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Inequality, Institutions, and Informality

by

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Abstract[*]

This paper presents theory and evidence on the determinants of the size of the informal sector. We propose a simple theoretical model in which the informal sector's size is negatively related to institutional quality and positively related to income inequality. These predictions are then empirically validated using different proxies of the size of the informal sector, income inequality, and institutional quality. The results are shown to be robust with respect to a variety of econometric specifications.

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1. Introduction

A significant part of economic activity in developing as well as in developed countries is conducted in the informal sector. Estimates suggest that, depending on the measure used, the relative size of the informal sector constitutes more than 30 percent of aggregate economic activity in developing countries and almost 20 percent in developed countries (see Table 1 below). While the informal sector's effect on economic growth has been debated in the literature,[1] there is much concern that the informal sector causes erosion of the tax base and, ultimately, deterioration of publicly provided goods and services.

Consequently, some recent work has been devoted to the study of the determinants of informality. In particular, the efforts have focused on various government interventions in the economy, such as through a high tax burden (e.g., Cebula, 1997; Giles and Tedds, 2002) and excessive regulation, especially in the labor market (as in Schneider and Enste, 2000; Schneider and Klingmair, 2003; Johnson, Kaufmann and Zoido-Lobatón, 1998).

In this paper, we take a fresh look at the determinants of the size of the informal sector. Quite apart from intervention by the government, we argue that income inequality, in conjunction with institutional quality, is a significant factor in this regard. The reason for this is that, when property rights in the formal sector are poorly protected, resources are to a large extent up for grabs. Poor individuals, whose endowments are relatively limited, are at a disadvantage in extracting a larger share of resources, hence find they it beneficial to move into the informal sector where, although less productive, they are able to fully retain their production output. High inequality, exacerbated by low institutional quality, magnifies this effect, implying a positive relationship between inequality and the size of the informal sector.

A simple model that exhibits these properties is first presented and then empirically tested in this paper using recent estimates on the size of the informal sector that employ different proxies, as well as different econometric approaches.[2] Overall, we find that income inequality, particularly in conjunction with institutional quality, is a statistically significant

[1] The relationship of the informal sector to economic outcomes has been the subject of some scrutiny recently. For instance, it has been suggested that a large informal sector implies, *inter alia*, slower economic growth (Loayza, 1996; Schneider and Klingmair, 2003); see Sarte (2000), however, for a more nuanced view.

[2] From a theoretical perspective, this work is related to a number of recent papers that generate informality in equilibrium, such as Acemoglu (1995), Acemoglu and Verdier (2000), and Loayza (1996), among others. However, none of these papers focuses on income inequality.

and substantively robust determinant of the relative size of the informal sector. For example, depending on the specification, an increase in inequality level from that of Mexico (a Gini of 0.49) to that of Brazil (a Gini of 0.57) one increases this size by about 3 to 4 percent.

While much of the earlier literature emphasizes the importance of the tax and regulatory burden, Friedman, Johnson, Kaufmann et al. (2000), is the closest to the present endeavor in focusing on the role of institutional quality in shaping the relative size of the informal sector. The main innovation here, both in the theoretical framework and in the empirical estimation, is including income inequality as another crucial factor in this regard. While uncovering the significance of these two, tax and labor regulatory components are also found to be significant—in line with much of the earlier work and unlike Friedman, Johnson, Kaufmann et al. (2000), where taxes are either found to be insignificant or negatively related to the size of the informal economy.

The next section presents the theoretical model including equilibrium analysis and comparative statics. Section 3 introduces the empirical approach and the data employed. Section 4 reports findings using ordinary least squares and instrumental variables, and Section 5 does so for the panel data. Section 6 summarizes and concludes.

2. Model

Consider a two-period economy populated by a measure one of individuals indexed by i. The initial level, in period 1, of individual i's income is exogenously given at y_i, and the income level in period 2, z_i is endogenously determined. We let H denote the cumulative distribution function of the initial income distribution. Production takes place in the formal sector (FS) and in the informal sector (IS). Aggregate productivity in the former is greater, but individual access to productive technology is limited—through licensing, regulation, etc. Individuals must therefore expend resources to gain access to these technologies. In contrast, in the informal sector productivity is smaller, but the technology used is readily accessible by all households.

In general, individuals allocate resources between current consumption, c_{i1}, productive investment, k_i, and—in the formal sector—investment in overcoming licensing and regulation

barriers, x_i , in order to gain access to production technologies. Normalizing all prices to one, the budget constraint is thus

$$y_i = c_{i1} + k_i + x_i\, d \tag{1}$$

where $d = 0$ when the individual is the informal sector, and $d = 1$ when he is in the formal sector.

In the informal sector, the production function is

$$z_i = Bk_i,\ B > 0 \tag{2}$$

where $B>0$ is the productivity parameter in the IS.

In contrast, the aggregate productivity parameter in the formal sector, A, is larger, and $A > B$. Production opportunities, however, are endogenously determined through individual efforts as well as through the prevailing rule of law system. Specifically, where the rule of law is strong, individual marginal efforts are insignificant in determining the allocation of production opportunities. Letting L, $0 \leq L \leq 1$, denote the degree of the rule of law, individual i's productivity parameter is

$$a_i = A\, x_i^{1-L} / \int_{i \in FS} x_i^{1-L}\, di \tag{3}$$

and her second-period income level is

$$z_i = a_i k_i \tag{4}$$

Note that the larger L is the lower is the marginal value of spending resources to gain access to the technology in the formal sector and the more equally is this access allocated.

Unlike the traditional view used to define the informal sector that focuses on the size and the type of technology of the firm and the occupation of the worker, we follow recent research that shows that most businesses and workers base their decision to enter and staying in the formal sector depending on the evaluation of the relative benefits and costs of doing so (Saavedra and Chong, 1999; Maloney, 1999).[3] Such evaluations are continuously revised by

[3] In the traditional view, the size of the informal sector is tied with the size distribution of firms so that an increase in the share of small businesses in total employment is interpreted as an increase in the share of the informal sector (Cole and Fayissa, 1991). This direct relationship between these two variables does not necessarily hold when using a cost-benefit definition of informality (Saavedra and Chong, 1999).

workers and firms and may result in different sector assignments depending on the institutional framework and changes in regulations. In this context, the informal sector should be viewed as part of a voluntary sector that, due to the laxity in enforcement of labor and other codes, is able to choose the optimal degree of participation in formal institutions (Maloney, 2003).[4]

Individual preferences derive from current consumption c_{i1} and future consumption, which in turn equals next-period income z_i. Assuming for simplicity symmetric logarithmic preferences, we write the expected utility:

$$V(c_{i1}, c_{i2}) = \ln(c_{i1}) + \ln(c_{i2}) = \ln(c_{i1}) + \ln(z_i) \quad (5)$$

Individuals first decide in which sector—IS or FS—to operate. Then, in the former case, they allocate income between consumption and investment; and, in the latter case, individuals choose among consumption, investment and influence activities. The equilibrium consists of such mutually consistent decisions.

2.1. Equilibrium Analysis

This analysis proceeds backwards, starting with the consumption-investment choices in each sector and then determining the allocation of the individuals across the two sectors.

Maximizing (5) subject to (1) for those in the informal sector, we obtain (clearly, there is no investment in obtaining access to technologies in this case):

$$c_{i1}^{IS} = k_i^{IS} = y_i / 2, \; z_i^{IS} = By_i / 2 \quad (6)$$

and the utility level of

$$V_i^{IS} = \ln(y_i /2) + \ln (By_i/ 2) \quad (7)$$

Likewise, for those in the formal sector:

$$c_{i1}^{FS} = k_i^{FS} = y_i / (3\text{-}L), x_i^{FS} = y_i(1\text{-}L)/ (3\text{-}L), \quad z_i^{FS} = A \, (y_i^{1\text{-}L} / \int_{i \in FS} y_i^{1-L} di \,) \, (y_i / (3\text{-}L)) \quad (8)$$

and

[4] In this context, the traditional dualistic view (Lewis, 1954) becomes more relevant in the presence of deep recessions and large labor market distortions (Maloney, 2003).

$$V_i^{FS} = \ln(y_i / (3\text{-}L)) + \ln \{ A (y_i^{1-L} / \int_{i \in FS} y_i^{1-L} di) (y_i / (3\text{-}L))\} \quad (9)$$

Anticipating consumption-investment decisions, individuals choose the sector in which they will produce by comparing the resulting expected utilities. Comparing (7) and (9), an individual prefers to produce in the formal sector if and only if,

$$V_i^{FS} - V_i^{IS} = \ln(y_i / (3\text{-L})) + \ln \{ A (y_i^{1-L} / \int_{i \in FS} y_i^{1-L} di) (y_i / (3\text{-L}))\} - [\ln(y_i /2) + \ln (By_i/ 2)] =$$

$$2\ln(2/ (3\text{-L})) + \ln \{ (A/B) (y_i^{1-L} / \int_{i \in FS} y_i^{1-L} di)\} > 0 \quad (10)$$

As the left-hand side of (10) increases with income, only sufficiently wealthy individuals produce in the formal sector, while poorer individuals move into the informal sector. This occurs because the rich gain disproportionately more from being in the formal sector relative to poor individuals. Letting y^* denote the income threshold level above which such production takes place, we write:

$$2\ln(2/ (3\text{-}L)) + \ln \{ (A/B) (y^{*1-L} / \int_{y_i > y^*} y_i^{1-L} di)\} = 0 \quad (11)$$

Equation (11), therefore, determines the threshold level and the relative size of the informal sector, $H(y^*)$.

2.2. Comparative Statics

Note that the left-hand side in (11) increases with y^*. This fact will play a role in establishing the comparative statics results below.

Institutional quality. Differentiation reveals that the left-hand side in (11) increases with L, implying a negative relationship between L and y^*, so that the better the institutional quality the smaller the share of the informal sector. This leads to:

Proposition 1. The lower the institutional quality the larger the size of the informal sector.

Income inequality. To study the effect of income inequality, suppose that the initial income distribution consists of two classes, the poor and the rich, whose respective relative size is P and

R (P+R = 1, P>R), with initial incomes y_P and y_R, $y_P < y_R$. It is not difficult to see that all rich individuals will produce in the formal sector. In equilibrium, then, some of the poor enter the informal sector, whereas others produce in the formal sector; let I and F denote these fractions, I + F = P.

The equilibrium condition (11) then becomes as follows:

$$2\ln(2/(3-L)) + \ln\{(A/B)[y_P^{1-L}/(F\,y_P^{1-L} + R\,y_R^{1-L})]\} =$$
$$2\ln(2/(3-L)) + \ln\{(A/B)[1/(F + R\,(y_R/y_P)^{1-L})]\} = 0 \qquad (12)$$

This condition determines *F*, the fraction of the poor participating in the formal sector, hence, *I* = *P*-*F*, the share of the population in the informal sector.

Consider now a mean-preserving spread in incomes, so that $y_R' = y_R + e$, $y_P' = y_P - e$, $e > 0$. Such a spread increases the ratio y_R/y_P, and hence, from (12), decreases *F* and increases the proportion of the population in the informal sector, *I*. This illustrates the existence of a positive relationship between income inequality and the size of the informal sector. Moreover, the elasticity of the ratio y_R/y_P with respect to the mean-preserving spread is higher the lower the institutional quality *L*, implying that poor institutional quality exacerbates the effect of inequality on the size of the informal sector.

The results above may be summarized by:

Proposition 2. The increase in income inequality, by lowering the relative benefits of formality for the poor, causes an increase in the relative size of the informal sector. This effect is stronger the lower the institutional quality.

3. Empirical Approach

In this section we study the empirical implications of the theoretical model above by using a benchmark specification based on the predictions of the model as well as on previous empirical research. In particular, we use the following specification:

$$\text{Informal}_j = \alpha_0 + \alpha_1 \text{Ineq}_j + \alpha_2 \text{Inst}_j + \alpha_3 \text{Tax}_j + \alpha_4 Rig_j + X\beta + \varepsilon_j \quad \text{for } j=1, 2, \ldots J \qquad (13)$$

where "Informal" is the dependent variable and represents the size of the informal sector. Based on the model above, our key explanatory variables are "Ineq," which represents a measure of income distribution, and "Inst," which is a measure of institutional quality.

Additionally, we follow previous research and also include other previously used controls, in particular, the variable "Tax," which represents the tax burden (Thomas, 1992; Lippert and Walker, 1997; Cebula, 1997), and the variable "Rig" which is a measure that captures entrance rigidities (Schneider and Klingmair, 2003; Johnson, Kaufmann and Shleifer, 1997; Johnson, Kaufmann and Zoido-Lobatón, 1998). Finally, X is a vector that includes some basic macroeconomic controls, namely output per capita, the rate of economic growth and the rate of inflation.

We use both cross-country and panel data approaches. In the former, the dependent variable is typically a "late value" or the average of the series available. In the case of the explanatory variables we use beginning-of-period values or earlier values (e.g., data corresponding to the 1970s or 1980s) in order to minimize potential endogeneity problems. In the case of the panel data approach, we take five-year averages and beginning-of- period values, in order to minimize for noise as well as endogeneity. This is explained in more detail below.

Measuring the size of the informal sector has been a difficult task. To be as comprehensive as possible, we follow Chong and López-de-Silanes (2004) and use two alternative data series. The first is from Schneider and Klingmair (2003) and is based on the so-called *demand for currency* approach.[5] These data provide recent cross-section measures, particularly for the 1990s. This approach assumes that all hidden economic activity uses cash as the means of exchange, so that an increase in the shadow economy produces an increase in the demand for currency. To calculate excessive demand for money, a standard equation for currency demand is estimated along with controls typically linked to tax evasion, which is believed to be a major reason for the existence of the informal economy.[6] Using an empirical estimation for the expected values of currency holdings, they are then re-estimated under the assumption that the tax variable takes the value of zero. The difference between these two series represents the excessive currency demanded as the result of the existence of the

[5] Another available data set that uses the currency demand approach is Botero, Djankov, La Porta et al. (2004), who largely base their series on Schneider and Enste (2000), which contains a less complete data set than Schneider and Klingmair (2003). Replicating all the empirical exercises using these data yield almost identical results.

informal economy. The size of the informal economy, typically expressed as a percentage of GDP, is then determined by multiplying the excessive currency by the velocity of money, which is assumed to be the same in both the formal and informal economy.

The second data series is based on the *Macroelectric Approach* (Kaufmann and Kaliberda, 1996). According to this method, the size of the informal economy may be measured from any discrepancy between an indicator of the overall economic activity and the official gross domestic product. Given the high correlation between consumption of electricity and economic activity, the growth rate of electricity consumption serves as an indicator of the evolution of the total gross domestic product.[7] Hence, any difference between the growth of electricity consumption and the growth of the official gross domestic product may be attributed to changes in the size of the informal economy. To calculate this measure, we use World Bank (2004) data on total electricity consumption. Data on real (official) gross domestic product, measured as the nominal GDP deflated by the implicit gross domestic product deflator, was obtained from the International Monetary Fund (2004), using annual observations from 1960 to 2000.[8] The resulting estimates of the size of the informal sector are expressed as a percentage of GDP. Appendix 1 contains the list of countries used, and Table 1 provides basic summary statistics on the size of the informal sector using the two data sources described above.

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[6] The basic equation is $\ln(C/M_2)_t = \alpha_0 + \alpha_1 \ln T_t + \alpha_2 \ln(WS/NI)_t + \alpha_3 \ln R + \alpha_4 Y_t + \varepsilon_t$ where C/M_2 is the ratio of currency holdings to broad money, Y is the real per capita income, R is the interest rate paid on time deposits, (WS/NI) is the ratio of wages and salaries in the national income, and T is an income tax variable.

[7] An explicit assumption is that the elasticity of electricity consumption to gross domestic product should be close to one. Since this assumption may be too strong, Kaufmann and Kaliberda (1996) perform sensitivity analysis allowing the value of the elasticity to vary across countries and time. These may account for technological changes in production process, variations of the sectoral composition of GDP and different production structures across countries. To account for the fact that economies may become more efficient in the use of electricity, we assume that the elasticity decreases by 0.05 from decade to decade (from 1.15 in the 1960s to 1 in the 1990s). The results, available on request, do not significantly change when applying different elasticities.

[8] Sources for seed values are Johnson, Kaufmann and Shleifer (1997), Loayza (1996), Lackó (1996, 1998), Giles (1999), Schneider and Bajada (2003) and Schneider and Enste (2000).

Table 1. Summary Statistics

	All Countries		Industrial Countries		Developing Countries	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Gini Coefficient	0.39	(0.09)	0.32	(0.05)	0.40	(0.09)
Size of Informal Sector						
- Schneider and Klingmair	0.32	(0.14)	0.17	(0.06)	0.36	(0.12)
- Macroelectric Approach	0.28	(0.21)	0.11	(0.14)	0.39	(0.21)

This table contains estimates on the size of the informal sector using two data sources and methods, the currency demand approach applied by Schneider and Klingmair (2003), and our estimates for the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector numbers are calculated as percent of gross domestic product. Specifics of the methods are described in the text.

With respect to the independent variables, we use the initial Gini coefficients, based on Deininger and Squire, 1997 as a proxy for income inequality. While the original data from Deininger and Squire go from 1960 to 1995 we are able to extend our inequality series using household data from Milanovic (2002a, 2002b) and by generating information using the coefficient of variation of income and the income's linear correlation with ranks.[9]

The institutional data come from International Country Risk Guide (ICRG) produced by the PRS group and originally used by Knack and Keefer (1995), Hall and Jones (1999), and several other researchers. The ICRG risk rating system assigns a numerical value to a predetermined range of risk components for about 130 countries for 1984 to 2000. In this paper we construct an average of the most commonly used institutional dimensions in the literature, in particular, government stability, corruption, rule of law, democratic accountability, and quality of bureaucracy quality. Additionally, we also consider two individual measures, corruption index and rule of law.[10] While these data are useful in our cross-country regressions as we are able to exploit beginning-of-the-period values (1984), their coverage is relatively limited when applying panel data analysis. In this latter case, we

[9] For the sake of robustness, we also use alternative measures of income distribution such as the income share ratio of the top to the bottom quintile of the population as well as the income shares of the middle quintiles as well as other measures of inequality, particularly Theil and Atkinson indices.

[10] We also tested all the other ICRG individual measures and find very similar results. Furthermore, we use Johnson, Kaufmann and Zoido-Lobatón (1998), and Kaufmann, Kraay and Mastruzzi (2003), testing their additional measures of governance and obtaining similar results. These data are much more limited as they are restricted to the cross-section approach. Finally, we use data from Freedom House (2002) and obtain very similar results. As shown by Knack and Keefer (1995), the correlation between Freedom House measures and other institutional measures (especially ICRG) is extremely high.

use data from Gastil (2002) instead.[11] These data, which contain an index of civil liberties and an index of political rights, were first used by Barro (1991). Freedom House (Gastil, 2002) publishes an annual assessment of the state of institutional freedom in each country. They report scores from 1 to 7, with lower scores denoting higher degrees of freedom. We rescaled these variables to 0-1, with higher scores implying more freedom, and we also compute an aggregate index, defined as the simple average of the civil liberties and political rights indices. While we use initial values in our cross-country regressions (1970), we are able to exploit the larger time-coverage for this variable in our panel exercises as the period goes from 1970 to 2000.

Our source for labor market rigidities is the aggregate index of *de facto* labor regulations constructed in Forteza and Rama (2002). This index is the simple average of the ratio of the minimum wage to unit labor costs in the manufacturing sector, social security contributions as a percentage of salaries, total trade union membership as a percentage of total labor force, and the share of general government employment in total employment.[12] As before, we use beginning-of-period data in the cross-section exercises and five-year averages in the panel exercises.

The data sources for the other controls employed in equation (13) consisted of the logarithm of initial per-capita income (Summers and Heston, 1991; World Bank, 2004), the average annual growth rate in gross domestic product per capita (Summers and Heston, 1991; World Bank, 2004), the initial rate of inflation (International Monetary Fund, 2004), and the initial corporate tax rate (KPMG, 2003).[13]

[11] While some panel exercises can be performed using the ICRG data, and result in similar findings, the dynamic panel methodology also employed cannot be used, as the number of observations is reduced drastically and does not allow the method to be applied.

[12] For robustness we follow Forteza and Rama (2002) and replicate the same exercise using a second index of regulations *de facto*, based on the simple average of the ratio of minimum wage to income per capita, the number of daysof maternity leave for a first child born without complications, the ratification of ILO Convention 87, which allows workers to organize, and the ratio of central government employment to total employment. Results are very similar. Additionally, while limited for our purposes, we use data on labor cost by Heckman and Pagés (2002) whenever possible. As before, the results do not change. We also use some limited data on entry costs whenever possible (La Porta, López-de-Silanes, Shleifer et al., 2003). Although the variable yields a positive and statistically significant sign, the results are not robust.

[13] In the case of these macro controls we also tested average values. The results are qualitatively identical.

4. Cross-Section Results

Table 2 shows simple cross-country ordinary least squares findings based on our benchmark specification in (13) and using the three alternatives measures of the informal sector as described in the previous section. Consistent with the theoretical model above, the findings in this table underscore the relevance of both income inequality and institutional quality as key determinants of size of the informal sector.

Table 2. Cross-Section: Ordinary Least Squares

	[1]	[2]	[3]	[4]
	Schneider and Klingmair (2003)		Macroelectric Approach	
Constant	0.456 **	0.093	-0.260	-1.567 **
	(0.12)	(0.18)	(0.41)	(0.50)
Output per capita	0.009	0.007	-0.019	-0.058
(in logs)	(0.02)	(0.02)	(0.06)	(0.06)
Economic Growth	-0.883	-0.735	1.524	1.707
	(0.67)	(0.65)	(1.87)	(1.77)
Inflation Rate	0.023	0.055	0.093	0.239
	(0.08)	(0.07)	(0.22)	(0.20)
Gini Coefficient	0.358 **	1.399 **	1.093 **	5.298 **
	(0.16)	(0.45)	(0.41)	(1.13)
Institutions	-0.104 **	-0.004	-0.025	0.376 **
	(0.02)	(0.04)	(0.06)	(0.12)
Gini * Institutions	…	-0.268 **	…	-1.043 **
		(0.10)		(0.24)
Tax rate	0.263 **	0.225 **	0.186	0.171
	(0.12)	(0.11)	(0.32)	(0.27)
Labor Rigidities	0.112	0.077	0.365	0.183
	(0.08)	(0.07)	(0.27)	(0.24)
Nobs.	72	72	54	54
R**2	0.7317	0.7511	0.2868	0.4361

(*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector from two data sources and methods, the currency demand approach applied by Schneider and Klingmair (2003), and our estimates for the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector numbers are calculated as percentage of gross domestic product. Specifics of the methods are described in the text.

As predicted by Proposition 1 in the model above, the institutional variable is negatively and statistically significant linked with the size of the informal sector when estimating the size of the informal sector using the currency demand approach (Schneider and Klingmair, 2003) as shown in Regression 1.[14] If the institutional quality index increases by

[14] This does not appear to be the case when using the Macroelectric approach, although the relationship is robust to a broad battery of institutional measures employed. In order to avoid unnecessary reporting such findings are

one unit, the size of the informal sector, measured as a percentage of the GDP, is reduced by 10.4 percent.

Furthermore, as predicted by Proposition 2, we find that there is a positive and statistically significant relationship between income inequality and the size of the informal sector. For example, if income inequality measured by the Gini coefficient, rises from, say, Mexican levels (0.49) to Brazilian levels (0.57), the size of the informal sector as a percentage of the GDP is predicted to increase by 2.92 percent. As shown in Table 2, this finding holds regardless of the type of the method of estimation of the size of the informal sector. More interestingly, we explore potential effects between the quality of institutions and inequality by introducing an interactive term between them. As shown in Regressions 2 and 4 in Table 2, the associated coefficient is negative and significant in both cases. Countries with poor institutional arrangements appear to have larger informal economies, especially so when income is unequally distributed. It should be noticed that when including the interactive term, the coefficient of the institutional measure turns out to be statistically insignificant, implying that the interactive term between institutions and inequality is the more relevant one. With respect to the other variables included in the regressions, the coefficient of the tax rate measure is, as expected, positive and statistically significant when using the currency demand approach to estimate the informal sector, although it yields no statistical significance when the Macroelectric approach is used. Interestingly, the labor rigidities coefficient is not statistically significant, although it yields the expected sign.[15] The key results are robust to the measure of income inequality employed, as shown in Table 3, where a broad battery of inequality measures (income quintiles, income ratios, and the often used measures of inequality by Atkinson and Theil), rather than the Gini coefficient, are used.[16]

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not presented. The results in terms of sign and statistically significance are always identical to the ones reported on the tables in this paper, unless explicitly stated. We would be happy to distribute these findings upon request.

[15] Our results do not change when using other labor cost measures (Heckman and Pages, 2001) as well as other cost of entrance variables (Djankov, La Porta, López-de-Silanes et al., 2000).

[16] For space reasons, only the coefficient of our variable of interest is reported. Overall, the coefficients of the other controls yield similar results to the full specification presented in Table 2.

Table 3. Cross-Section, Ordinary Least Squares, Robustness to Changes in Inequality Measures

	[1] Schneider and Klingmair (2003)	[2] Macroelectric Approach
I. Income Shares		
Top20	0.407 **	1.285 **
	(0.14)	(0.43)
Top40	0.520 **	1.245 **
	(0.17)	(0.51)
Middle 20	-0.880 **	-1.652 *
	(0.42)	(1.08)
Bottom 40	-0.843 **	-2.276 **
	(0.26)	(0.84)
Bottom 20	-1.525 **	-3.212 **
	(0.45)	(1.41)
II. Ratio of Income Shares		
Top20 / Bottom 20	0.005 **	0.012 **
	(0.00)	(0.00)
Top20 / Bottom 40	0.017 **	0.041 **
	(0.00)	(0.02)
III. Other Measures of Inequality		
Theil Coefficient	1.131 **	2.751 **
	(0.34)	(1.12)
Atkinson's Inequality (n=1)	1.421 **	2.829 **
	(0.38)	(1.34)
Atkinson's Inequality (n=2)	0.959 **	2.114 **
	(0.26)	(0.88)

This table reports the coefficient of the inequality proxy when applying the benchmark specification (13) in the text. (*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector from two data sources and methods, the currency demand approach applied by Schneider and Klingmair (2003), and our estimates for the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector numbers are calculated as percentage of gross domestic product.

While we use beginning-of-period values for the explanatory variables in the ordinary least squares exercise and late values for the dependent variable, the endogeneity between inequality and informality may still be a source of concern. We therefore control for potential endogeneity by employing legal origin variables (La Porta, López-de-Silanes, Shleifer et al., 1998), continental dummies, the average years of primary and secondary schooling attained by the population aged 25 or older (Barro and Lee, 2001), and the age dependency ratio defined as the number of people between 15 and 64 relative to the working population (World

Bank, 2004).[17] The basic instrumental variables results are presented in Table 4 and are complemented with robustness checks for inequality measures in Table 5. They are generally consistent with the ordinary least squares results presented above.

Table 4. Cross-Section: Instrumental Variables

	Schneider and Klingmair (2003)		Macroelectric Approach	
	[1]	[2]	[3]	[4]
Constant	0.394 **	-0.351	-0.560	-2.586 **
	(0.15)	(0.34)	(0.57)	(0.99)
Output per capita	0.015	0.009	-0.026	-0.089
(in logs)	(0.02)	(0.02)	(0.06)	(0.06)
Economic Growth	-0.397	0.075	2.503	2.748
	(0.71)	(0.73)	(2.33)	(2.12)
Inflation Rate	0.060	0.098	0.136	0.328 *
	(0.09)	(0.08)	(0.23)	(0.20)
Gini Coefficient	0.380 *	2.403 **	1.679 **	7.962 **
	(0.20)	(0.79)	(0.71)	(2.44)
Institutions	-0.107 **	0.080	-0.007	0.596 **
	(0.02)	(0.07)	(0.06)	(0.22)
Gini * Institutions	…	-0.489 **	…	-1.517 **
		(0.17)		(0.48)
Tax rate	0.315 **	0.274 **	0.295	0.286
	(0.14)	(0.13)	(0.40)	(0.36)
Labor Rigidities	0.082	0.055	0.368	0.220
	(0.09)	(0.09)	(0.27)	(0.25)
Nobs.	65	65	50	50
R**2	0.6943	0.7198	0.2857	0.3991

(*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector from two data sources and methods, the currency demand approach applied by Schneider and Klingmair (2003), and our estimates for the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector numbers are calculated as percentage of gross domestic product. Specifics of the methods are described in the text.

[17] Given the potential weakness of these instruments, we also apply a dynamic panel approach. See the following section.

Table 5. Cross-Section Instrumental Variables, Robustness to Changes in Inequality Measures

	[1] Schneider and Klingmair (2003)	[2] Macroelectric Approach
I. Income Shares		
Top20	0.265 *	1.556 **
	(0.16)	(0.60)
Top40	0.329 *	2.008 **
	(0.20)	(0.79)
Middle 20	-0.993 *	-5.337 **
	(0.63)	(2.38)
Bottom 40	-0.486 *	-3.143 **
	(0.30)	(1.17)
Bottom 20	-0.980	-7.289 **
	(0.67)	(2.61)
II. Ratio of Income Shares		
Top20 / Bottom 20	0.004 *	0.027 **
	(0.00)	(0.01)
Top20 / Bottom 40	0.013 *	0.078 **
	(0.01)	(0.03)
III. Other Measures of Inequality		
Theil Coefficient	0.729 *	4.591 **
	(0.43)	(1.66)
Atkinson's Inequality (n=1)	1.021 *	7.072 **
	(0.64)	(2.40)
Atkinson's Inequality (n=2)	0.605 *	4.256 **
	(0.39)	(1.49)

This table reports the coefficient of the inequality proxy when applying the benchmark specification (13) in the text. (*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector from two data sources and methods, the currency demand approach applied by Schneider and Klingmair (2003), and our estimates for the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector numbers are calculated as percentage of gross domestic product. Specifics of the methods are described in the text.

As predicted by Proposition 1, the sign of the institutional variable is negative and statistically significant at conventional levels when using the currency demand approach to estimate the informal sector. Using Regression 1 in Table 4, if the institutional variable increases by one unit, the size of the informal sector, measured as a percentage of the GDP, is

reduced by 10.7 percent. Furthermore, consistent with Proposition 2, the coefficient of the inequality variable is always positive and statistically significant. When the Gini coefficient increases from Mexican to Brazilian levels, the relative size of the informal sector is expected to increase by 3.1 percent, slightly more than under ordinary least squares. As in the OLS case, the interactive term between institutions and inequality is always negative and statistically significant, regardless of the method used to estimate the size of the informal sector (see Regressions 2 and 4).

5. Panel Data Findings

We also assemble a panel data set of 57 industrial and developing countries, spanning the corresponding full time periods for each sample; the data set consists of at most six non-overlapping 5-year period observations over the sample period 1970 to 2000.[18] This selection is based on the premise that inequality is persistent, as changes occur relatively slowly over time and the observed variation from year to year may be rather small (Chong and Gradstein, 2004).[19] Because of data limitations, we are only able to use the Macroelectric approach in order to estimate an informal sector series.[20] Fixed effects ordinary least squares regressions are presented in Regressions 1 and 2 in Table 6. Overall, the results are very similar to those from the cross-section regressions. In particular, the coefficient of the inequality variable is positive and statistically significant at five percent, while the interactive term between institutions and inequality is negative, although it is now statistically significant only at ten percent;[21] Regression 1 in Table 6 predicts that an increase in income inequality from Mexican to Brazilian levels would generate an increase of about 4.38 percent in the size of the informal sector. Notice that, unlike the cross-section cases, the coefficient of labor rigidities

[18] In order to maximize the time-span of the panel we use the Gastil institutional data. The ICRG data cannot be used, as it covers only the period 1984-2000, which results in too few usable observations.
[19] For the sake of completeness we also perform our analysis using different year groupings (ten years) as well as with annual data whenever possible. We find very similar results regardless of the sample size or data stacking.
[20] While theoretically it is also possible to create a time-series using the currency demand approach, our efforts did not yield credible results, perhaps because of the poor data available in many developing countries.
[21] Also, notice that the coefficient of the institutional variable is not statistically significant when the interactive term is not included (see Regression 1).

yields the expected sign at statistically significant levels; however, the coefficient of the tax rate yields an unexpected negative sign, although it is weakly statistically significant.[22]

Table 6. Panel Data Approaches

	Panel OLS with Fixed Effects		Panel IV with Fixed Effects	
	[1]	[2]	[3]	[4]
Constant	0.350 **	0.135	0.350 **	-0.171
	(0.16)	(0.19)	(0.16)	(0.25)
Output per capita	-0.029	-0.038 *	-0.029	-0.031
	(0.02)	(0.02)	(0.02)	(0.02)
Economic Growth	-0.188	-0.134	-0.188	0.198
	(0.44)	(0.43)	(0.44)	(0.44)
Inflation Rate	-0.009	0.034	-0.009	0.000
	(0.09)	(0.08)	(0.09)	(0.09)
Gini Coefficient	0.587 **	1.313 **	0.587 **	1.973 **
	(0.13)	(0.42)	(0.13)	(0.56)
Gini * Institutions	…	-1.146 *	…	-1.483 *
		(0.61)		(0.77)
Institutions	0.042	0.497 *	0.042	0.610 *
	(0.06)	(0.26)	(0.06)	(0.32)
Tax rate	-0.271 *	-0.297 *	-0.271 *	-0.199
	(0.15)	(0.15)	(0.15)	(0.18)
Labor Rigidities	0.243 **	0.217 **	0.243 **	0.175 *
	(0.10)	(0.10)	(0.10)	(0.10)
Nobs.	317	317	281	281
R**2	0.1426	0.1541	0.1671	0.1780

(*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector using the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector is calculated as percentage of the gross domestic product. Specifics of the methods are described in the text.

In columns 3 and 4 of Table 6, we tackle the potential endogeneity problem between inequality and the size of the informal sector by using an IV technique and the same instruments as in the cross-country case, namely, legal origin variables, continental dummies,

[22] When repeating the econometric exercise excluding this variable the signs and statistical significance of all the

average years of schooling attained, and the age dependency ratio. Overall, we obtain virtually the same results as in the pooled fixed effects case—that is, a positive coefficient in the inequality term, and a negative coefficient in the interactive term. Also, as before, we obtain a positive and statistically significant sign in the labor rigidities variable and, when including the interactive term (Regression 4), our results show the relevance of the non-linear effect between informality, inequality and institutions.[23]

An obvious problem in both the cross-section and the panel regressions using instrumental variables is the difficulty with finding good instruments. While some instruments may be deemed acceptable (e.g., legal origin, continental dummies) others may be considered less than perfect, as they may be potentially correlated with the dependent variable (e.g., age dependency ratio, schooling). Because of this, we also applied a GMM-IV dynamic panel data methodology, that allows us to take into account unobserved country and time specific effects, control for potential endogeneity of the explanatory variables (Arellano and Bover, 1995; Blundell and Bond, 1998). Using this method we estimate a regression equation in differences and a regression equation in levels simultaneously, with each equation using its own specific set of instrumental variables, as shown in Table 7 (further details of the estimation procedure are documented in an Appendix available on request). As in the other cases, we find that the coefficient of the Gini index is positive and statistically significant in the two specifications considered. We also find that the sign of the interactive term is negative, although only weakly statistically significant in Regression 2. The sign of the institutional variable reverses from positive, as in all our previous results, to negative, although the corresponding coefficient is not statistically significant.

other variables do not change.

[23] As in the ordinary least squares case, the coefficient of the tax rate still yields the wrong sign, although with no statistical significance when including the interactive term.

Table 7. Dynamic Panel Data Approach

	Dynamic Panel Data	
	[1]	[2]
Constant	0.779 **	0.896 **
	(0.09)	(0.15)
Output per capita	-0.059 **	-0.080 **
	(0.01)	(0.02)
Economic Growth	-0.123 **	-0.182 *
	(0.06)	(0.11)
Inflation Rate	0.094 **	0.083 *
	(0.04)	(0.05)
Gini Coefficient	0.172 **	0.236 **
	(0.09)	(0.10)
Gini*Institutions		-1.265 *
		(0.75)
Institutions	-0.109	-0.048
	(0.13)	(0.14)
Tax rate	-0.253 **	-0.164 *
	(0.06)	(0.09)
Labor Rigidities	0.337 **	0.292 **
	(0.06)	(0.08)
No. Observations	183	183
R**2	0.373	0.371
Specification Tests (p-values)		
- Sargan Test	(0.893)	(0.872)
- 2nd-Order Correlation	(0.301)	(0.326)

Regressions are performed with fixed effects. (*) statistically significant at ten percent; (**) statistically significant at five percent; (***) statistically significant at one percent. Standard errors are in parenthesis. We employ estimates on the size of the informal sector using the Macroelectric Approach based on Kaufmann and Kaliberda (1996). Informal sector is measured as the percentage of the gross domestic product. Specifics of the methods are described in the text.

With respect to the other controls, we obtain the expected signs in the case of output per capita, rate of economic growth, and the inflation rate, as well as with respect to the labor rigidities variable, all at significance levels of ten percent or better; but the coefficient of the tax rate gives, as before, the wrong sign at ten percent or better.

6. Conclusions

This paper presents theory and evidence on the relationship between institutional quality, inequality and informality. We propose a simple theoretical model in which the lower the institutional quality, the larger the size of the informal sector. Increasing income inequality, by lowering the relative benefits of formality for the poor, also causes informality to increase. We test our theory using different proxies of the size of the informal sector, income inequality, and institutional quality to confirm our model. We also use a broad range of econometric techniques for both a pure cross-country sample and a panel sample of countries, particularly ordinary least squares and instrumental variables, as well as pooled fixed effects and dynamic panel data models.

Overall, the empirical findings are consistent with the basic predictions of the model, in particular regarding (i) the predicted link between income inequality and the size of the informal sector, and (ii) the non-linear relationship between institutions and inequality and their corresponding impact on informality. The evidence is also suggestive on the link with the linear term of the institutional variable but such evidence is, perhaps, not sufficiently robust, as it fails to be corroborated when using all the econometric methods applied, particularly the dynamic panel data approach.

Finally, the empirical evidence also shows that other commonly believed determinants of the size of the informal sector do not necessarily behave as expected. While the labor rigidities variable yields a positive and statistically significant sign, including the tax rate proxy tends to result in a coefficient with the wrong sign that is, in some instances, statistically significant.

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Appendix 1. Full List of Countries[24]

1	ARE	United Arab Emirates
2	ARG	Argentina
3	AUS	Australia
4	AUT	Austria
5	BEL	Belgium
6	BFA	Burkina Faso
7	BGD	Bangladesh
8	BGR	Bulgaria
9	BHR	Bahrein
10	BHS	Bahamas
11	BLR	Bielorussia
12	BOL	Bolivia
13	BRA	Brazil
14	BWA	Botswana
15	CAN	Canada
16	CHE	Switzerland
17	CHL	Chile
18	CHN	China
19	CIV	Cote d'Ivoire
20	COL	Colombia
21	CRI	Costa Rica
22	CYP	Cyprus
23	CZE	Czech Republic
24	DEU	Germany
25	DNK	Denmark
26	DOM	Dominican Republic
27	DZA	Algeria
28	ECU	Ecuador
29	EGY	Egypt
30	ESP	Spain
31	EST	Estonia
32	ETH	Ethiopia
33	FIN	Finland
34	FRA	France
35	GBR	United Kingdom
36	GHA	Ghana
37	GIN	Guinea
38	GNB	Guinea Bissau
39	GRC	Greece
40	GTM	Guatemala
41	HKG	Hong Kong
42	HND	Honduras
43	HRV	Croatia
44	HUN	Hungary
45	IDN	Indonesia
46	IND	India
47	IRL	Ireland
48	IRN	Iran
49	IRQ	Iraq
50	ISR	Israel
51	ITA	Italy
52	JAM	Jamaica
53	JOR	Jordan
54	JPN	Japan
55	KAZ	Kazhakstan
56	KEN	Kenya
57	KGZ	Kirgyz Rep.
58	KOR	Korea, Rep.
59	KWT	Kuwait
60	LBN	Lebanon
61	LBY	Libya
62	LKA	Sri Lanka
63	LSO	Lesotho
64	LTU	Lithuania
65	LUX	Luxembourg
66	LVA	Latvia
67	MAR	Morocco
68	MDG	Madagascar
69	MEX	Mexico
70	MLI	Mali
71	MLT	Malta
72	MNG	Mongolia
73	MRT	Mauritania
74	MUS	Mauritius
75	MYS	Malaysia
76	NER	Niger
77	NGA	Nigeria
78	NIC	Nicaragua
79	NLD	Netherlands
80	NOR	Norway
81	NPL	Nepal
82	NZL	New Zealand
83	OMN	Oman
84	PAK	Pakistan
85	PAN	Panama
86	PER	Peru
87	PHL	Philippines
88	PNG	Papua New Guinea
89	POL	Poland
90	PRT	Portugal
91	PRY	Paraguay
92	QAT	Qatar
93	ROM	Romania
94	RUS	Russia
95	RWA	Rwanda
96	SAU	Saudi Arabia
97	SEN	Senegal
98	SGP	Singapore
99	SLE	Sierra Leone
100	SLV	El Salvador
101	SVK	Slovak Rep.
102	SVN	Slovenia
103	SWE	Sweden
104	SYR	Syria
105	THA	Thailand
106	TTO	Trinidad and Tobago
107	TUN	Tunisia
108	TUR	Turkey
109	TWN	Taiwan
110	TZA	Tanzania
111	UGA	Uganda
112	UKR	Ukraine
113	URY	Uruguay
114	USA	United States
115	VEN	Venezuela
116	VNM	Vietnam
117	YEM	Yemen
118	YSR	Yugoslavia
119	ZAF	South Africa
120	ZMB	Zambia
121	ZWE	Zimbabwe

[24] Not all the countries are included in all the regressions as, depending on the method used, other variables limited the sample size.