	36
Panel GLS estimation with panel-specific AR1 autocorrelation	Health rights ^{/1}	21.458**	10.301	331	35
	Salary bonus “aguinaldo” ^{/2}	26.048***	9.967	304	35
	Social security taxes ^{/2}	14.029*	7.891	304	35

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.; ^{/1} Period: 2000-2010; ^{/2}Period: 2001-2010.

¹¹ These estimates are larger than the ones obtained by Catão, Pagés and Rosales (2009) using data from Brazil. The coefficient they report would imply a 4.5 percent increase in formalization for the most financially dependent sector relative to the least financially dependent sector, if a 10 percent increase in the ratio of credit to GDP were to take place. It is worth mentioning that Catão, Pagés and Rosales (2009) use a different EFD measure than we use in this paper. These results are being revised in Catão, Pagés and Rosales (2011).

4.3 Robustness Checks

In Table 3 we explore the robustness of the previous result by considering an alternative measure of financial deepening (FD). We consider the sector’s credit/GDP ratio as an alternative measure, doing so because of concerns that the overall credit/GDP ratio might fail to reflect differences in the evolution in credit availability for firms in different sectors. As long as firm production is relatively small compared to the total output in the sector, and as long as it represents a small share of total credit to the sector, this measure should not suffer from endogeneity problems. Given that sectoral credit is only available for the 2005-2010 period, the re-estimation of equation (1) is done over this shorter period of time. The coefficients of interest are once again positive and significant, suggesting that bank credit has a positive effect on employment formality.

Table 3. Formal Employment and Financial Dependence: Robustness Exercises					
Dependent variable: share of formal to total employment according to various definitions					
Independent variable: Various alternatives					
Estimation method: Panel GLS estimation with heteroskedastic but uncorrelated error					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Sector Credit/GDP	Health rights ¹	0.018***	0.001	201	36
	Salary bonus “aguinaldo” ²	0.022***	0.005	201	36
	Social security taxes ²	0.021**	0.004	305	36

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

¹ Period: 2000-2010. ² Period: 2001-2010

Finally, we consider an alternative measure for external financial dependence (*EFD*). The use of *EFD* measures obtained from firms in developed countries as proxies for sectoral external financial dependence in developing countries is often criticized because of the underlying assumption that developed and developing economies have similar production and financing need structures. This criticism is less relevant if, instead of using sector-specific measures, one uses a coarser index of financial dependence. Following Catão, Pagés and Rosales, we re-estimate equation (1) using as the *EFD* index a dummy variable, defined as 1 if the sector has an above-average *FD* index and zero otherwise. We once again find a positive and significant when the health rights and aguinaldo definitions are used, but they are not significant for the social security

tax definition (see Table 4). All point estimates are higher than those obtained using the baseline EFD measure.

Table 4. Formal Employment and Financial Dependence: Robustness Exercises					
Dependent variable: share of formal to total employment according to various definitions					
Independent variable: Various alternatives					
Estimation method Panel GLS estimation with heteroskedastic but uncorrelated error					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Dummy EFD	Health rights ¹	58.896***	17.928	337	37
	Salary bonus “aguinaldo” ²	51.471***	17.481	310	37
	Social security taxes ²	23.980	16.720	310	37

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%
¹ Period: 2000-2010. ²Period: 2001-2010.

4.4 Group-Specific Effects

An interesting question to look at is whether there are differential effects of bank credit on the formality of different types of workers. To answer this question, we redefine the dependent variable f_{jt} in equation (1) as the share of formal workers of a given type c in sector j at time t and re-estimate that equation for different types of workers.

We first look at differences by gender group. Results in Table 5 show that except for the Aguinaldo definition of male formality, the coefficient of interest is positive and significant for both males and female. Nevertheless, the effect on females seems to be higher than those for males. The point estimates of the effect on women are between 4.3 and 4.8 times higher than those for males.

Table 5. Formal Employment and Financial Dependence: Gender Break					
Dependent variable: share of formal to total employment.					
Independent variable: Credit to the private sector (as percentage of GDP) interacted with RZ					
Estimation method: Panel GLS estimation with heteroskedastic but uncorrelated error					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Health rights ^{/1}	Males	23.883**	11.534	305	35
	Females	115.244***	8.964	200	23
Salary bonus “aguinaldo” ^{/2}	Males	15.448	10.946	280	35
	Females	67.127***	16.571	186	23
Social security taxes ^{/2}	Males	20.893**	10.490	280	35
	Females	99.090***	14.199	186	23

Note: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1% ^{/1}
 Period: 2000-2010. ^{/2}Period: 2001-2010.

Important differences also emerge when one looks at different age groups (see Table 6). We consider two age groups: workers up to 25 years of age and workers 26 years of age or older. Except for the social security definition of formality for workers 26 years of age or older, the coefficient of interest is positive and significant for younger and older workers. Nevertheless, the point estimates of the effect on workers aged 25 or younger are between 2.8 and 14.7 times higher than those for males.

Table 6. Formal Employment and Financial Dependence: Age Break					
Dependent variable: share of formal to total employment.					
Independent variable: Credit to the private sector (as percentage of GDP) interacted with RZ					
Estimation method: Panel GLS estimation with heteroskedastic but uncorrelated error					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Health rights ^{/1}	up to 25 years old	73.198***	19.636	197	25
	more than 25 years old	26.192***	8.958	321	35
Salary bonus “aguinaldo” ^{/2}	up to 25 years old	129.862***	21.373	181	25
	more than 25 years old	24.074***	9.127	294	35
Social security taxes ^{/2}	up to 25 years old	116.379***	20.741	181	25
	more than 25 years old	7.909	8.475	294	35

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%
^{/1} Period: 2000-2010. ^{/2}Period: 2001-2010.

Given that the number of sectors included in the regressions for younger workers and for females is lower than the sectors included in the regressions of older workers and male workers, one might be concerned that the differences in the reported effects are due to sector composition effects. To rule out this possibility we re-estimate Tables 5 and 6 restricting to the common set of sectors. The results (not reported) with age breaks do not change qualitatively but the positive effect on men is no longer significant. Therefore, the differential impact of bank credit on women and men is even higher than what is suggested by Table 5.

Finally, we look at whether differences emerge when one considers workers employed by firms of different sizes. We consider three size groups: self-employed, those working in firms with between 2 and 10 employees, and those working in firms with more than 10 employees. For all three measures of formality, we find statistically significant effects of credit on formalization of workers employed by firms with more than 10 employees. For other firm sizes, the effect is not significant for some measures of informality (see Table 7). The effect is higher for larger firms according to all informality measures.

Table 7. Formal Employment and Financial Dependence: Firm Size Break					
Dependent variable: share of formal to total employment.					
Independent variable: Credit to the private sector (as percentage of GDP) interacted with RZ					
Estimation method: Panel GLS estimation with heteroskedastic but uncorrelated error structure					
Time and sector dummies included in all regressions					
		coeff.	s.e.	Obs.	Sectors
Health rights ^{/1}	Self-employed	38.622 ^{***}	10.25	199	26
	Firms with 2 to 10 employees	35.907 ^{***}	11.564	218	26
	Firms with more than 10 employees	41.774 ^{***}	8.140	271	33
Salary bonus "aguinaldo" ^{/2}	Self employed	4.783	4.777	183	26
	Firms with 2 to 10 employees	16.896	11.649	202	26
	Firms with more than 10 employees	32.651 ^{***}	8.159	250	33
Social security taxes ^{/2}	Self employed	26.269 ^{**}	11.702	183	26
	Firms with 2 to 10 employees	19.064	12.090	202	26
	Firms with more than 10 employees	38.483 ^{***}	8.133	250	33

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

^{/1} Period: 2000-2010. ^{/2} Period: 2001-2010

4.5 Time-Varying Effects

As mentioned above, the economic crisis in Uruguay led to sharp contraction of credit and to an important restructuring of the banking sector. Given these events, it is interesting to examine whether the size of the effects of bank credit on informality has changed over time. To do this, we re-estimate equation (1) for different six-year periods (see Table 8). Even though point estimates suggest that the effect might have increased over time, the effects for the later years are more imprecisely estimated, and therefore differences in point estimates are not statistically significant. It thus appears that the size of the effect of bank credit on informality has remained constant over time. Similar results are obtained if either shorter or longer time periods are defined for the estimation of equation (1).

Table 8. Formal Employment and Financial Dependence: Business Cycle					
Dependent variable: share of formal to total employment according to various definitions					
Independent variable: Credit to the private sector (as percentage of GDP) interacted with RZ					
Estimation method: Panel GLS estimation with heteroskedastic but uncorrelated error					
Time and sector dummies included in all regressions					
Estimation method	Periods	coeff.	s.e.	Obs	Sectors
Health rights	2000-2005	30.52**	11.92	157	27
	2001-2006	32.76***	9.79	165	35
	2002-2007	28.55***	11.06	173	35
	2003-2008	64.05***	19.11	182	35
	2004-2009	67.96	53.49	191	35
	2005-2010	160.25	133.79	201	36
Salary bonus “aguinaldo”	2001-2006	33.19***	7.83	165	35
	2002-2007	25.59***	8.47	173	35
	2003-2008	61.65***	14.52	182	35
	2004-2009	114.16**	46.47	191	35
	2005-2010	73.99	140.92	201	36
Social security taxes	2001-2006	10.36	8.52	165	35
	2002-2007	9.36	9.16	173	35
	2003-2008	52.11***	18.94	182	35
	2004-2009	32.05	50.99	191	35
	2005-2010	76.76	133.46	201	36

Notes: Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%.

5. Conclusions

In this paper we followed the Catão, Pagés and Rosales methodology to study the impact of bank credit on employment formality. In our Uruguayan sample, we find that easier access to bank credit decreases informality, especially in more financially dependent sectors. This effect is found to be greater for women, younger workers and workers employed by larger firms. No evidence is found that the effect of bank credit on formality has changed over time.

Even though our analysis is able to unveil a positive effect of bank credit on employment formality, our work is silent on what explains the magnitude of the effect as well as the differential effects across different types of workers. Understanding how the economy's underlying key parameters and institutions affect the impact of bank credit on informality is of outmost importance. These topics, beyond the scope of this paper, call for further research.

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Appendix

Table A1. Employment Informality by Groups									
	Health Rights			Salary Bonus “aguinaldo”			Social Security Tax		
	2001	2005	2010	2001	2005	2010	2001	2005	2010
<i>Total</i>	45.58%	47.02%	40.95%	47.05%	49.73%	40.61%	39.82%	43.29%	34.81%
<i>Firm Size</i>									
Self-employed	85.35%	83.95%	79.32%	97.70%	98.43%	99.05%	76.72%	78.22%	76.45%
2 to 9 employees	50.64%	54.69%	50.24%	48.26%	52.51%	45.53%	44.42%	50.37%	44.67%
10 or more employees	12.82%	12.78%	13.88%	9.04%	10.14%	4.93%	9.49%	11.06%	5.56%
<i>Gender</i>									
Male	48.30%	49.42%	41.51%	49.87%	52.40%	41.54%	43.02%	45.95%	36.29%
Female	41.20%	43.30%	40.16%	42.50%	45.59%	39.28%	34.66%	39.18%	32.71%
<i>Age</i>									
Up to 25 years of age	49.27%	51.80%	42.25%	44.98%	48.01%	35.08%	46.80%	50.11%	39.00%
26 years of age or older	44.60%	45.90%	40.64%	47.61%	50.13%	41.94%	37.96%	41.70%	33.81%

Notes: For all years and definitions in the table, differences between males and females, self-employed and 2 to 9 employees, 2 to 9 and 10 or more employees are statistically significant at a 1% confidence level. The difference between workers up to 25 years of age and 26 years or older is significant at a 10% confidence level in 2005 when the aguinaldo definition is used. In all other cases, the difference for the two age groups is significant at a 1% level.

Table A2. Summary Statistics of Alternative Measures of Informality

<u>ISIC</u>	<u>Sector</u>	<u>Health Rights</u>			<u>Salary Bonus “aguinaldo”</u>			<u>Social Security Tax</u>		
		2001	2005	2010	2001	2005	2010	2001	2005	2010
13	Mining of metal ores	0.00%	N/A	5.56%	100.00%	N/A	0.00%	0.00%	N/A	0.00%
14	Other mining and quarrying	35.00%	27.27%	28.40%	40.00%	27.27%	22.22%	30.00%	27.27%	22.22%
15	Manufacture of food products and beverages	30.49%	30.40%	24.95%	26.81%	25.37%	17.13%	27.21%	28.34%	19.38%
17	Manufacture of textiles	30.49%	38.35%	44.97%	31.71%	38.35%	48.66%	30.49%	39.10%	48.66%
18	Manufacture of wearing apparel	72.09%	73.13%	64.56%	74.27%	75.47%	69.51%	69.17%	73.36%	68.24%
19	Tanning and dressing of leather	33.33%	25.23%	28.20%	31.85%	27.03%	25.56%	29.63%	24.32%	22.56%
20	Manufacture of wood and of products of wood and cork	65.05%	67.50%	51.93%	64.08%	70.00%	45.61%	61.17%	67.50%	49.12%
21	Manufacture of paper and paper products	25.00%	28.57%	13.14%	25.00%	22.45%	10.22%	25.00%	28.57%	8.76%
22	Publishing, printing and reproduction of recorded media	27.08%	34.42%	24.71%	26.39%	33.77%	21.76%	23.61%	31.82%	17.94%
23	Manufacture of coke, refined petroleum prod. and nuclear fuel	28.57%	0.00%	25.00%	28.57%	0.00%	0.00%	28.57%	0.00%	0.00%
24	Manufacture of chemicals and chemical products	12.15%	13.81%	14.49%	10.50%	11.60%	5.94%	9.39%	12.15%	5.94%
25	Manufacture of rubber and plastics products	11.58%	13.16%	14.96%	10.53%	11.84%	5.56%	10.53%	13.16%	7.26%
26	Manufacture of other non-metallic mineral products	66.95%	74.44%	55.76%	65.25%	73.33%	52.04%	64.41%	72.22%	52.42%
27	Manufacture of basic metals	30.77%	40.00%	35.71%	38.46%	20.00%	21.43%	23.08%	30.00%	28.57%
28	Manufacture of fabricated metal products	45.97%	45.41%	41.15%	47.58%	47.96%	40.63%	40.73%	43.37%	37.67%
29	Manufacture of machinery and equipment n.e.c.	29.27%	31.58%	28.05%	31.71%	39.47%	36.59%	29.27%	26.32%	28.66%
31	Manufacture of electrical machinery and apparatus n.e.c.	33.33%	31.25%	24.32%	27.78%	31.25%	10.81%	33.33%	25.00%	9.46%
32	Manufacture of radio, television and communication equip.	40.00%	30.00%	9.09%	40.00%	20.00%	18.18%	40.00%	10.00%	18.18%
33	Manufacture of medical, precision and optical instruments	10.53%	53.57%	30.59%	26.32%	60.71%	43.53%	5.26%	46.43%	22.35%
34	Manufacture of motor vehicles, trailers and semi-trailers	0.00%	0.00%	3.03%	14.29%	7.69%	0.00%	0.00%	0.00%	0.00%

Table A2. Summary Statistics of Alternative Measures of Informality (continued)

ISIC	Sector	Health Rights			Salary Bonus "aguinaldo"			Social Security Tax		
		2001	2005	2010	2001	2005	2010	2001	2005	2010
35	Manufacture of other transport equipment	48.39%	57.45%	48.48%	61.29%	59.57%	50.00%	48.39%	51.06%	39.39%
36	Manufacture of furniture; manufacturing n.e.c.	70.43%	74.63%	64.93%	73.48%	77.21%	71.64%	66.52%	73.90%	66.27%
40	Electricity, gas, steam and hot water supply	43.75%	20.00%	8.64%	18.75%	20.00%	3.70%	25.00%	20.00%	4.94%
45	Construction	66.14%	66.35%	52.45%	66.90%	68.46%	50.27%	64.79%	66.06%	49.73%
50	Sale, maintenance and repair of motor vehicles & fuel	51.40%	53.53%	48.61%	53.88%	55.13%	49.82%	47.20%	51.44%	45.91%
51	Wholesale trade	31.03%	41.23%	34.07%	31.66%	44.55%	31.09%	25.75%	38.03%	26.51%
52	Retail and commission trade	50.33%	54.79%	47.56%	54.49%	58.30%	49.99%	45.29%	51.69%	44.13%
55	Hotels and restaurants	41.24%	43.56%	43.07%	35.92%	41.45%	38.14%	35.92%	40.92%	37.20%
60	Land transport; transport via pipelines	24.37%	28.52%	23.88%	32.05%	37.52%	26.05%	20.70%	25.98%	17.75%
62	Air transport	3.85%	11.11%	20.37%	3.85%	11.11%	5.56%	3.85%	11.11%	5.56%
63	Supporting transport activities; activities of travel agencies	46.11%	30.89%	34.21%	49.72%	32.05%	28.82%	39.72%	28.19%	26.20%
64	Post and telecommunications	28.57%	39.10%	26.57%	23.47%	38.35%	22.99%	24.49%	33.08%	17.91%
70	Real estate activities	39.74%	37.50%	31.58%	55.13%	50.00%	37.32%	29.49%	35.71%	15.79%
72	Computer and related activities	32.11%	43.81%	36.43%	47.71%	55.67%	43.21%	26.61%	35.05%	23.30%
74	Other business activities	53.23%	50.60%	50.85%	53.44%	57.85%	57.94%	34.07%	36.81%	34.17%
80	Education	31.21%	30.65%	28.75%	31.41%	31.83%	23.39%	27.36%	27.90%	21.46%
85	Health and social work	24.35%	23.67%	25.75%	23.86%	25.71%	21.59%	15.11%	17.47%	13.45%
90	Sewage and refuse disposal, sanitation and similar activities	37.93%	47.83%	29.21%	41.38%	43.48%	10.11%	34.48%	43.48%	10.11%
92	Recreational, cultural and sporting activities	58.80%	58.90%	47.44%	58.37%	62.17%	52.95%	55.79%	58.08%	45.99%
93	Other service activities	69.03%	71.31%	63.64%	77.17%	78.83%	72.96%	64.83%	69.92%	61.45%