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Informality and Financial Development: A Literature Reviews

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Abstract

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Informality and Financial Development: A Literature Review

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Abstract: A large literature has documented an inverse relationship between financial development and the size of the informal economy, with some evidence that the link is depends on the institutional environment. The direction of causality, however, remains a matter of debate, making it hard to identify the right policy interventions for better economic outcomes. This paper reviews this literature. Drawing on the theoretical literature, it sketches out the various channels through which financial development can influence firms' choice to operate informally at all or the degree to which they operate informally, or vice versa. In addition, this paper summarizes the empirical evidence that, at the moment, does not settle the question of direction of causality in a broad sample of countries.

1. Introduction

Informality is pervasive around the world. It presents a formidable policy challenge, especially in emerging market and developing economies (EMDEs), where it accounts for about one-third of output and employment on average (Elgin et al. 2021).[1] Widespread informality is typically associated with a host of features of underdevelopment, ranging from poverty to low productivity (Ohnsorge and Yu 2021).

In recent decades, a considerable amount of research has been devoted to understanding the correlates of the informal economy: cumbersome regulations, excessive tax burdens, inefficient legal systems, and lack of economic development are some of the possible causes, as well as symptoms, of a large informal sector. In many cases, the direction of causality remains unsettled.

Financial development is one of the factors that influences firms' and individuals' choices to operate informally, and in turn, might be affected by the level of informality. For instance, informal firms and workers are often credit constrained and unable to access credit markets; but as financial markets conditions improve, the opportunity cost of informality increases, encouraging a shift towards formal activity and raising the aggregate size of the formal economy. In turn, by hampering aggregate productivity, an increase in the aggregate level of informality may affect bank's profitability and the smooth working and development of the financial markets.

The combination of high informality and lack of financial development can hold back long-term output and income gains: Informal firms lack access to external finance and this holds back their investment, restricts their scale of operations, and delays their implementation of new technologies. As a result, economies with pervasive informality and underdeveloped financial systems tend to have lower productivity than their peers (Capasso, Ohnsorge, and Yu 2021) and informal firms that lack access to finance tend to be lower productivity, active in more mature and non-competitive sectors, and more labor-intensive than their peers (Antunes and Cavalcanti, 2007; Capasso and Jappelli, 2013; Dabla-Norris, Gradstein, and Inchauste 2008).

A recent literature on informality has studied the complex relationship between financial development and the informal economy. For different sets of countries, different time periods, different definitions of financial development, different definitions of informality, and controlling for numerous alternative co-factors, many empirical studies have found a clearly robust and significant result: greater financial development is associated with less informality. While this correlation is well-established, some studies have pointed to nonlinearities or interactions with broader institutional environment.

This raises the question in which direction causality runs. Many theoretical papers and a few empirical papers have examined this question, with the answer remaining unsettled. The correct assessment of the direction of causality is key to identifying the right policy interventions to achieve greater financial development and mitigate the challenges associated with informality: if financial

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[1] In the economic literature, the term "informality" refers to all economic activities that are not covered or partially covered by legal or formal arrangements. The term is very general and encompasses other more specific terms such as underground economy, unofficial economy, etc. Hence, the informal economy embraces a broad variety of activities hidden to the government or to official statistics but that are not criminal. In our analysis we refer to this general meaning and we will use the terms underground, informal, unofficial synonymously.

development reduces informality, policy measures to broaden access to finance and lower bank intermediation cost can achieve better economic outcomes; if informality holds back financial development, streamlining and better enforcing tax regulations can achieve better economic outcomes.

The purpose of this paper is to, first, review the literature on the correlation between financial development and informality in all its complexities and, second, document the evidence for the direction of causality.

Several theoretical studies develop the channels through which financial development can influence firms' choice to operate informally at all or the degree to which they operate informally. These modelling efforts rely on financial market imperfections, especially information asymmetries, and regulatory and tax compliance costs. The typical model setup assumes that firms weigh the access to finance, or lower cost of finance, that is only available to formal activity with compliance cost. Greater financial development reduces the cost of finance, or expands access to finance, and therefore entices firms to operate formally. Several empirical studies have shown evidence consistent with this causal link using time series methods (and one study using an instrumental variable approach).

Fewer studies have developed theoretical channels for informality to affect financial developed and even fewer empirical studies have been based on this premise. The theoretical studies that underpin this direction of causality either explain how widespread tax underreporting forces banks to rely on inefficient and costly lending technologies or explain how widespread informality restricts the pool of savings available for financial intermediation. These studies also offer empirical support for their theoretical models.

In section II, we review the overwhelming evidence for a negative association between financial development and informality, both in the literature and in stylized facts. In section III, we review the theoretical studies that have offered mechanisms through which this negative association can arise, in either direction. Section IV summarizes the few empirical studies that establish causality. Section V concludes with policy implications and avenues for future research.

2. The negative correlation between informality and financial development

Empirical research on the relationship between the informal economy and financial development has grown rapidly. Employing different datasets and different specifications, such studies unanimously confirm the existence of a negative relationship between financial development and the informal economy (summarized in **Table 1**). Apart from model specifications and estimation strategies, these studies vary widely in the way they define financial development and measure the informal economy.

Indeed, this strand of literature faces two major measurement problems: one is the size of the informal economy, and the other is financial development. There are different methods used to estimate the size of the underground economy: direct approaches, indirect approaches, and the model latent estimation approach (Elgin et al. 2021). Direct approaches employ surveys of voluntary replies, labor force surveys, or tax auditing surveys. Indirect approaches use various macroeconomic indicators, from which it is possible to extract important information about the trend of the informal economy over time: the transaction approach; the currency demand approach; the electricity consumption method; and some other methods based on the discrepancy between national

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expenditure and income statistics, or between the official and actual labour force. Model-based approaches include the Multiple Indicators, Multiple Causes (MIMIC) model (as in Schneider, 2007 or in Schneider, Buehn, and Montenegro, 2010) or general equilibrium models (as in Elgin et al. 2021).

Financial development is usually defined through the variables that have been employed in the literature on financial development and growth: financial sector assets to GDP; commercial bank assets relative to central bank assets; the percentage of credit allocated to private firms; and the ratio of credit issued to private firms to GDP (King and Levine, 1993; Levine, 1997). Some recent empirical papers have employed a broader range of measures that draw on firm and household surveys (Capasso, Ohnsorge, and Yu, 2021).

In the following subsection II.1 we review the studies that document empirically the correlation between informality and financial development (invariably found to be negative). In the subsequent section II.2 we offer some additional stylized facts to document the same negative correlation with the most comprehensive set of measures of financial development and informality available to date.

2.1 Literature

Dabla-Norris, Gradstein and Inchauste (2008) do not explicitly focus on the relationship between financial development and the informal economy, but more generally investigate the determinants of informality. By employing data drawn from the World Business Environment Survey (WBES) compiled by the World Bank, they study the effects of the quality of the legal system, financial constraints, and the regulatory burden on the extent of informality, defined as the share of sales not reported to tax authorities. The sample comprises more than 4000 firm-level observations in 41 developing and developed countries. The measure of financial development is private credit by deposit money banks and other financial institutions in percent of GDP. The results of their ordered probit model show that firms that rate financing as major obstacles to their business have, on average, a 16 percent probability of hiding 50 percent of their sales, while those that consider finance to be a minor obstacle have a probability of less than 10 percent. The estimations also show that the tax burden, regulations, and financial constraints have a reduced correlation with informality in a context of a well-functioning legal system.

Since credit availability and lending conditions have implications for the size of the informal economy, Bose, Capasso and Wurm (2012) estimate the extent to which improvements in credit markets are associated with lower informality, using a range of measures of banking system efficiency and depth. They employ liquid liabilities and total domestic credit provided by depository banks in percent of GDP as a measure of banking sector depth, while they use bank overhead costs, net interest margin, lending-deposit rate spread, and the level of bank concentration as a measure of bank efficiency. Informality is measured as in the MIMIC estimates of Schneider (2007) and through survey data (2006-07) reported in the World Economic Forums' *Global Competitiveness Report* in which business leaders were asked to estimate the size of the informal sector. By means of cross-sectional and panel analysis on a sample of 137 countries over the time period of 1995–2007, they show that improvements in banking sector depth and efficiency are associated with a significant reduction in the size of the informal economy.

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Some studies have documented non-linearities in the correlation between financial development and informality. Canh and Thanh (2020) classify various indicators of financial development along three different dimensions—financial system depth, access, and efficiency—and distinguish two sub-sectors—financial institutions and financial markets. Financial development indicators are based on the dataset of Svirydzenka (2016). A measure of the underground economy is drawn from the Medina-Schneider database (2018). The result of this setup is a rich set of financial variables which reveals a variety of interactions with the informal economy. Employing several econometric techniques and estimation strategies on a balanced panel dataset of a global sample of 114 countries covering the period 2002-2015, Canh and Thanh (2020) find a statistically significant and negative relationship between financial development and the informal economy for eight out of the nine financial indicators (except financial institutions' efficiency). The analysis uncovers a non-linear, U-shaped relationship between each financial indicator and the informal economy. In addition, estimates from a dynamic fixed effects autoregressive distributed lag model suggest different short- and long-term effects. For example, greater financial depth and access are associated with a larger informal economy in the short run, and financial institutions are associated with a smaller informal economy in the long run. The negative correlation between financial depth and access and the informal economy, both in the short and long run, is particularly strong in low- and middle-income economies but, for high-income countries, only observable in the long run.

Gharleghi and Jahanshahi (2020) use data from the World Bank's *World Development Indicators* and global financial development database to test for a possible threshold in the relationship between financial development informality. In a panel threshold fixed effect regression on a set of 29 developed and developing countries over the period 1975-2015, they look for structural breaks and non-linearity. As in other works, the size of the informal economy is measured by the MIMIC approach (Medina and Schneider, 2018), while liquid liabilities, private credit and stock market capitalisation (all in percent of GDP) act as measures of financial development. The authors find that financial development is statistically significantly and negatively associated with the size of the informal economy, but only for countries with a per capita GDP of US$33,600 or more.

In an exceptionally comprehensive exploration of the negative association between financial market development and informality, Capasso, Ohnsorge and Yu (2021) conduct correlations and regression analyses of various specifications for 122 countries for 1990-2018 using a wide range of indicators of financial development and informality. Financial development is proxied, first, by firms' reported access to bank credit and capital markets, their reported difficulty in accessing credit, and their reported share of internal finance used in investment. Second, at the household level, financial development is proxied by the number of commercial bank branches, automated teller machines (ATMs), and bank credit as well as account ownership and reported use of mobile payment services. In addition, the International Monetary Fund (IMF)'s Financial Development Index and its sub-components are used as proxies for overall financial development and for development in "financial institutions" and "financial markets". Informality is proxied by both the general equilibrium-based measure of Elgin et al. (2021) and the share of self-employed in total employment. Without exception, a negative relationship between the various indicators of financial development and informality emerges.

Departing from the presumed direction of causality running from financial development to informality in other studies, Gatti and Honorati (2007) show how firms' choice to report sales for tax purposes correlates with firms' access to finance. Their hypothesis is that lower tax compliance limits

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the visibility of firm's balance sheets and reduces access to credit which, in turn, squeezes investment and productivity. Specifically, Gatti and Honorati (2007) use panel regression for firm-level survey data for 49 EMDEs during 1999-2005 to regress access to credit on the share of sales that is reported for tax purposes, controlling for a wide range of firm characteristics. Access to credit is measured in two ways. The first measure is a binary indicator of whether or not the firm has an overdraft facility or a line of credit. The second measure is a binary indicator of whether or not the firm has obtained financing from external sources such as banks, leasing arrangements, and credit cards or informal sources such as family loans, money lenders and trade credit. They find that greater tax compliance is robustly and significantly related to more access to credit; moreover, this relationship is stronger in high-formality countries. These findings suggest a non-monotonic negative relationship between informality and access to credit.[2]

2.2 Stylized Facts

In this section, we bring this literature together by offering stylized facts for the most comprehensive set of measures of informality and financial development yet. Specifically, we split a sample of up to 120 EMDEs for the period 2000-2018 into those with above-median and below-median shares of informality (by ten measures).[3] We then test for statistically significant differences in the simple averages of the [12] different financial development indicators for EMDEs with above-median informality and those with below-median informality (as grouped above).

We group financial development indicators into two groups. A first group of indicators captures access to financial institutions. These include, at the firm level, firms' reported access to bank credit and capital markets, their difficulty in accessing credit, and the share of investment financed internally. At the household level, they include the number of commercial bank branches, automated teller machines (ATMs), and bank credit, as well as account ownership and reported use of mobile payment services. A second group of indicators captures the depth of the financial system. This includes credit to the private sector in percent of GDP, stock market capitalization in percent of GDP, deposit money banks' assets in percent of GDP. As a robustness check, we also include the two aggregate indicators of financial development prepared by the International Monetary Fund (IMF). The IMF's "financial markets" development index captures access to, and depth and efficiency of, a country's stock and debt markets, which is less relevant for informal participants in EMDEs. The IMF's "financial institutions" development index measures how developed financial institutions are in terms of their depth (size and liquidity), access (the ability of individuals and companies to access financial services), and efficiency (the ability of institutions to provide financial services at low cost and with sustainable revenues). Data are available from World Bank *Enterprise Surveys*, the World Bank's *Global Financial Development Database*, the *World Development Indicators*, and the *Global Findex Database*. These financial development indicators are available for up to 120 EMDEs during 2000-18.[4]

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[2] Gatti and Honorati (2007) recognize that their estimation could potentially suffer from reverse causality because firms, especially less efficient ones, that are denied credit have an incentive not to pay taxes in order to compete in the market and to employ additional resources to self-finance their investments.

[3] Not all informality measures are available for the whole period over 2000-2018. Please check Elgin et al. (2021) for detailed data coverage.

[4] Some indicators are available for a much longer period. For instance, data on domestic credit to the private sector in some EMDEs can go back to the 1960s, and the IMF Financial Development Index covers the period from 1980 onwards. However, indicators that

We use the 12 measures of informality available in Elgin et al. (2021): two measures of output informality in percent of official GDP (MIMIC and DGE-based), four measures of employment informality (self-employment and informal employment in percent of total employment, employment outside the formal sector in percent of total employment, share of labor force without pension insurance), and six measures of perceived informality (World Economic Forum surveys, World Bank Enterprise Surveys, and the World Value Surveys).[5]

This yields a total of 12 x 12=144 comparisons of financial development for above-median and below-median informality (**Table 2**). Three-quarters of these comparisons show statistically significantly lower financial development in countries with above-median informality than in countries with below-median informality. This pattern holds for output-related, employment-related, and most of the perceptions-related measures of informality. On household perceptions of informality are captured in the World Value Survey's question about tax morality are not significantly associated with any of the financial development indicators under consideration.

3. The theory behind the informality-financial development nexus

Hence, the empirical evidence is unambiguous: greater financial development is associated with lesser informality. This evidence raises a crucial question: why is this the case? In this section, we review the theoretical studies that have identified the various channels through which the negative relationship between financial development and informality can arise. By considering trade-offs between firms' choices between formal and informal activity, these studies attempt to uncover how changes in the financial structure of an economy can influence entrepreneurs' attitudes towards tax compliance. On the one hand, by operating informally, firms avoid the cost of regulatory and tax compliance; on the other hand, they face a reduced access to external finance and have limited investment possibilities. Hence, the prevailing notion is that more favorable financing conditions raise the opportunity cost of informality and encourage firms to operate in the formal economy. Broadly speaking, these studies differ in three dimensions: the modelling of financial market frictions, the incorporation of technological choices, and the nature (binary or continuous) of informality choices.

The theoretical studies exploring the reverse causality take a different angle entirely. They either introduce technological decisions for banks or they invoke general equilibrium constraints on the size of the financial system. The first mechanism relies on widespread informality pushing firms into inefficient, costly lending technologies that hold back financial development; the second mechanism relies on large informal sectors without access to the formal financial system undermining the pool of savings available for financial intermediation.

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capture firms' access to finance are available only periodically between 2006 and 2017, making them unsuitable for time-series analyses.

[5] World Value Survey (WVS) asks whether cheating on taxes is justifiable (1 is "never justifiable" and 10 is "always justifiable") and reports average responses at the country-year level, with a higher level suggesting that the country is more tolerant towards the informal sector. World Economic Forum (WEF) asks "In your country, how much economic activity do you estimate to be undeclared or unregistered? (1= Most economic activity is undeclared or unregistered; 7= Most economic activity is declared or registered)" and reports average responses at the country-year level. Here the average responses have been reordered to make "7= Most economic activity is undeclared or unregistered; 1= Most economic activity is declared or registered" where a higher level suggesting a larger informal sector in the country. The World Bank Enterprise Surveys report four measures: the percent of firms competing against informal firms, the percent of firms formally registered when founded, the number of years operated without registration, and the percent of firms that found competitors in the informal sector as a constraint.

3.1 Financial development as a determinant of informality

One of the first studies exploring the reason for the link between financial underdevelopment and informality was that of Straub (2005) who analyzed the optimal choice between formality and informality in a continuous investment model with moral hazard. The model hinges on the idea that informational costs raise the cost of financial contracts which, in turn, represents the opportunity cost of agents choosing to operate informally. Hence, by changing the terms of the financial contract, financial development may affect the choice between formality and informality. As similar frameworks have since been employed, it is useful to describe the analytics of this model in greater detail.

The economy is populated by entrepreneurs in search of external funding to finance an investment project, and each entrepreneur is endowed with an initial capital endowment, which can be employed as collateral. Each entrepreneur has a different initial capital endowment. This capital endowment introduces an opportunity cost for an investment in the formal sector.

Access to financial markets is costly and informational problems account for a substantial part of such costs. To introduce informational costs, Straub (2005) focuses on moral hazard where the outcome of an investment project is fully verifiable but the exerted effort is not. The project requires an investment that exceeds the initial capital endowment and that yields a return in the event of success—to be shared between borrower and lender—but 0 otherwise. The success of the project depends on the entrepreneur's/borrower's effort: with low effort the probability of success is lower, but the entrepreneur obtains a private benefit. The financial contract between the lender and the borrower must be incentive-compatible such that the borrower finds it optimal to exert high effort. This constraint, together with the lender break-even constraint, determines the minimum level of collateral below which the entrepreneur cannot obtain a loan.

A further assumption is necessary to portray the choice between formality and informality. Formal entrepreneurs pay a formality fee that reflects tax and regulatory compliance costs but can access the credit market with no further costs. In contrast, informal entrepreneurs do not pay the formality fee but pay higher financing cost. In particular, in the event of default by an informal borrower, the lender imposes a penalty on the informal borrowers (perhaps an asset seizure or even "mafia-style' enforcement). The financing cost implicit in this contract for the informal borrower are higher than those implicit in the contract with a formal borrower.[6] A comparison between the entrepreneur's expected utility under the two options determines whether or not the formality choice prevails. In particular, entrepreneurs with initial assets or collateral below a minimum threshold choose to remain informal. However, Straub (2005) also show that better enforcement of creditor rights and contracts and greater macroeconomic stability can tilt entrepreneur's choice towards operating in the formal economy at lower levels of initial assets.

Hence, Straub (2005) models how the structure of financial markets affects a firm's decision to operate informally or not. Amaral and Quintin (2006) augment the model of Straub (2005) to show

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[6] Formally, the incentive compatibility constraint for the informal entrepreneur is $p_H R_b - (1 - p_H)K \geq p_L R_b - (1 - p_L)K + BI$, where p_H is the probability of success with high effort, p_L is the probability of success with low effort, R_b is the return on investment I for the borrower, and BI is the side benefit of a shirking borrower. The incentive compatibility constraint for the informal entrepreneur is $p_H R_b \geq p_L R_b + BI$.

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how the interaction of financial under-development and informality causes informal production to be less capital-intensive and lower-skilled than formal production.

Amaral and Quintin (2006) build a rich discrete time model in which two-period lived agents choose in the first period of their life whether to supply unskilled labour in the market or access education. In the second, they can either supply labour or, alternatively, operate as managers to produce a consumption good. The technology is such that output is produced with labour and physical capital, financed through savings or credit; and the crucial assumption is that unskilled labour is a better substitute for physical capital than skilled labour. As in Straub (2005), managers can operate formally and pay taxes on their profits, or they can operate informally, saving on taxes but facing costlier credit to finance their investments in physical capital since lenders may not be able to recover their loan in case of default.[7] The higher cost of loan default for formal entrepreneurs than for informal entrepreneurs lowers their financing cost and encourages the most talented entrepreneurs to operate formally with more capital-intensive technologies. In contrast, less talented entrepreneurs will remain informal and opt for more labor-intensive technologies with only self-financed capital. In equilibrium, the formal sector will employ more skilled labour and markets appear to be segmented despite the absence of barriers.

Implicitly, Amaral and Quintin (2006) suggest that any improvement in the financial markets which lowers the cost of credit favours the expansion of the formal sector. Antunes and Cavalcanti (2007), and Quintin (2008) apply these mechanisms developed by Straub (2005) and Amaral and Quintin (2006) to build general equilibrium models in which limited access to external finance, along with other entry barriers, can explain managerial decisions to operate informally.

The aim of Antunes and Cavalcanti (2007) is to refine and calibrate the mechanisms proposed by Straub (2005) to assess the quantitative importance of credit market imperfections (modelled as weak enforcement of financial contracts) and regulatory and tax compliance cost in explaining informality in the United States, Mediterranean Europe (Italy, Portugal, Spain) and Peru. For Peru and the United States, for example, differences in enforcement of financial contracts and regulatory cost are estimated to account for about one-half, each, of the difference in the size of the informal economy. Quintin (2008) calibrates a similar general equilibrium model (although with different modelling and calibration parameters) to the United States and shows that weak tax enforcement alone cannot explain large informal sectors. On the contrary, poor enforcement of financial contracts can easily generate large informal sectors where all but the most productive entrepreneurs self-select into labor-intensive, low-skilled, informal production.

A common feature of the above contributions is that the extent of informal activity is a reflection of the individual's all-or-nothing choice as to whether to participate in the informal sector. By contrast, Blackburn, Bose and Capasso (2012) focus on individual incentives to exploit unofficial opportunities whilst still doing business in the formal sector. Their analysis specifically attempts to explain the empirical evidence of an inverse relationship between the size of the underground economy and financial development. They do so within the context of a simple model of tax evasion and financial intermediation. The basic idea is as follows. As in Straub (2005) and Amaral and Quintin

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[7] The modelling of default cost differs between Straub (2005) and Amaral and Quintin (2008). Whereas Straub (2008) assumes an explicit loss in the event of default for informal entrepreneurs (but none for formal entrepreneurs), Amaral and Quintin (2006) assume the reverse.

(2006), suppose that entrepreneurs would like to undertake an investment project, but that the cost of doing so exceeds their current income or wealth such that external finance is needed; this finance is acquired from banks under the terms and conditions of optimal loan contracts. In contrast to earlier studies, asymmetric information between borrowers and lenders leads to a menu of such contracts that determines not only the rate of interest charged on loans, but also the probability that a loan will be granted (introducing the possibility of credit rationing). Individual entrepreneurs submit a loan application which requires them to decide how much current wealth to declare or to conceal from lenders (as well as tax authorities). The more wealth entrepreneurs hide, the less collateral they can offer for securing a loan and the worse are the terms and conditions of the loan contract, and this relationship is stronger at lower levels of financial development. The key implication of this analysis is that the marginal net gain from greater wealth disclosure—and hence formal activity—increases with the level of financial development.

More formally, in Blackburn, Bose and Capasso (2012), the economy is assumed to be populated by agents with different skills and different capital endowments. Such heterogeneity in borrowers' characteristics produces adverse selection and the need to build optimal financial contracts. As has been shown (e.g., Rothschild and Stiglitz, 1976), the only possible equilibrium in this framework is a separating equilibrium induced by borrowers' self-selection into differentiated contracts. To separate borrowers, the lender constrains high-skilled borrowers' access to credit but, in return, offers them a lower interest rate.[8] The greater a borrower's declared assets, the higher the probability that the borrower obtains a loan. The lender incurs costs of intermediation regardless of loan repayment and can claim collateral in the event of default. In this model setup, lower costs of intermediation are associated with a higher probability of high-skilled entrepreneurs obtaining a loan. Hence, the better financial markets function—understood as lower intermediation costs or lower information asymmetries—the more entrepreneurs are encouraged to declare their real wealth, and therefore to operate in the legal sector.

To calibrate to data for Italy, Capasso and Jappelli (2013) build on a similar model. But instead of introducing information asymmetries between borrowers' skill and lenders' knowledge thereof, they introduce the assumption that pledged assets can be lost in the case of a dispute, for example because of legal costs and judicial inefficiencies. Agents in need of financial resources to run high-tech projects can reduce such costs by pledging more collateral. Alternatively, assets that might otherwise have been used for collateral can be employed in low-tech production and generate a return that can be hidden from the government and subtracted from tax obligations. Hence, in this model the formality/informality choice is a technological choice and it is not exclusive. Firms can operate partially in the formal sector by running high-tech high-return projects, and partially underground, operating low-tech low-return projects. This model can account for the evidence that informality dominates in mature and non-competitive sectors, and that informal firms mainly employ low-return technologies, tend not to innovate, and typically run on smaller scales. By reducing the cost of credit—say, by improving contract enforcement—financial development makes the formality choice more rewarding, increases disclosure of collateral, and reduces the size of the informal economy at

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[8] Formally, a financial contract is represented by a pair $C_i = [R_i; \pi_i]$; $i = (H, L)$ where the probability of low-skilled entrepreneurs (L-type) obtaining a loan is higher than that of a high-skilled (H-type) entrepreneur, $\pi_L > \pi_H$, but the interest rate R_L is higher, $R_L > R_H$.

the aggregate level. At the same time, the share of investments in high-tech projects increases and so does the level of aggregate output.

Bittencourt, Gupta, and Stander (2014) introduce inflation into the standard model in which entrepreneurs face the tradeoff between accessing external finance by declaring part of their wealth for collateral and avoiding taxation. Banks face information asymmetries in that entrepreneurs may declare bankruptcy and default on their loans when they are not in fact bankrupt. Banks incur monitoring cost to verify that a declared bankruptcy is bona fide. Bittencourt, Gupta and Stander (2014) introduce inflation by modelling the banking sector in greater detail. Banks are explicitly modelled as pooling savings from households and lending them out to entrepreneurs against collateral, after meeting a cash reserve requirement. In this setup, greater financial development—as proxied by lower monitoring costs—is again associated with smaller informality. In addition, the authors interpret money growth as inflation and derive a link between lower inflation, higher real deposit rates that attract more deposits, and smaller informality.

Very recently, Guo and Hung (2020) introduced regulatory enforcement into a similar framework. Specifically, as the power of the government to collect taxes increases, so does the aggregate tax-auditing probability, with the result that tax compliance increases as well. The remainder of their theoretical framework is similar to that of other studies: entrepreneurs endowed with an initial wealth that can be used as collateral need external funds to undertake a project, and both the level of initial wealth and the return on the project are private information. Thus, entrepreneurs can underreport the initial capital to the lender and the project's return to the fiscal authority. Tax-auditing occurs with a positive probability that depends on the aggregate level of tax evasion and the level of government resources. The model shows that in equilibrium, lower financial intermediation costs increase the probability of socially optimal tax-auditing, raise tax compliance, and, as a result, also lower informal activity.

3.2 Informality as a determinant of financial development

While most theoretical studies model a causal relationship running from financial development to informal activity, there are a few studies that show channels for causality running in the opposite direction. They achieve this by modelling how widespread informality reduces the pool of savings available for lending or how informality leads banks into inefficient lending technologies.

Elgin and Uras (2013) built a model in which the informal sector can influence financial development through intermediation costs. The tax evasion inherent in informal activity forces governments to raise taxes further and, thus, in equilibrium is accompanied by higher intermediation costs. This, in turn, holds back financial development. More specifically, their model assumes an economy inhabited by entrepreneurs that are either risk averse or risk-neutral; all entrepreneurs are endowed with an initial wealth which can either be deposited in a bank for a fixed rate of return or, alternatively, it can be invested in a project with a random return. Only agents who choose to operate formally can access the financial system by borrowing or depositing money, but they have to pay a lump sum tax.[9] Agents who operate informally do not pay taxes but cannot access the financial market. In equilibrium, risk-neutral agents invest more than their initial wealth in the risky investment by borrowing the remaining amount, while risk-averse agents invest only part of their initial wealth

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[9] The authors argue that this is equivalent to the financial repression modelled in Roubini and Sala-i-Martin (1992, 1995).

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and deposit the rest. Because only entrepreneurs know of the success of their project, banks incur monitoring costs. These depend on the level of tax evasion: higher levels of tax evasion lead to higher taxes and this increases intermediation costs and harms financial development. Yet the effect of tax evasion on the financial system is non-monotonic. When the informal sector is very large, a decrease in informality (and, hence, tax evasion) boosts financial development.

In a similar vein, Massenot and Straub (2016) model a banking system whose pool of savings is fed by (formal and informal) entrepreneurs' saved profits from the previous period that are lent to other formal entrepreneurs in the current period. In an overlapping generations model, entrepreneurs' decision to operate formally depends on the benefits of accessing the financial system using collateral—itself dependent on the quality of enforcement of financial contracts—compared with a sunk cost of regulatory compliance. In this setup, measures to shrink the informal sector such as lowering regulatory compliance cost or better enforcing financial contracts are associated with greater demand for loans from a larger number of formal entrepreneurs. In open economy, this demand generated by greater formal activity can be satisfied by capital inflows and lower interest rates; in a closed economy, however, this demand cannot be satisfied from the existing pool of savings and, hence, financial markets cannot expand.

While Elgin and Uras (2013) and Massenot and Straub (2016) motivate the impact of informality on financial development with a smaller pool of savings, Capasso, Monferrà and Sampagnaro (2015) motivate it with the influence of informality on banks' optimal lending strategy. Banks may adjust their screening and monitoring strategies depending on the degree of transparency of borrowers they face. At the extremes, banks can apply two lending technologies: one which gathers financial and tax statements and lowers monitoring costs; the other which gathers in-depth information on borrowers and entails higher monitoring/screening costs. A consolidated terminology in the literature (Berger and Udell, 2002, 2006) generally refers to the first set of strategies as transaction lending and to the second as relationship lending. Despite being less costly, transaction lending may not always be optimal, for example in the presence of many potential underground borrowers. To escape taxes, informal entrepreneurs fabricate their financial accounts and tax statements—which are primary information sources to lenders. By doing so, informal entrepreneurs become opaque to potential lenders and unable to signal income returns and endowments. The result of this action is an increase in the probability of being credit-rationed, and in general costlier credit. Hence, if the bank operates in a market plagued by informal firms that can only provide poor quality financial statements, standardized lending procedures might decrease banks' revenue to the extent that they cannot be profitable. In such circumstances, banks find it optimal to switch to more intense monitoring. Hence, the model predicts that an increase in the size of the informal economy affects hampers financial development by reducing the use of more efficient lending technologies.

4. The empirical evidence

While many empirical studies have documented the negative correlation between financial development and informality, few have shown causality. These ones that have, have typically relied on Generalized Methods of Moments (GMM) estimation to establish causality (Bittencourt , Gupta, and Stander, 2014; Berdiev and Saunoris, 2016; Elgin and Uras, 2013), with the exception of one study that used an instrumental variable approach (Capasso and Japelli 2013). A few more studies establish causality running from financial intermediation to informality than the reverse, but almost as many document evidence suggesting two-way causality.

D'Erasmo (2016) provides further support for the evidence of the inverse relationship between the size of the informal economy and credit conditions in Brazil by developing a model with endogenous formal and informal sectors. The main idea is that tighter credit conditions raise the cost of entry into the formal sector and distort the allocation of capital towards less efficient investments. D'Erasmo and Boedo (2012) and Lopez-Martin (2019) refine this mechanism further in general equilibrium models of firm dynamics in which the size of the informal sector is determined by different forms of financial frictions, the burden of taxation, and other regulatory costs.

Employing panel data for 150 countries over the period 1980‑2009, Bittencourt, Gupta and Stander (2014) establish an impact of financial development on informality. They compare two measures of the size of the informal economy: the MIMIC method developed by Schneider, Buehn and Montenegro (2010) and a general equilibrium model-based measure developed by Elgin and Otzunali (2012).[10] Financial development is captured in terms of banking sector efficiency, measured as the average overhead cost in percent of the banking sectors total assets. Controlling for the level of institutional quality, the ability of the central bank to intervene in the economy, and financial system depth, their system (GMM) dynamic panel data estimation suggests that poorer banking system efficiency as proxied by higher banking costs (causally) increase the size of the informal economy.[11]

Only one study documents a causal link from financial development to informality through an instrumental variable estimation. It does so by leveraging an unusual data source for innovative proxies of informality or financial development. Capasso and Jappelli (2013) use the Bank of Italy's Survey on Household Income and Wealth (SHIW) to build two proxies of informality that make of the predominant use of cash transactions for informal activity and of underreporting of irregular or overtime hours. The authors use household-level data to define informality indirectly in two ways: first, as the ratio of number of years not covered by social security contributions to the length of the working life, and, second, as the fraction of income received in cash. The SHIW also provides an index of local financial development (Guiso, Sapienza, and Zingales, 2004) to identify actual and potential credit constraints. The indicator is built using the information on whether households in the 12 months before the interview had been denied credit or did not apply for credit because they thought they would be turned down. By simple ordinary least squares and an instrumental variable approach, Capasso and Jappelli (2013) find that financial development strongly and significantly reduces the level of informality—with causality running from financial development to informality.

Two studies—Catão, Pages, and Rosales (2009) for Brazil and Morón, Salgado, and Seminario (2012) for Peru—approach the question of causality from a different direction, based on household and sectoral data. They categorize informal firms and households into sectors according to the sector's dependence on external finance, as in Rajan and Zingales (1998). Using this approach, they find that aggregate credit growth has a statistically significant effect on informal activity among the self-employed and this effect is larger in those sectors that depend more heavily on external finance.

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[10] The correlation coefficient between these two measures is very close to one (Elgin et al. 2021).
[11] Proxied by the common factor of various indicators such as domestic credit in percent of GDP; the interest rate differential between loans and deposits; liquid liabilities in percent of real GDP, and the market capitalisation of all listed companies in percent of real GDP).

A few studies explore the possibility that the direction of causality runs from the informal economy to financial development. These studies fall into two types: those that test for two-way causality using time-series methods (and find evidence of two-way causality) and those that assume causality (based on theoretical models) running from informality to financial development.

Two studies explicitly explore the possibility of causality running in both directions. Berdiev and Saunoris (2016) estimate a system GMM for 161 countries over the period 1960–2009 with three endogenous variables: the log of real GDP per capita, as a proxy of economic development; the size of the informal economy as proxied by the general equilibrium-based measured of Elgin and Otzunali (2012); and financial development. The authors use three different indicators as proxies for financial development: money and quasi money (M2) in percent of GDP; domestic credit provided by financial corporations to the private sector in percent of GDP; and domestic credit from the financial sector to various sectors and net credit to the central government in percent of GDP. The results suggest that an initial increase in financial development—such as that captured in an orthogonal shock to M2—is followed by a decline in informality but the effect dissipates within a few years (eight years in the case of M2). They also find some evidence for reverse causality, from a shock to the size of the informal sector to financial development.

Bayar and Ozturk (2016) employ data for nine countries (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Poland, Romania, Slovakia, Slovenia) during 2003–2014 to study the interaction between the informal economy, financial development, and institutional quality. The informal economy is measured by the MIMIC estimates of Schneider, Raczkowski, and Mróz (2015). Domestic credit to the private sector in percent of GDP is the proxy for financial development. A cointegration analysis, combined with a test for Granger-causality, reveals a cointegrating relationship among the informal economy, the financial development and institutional quality, and a two-way causality between informality and financial development, and between informality and institutional quality. The effects are persistent: in the long run financial development and improvements in institutional quality are associated with a smaller informal economy.

Elgin and Uras (2013) test their theoretical model (discussed in section III.2) in a GMM estimation of financial development on informality. They test three different measures of financial development: money and quasi money; domestic credit provided by financial corporations to the private sector; domestic credit from the financial sector and net credit to the central government (all defined in percent of GDP). To capture the degree of taxation, they also include the ratio of the increase in the monetary base to total government revenue as a measure of seignorage. Financial efficiency is measured by means of both the value of banks' net interest margin to total assets, and banks' overhead costs. Informality is measured using the MIMIC estimates of Schneider, Buehn, and Montenegro (2010). The analysis involves a cross-country panel data set of 152 countries over the period 1999–2007, extracted from the World Development Indicators (WDI) of the World Bank. In line with their theoretical model, the results suggest an inverse-U-shaped relationship between financial development and the informal economy.

5. Conclusion

The empirical evidence strongly indicates that financial development is associated with a smaller informal economy. This result is robust to different specifications and it survives the use of various empirical strategies.

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A large body of theoretical papers has sought to explain why this is the case, and the core of the answer lies in how informational problems influence firms' and individuals' choices of operating informally. The main idea is that, in the presence of information asymmetries, the cost of accessing external financing represents the opportunity cost of being informal. By hiding their income, firms and individuals face a higher cost of credit and, by reducing this cost, financial development spurs formality and reduces the size of the informal economy.

This account of seemingly straightforward evidence might suggest that one could count on a simple set of policy recipes to reduce the level of informality in the economy, mainly aimed at improving the financial system and facilitating firms' and individuals' access to credit. Yet, several findings in the literature suggest otherwise. First, the relationship between informality and financial development is nonlinear, with limited impact of financial development when it is starting from a rudimentary level.[12] In these cases, other development policies may be priorities over financial development.

Second, the impact of financial development on informality appears to depend on the institutional environment, including contract enforcement, tax enforcement, rule of law more broadly, and even financial openness. This calls for complementing any effort at financial development with complementary policies to strengthen institutions, increasing competition and opening markets.

Third, the evidence of some reverse causality suggests that, in some instances, there may be room for targeted measures to reduce informality while aiming at financial development. This could include efforts to improve regulatory enforcement and reducing the regulatory compliance cost. These policies, as well as reducing the weight of informality in the economy, may spur financial development and, in turn, help curb informality further.

While the literature has unambiguously documented the negative association between informality and financial development, future research can make additional efforts at uncovering the direction of causality. In particular, rather than relying on GMM estimation, an increased use of instrumental variables may help detect causality in a more robust way.

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[12] Gharleghi and Jahanshahi (2020) even quantify (US\$33,600) the threshold in GDP per capita above which financial development significantly contributes to reducing the size of the informal economy.

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Table 1. Summary of the literature

Paper	Measure of financial development	Measure of informality	Methodology	Main database	Results
Gatti and Honorati (2007)	Access to credit, indicating whether the firm has a credit or overdraft line.	Percent of firms' sales reported to tax authority.	Ordinary least squares and fixed effects estimation.	World Bank *Investment Climate* surveys.	Less informality is robustly and significantly related with greater access to credit. The relationship between credit and formality is stronger in countries with less informality.
Dabla-Norris and Inchauste (2008)	Private credit over deposit money at banks and other financial institutions in percent of GDP	Percent of sales not reported to tax authorities	Ordinary least squares.	The 2005 *Business Environment and Enterprise Performance* Surveys of the World Bank and the European Bank for Reconstruction and Development.	Firms that rate financing as major obstacles to their business have, on average, a 16 percent probability of hiding 50 percent of their sales.
Bose, Capasso and Wurm (2012)	Liquid liabilities and total domestic credit provided by depository banks, bank overhead costs, net interest margin, lending-deposit rate spread, and level of bank concentration. All in percent of GDP.	Percent of sales not reported to tax authorities, DYMIMIC method (Schneider 2007), and World Economic Forum survey indicator.	Fixed effects and generalized method of moments.	Beck et al. (2000) database and World Bank *World Development Indicators*.	Improvements in the depth and efficiency of the banking sector reduces informal economy.
Elgin and Uras (2013)	Money and quasi money; domestic credit provided by financial corporations to the private sector; domestic credit from the financial sector and net credit to central government	DYMIMIC approach (Schneider 2007).	Generalized method of moments.	World Bank *World Development Indicators*.	A non-linear inverse-U relationship exists between financial development and informal economy size.
Capasso and Jappelli (2013)	Probability of being credit-rationed (Guiso et al. 2004).	Irregular job rate; Share of income paid in cash.	Ordinary least squares and instrumental	Bank of Italy's Survey of Households	Negative and significant effect of financial development on informality. The impact is particularly strong in construction but also in the retail and tourism sectors.

				variables estimation.	Income and Wealth (SHIW).	
Bittencourt, Gupta and Stander (2014)	Domestic credit as share of GDP; interest rate differential between loans and deposits; liquid liabilities in percent of real GDP; market capitalisation of listed companies in percent of real GDP	DYMIMIC approach (Schneider 2010) and dynamic general equilibrium (DGE) model (Elgin and Otzunali 2012).	Generalized method of moments and fixed effects.		Schneider et al. (2010); Elgin and Otzunali (2012); World Bank *World Development Indicators* and *Global Development Finance*; World Bank *Worldwide Governance Indicators*.	Lower (higher) levels of financial development and higher (lower) levels of inflation increase (lower) the size of the informal economy.
Berdiev and Saunoris (2016)	Money and quasi money (M2) as percentage of GDP; domestic credit provided by financial corporations to the private sector (private credit) as a percentage of GDP; and domestic credit from the financial sector to various sectors and net credit to the central government (financial credit) as percentage of GDP	Dynamic general equilibrium (DGE) model (Elgin and Otzunali 2012).	GMM (generalized method of moments) and panel vector autoregression (VAR) analysis		World Bank's World Development Indicators and Elgin and Otzunali 2012.	A shock to M2 reduces the size of the informal economy, and this effect becomes insignificant after eight years. A shock to the informal economy shrinks financial development.
Bayar and Ozturk (2016)	Domestic credit to private sector.	DYMIMIC approach (Schneider, Raczkowski, and Mróz 2015).	Cointegration analysis		Schneider, Raczkowski, and Mróz (2015); World Bank and Heritage Foundation.	Financial development and improvements in institutional quality reduce the size of the informal economy in the long run.
Canh and Thanh (2020)	IMF indices of overall financial development, overall financial institutions, overall financial markets, financial institutions' depth, financial institutions'	DYMIMIC approach (Medina and Schneider 2018).	Dynamic fixed effects, autoregressive distributed lag.		Medina and Schneider (2018); Svirydzenka (2016); World Bank *World*	Non-linear relationship between financial development informal informal economy for eight out of the nine financial indicators.

	access, financial institutions' efficiency, financial markets' depth, financial markets' access, and financial markets' efficiency.			*Development Indicators*; Heritage Foundation and *Worldwide Governance Indicators* (Kaufmann et al. 2011).	
Gharleghi and Jahanshahi (2020)	Liquid liabilities, private credit and stock market capitalisation.	MIMIC and PMM (Predictive Mean Matching) method (Medina and Schneider 2018).	Threshold fixed effects.	World Bank *World Development Indicators* and World Bank *Global Financial Development* database.	Financial development significantly reduces the size of the informal economy, but only for countries with a per capita GDP of US$33,600 or more.

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Table 2. Financial development and informality

Informality level=	DGE-based output informality			MIMIC-based output informality			Self-employment		
	Low	High	P-val	Low	High	P-val	Low	High	P-val
Identify access to finance as a major constraint (percent of firms)	26.35	35.39	0.00	24.96	34.61	0.00	29.08	31.92	0.33
Use banks to finance investments (percent of firms)	28.99	19.83	0.00	29.19	18.81	0.00	30.82	21.60	0.00
Investment financed internally (percent)	68.15	74.23	0.01	67.65	74.83	0.00	66.70	72.67	0.01
Commercial bank branches (per 100,000 adults)	15.27	9.06	0.00	14.99	8.54	0.00	18.46	9.88	0.00
Automated teller machines (ATMs) (per 100,000 adults)	33.40	21.48	0.01	32.35	20.86	0.01	43.09	15.89	0.00
Domestic credit to private sector (percent of GDP)	45.23	28.17	0.00	45.11	26.25	0.00	48.20	29.69	0.00
Account ownership (percent of age 15+)	50.99	33.52	0.00	52.14	33.25	0.00	54.32	33.86	0.00
Internal financing (percent of age 15+)	12.68	15.93	0.02	12.85	16.01	0.03	11.03	16.39	0.00
Stock market capitalization (percent of GDP)	50.57	36.06	0.07	50.05	34.40	0.04	53.15	38.37	0.05
Deposit money bank's assets (percent of GDP)	44.63	24.26	0.02	43.38	24.40	0.04	43.93	27.68	0.06
IMF's "financial institutions" development index	0.38	0.26	0.00	0.38	0.25	0.00	0.42	0.26	0.00
IMF's "financial markets" development index	0.20	0.07	0.00	0.20	0.07	0.00	0.20	0.08	0.00

Informality level=	Informal employment			Employment outside the formal sector			Labor force w/o pension insurance		
	Low	High	P-val	Low	High	P-val	Low	High	P-val
Identify access to finance as a major constraint (percent of firms)	25.84	37.16	0.00	25.09	37.10	0.00	24.58	37.26	0.00
Use banks to finance investments (percent of firms)	24.98	17.01	0.00	24.94	17.35	0.00	28.82	18.56	0.00
Investment financed internally (percent)	65.48	76.27	0.00	66.14	75.79	0.00	66.14	74.99	0.00
Commercial bank branches (per 100,000 adults)	15.27	6.58	0.00	15.85	6.26	0.00	18.76	6.16	0.00
Automated teller machines (ATMs) (per 100,000 adults)	36.62	8.17	0.00	37.44	9.53	0.00	41.35	10.90	0.00
Domestic credit to private sector (percent of GDP)	45.98	21.42	0.00	46.46	21.52	0.00	44.35	26.13	0.00
Account ownership (percent of age 15+)	46.59	27.81	0.00	49.26	27.17	0.00	52.33	31.32	0.00
Internal financing (percent of age 15+)	11.47	17.68	0.00	12.11	16.83	0.01	10.52	16.94	0.00
Stock market capitalization (percent of GDP)	44.70	36.10	0.47	44.41	35.35	0.42	49.37	27.83	0.00
Deposit money bank's assets (percent of GDP)	31.64	34.42	0.87	32.76	31.29	0.92	30.76	35.70	0.64
IMF's "financial institutions" development index	0.37	0.23	0.00	0.38	0.23	0.00	0.39	0.25	0.00
IMF's "financial markets" development index	0.15	0.05	0.01	0.15	0.06	0.01	0.19	0.09	0.00

Informality level=	World Economic Forum			WBES1			WBES2		
	Low	High	P-val	Low	High	P-val	Low	High	P-val
Identify access to finance as a major constraint (percent of firms)	23.64	35.57	0.00	25.87	35.17	0.00	24.97	35.36	0.00
Use banks to finance investments (percent of firms)	27.71	21.24	0.01	26.08	22.91	0.19	26.75	22.63	0.09
Investment financed internally (percent)	68.16	73.30	0.04	70.78	71.25	0.83	69.55	72.26	0.23

	WBES3			WBES4			WVS		
Commercial bank branches (per 100,000 adults)	15.67	10.91	0.04	16.05	10.31	0.01	15.72	10.85	0.03
Automated teller machines (ATMs) (per 100,000 adults)	40.08	18.29	0.00	31.72	21.16	0.01	34.36	18.96	0.00
Domestic credit to private sector (percent of GDP)	48.37	26.48	0.00	45.78	26.30	0.00	39.90	32.78	0.14
Account ownership (percent of age 15+)	54.83	34.25	0.00	44.51	33.65	0.01	42.90	35.82	0.08
Internal financing (percent of age 15+)	13.29	15.18	0.20	10.25	17.68	0.00	11.14	16.43	0.00
Stock market capitalization (percent of GDP)	58.32	30.77	0.00	49.06	35.72	0.08	42.03	43.27	0.87
Deposit money bank's assets (percent of GDP)	48.21	23.03	0.00	37.99	31.68	0.51	37.89	32.47	0.55
IMF's "financial institutions" development index	0.39	0.27	0.00	0.37	0.28	0.00	0.35	0.30	0.07
IMF's "financial markets" development index	0.22	0.07	0.00	0.17	0.06	0.00	0.14	0.09	0.10
	WBES3			**WBES4**			**WVS**		
Informality level=	**Low**	**High**	**P-val**	**Low**	**High**	**P-val**	**Low**	**High**	**P-val**
Identify access to finance as a major constraint (percent of firms)	26.07	34.39	0.00	23.77	37.39	0.00	23.94	31.01	0.11
Use banks to finance investments (percent of firms)	25.75	23.59	0.37	26.36	22.50	0.11	25.61	24.81	0.81
Investment financed internally (percent)	70.44	71.38	0.68	71.54	70.72	0.72	69.66	69.32	0.92
Commercial bank branches (per 100,000 adults)	14.24	12.28	0.37	15.35	11.13	0.05	14.05	15.60	0.66
Automated teller machines (ATMs) (per 100,000 adults)	32.52	20.62	0.01	31.19	22.09	0.04	32.16	35.78	0.61
Domestic credit to private sector (percent of GDP)	40.04	32.52	0.12	44.11	27.95	0.00	45.52	41.53	0.66
Account ownership (percent of age 15+)	42.83	35.63	0.07	45.49	33.91	0.00	45.61	46.54	0.86
Internal financing (percent of age 15+)	12.58	15.16	0.07	12.15	15.36	0.02	12.66	12.67	1.00
Stock market capitalization (percent of GDP)	41.02	44.37	0.67	45.94	38.85	0.36	48.38	46.60	0.84
Deposit money bank's assets (percent of GDP)	38.40	32.19	0.50	40.78	29.76	0.24	33.74	48.89	0.29
IMF's "financial institutions" development index	0.34	0.31	0.24	0.36	0.29	0.01	0.36	0.38	0.57
IMF's "financial markets" development index	0.13	0.09	0.11	0.16	0.06	0.00	0.22	0.21	0.76

Notes: A series of t-tests are conducted here with emerging market and developing economies with above-median informality ("Informality level = high") and others with below-median informality ("Informality level = low") over the period 2000-2018. The cells show the corresponding unweighted group averages and p-value for the t-tests. Output informality are proxied by the dynamic general equilibrium (DGE; MIMIC) model-based estimates on informal output in percent of official GDP. Employment informality is captured by self-employment in percent of total employment, informal employment in percent of total employment, employment outside the formal sector in percent of total employment, share of labor force without pension insurance. World Value Survey (WVS) asks whether cheating on taxes is justifiable (1 is "never justifiable" and 10 is "always justifiable") and reports average responses at the country-year level, with a higher level suggesting that the country is more tolerant towards the informal sector. World Economic Forum (WEF) asks "In your country, how much economic activity do you estimate to be undeclared or unregistered? (1= Most economic activity is undeclared or unregistered; 7= Most economic activity is declared or registered)" and reports average responses at the country-year level. Here the average responses have been reordered to make "7= Most economic activity is undeclared or unregistered; 1= Most economic activity is declared or registered" where a higher level suggesting a larger informal sector in the country. The World Bank Enterprise Surveys report four measures: the percent of firms competing against informal firms (WBES1), the percent of firms formally registered when founded (WBES2, here economies with below-median values are classified as "informality level=high" and those with above median values are "informality level=low"), the number of years operated without registration (WBES3), and the percent of firms that found competitors in the informal sector as a constraint (WBES4). See section 3 for details. "Account ownership" is the percentage of survey respondents (aged 15 or above) who report having an account (by themselves or together with someone else) at a bank or another type of financial institution or report personally using a mobile money service in the past 12 months. "Internal financing" is captured by the percentage of respondents (aged 15 or above) who report saving or setting aside any money in the past 12 months to start, operate, or expand a farm or business.