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FINANCIAL FRICTIONS AND THE RULE OF LAW

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ABSTRACT

Using cross-country micro establishment-level data we document that crime and lack of access to finance are two major obstacles to business operation in poor and developing countries. Using an otherwise standard model of production heterogeneity that integrates institutional differences in the degree of financial development and the rule of law, we quantify the effects of these institutions on aggregate outcomes and economic development. The model accounts for the patterns across establishments in access to finance and crime as obstacles to their operation. Weaker financial development and rule of law have substantial negative effects on aggregate output, reducing output per capita by 50 percent. Weak rule-of-law institutions substantially amplify the negative impact of financial frictions. While financial markets are crucial for development, an essential precondition to reap the gains from financial liberalization is that property rights are secure.

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1 Introduction

Understanding the causes of cross-country income differences is a fundamental question in the macro-development literature. Recent work has emphasized that the allocation of resources across heterogeneous establishments is important for understanding cross-country productivity differences (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Bartelsman et al., 2013).[1] What are the frictions, policies, and institutions that create factor misallocation and hence reduce aggregate productivity in poor countries? In this paper, we focus on two institutions that are empirically relevant for business operation in poor countries: financial market development affecting access to credit and the rule of law affecting the potential for crime. These institutions create idiosyncratic effects across establishments since heterogeneous producers are affected differently by them. We evaluate the quantitative relevance of institutional differences in financial development and the rule of law in accounting for resource misallocation and aggregate income differences across countries.

Our focus on the rule of law and financial development as key institutional features is motivated by their importance for development as highlighted across separate strands in the literature, (e.g. King and Levine, 1993; Rajan and Zingales, 1998; Shleifer and Vishny, 1998; Svensson, 1998). The rule of law and financial development are closely linked to crime and access to credit, two highly relevant distortions in developing countries. While the importance of access to finance is well documented in the literature, less known is the prevalence of establishment-level crime across countries. We document that crime is a prevalent and severe obstacle to business operation in developing countries, at least as prevalent as the lack of access to finance across a host of countries in several sub-continents. For instance, using data from the World Bank Enterprise Surveys (WBES), we find that in South America 34 percent of establishments report crime as a major obstacle to business operation, whereas 23 percent of establishments report access to finance as a major obstacle. The corresponding percent of

[1] See also surveys of the misallocation literature in Restuccia and Rogerson (2013), Hopenhayn (2014), and Restuccia and Rogerson (2017).

establishments in Africa reporting crime and finance as major obstacles to business operation are 26 and 41 percent. To provide context, in a developed country such as Germany, less than 5 percent of establishments report crime as a major obstacle to business operation and 15 percent report access to finance as a major obstacle.[2]

To study the quantitative importance of institutional differences in the rule of law and financial development, we consider a unified framework whereby differences in the rule of law affect the potential for crime at the establishment level and differences in financial market development restricts establishment access to credit. The model is a variant of Lucas (1978) span-of-control framework. Individuals differ along entrepreneurial productivity and asset holdings, and choose either to operate an establishment as an entrepreneur or supply labor as a worker. Two market imperfections are central to our analysis. First, economies differ along financial market development, which is modelled as an endogenous collateral constraint that restricts access to finance and is proportional to entrepreneur asset holdings. Entrepreneurs in less developed financial markets face a more stringent collateral constraint (financial frictions). Second, economies differ in the strength of the rule of law which affects the potential for crime. We model crime as the proportion of capital that is expropriated from an entrepreneur post-production, an outcome determined within the model. The potential for crime is inversely related to the rule of law and how much protection an entrepreneur is able to purchase. Differences in the rule of law and financial market development affect occupational choices and the scale operation of entrepreneurs, generating effects on aggregate productivity and output. Moreover, as we elaborate below, these institutions have the potential to amplify the effects arising from crime or access to finance individually. Our goal is to quantify these effects and assess their implications for cross-country income differences.

[2]Crime in the data is defined as theft, robbery, vandalism or arson on the establishment's premises. This notion of crime is likely an under-estimate of crime more broadly defined to include corruption in the form of extortion/bribery by government officials as this is a prevalent form of crime in most poor and developing countries. In this paper, we focus on the narrow notion of crime because of limited data availability on corruption at the establishment level. However, the economic insights of our analysis holds for the broader notion of crime likely corresponding with larger quantitative implications.

We discipline the quantitative analysis using the WBES dataset, which contains information on crime and external finance at the establishment level. The dataset contains detailed information related to theft, robbery, vandalism, and arson on the establishment's premises, which is our notion of crime. For financial market development we use data on whether an establishment is able to obtain a loan and whether it is financed through internal or external sources. Key parameters in the model are calibrated to match relevant micro and macro moments on crime and access to finance in Colombia. In particular, we pin down the parameter that governs the rule of law in Colombia by targeting the proportion of establishments that report incidences related to crime in a given year, and pin down the level of financial market development by targeting the share of capital financed through external sources. Each of these targets are based on an aggregation of establishment-level observations from the micro data.[3]

We show that the model can broadly capture the disaggregate patterns of crime, protection, and external finance across establishments in Colombia. In addition, we provide some evidence that the model generates reasonable quantitative predictions for these variables in institutional settings that differ from that in Colombia, spanning a portion of the variation in institutional development across countries. For example, the higher rule of law in China and India in the model compared to Colombia implies that the share of crime and protection is much more uniform across establishments than in Colombia, a pattern that is broadly consistent with the micro data for these countries. The model with lower levels of institutional development than Colombia, such as in Guatemala and Mozambique, implies that the across establishment profile of crime and protection is steeper, consistent with the implications of the micro data for these countries. The evidence suggests that our quantitative framework provides a reasonable setting to evaluate the aggregate implications of institutional development and the relative merits of institutional reform.

[3]We choose Colombia for the calibration because crime and access finance are equally important obstacles to business operation in this country.

Our main findings are as follows. The long-run effects of crime and access to finance are quantitatively important. The difference in institutional development between Colombia and the undistorted economy lowers aggregate output by close to 30 percent in Colombia, lowers TFP by close to 20 percent, and lowers consumption by over 30 percent. In an economy with the weakest level of institutional development, as implied by the data in our sample of countries, aggregate output and consumption is about 50 percent lower than in the undistorted economy. Since institutional development is uniquely identified through separate parameters in the model, we can assess the relative importance of crime and financial frictions in generating these effects. Crime lowers aggregate output by 3 percent in Colombia relative to the undistorted economy—a substantial effect considering that the aggregate losses from crime is only 0.2 percent of output in Colombia—and financial frictions lower output by 20 percent. Their joint effect exceed the sum of their individual effects implying a substantial amplification on output. Crime and finance account for about 10 and 70 percent of the total output losses while the remaining 20 percent is from their joint interaction. Moreover, we find that including crime into a standard model of financial frictions is quantitatively important; for instance, including crime generates a doubling of the output losses in the economy with the weakest level of institutional development.

The intuition for the amplification effect is straightforward. In models that feature financial frictions, constrained entrepreneurs can overcome their financing constraint by reinvesting profits in their business and gradually expanding, the motive to self-finance (Buera and Shin, 2011; Midrigan and Xu, 2014; Moll, 2014). Crime hinders this process. As entrepreneurs invest and expand, they become a bigger target for crime. Constrained entrepreneurs face a trade-off: gradual expansion is a necessary condition to alleviate financing constraints but doing so exposes them to crime. Resources are lost due to crime and/or spent on protection which slows re-investment and the process of overcoming the financing constraint. Financial frictions, in turn, increase the potential for crime. This is because financing constraints lower entrepreneur profit which reduces how much is spent on protection, thus raising the poten-

tial for crime. Taken together, financial frictions increase the likelihood of crime, and crime impedes the motive to self-finance, both of which amplify output losses.

Our results broadly contribute to the long-standing questions in the macro-development literature related to institutions and their relevance for development. One strand in the literature stresses the importance of a strong rule of law for development through its effects on entrepreneurial investment and expansion (Besley, 1995; Shleifer, 1997; Shleifer and Vishny, 1998; Svensson, 1998; Acemoglu et al., 2001) while a separate strand emphasizes that financial market development is critical for the efficient allocation of capital (King and Levine, 1993; Levine, 1997; Rajan and Zingales, 1998; Levine et al., 2000). Our framework, which incorporates these measures of institutional development is able to assess the importance of each of these factors. Specifically, we use our framework to ask whether improving financial market development (i.e. access to finance) or the rule of law (i.e. lowering crime) has a bigger effect on economic development (as measured by aggregate output), and if the impact of the policy depends on the level of institutional development. We find that when the rule of law is weak improving it is more important for development, irrespective of the level of financial market development. However, when the rule of law is above a certain threshold, improving financial markets become more important for development.[4] Hence, while financial markets are crucial for development, a necessary condition is that property rights are secure (McMillan, 1997; Johnson et al., 2002). Moreover, we use our framework to inform which countries are associated with a weak rule of law and financial markets by mapping relevant moments in the model to the data on crime and access to finance. Based on our simulations, improving the rule of law is more important for development for about 20 percent of our sample of countries, notably Guatemala, South Africa and Costa Rica, while for the majority of countries improving financial markets is more important.

Our paper relates to the broad misallocation literature but more closely to the misalloca-

[4]Clearly, these considerations must also take into account the cost and implementation of such policies which we abstract from in this paper.

tion literature emphasizing either financial frictions or crime. The macro literature emphasizing financial frictions include Jeong and Townsend (2007), Amaral and Quintin (2010), Buera et al. (2011), Buera and Shin (2013), Caselli and Gennaioli (2013), Greenwood et al. (2013), Midrigan and Xu (2014), Moll (2014), among many others. Fewer studies examine the macro effects of crime, an exception being Ranasinghe (2017) who studies the effects of extortion in Eastern Europe. Our framework integrates these two relevant institutions studying their interaction and potential to account for the substantial differences in output per capita across countries.

The remainder of the paper is organized as follows. Section 2 provides micro-level evidence relating to the prevalence of crime and access to finance across countries. In Section 3 we present the model which combines the effects of crime and financial frictions. Section 4 describes the calibration of the model and the cross-country calibration of the rule of law and financial friction institutions. In Section 5, we report our quantitive results. Section 6 concludes.

2 Facts

We use data from the World Bank Enterprise Surveys (WBES) 2006-17 to document the prevalence of crime and lack of access to finance among establishments across countries at different levels of development. We use the most recent survey for each country within this timeframe. The survey contains establishment-level information for a sample of 138 countries, mostly developing and poor countries. See Table A.1 in Appendix A.1 for a comprehensive list of countries in this sample.

While the importance of access to finance is well documented in the literature, less known are the key patterns related to crime across countries. The micro data contains information related to obstacles to doing business at the establishment level. There are several questions

in the survey devoted to understanding crime. In particular, establishments report whether they experienced theft, robbery, vandalism or arson on their premises in the past year—which we interpret as crime against the establishment—and the value of losses from crime as a share of sales. Establishments also report whether crime is a severe, major, moderate, minor or non-obstacle to business operation.[5] The WBES also contains information on whether an establishment paid for private security and the amount paid for these services as a share of sales. Also included in the survey are questions related to financing, specifically the proportion of establishment capital and investment financed through external sources. Relevant to our analysis is an establishment's potential to access finance from financial intermediaries. We use the proportion of working capital financed through banks as a proxy for financial market development and access to finance. Establishments also report whether access to finance is a severe, major, moderate, minor or non-obstacle to business operation.[6]

Table 1 reports the percentage of establishments that state a given distortion is a severe or major obstacle to business operation across sub-continents in the world. While our focus is on crime and access to finance, for comparison we also report two distortions that are generally viewed as important obstacles for business operation in poor countries: practices of the informal sector and tax administration. There are two main points that Table 1 highlights. First, access to finance is a major constraint to business operation in many parts of the world, notably in Sub-Saharan Africa where over 40 percent of establishments report finance as a major obstacle. Second, crime is also a major obstacle to business operation, and an equally pressing issue in several sub-continents as the other distortions listed in the table. For instance, in Central and South America about 30 and 35 percent of establishments report crime as a major obstacle to business operation.

[5]Corruption is often listed as the biggest obstacle to business operation in poor countries, and like crime, is closely connected to a country's rule of law.

[6]See Hallward-Driemeier and Pritchett (2015) for a broader discussion of the relevance of establishment-level data to measure costs associated with doing business in a country. Compared to legal institutional measures in the World Bank's Doing Business, measures from establishment-level data paint a more accurate picture of actual costs of operating in a country.

Table 1: Obstacles to doing business across sub-continents

	Access to Finance	Crime	Informal Sector	Tax Administration
Africa (Sub-Saharan)	40.7	26.2	40.7	28.8
Central America	32.9	28.8	28.5	22.6
East Asia and Pacific	13.2	13.9	17.3	13.2
Europe and Central Asia	16.5	9.0	19.5	16.9
Middle East and North Africa	31.9	21.5	27.7	20.5
South America	23.0	34.2	36.8	27.8
South Asia	26.5	17.7	20.4	18.8

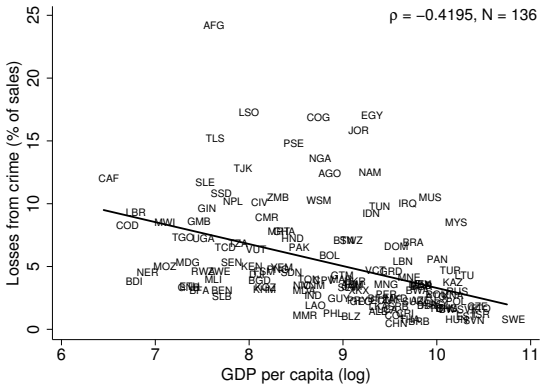
Notes: The table documents the percentage of establishments that report a given obstacle (access to finance, crime, informal sector, tax administration) is a severe or major obstacle to business operation by sub-continents. Possible responses include severe, major, moderate, minor or non-obstacle to operation. Sub-continent averages are based on country-level statistics from the most recent survey for each country from the WBES 2006-17. The country-level data includes 138 countries, see Appendix A.1 for a list of countries and more details.

Next, we examine how measures related to access to finance and crime vary across countries. These measures are shown in Figure 1. Panel A documents average losses from crime as a percentage of sales, contingent on establishments facing crime, plotted against log GDP per capita (PPP prices, 2014). There is a negative correlation between these variables (-0.42) implying that countries with higher GDP per capita have fewer losses from crime. Average losses from crime as a share of sales among establishments that face crime exceed 10 percent in several countries, notably those in Africa. While we have focused on average losses from crime, other measures related to crime share a similar pattern with GDP per capita. In particular, countries that have high average losses from crime report crime as a major obstacle to operation and have a high frequency of crime. For instance, in Chad, Chile, South Africa and Venezuela over 35 percent of establishments report at least one incident related to crime in a given year. Figure 1 Panel B documents the proportion of investment financed by banks, which is a proxy for access to finance, plotted against log GDP per capita (PPP prices, 2014) across countries. There is a positive correlation between these variables (0.40) implying that countries with higher GDP per capita feature a larger share of investment financed through financial institutions. This pattern holds for other measures related to access to finance as

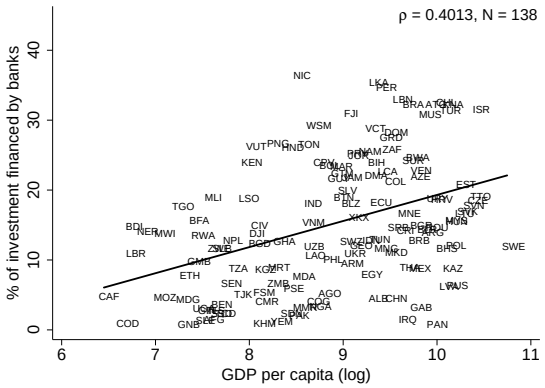
well; percentage of establishments that use banks to finance investment and proportion of investment financed through external sources (banks and non-bank financial institutions), among others.

Figure 1: Crime and access to finance across development

Panel A: Crime



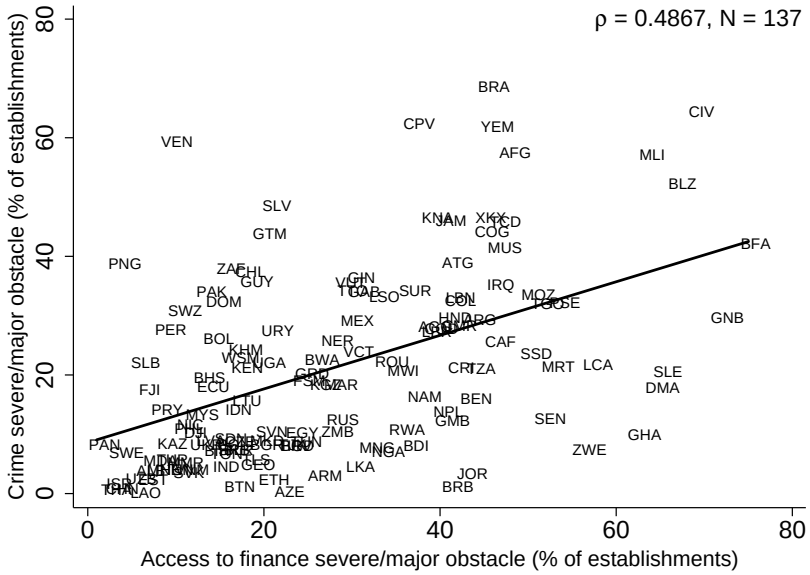
Panel B: Access to finance



Notes: Country-level statistics for crime and access to finance are from the WBES 2006-17, most recent year for each country. GDP per capita, PPP adjusted 2014, is from the World Bank. The sample is based on 138 countries described in Appendix A.1, where two countries do not report the statistic on crime. Crime refers to losses from theft, robbery, vandalism or arson in the establishment's premises in a given year as a proportion of sales, among the sub-sample of establishments that face crime. Access to finance refers to the proportion of investment financed through banks. Both variables are weighted averages across establishments in each country.

To further assess the effects of crime and access to finance across countries, Figure 2 plots the relationship between the percentage of establishments that report crime is a major or severe obstacle to business operation and the percentage of establishments that report access to finance is a major or severe obstacle. The correlation between these measures of crime and access to finance is 0.49 implying that in countries where access to finance is particularly acute, so is crime. Notably, for several countries in Africa a substantial proportion of establishments report that both access to finance and crime are major obstacles to business operation. Given the importance and correlation of these variables, evaluating the joint interaction of these institutions may provide key insights in accounting for differences in income per capita across countries.

Figure 2: Crime and access to finance



Notes: Country-level statistics for crime and access to finance is from the WBES 2006-17, most recent year in each country. Crime and access to finance refer to the proportion of establishments that report each as severe or major obstacles to doing business. The sample includes 138 countries as described in Appendix A.1 with one country not reporting the statistic on crime.

So far, we have documented that lack of access to finance and crime are particularly severe in poor countries. A key feature in models of production heterogeneity is whether institutions such as financial development and the rule of law at the country level translate into effects that are idiosyncratic across establishments (i.e. affect establishments differently). We now evaluate how access to finance and crime vary across the size distribution of establishments. Our general finding is that the effects from lack of finance dissipate as the size of the establishment increases, whereas the effects of crime are non-monotone on establishment size, being largest for middle size establishments. To highlight these points, we regress measures related to access to finance and crime on establishment size controlling for industry, city, country, continent-level and time fixed effects. These regressions are meant to provide a general pattern and do not have a causal interpretation. To get at the cross-establishment patterns, we use establishment-level data from the WBES 2006-17 and restrict the sample

to countries that have 500 or more establishments surveyed.[7] We consider four dependent variables: (1) whether access to finance is an obstacle to doing business ($0-4$ scale), (2) proportion of working capital financed by banks ($0-4$ scale), (3) whether crime is an obstacle to doing business ($0-4$ scale), and (4) whether an establishment has faced crime in the past year (yes/no).[8] The independent variable is establishment size, a categorical variable based on the number of employees.

We report the results in Table 2 for all establishments, for small establishments ($n \leq 20$), and for non-small establishments ($n > 20$). There are two main points we highlight. First, lack of access to finance is negatively related with establishment size. This conclusion arises from the negative coefficient in column (1), for all, small, and non-small establishments, implying that as establishment size rises access to finance is less of an obstacle to business operation—for instance, a categorical increase in the size variable lowers the likelihood of reporting finance as a major or severe obstacle by over 12 percent for non-small establishments.[9] Also, the positive coefficient in column (2) means that the proportion of working capital financed by banks rises with size, implying that larger establishments are better able to access credit, at least relative to smaller establishments.[10] The estimates in columns (1) and (2) clearly point to the effects from lack of access to finance falling with size. This

[7] A well-known issue with the WBES dataset is the limited number of observations in many countries, which can render noisy statistics, especially for indicators that are not populated by many establishments or when disaggregating by establishment characteristics such as size. In this context, we restrict the sample to countries that have 500 or more establishments surveyed, which results in a sample of 40 countries. See Appendix A.2 and Table A.2 for a documentation of countries in the sample, survey year and number of observations (establishments) of each crime and finance variable for each country. We note that the resulting patterns hold when including countries that have fewer than 500 establishments surveyed (e.g. a threshold of 250 establishments).

[8] Crime obstacle is our preferred measure for the severity of crime because it captures the broader indirect consequences of crime among the entire sample of establishments, including non-victims of crime whose behaviour may yet be adversely affected by its presence. For the same reason we also favour the finance obstacle variable as an indicator of the severity of access to finance.

[9] The standard coefficients from the ordered Logit are reported in Table 2 because their signs point to the direction of the relationship between the dependent and independent variables. Raising the coefficients to the exponential function (i.e. e^{β_i}) provide the odds-ratio.

[10] It is worth noting that the percentage of working capital financed by banks is highly correlated with the percentage of fixed capital purchased in the current year that is financed by banks (with a correlation coefficient of 0.52). We focus on the working capital variable because there are more than twice as many observations than for the fixed capital variable. Nevertheless, the estimates reported in Table 2 are similar under either variable.

Table 2: Access to finance and crime across establishment size

	(1) Finance obstacle $(0-4)$	(2) Borrow from banks $(0-4)$	(3) Crime obstacle $(0-4)$	(4) Faced crime (yes/no)
All establishments:				
Establishment size	-0.054^{***}	0.136^{***}	0.012^{*}	0.081^{***}
	(0.0091)	(0.0090)	(0.0068)	(0.0120)
Observations	47252	45132	47468	47684
Establishments with ≤ 20 employees:				
Establishment size	-0.058^{***}	0.188^{***}	0.059^{***}	0.070^{***}
	(0.0213)	(0.0185)	(0.0172)	(0.0214)
Observations	22569	21515	22697	22816
Establishments with > 20 employees:				
Establishment size	-0.081^{***}	0.120^{***}	-0.017^{*}	0.0763^{***}
	(0.0129)	(0.0125)	(0.0092)	(0.0192)
Observations	24683	23617	24771	24868

Notes: The table reports point estimates of an ordered Logit regression for all establishments, small establishments (≤ 20 employees) and non-small establishments (> 20 employees), based on the WBES definition for small establishments. Size is an independent categorical variable based on full-time employees: ≤ 5, $6-9$, $10-14$, $15-20$, $21-30$, $31-40$, $41-50$, $51-100$, $101-250$ and $251-5000$. The dependent variables in columns (1) and (3) are whether access to finance and crime are not an obstacle, a minor, moderate, major or severe obstacle to business operation ($0-4$ scale). The dependent variable in column (2) is the percentage of working capital borrowed from banks ($0-4$ scale), and in column (4) is whether an establishment faced crime in the last year (yes/no). Categories for percentage of working capital borrowed from banks are 0%, $1-25$%, $26-50$%, $51-75$% and > 75%. All estimates include industry, city, country, and continent-level fixed effects, as well as time fixed effects to account for differences in survey year. Industry-level controls are manufacturing, services and core industries, and city-level controls are related to population size. Standard errors are clustered at the country-level. ***, ** and * denote significance at the 1, 5 and 10 percent level.

does not imply, however, that capital is efficiently allocated across establishments since the link between establishment size and productivity is tenuous in poor countries (Restuccia and Rogerson, 2008; Bartelsman et al., 2013).

Second, the effects of crime are non-uniform across establishment size. The regression estimate in column (3) is positive for all establishments, positive, larger in magnitude and strongly significant for small establishments, and negative for non-small establishments, implying that the severity of crime initially rises with establishment size and falls thereafter.[11]

[11]In Appendix A.2, we show our estimates across small and non-small establishments in Table 2 are

We also find that losses from crime as a percentage of establishment sales falls with size which may account for the non-monotone effect across size in column (3). The coefficients for all, small, and non-small establishments in column (4) are positive implying the likelihood of facing crime rises with size.

3 Model

Our aim is to evaluate the joint effects of crime and financial frictions on establishment behaviour and to understand their implications for economic development. To this end, we consider an otherwise standard span-of-control framework of establishment size as in Lucas (1978) extended to allow for institutional differences in financial market development and the rule of law. In the model, individuals differ in entrepreneurial productivity and asset holdings and choose between operating an establishment as an entrepreneur or being a worker. We follow a large literature by considering financial market development as a collateral constraint, which restricts that entrepreneur borrowing is proportional to wealth. The rule of law influences the potential for crime which affects the returns to entrepreneurship. Hence, in our framework production and occupation choices are affected by access to finance and the potential for crime.

3.1 Environment

The economy is populated by a measure one of infinitely-lived individuals who differ in entrepreneurial productivity $s \in S$ and asset holdings $a \in A \equiv [0, \infty)$. Productivity evolves over time according to an exogenous Markov process $M(s, s')$. The cumulative distribution over assets and productivity is denoted by $G(a, s)$. There is no market for consumption insurance which implies that individual asset holdings are the only mechanism for self-insurance

consistent with alternative definitions of small establishments (see Table A.3) and also to using number of employees rather than the categorical size variable as the independent variable (see Table A.4).

against productivity shocks. Preferences are over streams of consumption, $\sum_{t=0}^{\infty} \beta^t u(c_t)$, are time separable and $\beta \in (0,1)$ represents the time discount factor.

Individuals are endowed with one unit of productive time each period, which is supplied inelastically, and choose between operating an individual specific production technology (entrepreneurship) or working for a wage (worker). Each occupation requires one unit of labor so that individuals select into one occupation every period. The production technology is standard, $f(s,k,n)$, which combines the inputs of capital k, labor from workers n, and entrepreneur productivity s to produce output. We assume $f(s,k,n)$ is increasing in all inputs and features decreasing returns to scale in k and n.

The economy features two distinct distortions. The first is related to financial frictions arising from underdeveloped financial markets which restricts how much capital entrepreneurs can borrow. The second is related to crime on entrepreneur capital arising from imperfections in the rule of law. We describe these in turn.

3.2 Financial frictions

We follow Buera et al. (2011), Midrigan and Xu (2014), and Moll (2014) among others in modelling financial market development. In particular, financial market imperfections—due to limited enforcement or monitoring technology—imply that entrepreneurs face a collateral constraint for borrowing capital given by $(1-\phi)k \leq a$, where $\phi \in [0,1]$ represents the fraction of capital that can be recouped by financial intermediaries if an entrepreneur defaults. In this setup, ϕ serves as a measure of financial market development with higher values of ϕ representing more developed financial markets (a higher fraction of capital can be recouped). This formulation has the intuitive appeal that the amount of capital borrowed depends on entrepreneur assets a, and is proportional to financial market development ϕ.[12] When $\phi = 1$

[12]The collateral constraint can be re-written as $k \leq \tilde{\lambda} a$, where $\tilde{\lambda} \equiv \frac{1}{1-\phi}$, as is more standard. We use ϕ for consistency with our modelling of the rule of law and for easier comparison across measures of institutional development.

financial markets are fully developed and the collateral constraint is non-binding. Conversely, when $\phi = 0$ financial markets are non-existent, there is no potential to borrow and capital is restricted to equal entrepreneur asset holdings. Thus, values of $\phi \in [0, 1]$ capture differences in the potential to borrow across economies, and holding ϕ constant, a captures differences in the potential to borrow *within* economies.

We note that the collateral constraint is the only friction in the financial market. In particular, we abstract from issues related to irreversibility and adjustment costs on entrepreneur capital. Also, the collateral constraint we examine is static and on a per-period basis. While in reality financial contracts are dynamic, a static one-period contract is sufficient to capture the key features in our analysis—entrepreneur borrowing depends on individual asset holdings and the level of financial market development in a country.

3.3 Rule of law

The second source of friction arises from the potential for crime against entrepreneurs, which we model following Ranasinghe (2017). The probability of facing crime depends on two factors: the rule of law and spending on protection. We think of the rule of law as the probability with which the state can prevent criminal activity $\lambda \in [0, 1]$, with higher values of λ representing a stronger rule of law and a lower potential that entrepreneurs face crime. Entrepreneurs can also reduce the potential of facing crime by buying private protection $p \geq 0$, which supplements the existing rule of law. The cost of private protection p is $\frac{bp^{\psi}}{\psi}$, where $b > 0$ is a scale parameter and ψ is an elasticity parameter. Taken together, the probability an entrepreneur faces crime is $1 - F(\lambda, p)$, where $F(\lambda, p) = \lambda(1 + p^{\theta}) \in [0, 1]$, $\theta > 0$, is increasing in both arguments.[13] In this setup, λ has a similar interpretation for institutional development as ϕ. When $\lambda = 1$ there is no opportunity for crime and when $\lambda = 0$

[13]It follows that $p \in [0, \bar{p}]$ where $\bar{p} = \left(\frac{1-\lambda}{\lambda}\right)^{\frac{1}{\theta}}$, which ensures that $F(\lambda, p) \leq 1$. We also assume protection is bought post-production and does not require financing. This allows us to isolate the effects of financial frictions on capital demand and avoid unnecessary complexity.

the rule of law is non-existent and criminal activity occurs un-impeded. Values of $\lambda \in [0, 1]$ therefore capture institutional differences in the potential for crime across countries, and holding λ constant, p captures differences in the potential for crime across establishments *within* countries due to differences in private protection spending.

We now discuss the motivation for our modelling and functional form choices for crime. The functional form for $F(\lambda, p)$ allows for an economy-wide component—the rule of law λ—and an idiosyncratic component—private protection p—which capture differences in the severity of facing crime across establishments within a country as well as differences across countries, the strength of which depends on two parameters λ and θ. Note that the assumed functional form has other implications to capture features of reality. First, the likelihood of facing crime decreases with the rule of law and private protection. Second, the rule of law and protection are complementary. Protection spending is more effective in lowering crime when the rule of law is strong. In particular, λ is the minimum level of protection common to all entrepreneurs ($F(\lambda, 0) = \lambda$) and protection is ineffective in lowering crime when there is no rule of law ($F(0, p) = 0$). In the quantitative analysis that follows, the parameters λ and θ will be disciplined with data on the prevalence of crime in an economy as well as crime differences across establishments. In addition, data on losses from crime and protection spending will inform and put discipline on the values for the parameters on the cost of private protection.

We model crime as the fraction of entrepreneur capital expropriated by an exogenous stand-in Crime Group.[14] In particular, if an entrepreneur does not face crime, which occurs with probability $F(\lambda, p)$, profit from production is

$$\pi(a, s, k, n) \quad = \quad f(s, k, n) - wn - (1 + r)k + (1 - \delta)k,$$

[14]We could instead assume that crime is related to output with little consequence to our main results. Since access to finance is related to capital, for consistency, we also model crime as dependant on entrepreneur capital.

and if they face crime, which occurs with probability $1 - F(\lambda, p)$, profit from production is

$$\pi_c(a, s, k, n) \quad = \quad f(s, k, n) - wn - (1 + r)k + (1 - \delta - e)k,$$

where w is the wage paid to workers, r is the real interest rate, $\delta \in (0, 1)$ is the depreciation rate (hence, $r + \delta$ is the rental rate of capital), and $e \in (0, 1)$ is the fraction of capital lost due to crime. We use e for notational simplicity but note that it is an endogenous outcome which in equilibrium depends on assets and productivity (i.e. $e(a, s)$). In each of these scenarios, entrepreneur choice of capital is constrained by the collateral constraint, $(1 - \phi)k \leq a$.[15]

The timing is as follows. Entrepreneurs first make decisions related to production. Then the Crime Group chooses the fraction of capital to expropriate taking into consideration entrepreneur capital and protection. In what follows, entrepreneur decisions on capital, labor and protection are made in anticipation of the Crime Group's best-response to these choices.

Note that we focus on crime faced by entrepreneurs, abstracting from crime on individual asset holdings. This is because we focus on the distortionary effects of the rule of law institution on establishment decisions and hence the data we use on crime is at the establishment-level. Furthermore, individuals in the model that have the most assets tend to be entrepreneurs, and hence, asset accumulation and capital are closely linked.

[15]The presence of crime can affect financial intermediary lending to entrepreneurs. We abstract from this effect because it only plays a quantitatively minor role in our framework. Including this channel implies that the collateral constraint becomes $(1 - \phi)(1 - \hat{e})k \leq a$, where $(1 - \hat{e})k$ is end of period capital that can be recouped and $\hat{e} \equiv (1 - \overline{F(\lambda, p)})\overline{e}$ is average expected losses from crime, where the over-line represents the economy-wide average. We assume that financial intermediaries cannot observe entrepreneur productivity and therefore how much crime they will face. In the WBES data for Colombia, which we use to calibrate our model for crime, $\hat{e}$ is less than one percent and hence this feature would have a limited effect on the collateral constraint.

3.4 Decisions

Entrepreneur decisions are the purchase of protection—which reduces the potential of crime—and capital and labor inputs in production. Since entrepreneurs face crime with probability $F(\lambda, p)$, capital, labor, and protection are chosen to maximize expected profit. Specifically, the problem of an entrepreneur is

$$\widetilde{\pi}(a,s) = \max_{k\geq 0,\ n\geq 0,\ p\in[0,\overline{p}]} \left\{ F(\lambda,p)\pi(a,s,k,n) + [1-F(\lambda,p)]\,\pi_c(a,s,k,n) - \frac{bp^{\psi}}{\psi} \right\},$$

which using the definitions of profit above simplifies to,

$$\widetilde{\pi}(a,s) = \max_{k\geq 0,\ n\geq 0,\ p\in[0,\overline{p}]} \left\{ \pi(a,s,k,n) - [1-F(\lambda,p)]ek - \frac{bp^{\psi}}{\psi} \right\}, \tag{1}$$

subject to the collateral constraint $(1-\phi)k \leq a$. Equation (1) states that with probability $F(\cdot)$, an entrepreneur does not experience crime and earns profit $\pi(a,s,k,n)$, and with probability $1-F(\cdot)$ faces crime and earns profit $\pi_c(a,s,k,n)$. This expression simplifies to imply that an entrepreneur earns full profit from production less the fraction of capital lost due to crime, ek, which occurs with probability $1-F(\cdot)$. Expected profit from entrepreneurship for an individual of type (a,s) is $\widetilde{\pi}(a,s)$.

The Crime Group optimizes by choosing how much capital to expropriate from each entrepreneur of type (a,s), which determines the fraction of capital lost due to crime, $e \in (0,1)$,

$$\Pi_M(a,s) = \max_{e\in[0,1]} \left\{ [1-F(\lambda,p)]ek - \frac{he^{\rho}}{\rho} \right\}. \tag{2}$$

The Crime Group is successful in expropriating entrepreneur capital with probability $1-F(\lambda,p)$ earning ek and with probability $F(\lambda,p)$ is unsuccessful earning zero. We assume the Crime Group incurs a cost for engaging in crime due to monitoring, collection and 'flying under the radar' given by $\frac{he^{\rho}}{\rho}$, where $h>0$ is a scale parameter and ρ is the elasticity term.[16]

[16]The cost functions for protection and crime do not depend on entrepreneur capital. Nevertheless in

The individual problem of asset accumulation and occupational choice can be written recursively using the Bellman equation as

$$v(a,s) = \max_{c,a' \geq 0} \left\{ u(c) + \beta \mathbb{E} v(a',s') \right\}, \tag{3}$$

$$s.t.\ c + a' \leq \max\{w, \widetilde{\pi}(a,s)\} + (1+r)a,$$

where the expectation operator is over next period productivity s' governed by the Markov process $M(s,s')$. Individuals make a consumption-savings inter-temporal choice and an occupational choice based on $\max\{w, \widetilde{\pi}(a,s)\}$. Since there is no capital irreversibility or adjustment costs, the occupational choice is static which we denote by $o(a,s) \in \{E, W\}$ for an entrepreneur or worker.

3.5 Stationary competitive equilibrium

A stationary competitive equilibrium consists of an invariant distribution over assets and productivity $G(a,s)$, policy functions for individuals $\{c(a,s), a'(a,s), o(a,s)\}$, policy functions for entrepreneurs $\{k(a,s), n(a,s), p(a,s)\}$, profits $\widetilde{\pi}(a,s)$, policy function for the Crime Group $e(a,s)$, and prices $\{w, r\}$, such that:

(*i*) Given prices, $k(a,s)$, $n(a,s)$ and $p(a,s)$ solve the entrepreneurs problem in (1), determining $\widetilde{\pi}(a,s)$.

(*ii*) Policy function $e(a,s)$ solves the Crime Group's problem in (2).

(*iii*) Given prices and profits, $c(a,s)$, $a'(a,s)$ and $o(a,s)$ solves the individual's problem described in (3).

equilibrium, spending on protection is increasing with establishment capital, consistent with micro-level evidence. For crime, it is likely that expropriating from high capital establishments is more costly for the Crime Group. This feature is captured in our framework since protection expenditure rises with establishment capital, making it more costly to expropriate from high capital establishments due to a lower probability of success $F(\cdot)$.

(*iv*) Markets clear:

$$\int_{o(a,s)=E} n(a,s)G(da,ds) = \int_{o(a,s)=W} G(da,ds),$$

$$K \equiv \int_{o(a,s)=E} k(a,s)G(da,ds) = \int aG(da,ds),$$

$$\int c(a,s)G(da,ds) + \delta K + P + E = \int_{o(a,s)=E} f(s,k,n)G(da,ds),$$

where $P = \int_{o(a,s)=E} \frac{bp(a,s)^{\psi}}{\psi} G(da,ds)$ is aggregate spending on protection and $E = \int_{o(a,s)=E} [1 - F(\lambda, p(a,s))]\, e(a,s)k(a,s)G(da,ds)$ is aggregate losses from crime.

(*v*) G is an invariant distribution that satisfies the equilibrium mapping:

$$G(a,s) = \iint_{a'(\hat{a},\hat{s})\leq a} \int_{s'\leq s} M(\hat{s}, ds')G(d\hat{a}, d\hat{s}),$$

where $\hat{a}$, $\hat{s}$, and s' are indices of elements in the sets for assets and ability.

3.6 Discussion

Prior to evaluating the quantitative implications of crime and financial frictions we discuss some important insights from the model. In the undistorted economy, when $\phi = \lambda = 1$, allocations achieve the first-best and productivity is the sole criterion for selection into entrepreneurship and the scale of production. With lower values for ϕ and λ, the collateral constraint tightens and the potential for crime increases, distorting selection and production decisions. When $\phi < 1$ establishment size depends on both productivity and asset holdings implying that low asset entrepreneurs operate below the optimal capacity, $k(a,s) \leq k(s)$. Likewise, when $\lambda < 1$ capital is chosen to maximize expected profit, instead of first-best profit, which distorts the optimal choice of capital—entrepreneurs who are most vulnerable to crime choose capital below the optimal scale. Taken together, access to finance restricts how much capital can be borrowed and crime affects how much capital an entrepreneur wants to borrow. These distortions affect expected profit from production and have the potential

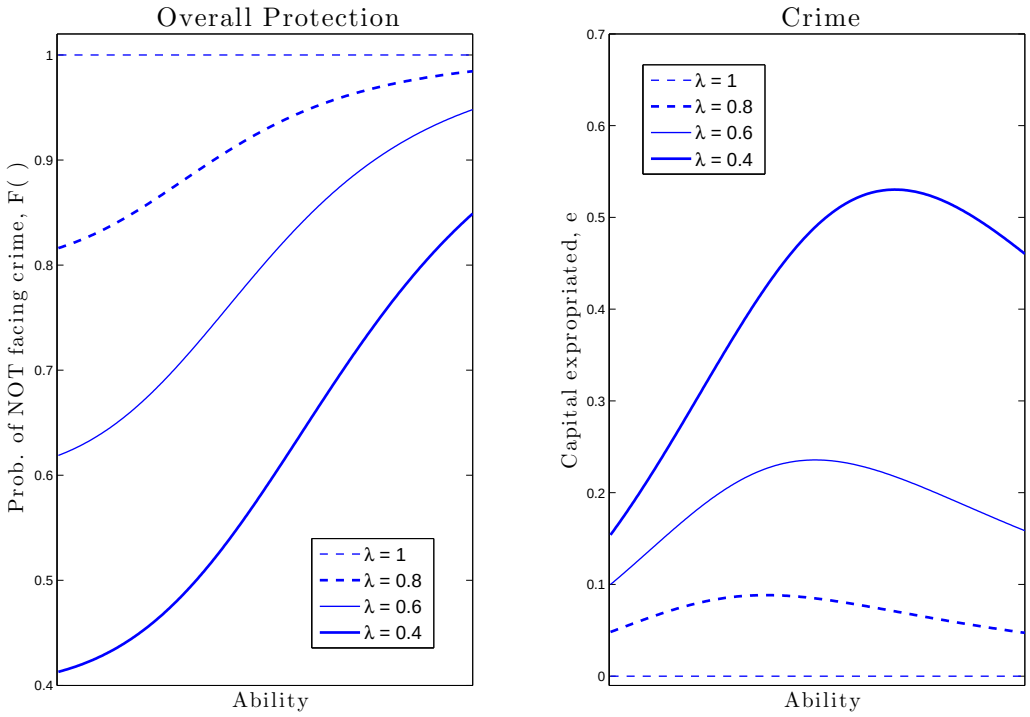
to alter occupational choices.

In our framework each distortion can be analyzed jointly or in isolation, which enables us to understand how these distortions interact and amplify aggregate output losses. While we evaluate the effects of these institutions numerically, it is convenient to consider special cases of the model to highlight the underlying mechanisms at work. Consider the case when crime is the only distortion in the economy ($\phi = 1$ and $\lambda < 1$). When $\rho = \psi = 2$ and $\theta = 1$, a closed-form solution for crime and protection exists and depends solely on entrepreneur productivity. This is depicted in Figure 3 for selected values of λ. Note that as λ increases (stronger rule of law), the incidence of crime and losses from crime decreases overall, and the pattern across entrepreneurs become flatter, illustrating how the extent of rule of law in a country can generate idiosyncratic effects across establishments with different productivity. We show in Section 4.4 that this broad pattern of differences in crime and protection across entrepreneurs in economies with different levels of institutional development is consistent with micro evidence for individual countries at the corresponding levels of institutional development.

In the particular numerical example in Figure 3, protection expenditure is increasing in productivity and losses from crime—the expropriation of capital—is hump-shaped in entrepreneur productivity, especially so for low values of λ. This pattern arises in this case because high productivity entrepreneurs purchase sufficient protection to induce lower losses from crime, whereas low productivity entrepreneurs are not a lucrative target since they use little capital in production and crime is costly. Moderate productivity entrepreneurs face the most crime, although the magnitude of this effect depends on λ.

When financial frictions are introduced in the economy ($\phi < 1$ and $\lambda < 1$) the potential for crime rises, especially among high productivity entrepreneurs. To appreciate this point, note that high productivity entrepreneurs mitigate the effects of crime by spending on protection. However, when they face financial frictions they choose capital based on their collateral

Figure 3: Crime across entrepreneur productivity ($\phi = 1$)



constraint, which lowers profit and thus spending on protection, raising the potential for crime. As such, a higher proportion of entrepreneurs become more vulnerable to crime when financial frictions are present.

Crime amplifies the effects from financial frictions as well. To illustrate this, consider the case when only financial frictions are present ($\phi < 1$, $\lambda = 1$). As highlighted in Buera and Shin (2011), Midrigan and Xu (2014) and Moll (2014), constrained entrepreneurs can gradually overcome their collateral constraint through self-financing. By re-investing their profit, entrepreneurs loosen their collateral constraint which enables them to operate on a larger scale in subsequent periods. When $\lambda < 1$, however, the presence of crime can hinder this process. Since crime initially rises with capital, as capital rises with productivity, an entrepreneur that has low assets faces increasing crime since they initially start with little capital in production. While re-investment and gradual expansion is necessary to overcome the collateral constraint, doing so also increases the potential for crime. As these entrepreneurs

expand, more resources are either spent on protection or lost to crime which hinders the process of relaxing the collateral constraint. These effects are especially severe when the rule of law is weak (higher potential for crime) magnifying the implied output losses from these institutions.

We emphasize that our modelling of crime is flexible and can accommodate a variety of profiles for crime across establishments. The resulting profiles depend on the effectiveness of private protection on crime and the shape of the protection cost function. It also depends on the selection of establishments that operate in equilibrium. In particular, because the peak of the hump-shaped profile expands out as λ falls, as illustrated in Figure 3, losses from crime can be decreasing, increasing, or non-monotone across establishments depending on the ability threshold for selection into entrepreneurship and on the parameters for crime. In the next sections, we show that the model can account for losses from crime across establishments in the calibrated economy as well as for other countries that differ only in the level of institutional development.

4 Calibration

To study the effects arising from financial frictions and crime, we take the stance that countries are identical in every respect except for the level of institutional development reflected in ϕ as a measure of financial market development and λ as a measure of rule of law. While countries clearly differ along many additional dimensions, our abstraction enables us to use our framework to evaluate the quantitative effects arising from these specific institutional differences.

Our calibration strategy is as follows. We calibrate the model in two steps. First, we consider an undistorted economy with prefect credit markets and no crime and calibrate this economy to data for the United States. This allows us to assign values to technology

and preference parameters that are well established in the literature. Second, holding the calibrated parameters for preferences and technology constant, we consider an economy with financial frictions and crime and calibrate this economy to micro data for Colombia.[17] This allows us to calibrate the remaining parameters on crime and access to finance to match related moments in the data for Colombia.

4.1 Preferences and technologies

We assume per-period utility features constant relative risk aversion $u(c) = \frac{c^{1-\nu}}{1-\nu}$ and the future is discounted at a rate $\beta \in (0,1)$. The entrepreneurial production technology is $f(s,k,n) = s(k^{\alpha}n^{1-\alpha})^{1-v}$, where $1-v$ determines returns to scale at the establishment level and in a competitive economy also determines the share of income accruing to production inputs (k,n). Then α represents the share of production inputs' income accruing to capital and $1-\alpha$ to labor. Capital depreciates at the rate δ every period. We assume shocks to the log of entrepreneurial productivity follow an AR(1) process with persistence ρ and innovation variance σ^2. As a result, there are 7 parameters to calibrate at this stage $\{\nu, \delta, \alpha, v, \rho, \sigma, \beta\}$. We consider an economy with $\phi = \lambda = 1$ and calibrate this economy to U.S. data, which allows us to pin down these seven parameters without having to take a stance on parameters related to crime. When $\phi = \lambda = 1$ the model reduces to a standard span-of-control framework where there are no financial frictions and no crime. We take this stance not because we think the U.S. is a crime-free economy but because data on establishment-level crime is mostly for developing economies which excludes the United States.[18]

We set $\nu = 1.5$, $\alpha = 1/3$, $\delta = 0.08$, $\rho = 0.95$ and $\sigma = 0.2$ which are fairly standard

[17] In particular, from the WBES 2006-17, we use the latest year for Colombia which is the 2010 survey. In the Appendix A.4, we consider alternative calibrations to data for Brazil—where crime is more severe than in Colombia—and to Peru—where access to finance is more severe than in Colombia. Our main results are qualitatively similar across these alternative calibrations.

[18] The data we use is from the WBES which focuses primarily on developing countries and a few developed countries in Europe. For the most developed countries in Europe, establishment level crime is very small as is the extent to which establishments face difficulties in obtaining external finance. These facts motivate our abstraction.

Table 3: Calibration of $\lambda = \phi = 1$ economy to U.S. data

Target Moments:	U.S. Data	Model	Parameter
Entrepreneurship rate	0.075	0.075	$v = 0.22$
Interest rate	0.05	0.05	$\beta = 0.93$

and within the range of values used in the literature. The remaining parameters, v and β, are calibrated to match two relevant moments in the U.S. data: (a) the proportion of entrepreneurs in the working population (entrepreneurship rate), which we target to 7.5 percent (Cagetti and DeNardi, 2006); and (b) the real interest rate which we target to 5 percent. Table 3 reports the model fit for the economy with $\lambda = \phi = 1$ relative to the U.S. data and the last column documents the resulting parameter values.

4.2 Institutional development and protection technology

We now turn to the parameters related to institutional development and to establishment crime and protection. There are two parameters related to institutional development $\{\phi, \lambda\}$ and five parameters related to crime and protection $\{\rho, \psi, h, b, \theta\}$. We calibrate (ϕ, λ) to the level of institutional development in Colombia and select crime and protection parameters to match establishment-level observations related to the severity of crime and protection in Colombia.[19] We choose Colombia for our calibration because crime and access to finance are equally severe obstacles to business operation. Our data from the WBES discussed in Section 2 indicates that in Colombia 33 percent of establishments report crime as a major obstacle to business operation, whereas 41 percent of establishments report access to finance as a major obstacle.[20]

[19] Throughout, an entrepreneur represents an establishment unit in the data.

[20] For other countries in South America the gap between the proportion of establishments that report crime and access to finance as major obstacles to operation is more spread, or there are too few observations. See Appendix A.4 for alternative calibrations of the model to data for Brazil and Peru. Even though crime and the lack of access to finance is equally or more prevalent in Africa than in South America, we do not calibrate the model to countries in Africa because there are many missing observations for capital at the establishment-level in these countries.

We jointly calibrate the remaining seven parameters by solving the stationary equilibrium of the model in order to minimize the distance between seven statistics in the model and the corresponding data moments. While the procedure involves solving all the parameters simultaneously, because each parameter has a first-order effect on some statistic, we discuss them in turn to motivate the relevance of each data target. We determine ϕ, the level of financial market development, by targeting the proportion of capital financed through external sources (bank and non-bank financial intermediaries) which is 35 percent in Colombia (see Appendix A.3 for details). This target closely mimics the collateral constraint in the model where higher values of ϕ imply that a higher proportion of capital is financed through external sources. We determine λ, the rule of law, by targeting the percentage of establishments that report facing crime in Colombia, which is 24 percent.[21] Recall that the probability an establishment faces crime is $1 - F(\lambda, p)$ where λ has a first-order effect on the probability of crime. Hence, the fraction of establishments that face crime is informative of λ.

Data on crime is used to determine the parameters for the cost function of crime, ρ and h. The parameter ρ is the elasticity term for engaging in crime with higher values implying that stealing a larger share of entrepreneur capital is increasingly costly. Hence, ρ is informative of the share of crime occurring across the establishment size distribution; we target the share of crime among the top decile of establishments (based on employees), which is 28 percent. The parameter h is a scale which is useful to target aggregate losses from crime relative to output, which is 0.2 percent. We pin down parameters for the private protection cost function, ψ and b, similar to the approach used for the crime cost function. The parameter ψ is the elasticity term where higher values imply that buying additional protection is increasingly costly and b is the scale parameter. Therefore, ψ is chosen to target the share of protection spending among the top decile of establishments, which is 54 percent in the data; and b is chosen to

[21] As discussed earlier, our analysis is likely understating the importance of the rule of law since we focus on a narrow notion of crime by abstracting from corruption. This abstraction is motivated by data limitations as there is heavy under-reporting and non-response in questions related to corruption and bribe payments. For example, in Colombia over 50 percent of establishments report corruption is a major obstacle to business operation but only 3 percent report having to bribe public officials "to get things done".

Table 4: Calibration of crime and external finance in Colombia

Target Moments	Colombian Data	Model	Parameter
External finance to capital	0.346	0.343	$\phi = 0.369$
Prevalence of crime	0.237	0.232	$\lambda = 0.496$
Crime share (top emp. decile)	0.281	0.271	$\rho = 1.174$
Crime loss to output	0.002	0.002	$h = 19.35$
Protection share (top emp. decile)	0.542	0.502	$\psi = 1.985$
Protection spending to output	0.010	0.010	$b = 7.422$
(protection+crime)/output (top 50% of emp. decile)	0.012	0.014	$\theta = 0.228$

Notes: External finance to capital is capital less assets summed across entrepreneurs and divided by aggregate capital, and prevalence of crime is the percentage of entrepreneurs that face crime. Crime share is losses from crime in the top employment decile relative to aggregate losses from crime, and crime loss to output is aggregate losses from crime relative to aggregate output. Protection share and protection spending to output are defined in like manner. (protection+crime)/output is the sum of protection spending and losses from crime divided by the sum of output among the top 50 percent of establishments, by employment decile.

target aggregate spending on protection relative to output, which is 1 percent. Finally, the parameter θ affects the returns to protection spending and is chosen to target the cost of protection and crime (total cost associated with crime) relative to output among the top 50 percent of establishments.[22]

Table 4 reports the target moments from data, the corresponding statistics in the model, and resulting parameter values associated with a moment. To target the share of capital financed through external sources the model implies $\phi = 0.37$, which means an entrepreneur can borrow close to 1.6 times their asset holdings.[23] The parameter for the rule of law is $\lambda = 0.5$. In the absence of protection the probability of facing crime is 50 percent $(1 - \lambda)$, however, after accounting for protection expenditure, close to 23 percent of entrepreneurs

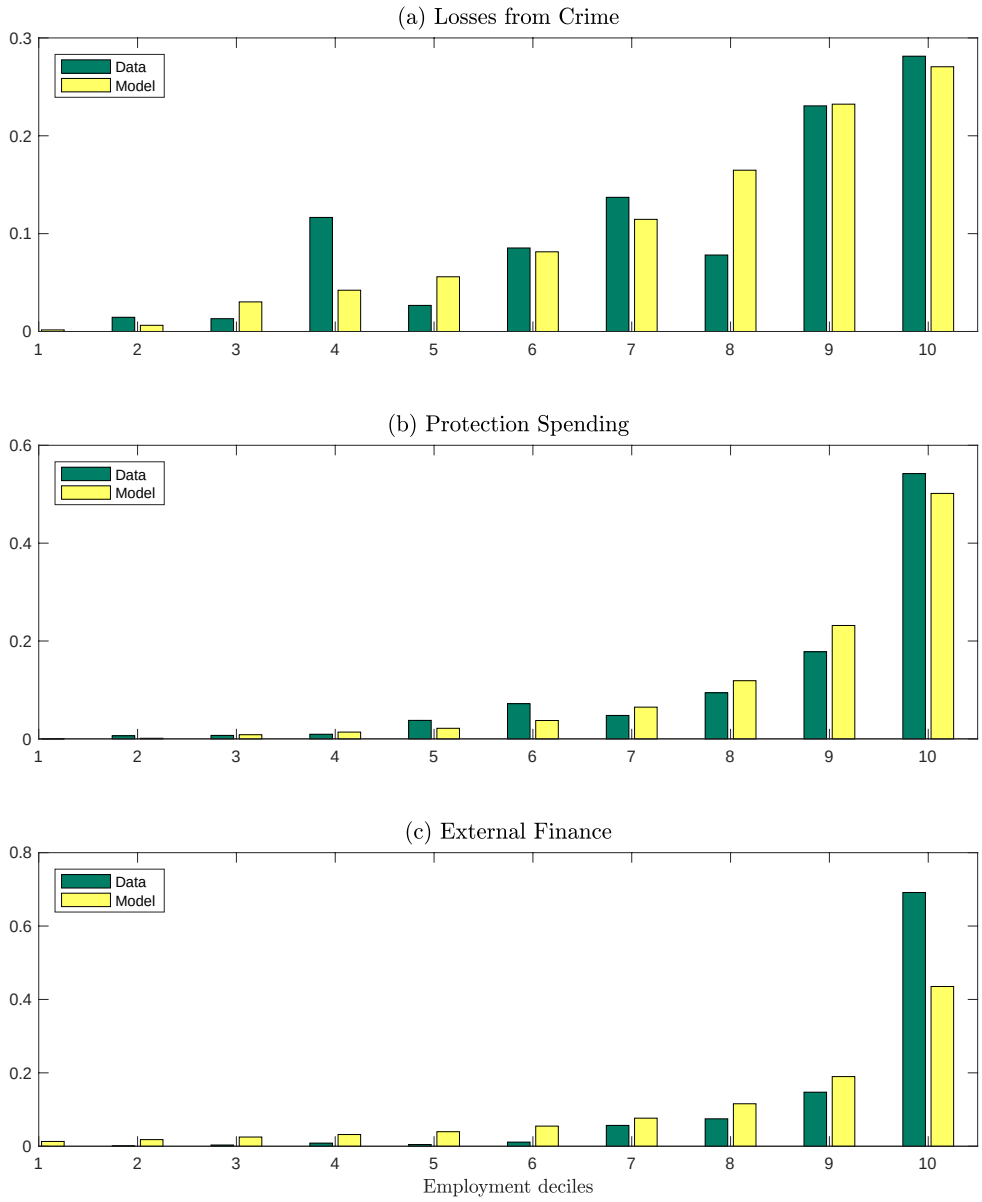
[22]While choosing specific deciles in the distribution of establishments to target ρ, ψ and θ is arbitrary, we show below that the model with the resulting calibrated parameters does well in matching crime and protection shares across employment deciles. Our focus on the top decile of the establishment distribution is motivated by the fact that establishments in this group account for the bulk of production. Similarly, establishments in the middle of the distribution account for the bulk of protection and crime.

[23]Recall that the collateral constraint is $k \leq [1/(1-\phi)]a$, where $1/(1-\phi)$ is the proportion factor of assets that can be used for borrowing.

actually face crime. It is important to note that this average masks considerable heterogeneity across establishment's productivity and wealth: crime rates are hump-shaped in productivity and decreasing in asset holdings. The elasticities for the cost function for crime and protection are greater than one, $\rho, \psi > 1$, implying that stealing a larger share of capital and buying additional protection is increasingly costly. The scale parameters on the cost functions are high, especially for crime, to ensure the share of output going to crime and protection is in line with the evidence.

It is worth noting that the elasticity and scale parameters for the crime and protection cost functions are non-standard in the literature and there are no direct estimates we can rely on to gauge whether their values are reasonable. Nevertheless, as we show in Figure 4, panel (a) and (b), the model does well matching the share of losses from crime and protection expenditure across employment deciles, despite that we target only the top deciles in our calibration (and aggregate moments). Furthermore, Figure 4, panel (c), shows that the model does well matching the share of external finance across employment deciles even though we target only the aggregate external finance to capital ratio as is common in the literature. While the model does not match the top decile well, it accounts for the general pattern that external finance is primarily concentrated among large establishments and negligible among small establishments. That the model captures closely these features of crime and external finance across the size distribution of establishments give us confidence in using our quantitative framework to study the implications of the rule of law for economic development. Furthermore, in Section 4.4, we show that the disaggregate implications of the model for economies with different levels of institutional development are consistent with micro evidence across countries, providing further confidence on the aggregate implications of the model.

Figure 4: Model fit—non-targeted moments across establishments by employment deciles



Notes: The figure reports the shares of losses from crime, protection spending, and external finance, across establishments by employment deciles.

4.3 Financial development and the rule of law across countries

In our quantitative analysis in the next section, we consider cross-country variations in the two parameters describing institutional development: financial development ϕ and the rule of law λ. What are the plausible ranges for these parameters across countries? In the model, financial market development maps to the proportion of capital financed through external sources and the rule of law maps into the prevalence of crime. We therefore, holding all parameters in the model fixed, re-calibrate ϕ and λ to replicate these statistics based on the WBES 2006-17 for countries that have at least 100 observations for both external finance and crime.[24]

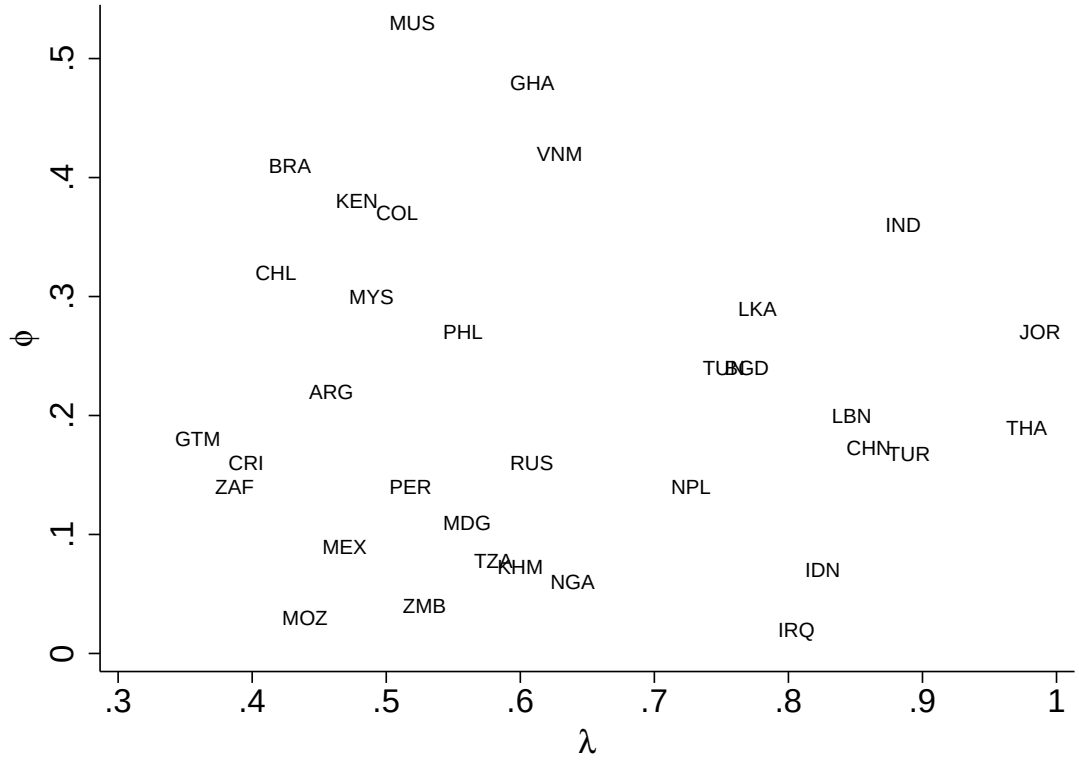
Figure 5 reports the implied values of ϕ and λ based on this sample. The proportion of capital financed through external sources range from 2 to 50 percent and the percentage of establishments facing crime range from 0 to just over 45 percent. The implied values for ϕ and λ given the above ranges are $\phi \in (0.02, 0.55)$ and $\lambda \in (0.35, 0.99)$. We think the lower range for λ is conservative. For example, expanding the sample of countries to include all countries that have over 100 observations for crime (dropping the requirement on observations for external finance), the proportion of establishments facing crime range from 0 to over 50 percent, where close to 20 percent of the countries in the sample have crime rates in excess of 30 percent. Accounting for these additional countries implies values of λ as low as 0.3.

4.4 Model outside validation

We have shown that the model calibrated to data for Colombia can broadly capture the disaggregate patterns of crime, protection, and external finance across establishments. Since the analysis that follows consists of studying the aggregate implications of variations in the degrees of crime and financial frictions across countries as reported in the previous section,

[24] This renders a sample of 34 countries. See Appendix A.3 and Table A.5 for a list of countries, the number of observations per country, and the implied values of ϕ and λ for each country.

Figure 5: Financial frictions ϕ and rule of law λ across countries



Notes: The figure shows the values of ϕ and λ that generate the external finance to capital ratio and the percentage of establishments facing crime for a sample of 34 countries in the WBES 2006-17, holding all other parameters in the model fixed. The sample is restricted to countries that have at least 100 observations on incidence of crime and external finance. See Appendix A.3 for details of the resulting sample.

we would like to provide some evidence that the model generates reasonable quantitative predictions for key variables in institutional settings that differ from that in Colombia.

Based on the evidence for ϕ and λ in Figure 5, we study the implications of the model in four countries that span a portion of the variation in institutional development across countries. We study India and China that have a much higher rule of law (higher λ) than Colombia; and Guatemala and Mozambique with a lower rule of law than Colombia. These countries also span similar or higher financial frictions (lower ϕ) than Colombia. In each case, we modify the values of λ and ϕ keeping all the other calibrated parameters the same. As suggested by our discussion in Section 3.6, we expect that the pattern of crime and protection across establishments becomes flatter for economies with high λ compared to economies with

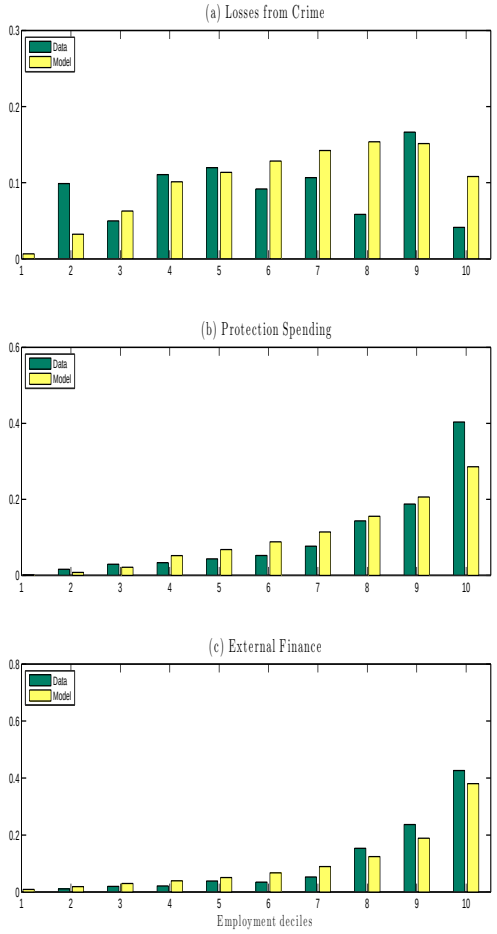
low λ. If so, the key question is whether these patterns are consistent with the micro evidence for countries with high and low levels of institutional development.

We report the results of these experiments in Figures 6 and 7, along with the corresponding data statistics for each country. These figures are analogous to Figure 4 for Colombia discussed earlier. The figures show that the patterns implied by the model for differences in institutional development are broadly consistent with the establishment-level implications in the corresponding countries. For example, the higher λ in China and India compared to Colombia implies that the incidence of crime is much lower in these countries, the prevalence of crime is 3.8 percent of the establishments in China and 3.2 percent in India, whereas it is 23.7 percent in Colombia. Importantly, the higher λ in China and India in the model implies that the share of crime and protection is much more uniform across establishments than in the case of Colombia, a pattern that is broadly consistent with the micro data for these countries, as illustrated in Figure 6. The model with lower levels of institutional development than Colombia, such as Guatemala and Mozambique, implies that the across establishment profile of crime and protection is steeper, again consistent with the implications of the micro data for these countries, as illustrated in Figure 7. In particular, for the level of institutional development in Guatemala, the model implies that the total cost of crime among the above median establishment is 3.7 percent of output compared to 3.9 percent in the model, whereas in the Colombian data this statistic is only 1.2 percent.

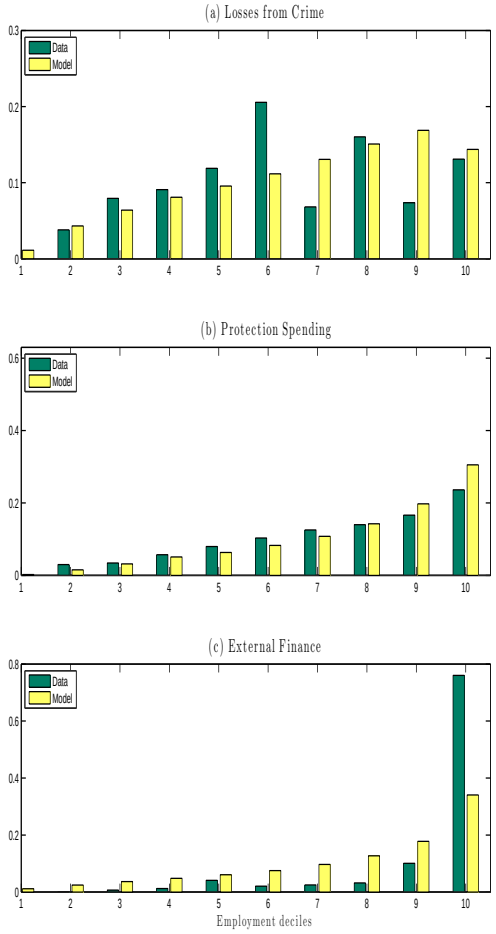
We conclude that our quantitative framework provides a reasonable setting to evaluate the aggregate implications of institutional development in the next section and in particular to evaluate the relative merits of institutional reform we purse in Section 5.3.

Figure 6: Differences in institutional development (ϕ, λ)—moments across establishments

Panel A: India



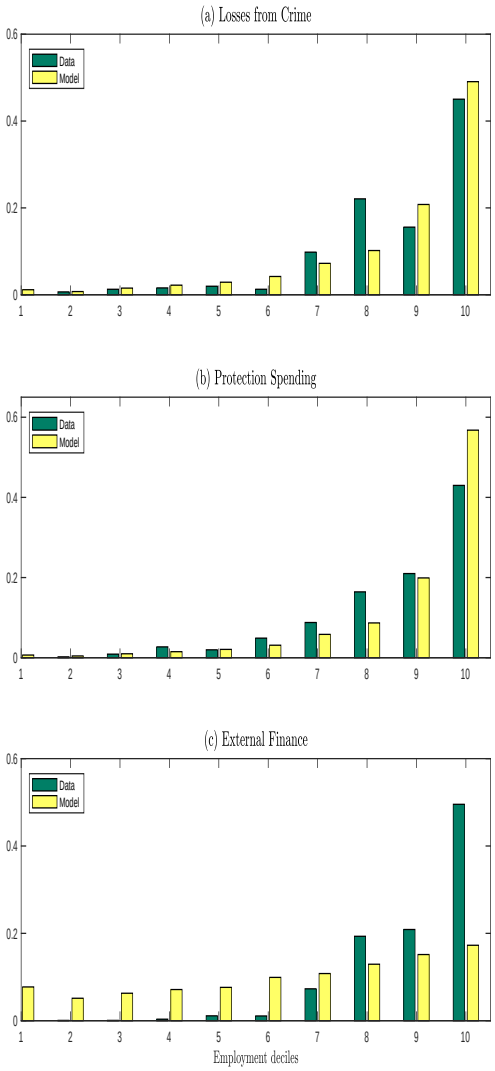
Panel B: China



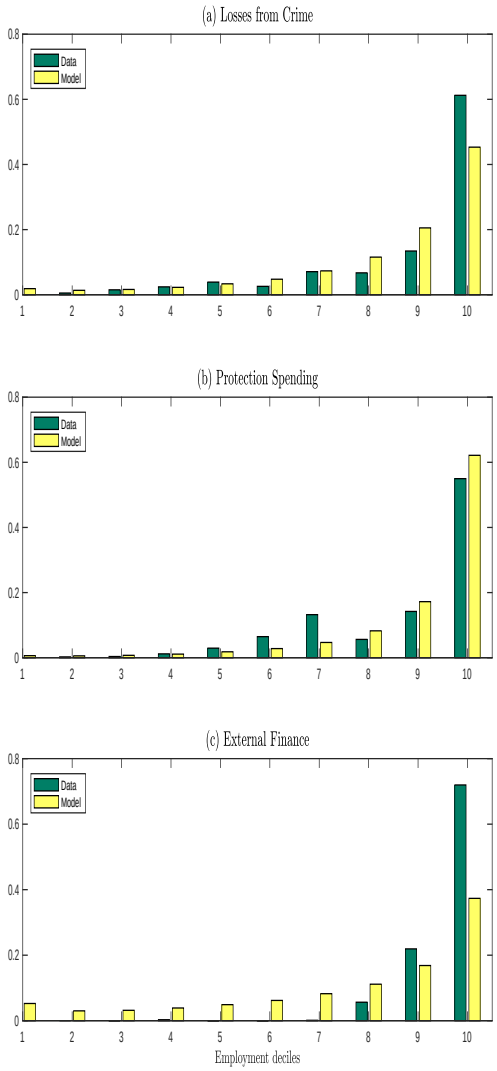
Notes: The figure reports the shares of losses from crime, protection spending, and external finance across establishments by employment deciles for each country. Model refers to the calibrated economy for values of λ and ϕ corresponding to each country according to Figure 5.

Figure 7: Differences in institutional development (ϕ, λ)—moments across establishments

Panel A: Guatemala



Panel B: Mozambique



Notes: The figure reports the shares of losses from crime, protection spending and external finance across establishments by employment deciles for each country. Model refers to the calibrated economy for values of λ and ϕ corresponding to each country according to Figure 5.

5 Results

We evaluate the implications of crime and financial frictions by studying economies that are otherwise identical to our calibrated economy except on the parameters ϕ and λ representing differences in the level of institutional development. We study the effects on aggregate outcomes of these institutions jointly and in isolation to assess the importance of each institution and their amplification effects. We also evaluate the importance for economic development of policy reforms that improve the rule of law or financial market development across economies that differ along the level of institutional development.

5.1 Quantitative effects

Table 5 reports relevant statistics such as aggregate output, capital, consumption, and total factor productivity (TFP) for two economies: an economy with $(\lambda = .5, \phi = .37)$ which was calibrated to institutional levels and establishment crime and protection data for Colombia, and an economy with $(\lambda = 0.35, \phi = .15)$, one of the weakest levels of institutional development observed in the cross-country data documented earlier (Guatemala in Figure 5). All results are reported relative to the undistorted economy $(\phi = \lambda = 1)$ which was calibrated to U.S. data.

The main result from Table 5 is that institutional differences in the rule of law and financial market development have substantial negative effects on aggregate variables. In the Colombia economy, output is 28 percent below the undistorted economy, TFP is 17 percent lower, and aggregate capital and consumption are 35 and 32 percent lower. These aggregate effects are magnified in the economy with the weakest level of institutional development where aggregate output is about half that of the undistorted economy. Hence, for this economy, an improvement in institutional development alone to levels in the undistorted economy would increase output by close to a two-fold factor. Consumption is more than 50 percent below

the undistorted economy.[25] The reduction in these aggregate variables are attributed to effects along the intensive and extensive margins of production. Along the intensive margin, entrepreneur capital demand falls both due to the collateral constraint and anticipated losses from crime. This translates to effects along the extensive margin lowering the number of entrepreneurs (entrepreneurship rate) and raising average establishment size. Nonetheless, the average capital to labor ratio used in production—or capital intensity—is lower; relative to the undistorted economy, capital intensity in production is about five times lower in the Weakest economy. Importantly, these effects are despite lower equilibrium prices for capital and labor in the distorted economies.

Table 5: Quantitative effects of crime and access to finance

	Colombia Economy ($\lambda = .50, \phi = .37$)	Weakest Economy ($\lambda = .35, \phi = .18$)
Output (Y)	0.72	0.51
Total factor productivity (TFP)	0.83	0.91
Capital (K)	0.65	0.18
Consumption (C)	0.68	0.45
Entrepreneurship rate	0.94	0.91
Wage	0.72	0.51
Avg. capital-labor ratio (k/n)	0.65	0.18

Notes: All statistics are reported relative to the undistorted economy, $\lambda = \phi = 1$.

Next, we isolate the effects attributable to crime and financial frictions. We decompose the effects of crime and finance in the Colombia economy and the Weakest economy. Table 6 reports the results relative to the undistorted economy. The columns labelled "Crime" present the scenario where each economy maintains its rule of law and adopts the level of financial market development in the undistorted economy. In this scenario, differences between the distorted economies and the undistorted economy are solely attributable to differences in the rule of law, thereby isolating the quantitative importance of crime. In the Weakest economy, crime alone reduces output by 24 percent, capital by more than 60

[25] TFP in the Weakest economy is higher than in the Colombia economy due to lower equilibrium prices which allow the most productive high-asset entrepreneurs to operate close their optimal scale.

percent, and consumption by 30 percent. In the Colombia economy, crime reduces output by 3 percent, capital by 10 percent, and consumption by 5 percent. These effects are substantial considering that the aggregate losses from crime represent only 0.2 percent of output in Colombia. Protection plays an important role in accurately accounting for the importance of crime across establishments by for example ensuring that the share of crime for the top employment decile of establishments is in line with the evidence.[26]

Table 6: Isolating the effects of crime and access to finance

	Colombia Economy ($\lambda = .50, \phi = .37$)			Weakest Economy ($\lambda = .35, \phi = .18$)		
	Total	Crime ($\phi = 1$)	Finance ($\lambda = 1$)	Total	Crime ($\phi = 1$)	Finance ($\lambda = 1$)
Output (Y)	0.72	0.97	0.80	0.54	0.76	0.74
Total factor productivity (TFP)	0.83	1.01	0.87	0.90	1.05	0.84
Capital (K)	0.65	0.90	0.76	0.22	0.37	0.69
Consumption (C)	0.68	0.95	0.80	0.48	0.70	0.75
Entrepreneurship rate	0.94	0.96	1.32	0.93	1.27	1.42
Wage	0.72	0.97	0.82	0.54	0.77	0.77
Avg. capital-labor ratio (k/n)	0.65	0.89	0.78	0.22	0.38	0.71

Notes: Statistics are reported relative to the undistorted economy, $\lambda = \phi = 1$. Total reports the effects of access to finance and crime in each economy. Crime reports the effects if only crime is present (i.e. $\phi = 1$) and Finance reports the effects if only weak access to finance is present (i.e. $\lambda = 1$).

The columns "Finance" isolate the effects arising from financial frictions by considering the case where each economy maintains its level of financial market development and adopts the rule of law of the undistorted economy. We find that in the Colombia economy, access to finance has substantially larger effects on aggregate output, capital and consumption than crime. Aggregate output falls by 20 percent, capital and consumption by 24 and 20 percent. In the Weakest economy, the effects of access to finance are similar to those for crime, lowering output and consumption by about 25 percent. Our results also imply that TFP losses arise primarily from frictions in access to finance.

It is worth noting that the difference between "Total" and "Finance" represents the ad-

[26]Excluding protection from the model would imply that crime rises with establishment size, producing substantially larger effects on aggregate variables.

ditional quantitative effects of including crime in a standard model of financial frictions with collateral constraints.[27] The quantitative effects of adding crime to the Colombia economy with financial frictions generates an additional 40 percent reduction in output, 45 percent lower aggregate capital, and 60 percent lower consumption. These negative effects are much larger in the Weakest economy where adding crime roughly doubles the negative impact output, capital, and consumption.

5.2 Amplification

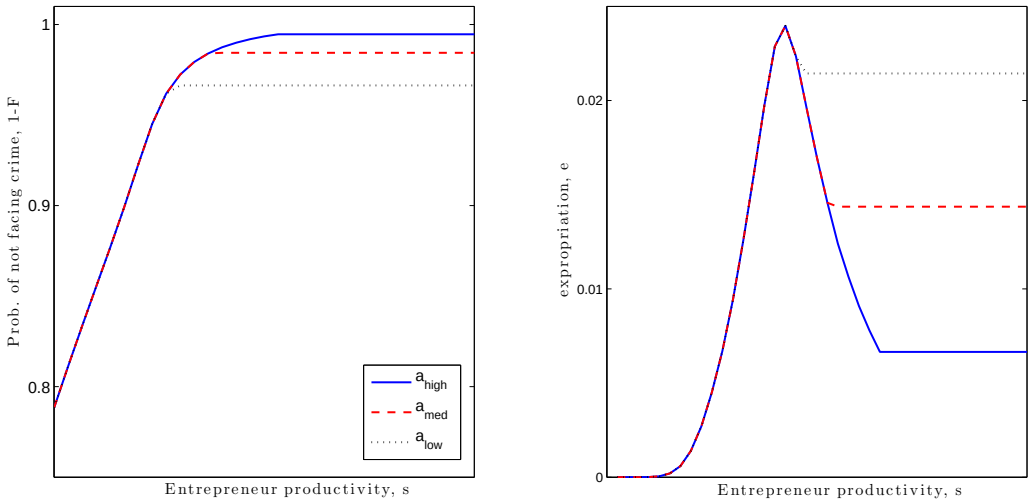
We now turn to the amplification effects that arise from evaluating crime and financial frictions together. As presented in Table 6, the joint effects from these distortions are greater than the sum of their individual effects. For instance, when examined in isolation crime lowers output by 3 percent and financial frictions lower output by 20 percent in the Colombia economy; when examined jointly they account for a 28 percent reduction in output—a more than 20 percent bigger effect on output than the sum of their individual components. Similarly for consumption—examined in isolation crime and financial frictions lower output by 5 and 20 percent respectively, but when evaluated together consumption falls by 32 percent.[28] Put differently, about 63 percent of the drop in consumption is accounted for by financial frictions, about 15 percent by crime and the remaining 22 percent is due to the interaction of these distortions.

The model provides a simple intuition for the amplification mechanism. As already discussed, in models that feature financial frictions, entrepreneurs can self-finance and overcome collateral constraints. Crime hinders this process because as constrained entrepreneurs expand they become a bigger target for crime. In equilibrium, the proportion of individuals with

[27] Setting $\lambda = 1$ and re-calibrating ϕ to match the proportion of capital financed through external sources generates a value almost identical to the one in Table 4. Hence, the results reported in column "Finance" in Table 6 represents the quantitative effects from a model that only features financial frictions.

[28] We find similar patterns for alternative calibrated economies to data in Brazil and Peru, see Appendix A.4.

Figure 8: Crime across entrepreneur productivity and wealth in the Colombia economy



low wealth rises and the wealth distribution becomes positive skewed amplifying aggregate losses.

Financial frictions magnify the severity of crime as well. In the model, high productivity entrepreneurs buy protection to limit their exposure to crime. Financial frictions restrict establishment size and spending on protection which raises the potential for crime. Figure 8 shows overall protection, $1 - F(\lambda, p)$, and the fraction of capital lost due to crime across entrepreneur productivity in the Colombian economy. The solid line in the left panel shows overall protection for high asset (or relatively unconstrained) entrepreneurs, and the corresponding line on the right panel shows the fraction of capital expropriated, contingent on facing crime. High productivity entrepreneurs, who account for the bulk of aggregate output, face minimal losses from crime (the curve is hump-shaped in productivity). In contrast, low/moderate asset–high productivity entrepreneurs face a higher probability of crime and lose a larger share of capital (dashed and dotted lines in the figure). For these entrepreneurs, financial frictions limit their scale of operation, spending on protection and increase the severity of crime.

Taken together, crime limits entrepreneur self-financing and financial frictions raise the

probability of crime. These channels are reinforcing, and account for the amplification effects on output, capital and consumption.

5.3 Policy reform

A long standing question in economic development surrounds which institutional factors are most crucial for development. A strand of the literature stresses that a strong rule of law is critical to incentivize investment and business expansion, thereby spurring development (e.g., Besley, 1995; Shleifer and Vishny, 1998; Svensson, 1998). Another strand of the literature emphasizes that financial markets are essential for the efficient allocation of resources across establishments and is a key component for economic development (e.g., King and Levine, 1993; Levine, 1997; Rajan and Zingales, 1998). While the underlying mechanisms in both literatures are important, it remains elusive which institutional factor is most relevant for development. Our framework allows us to provide some insight into this question by assessing the relative importance of each institutional factor for development, side-stepping issues related to identification often encountered in empirical work in this area.[29]

We ask, do comparable improvements in financial market development (ϕ) or the rule of law (λ) have differential effects on aggregate output? If so, how do the differences depend on the level of institutional development of the country (e.g., the level of ϕ and λ)? Our approach is to evaluate the long-run effects on aggregate outcomes of a hypothetical policy reform that improves either financial markets (ϕ) or the rule of law (λ). Our analysis focuses on the long-run benefits associated with a given reform, abstracting from important issues such as the cost of the reform, the transition to long-run outcomes, the source of reform or political viability, and the important details of implementation, among others. For this

[29]Determining the relative importance of rule of law and financial frictions for development empirically is challenging since improvements in one source of institutional measure often triggers an improvement in another institutional measure, preventing identification. An exception is Johnson et al. (2002) who use an exogenous policy change in post-Communist Europe to evaluate the effects of improved access to finance across six countries.

reason, we refrain from making statements on welfare from these reforms. We assume only one of these reforms is implemented at a time. Reforms that improve the rule of law can be interpreted as policies that lower crime and reforms that improve financial markets are policies that increase access to finance.[30]

Table 7 reports values for steady-state aggregate output across economies that differ in the rule of law and financial market development, based on the range of calibrated parameters from Section 4.3. The numbers reported in the table are relative to aggregate output in the economy with $\lambda = \phi = 0.3$. We begin with financial market reform, studying the effects of improving access to finance from $\phi = 0.3$ across economies that differ in the rule of law λ. Improving access to finance raises output in each case, with the largest effects in economies that have a weak rule of law. For example, improving access to finance from $\phi = 0.3$ to 0.9 (roughly equivalent to a policy that raises external finance to capital ratio from 21 to 62 percent) increases aggregate output by 36 percent in the economy with a weak rule of law $\lambda = 0.3$, whereas 28 percent in the economy with $\lambda = 0.9$.[31] Improving access to finance in low λ economies not only improves the allocation of resources across entrepreneurs, but also enables them to negate the potential of crime by spending on protection, amplifying output gains. We now focus on the reform of the rule of law, evaluating the effects of improving the rule of law from $\lambda = 0.3$ across economies that differ in financial market development ϕ. Output increases substantially in each case with the largest gains in economies that have weak financial markets. For example, a reform that increases λ from 0.3 to 0.9 (roughly equivalent to a policy that lowers incidence of crime from 55 to 3 percent) generates an increase in output of 52 percent for the $\phi = 0.3$ economy and 42 percent in the $\phi = 0.9$ economy.

Our results indicate that when the rule of law is relatively weak, i.e. $\lambda < 0.4$, improving

[30]There are many examples of large-scale economy-wide reforms. Related to access to finance, recent examples include a major reform in India in 1998 (Banerjee and Duflo, 2014) and in Mexico in 2014. Mexico's stance on the drug war in 2010 is an example of a policy reform that aims to improve the rule of law.

[31]In the undistorted economy with $\lambda = \phi = 1$, the crime rate is zero percent and external finance to capital is 77 percent.

Table 7: Effects of policy reform on aggregate output

	Access to finance ϕ:			
Rule of law λ:	0.3	0.5	0.7	0.9
0.3	1.00	1.11	1.24	1.36
0.5	1.38	1.54	1.71	1.89
0.7	1.48	1.62	1.77	1.93
0.9	1.52	1.65	1.79	1.94

Notes: Aggregate output across economies that differ in institutional development (ϕ, λ) relative to aggregate output in the economy with $\phi = \lambda = 0.3$.

the rule of law is more important for development than improving financial markets, and when the rule of law is above this threshold, improving financial markets becomes more important for development. Within the context of the model, in countries where the probability an establishment faces crime exceeds 33 percent and crime as percentage of output is close to 2 percent, improving the rule of law has larger effects on output than improving access to finance. To appreciate this point note in Table 7 that the output gains from improvements in the rule of law mostly occur from 0.3 to 0.5, whereas for financial market development the gains are spread more evenly over the increase in access to finance. These results imply that when the rule of law is weak, improving it should take priority over financial market development; beyond this, improving financial market development becomes more important. Of course, the costs of improving these institutions could be vastly different and hence these findings should be interpreted with this in mind.

These results relate to the empirical literature on why access to finance programs can have muted effects, see for instance Berge et al. (2015) and Karlan et al. (2014). Our framework emphasizes that in environments where other factors are more pressing concerns, such as crime, policies that improve access to finance are likely to have smaller effects. In other words, the rule of law is a precondition to reap the benefits from financial market development. We note that our results imply that in several countries in the world (for instance, Guatemala, South Africa, Costa Rica and Chile, where crime rates exceed 35 percent) improving the rule

of law (lowering crime) is essential for development, whereas for most countries, improving financial markets is the most relevant institution for development.

6 Conclusion

We developed an integrated framework to evaluate the effects of two highly relevant institutions that are prevalent in developing countries: weak access to finance and crime. The framework is an otherwise standard model of occupational choice and entrepreneurship extended to incorporate financial frictions and the rule of law. A calibrated version of this framework revealed several key insights. First, weak access to finance and rule of law have strong negative effects on aggregate outcomes, reducing output by close to two-fold factor relative to a undistorted economy. Second, we find strong complementarities among the two institutions we consider, that is we find the amplification effects of crime and access to finance on macro variables to be substantial. In our model output losses are amplified because weak access to finance lowers the ability of an entrepreneur to buy protection against crime, thereby raising the possibility for crime. Likewise, crime deters the self-finance motive which exacerbates the effects on output from financial frictions. Third, we studied the effects of policy reforms in our framework. When both financial market development and the rule of law are weak, policies that improve the rule of law have a bigger positive impact on aggregate output than those that improve financial market development. However, at reasonable levels of rule of law, polices that liberalize financial markets increase output more than further improvements in rule of law. An interpretation of our result is that financial markets are crucial for development, but a necessary condition is that property rights are secure.

Recent empirical studies on micro-finance programs show mixed results and a lack of consensus whether these programs are an effective tool for promoting development (e.g Karlan et al., 2014; Berge et al., 2015). Our results highlight that expropriation can influence whether micro-finance programs have viable long-run effects. In particular, our results indicate that

polices that liberalize financial markets have large aggregate output effects in economies where the rule of law is at least moderate, but much smaller effects when the rule of law is weak. A relevant extension of our analysis would be to incorporate the rule of law in macroeconomic studies of micro-finance programs such as the quantitative study in Buera et al. (2014).

We have focused on the misallocation effects created by weak access to finance and rule of law. A weak rule of law and the prevalence of crime can help account for why managers in less developed countries do not utilize the best management practices as emphasized in Bloom and VanReenen (2010), Bloom et al. (2010), and Bloom et al. (2013). We leave this potentially useful exploration for future research.

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A Appendix

A.1 Data sources and countries

The descriptive statistics presented in Table 1 are based on the most recent country-level data from the World Bank Enterprise Surveys 2006-17 (enterprisesurveys/data). Table A.1 reports country-level statistics on the percentage of establishments that report finance and crime as severe/major obstacles to business operation. Countries in the sample with year of survey are grouped by sub-continents. There are 138 countries in our sample.

Statistics reported in Table 1 are simple averages based on the number of countries in a sub-continent. These statistics differ from the sub-continent averages reported in the WBES website because we include all countries to calculate averages, whereas the WBES does not include high-income countries. Also reported are country-level statistics on the proportion of investment financed by banks and average losses from crime as a share of sales among establishments that face crime. Figures 1 and 2 are based on the sample of countries reported in Table A.1 as well. The statistic for crime as an obstacle to doing business is not reported for Madagascar, and losses from crime as a percentage of sales among establishments that face crime is not reported for Dominica and Uzbekistan, which accounts for the slight sample size differences in Figures 1 and 2.

Table A.1: Country-level statistics for crime and finance

Country	ISO code	Major obstacles to doing business: Finance	Crime	Investment financed by banks (%)	Losses from crime (% of sales)
Sub-Saharan Africa					
Angola (2010)	AGO	38.4	28.1	5.2	12.4
Benin (2016)	BEN	43.2	16.0	3.6	3.1
Botswana (2010)	BWA	25.5	22.6	24.7	3.1
Burkina Faso (2009)	BFA	75.0	42.2	15.6	3.1
Burundi (2014)	BDI	36.7	8.0	14.8	3.8
Cabo Verde (2009)	CPV	36.7	62.3	23.9	3.9
Cameroon (2016)	CMR	41.1	28.3	4.1	8.9
Central African Republic (2011)	CAF	46.0	25.6	4.8	12.0
Chad (2009)	TCD	46.5	45.8	2.3	6.5
Congo, Dem. Rep. (2013)	COD	39.1	27.8	0.9	8.3
Congo, Rep. (2009)	COG	44.8	44.1	4.0	16.9
Côte d'Ivoire (2016)	CIV	69.1	64.4	14.9	10.1
Ethiopia (2015)	ETH	20.3	2.4	7.8	3.4
Gabon (2009)	GAB	30.4	34.1	3.2	3.5
Gambia, The (2006)	GMB	40.3	12.3	9.8	8.6
Ghana (2013)	GHA	62.2	9.9	12.6	7.8
Guinea (2016)	GIN	30.4	36.4	2.8	9.6

Table A.1: Country-level statistics for crime and finance

Country	ISO code	Major obstacles to doing business: Finance	Crime	Investment financed by banks (%)	Losses from crime (% of sales)
Guinea-Bissau (2006)	GNB	71.6	29.6	0.8	3.3
Kenya (2013)	KEN	17.2	21.2	23.9	5.0
Lesotho (2016)	LSO	32.8	33.2	18.8	17.3
Liberia (2017)	LBR	38.8	27.3	10.9	9.3
Madagascar (2013)	MDG	12.6	-	4.3	5.3
Malawi (2014)	MWI	34.9	20.7	13.8	8.5
Mali (2016)	MLI	63.5	57.1	19.0	4.0
Mauritania (2014)	MRT	52.4	21.4	9.0	7.8
Mauritius (2009)	MUS	46.3	41.5	30.8	10.5
Mozambique (2007)	MOZ	50.1	33.6	4.7	5.0
Namibia (2014)	NAM	37.2	16.4	25.6	12.5
Niger (2017)	NER	27.4	25.8	14.1	4.5
Nigeria (2014)	NGA	33.1	7.0	3.4	13.6
Rwanda (2011)	RWA	35.1	10.7	13.5	4.6
Senegal (2014)	SEN	51.6	12.7	6.6	5.3
Sierra Leone (2017)	SLE	65.1	20.6	1.3	11.7
South Africa (2007)	ZAF	15.5	38.0	25.8	2.4
South Sudan (2014)	SSD	50.0	23.6	2.4	10.8
Swaziland (2016)	SWZ	10.0	30.8	12.7	7.1
Tanzania (2013)	TZA	43.9	21.1	8.8	6.8
Togo (2016)	TGO	51.2	32.0	17.6	7.3
Uganda (2013)	UGA	19.6	22.0	3.1	7.2
Zambia (2013)	ZMB	27.4	10.5	6.6	10.5
Zimbabwe (2016)	ZWE	55.9	7.4	11.7	4.6
Central America					
Antigua and Barbuda (2010)	ATG	41.1	38.9	32.3	2.6
Bahamas (2010)	BHS	12.9	19.5	11.7	1.7
Barbados (2010)	BRB	41.1	1.2	12.8	0.6
Belize (2010)	BLZ	66.8	52.3	18.1	1.0
Costa Rica (2010)	CRI	41.8	21.3	14.2	1.3
Dominica (2010)	DMA	64.2	17.8	22.1	-
Dominican Republic (2016)	DOM	14.3	32.4	28.3	6.6
El Salvador (2016)	SLV	20.7	48.5	20.0	3.3
Grenada (2010)	GRD	24.4	20.3	27.6	4.6
Guatemala (2010)	GTM	19.6	43.8	22.4	4.3
Honduras (2016)	HND	40.7	29.7	26.1	7.2
Jamaica (2010)	JAM	40.4	46.1	21.8	3.4
Mexico (2010)	MEX	29.6	29.1	8.8	3.6
Nicaragua (2016)	NIC	11.0	11.6	36.4	3.5

Table A.1: Country-level statistics for crime and finance

Country	ISO code	Major obstacles to doing business: Finance	Major obstacles to doing business: Crime	Investment financed by banks (%)	Losses from crime (% of sales)
Panama (2010)	PAN	1.0	8.2	0.8	5.6
St. Kitts and Nevis (2010)	KNA	38.8	46.6	32.3	2.7
St. Lucia (2010)	LCA	57.1	21.8	22.7	1.6
St. Vincent and Grenadines (2010)	VCT	29.9	24.0	28.8	4.7
Trinidad and Tobago (2010)	TTO	29.2	34.2	19.1	1.7
East Asia and Pacific					
Cambodia (2016)	KHM	16.9	24.2	0.9	3.2
China (2012)	CHN	2.9	0.8	4.5	0.5
Fiji (2009)	FJI	6.7	17.6	30.9	3.6
Indonesia (2015)	IDN	16.5	14.2	12.8	9.2
Lao PDR (2016)	LAO	5.7	0.2	10.6	1.9
Malaysia (2015)	MYS	12.0	13.3	15.7	8.5
Micronesia (2009)	FSM	24.2	19.1	5.4	4.6
Mongolia (2013)	MNG	31.7	7.8	11.6	3.6
Myanmar (2016)	MMR	9.9	5.2	3.2	1.1
Papua New Guinea (2015)	PNG	3.2	38.7	26.6	4.8
Philippines (2015)	PHL	10.7	10.9	10.1	1.3
Samoa (2009)	WSM	16.1	23.0	29.2	10.3
Solomon Islands (2015)	SLB	5.8	22.0	11.6	2.6
Thailand (2016)	THA	2.4	0.6	8.9	0.8
Timor-Leste (2015)	TLS	18.4	5.7	2.8	15.2
Tonga (2009)	TON	14.8	6.7	26.5	4.0
Vanuatu (2009)	VUT	29.0	35.6	26.3	6.4
Vietnam (2015)	VNM	10.8	4.1	15.4	3.5
Europe and Central Asia					
Albania (2013)	ALB	6.4	3.8	4.5	1.4
Armenia (2013)	ARM	25.9	3.0	9.5	3.6
Azerbaijan (2013)	AZE	22.1	0.3	21.9	2.3
Belarus (2013)	BLR	16.3	7.4	14.3	1.9
Bosnia and Herzegovina (2013)	BIH	14.1	7.2	23.9	2.5
Bulgaria (2013)	BGR	19.3	8.3	15.0	3.4
Croatia (2013)	HRV	22.7	8.0	18.6	1.7
Czech Republic (2013)	CZE	16.4	8.8	18.5	1.8
Estonia (2013)	EST	6.6	2.4	20.8	1.0
Georgia (2013)	GEO	18.3	4.8	12.1	2.2
Hungary (2013)	HUN	9.1	4.1	15.5	0.8
Kazakhstan (2013)	KAZ	8.8	8.4	8.8	3.7
Kosovo (2013)	XKX	44.9	46.6	16.1	3.1
Kyrgyz Republic (2013)	KGZ	26.1	18.3	8.7	3.3

Table A.1: Country-level statistics for crime and finance

Country	ISO code	Major obstacles to doing business: Finance	Major obstacles to doing business: Crime	Investment financed by banks (%)	Losses from crime (% of sales)
Latvia (2013)	LVA	13.2	9.0	6.2	1.6
Lithuania (2013)	LTU	17.3	15.7	16.7	4.3
Macedonia (2013)	MKD	19.3	9.0	11.1	2.5
Moldova (2013)	MDA	7.2	5.6	7.7	3.1
Montenegro (2013)	MNE	7.6	4.1	16.6	4.1
Poland (2013)	POL	15.6	8.2	12.1	2.2
Romania (2013)	ROU	33.5	22.3	14.6	2.8
Russian (2012)	RUS	28.0	12.4	6.3	3.0
Serbia (2013)	SRB	15.7	7.4	14.6	1.8
Slovak Republic (2013)	SVK	10.6	3.6	16.9	1.6
Slovenia (2013)	SVN	20.0	10.4	17.8	0.7
Sudan (2014)	SDN	15.3	9.3	2.4	4.5
Sweden (2014)	SWE	3.3	6.9	12.0	0.8
Tajikistan (2013)	TJK	22.6	8.3	5.1	12.8
Turkey (2013)	TUR	8.7	5.7	31.4	4.7
Ukraine (2013)	UKR	12.5	8.3	11.0	3.8
Uzbekistan (2013)	UZB	5.2	2.5	12.0	-
Middle East and North Africa					
Djibouti (2013)	DJI	11.8	10.2	13.8	4.4
Egypt (2016)	EGY	23.4	10.3	7.9	17.0
Iraq (2011)	IRQ	46.2	35.2	1.5	10.0
Israel (2013)	ISR	3.0	1.7	31.6	1.2
Jordan (2013)	JOR	42.8	3.4	25.0	15.8
Lebanon (2013)	LBN	41.5	33.0	32.9	5.4
Morocco (2013)	MAR	27.7	18.4	23.4	4.0
Tunisia (2013)	TUN	23.9	8.8	12.9	9.8
West Bank and Gaza (2013)	PSE	53.3	32.2	6.0	14.8
Yemen (2013)	YEM	45.5	61.8	1.2	4.9
South America					
Argentina (2010)	ARG	43.5	29.4	13.9	2.0
Bolivia (2017)	BOL	14.0	26.1	23.5	5.9
Brazil (2009)	BRA	45.2	68.6	32.3	6.9
Chile (2010)	CHL	17.6	37.5	32.5	1.7
Colombia (2010)	COL	41.4	32.5	21.2	1.1
Ecuador (2017)	ECU	13.3	18.0	18.2	2.3
Guyana (2010)	GUY	18.2	35.7	21.6	2.5
Paraguay (2017)	PRY	8.1	14.1	25.3	2.3
Peru (2010)	PER	8.5	27.6	34.7	2.8
Suriname (2010)	SUR	36.2	34.2	24.3	2.2

Table A.1: Country-level statistics for crime and finance

Country	ISO code	Major obstacles to doing business: Finance	Major obstacles to doing business: Crime	Investment financed by banks (%)	Losses from crime (% of sales)
Uruguay (2017)	URY	20.6	27.4	18.8	2.1
Venezuela (2010)	VEN	9.2	59.4	22.8	3.6
South Asia					
Afghanistan (2014)	AFG	47.6	57.5	1.5	24.2
Bangladesh (2013)	BGD	22.8	8.0	12.4	3.9
Bhutan (2015)	BTN	16.4	1.2	18.9	7.1
India (2014)	IND	15.1	4.6	18.1	2.7
Nepal (2013)	NPL	40.1	13.8	12.8	10.2
Pakistan (2013)	PAK	13.2	34.1	2.0	6.5
Sri Lanka (2011)	LKA	30.2	4.5	35.4	1.8

A.2 Access to finance and crime by establishment size

Table A.2 documents the sample characteristics for the results reported in Table 2 where we regress measures of access to finance and crime on establishment size. The table reports the number of observations for each variable by country and also the proportion of establishments that are small (less than or equal to 20 employees). The WBES classifies establishment responses to subjective questions, broadly defined, as truthful, somewhat truthful and not truthful, and for more objective questions as reliable and unreliable. In generating our sample, we exclude establishments whose responses are deemed not truthful and unreliable (about 8 percent of the initial sample), as well as establishments that do not report number of full-time employees. We then drop countries that survey fewer than 500 establishments, which leaves a sample of 40 countries from the WBES 2006-17.

Table 2 shows that the adverse effects of limited access to finance falls with establishment size, the likelihood of facing crime rises with size, and that crime as an obstacle to doing business is non-monotone across size. Specifically, crime as an obstacle to doing business rises with size for small establishments ($n \leq 20$ employees) and falls among non-small establishments ($n > 20$ employees), where we use the definition for small establishments from the WBES. We investigate whether the pattern that crime as an obstacle to doing business rises with size for small establishments and falls with non-small establishments hold under alternative definitions of small establishments. We consider two alternate definitions of small establishments: $n \leq 15$ and $n \leq 40$. Table A.3 shows the results. The general pattern highlighted in Table 2 that crime as an obstacle to doing business rises with size for small establishments, and falls with size for non-small establishments (to an extent), holds for these alternative definitions of small establishments.

Table A.4 documents that the patterns highlighted in Table 2 also hold when we use the number of full-time employees as a regressor instead of a categorical variable for establishment

Table A.2: Sample information on establishment-level observations for access to finance and crime by country

Country	Year	Number of observations for:				Percentage of small estabs. (%)
		Finance obstacle	Borrow from banks	Crime obstacle	Faced crime	
Argentina	2010	984	991	994	992	34.8
Bangladesh	2013	1385	1382	1390	1390	38.9
Brazil	2009	1635	1625	1649	1651	40.9
Chile	2010	1001	994	1010	1007	32.8
China	2012	2591	2562	2610	2613	26.3
Colombia	2010	900	901	905	905	40.7
Egypt	2016	1666	1663	1659	1657	41.9
El Salvador	2016	642	648	655	652	53.9
Ethiopia	2015	797	0	746	811	53.6
Ghana	2013	659	655	663	662	68.9
India	2014	8742	8293	8713	8751	37.7
Iraq	2011	649	655	651	650	86.3
Kazakhstan	2013	536	550	554	557	56.3
Kenya	2013	714	693	722	720	52.4
Malaysia	2015	783	783	783	779	36.3
Mexico	2010	1329	1345	1342	1345	36.0
Myanmar	2016	575	581	582	587	64.5
Namibia	2014	531	457	534	533	77.9
Nigeria	2014	2270	2100	2302	2312	71.0
Pakistan	2013	1151	1014	1187	1162	47.5
Peru	2010	963	958	963	964	36.6
Philippines	2009	1257	1199	1290	1297	39.4
Poland	2013	514	439	504	515	59.3
Romania	2013	520	520	518	524	60.8
Russia	2012	3865	3890	3883	3958	58.6
Senegal	2014	547	538	551	548	74.1
South Africa	2007	934	934	934	932	43.2
South Sudan	2014	652	651	657	656	90.7
Sri Lanka	2011	551	527	565	568	54.6
Sudan	2014	594	586	594	577	68.0
Sweden	2014	580	552	585	585	36.8
Tanzania	2013	642	467	642	658	68.1
Thailand	2016	933	948	946	943	45.2
Tunisia	2013	571	566	571	571	39.4
Turkey	2013	1217	1211	1203	1240	45.8
Uganda	2013	620	604	637	630	72.3
Ukraine	2013	864	744	862	863	55.2
Vietnam	2009	1,010	1024	1028	1038	29.6
Zambia	2013	656	648	666	670	65.1
Zimbabwe	2016	566	560	567	566	61.4

Table A.3: Access to finance and crime by size, alternative definitions of small establishments

	(1) Finance obstacle $(0-4)$	(2) Borrow from banks $(0-4)$	(3) Crime obstacle $(0-4)$	(4) Faced crime (yes/no)
Establishments with ≤ 15 employees:				
Establishment size	-0.043	0.255^{***}	0.056^{**}	-0.005
	(0.0298)	(0.0341)	(0.0284)	(0.0368)
Observations	16637	15814	16731	16837
Establishments with > 15 employees:				
Establishment size	-0.061^{***}	0.126^{***}	-0.010	0.075^{***}
	(0.0103)	(0.0114)	(0.0081)	(0.0137)
Observations	30615	29318	30737	30847
Establishments with ≤ 40 employees:				
Establishment size	-0.045^{***}	0.159^{***}	0.040^{***}	0.079^{***}
	(0.0129)	(0.0143)	(0.0114)	(0.0181)
Observations	30500	29123	30673	30804
Establishments with > 40 employees:				
Establishment size	-0.140^{***}	0.133^{***}	-0.041^{*}	0.097^{***}
	(0.0251)	(0.0285)	(0.0216)	(0.0299)
Observations	16752	16009	16795	16880

Notes: The table reports point estimates of an ordered Logit regression for alternate definitions of small and non-small establishments. Establishment size is an independent categorical variable based on full-time employees: ≤ 5, $6-9$, $10-14$, $15-20$, $21-30$, $31-40$, $41-50$, $51-100$, $101-250$ and $251-5000$. Dependent variables in columns (1) and (3) are whether access to finance and crime are not an obstacle, a minor, moderate, major or severe obstacle to business operation $(0-4$ scale). The dependent variable in column (2) is the percentage of working capital borrowed from banks $(0-4$ scale), and in column (4) is whether an establishment faced crime in the last year (yes/no). Categories for percentage of working capital borrowed from banks are 0%, $1-25\%$, $26-50\%$, $51-75\%$ and $> 75\%$. All estimates include industry, city, country, and continent-level fixed effects, as well as time fixed effects to account for differences in survey year. Industry-level controls are manufacturing, services and core industries, and city-level controls are related to population size. Standard errors are clustered at the country-level. ***, ** and * denote significance at the 1, 5 and 10 percent level.

Table A.4: Access to finance and crime across establishment size (employees)

	(1) Finance obstacle (0 − 4)	(2) Borrow from banks (0 − 4)	(3) Crime obstacle (0 − 4)	(4) Faced crime (yes/no)
Establishments with ≤ 500 employees:				
Establishment size	−0.00143***	0.00306***	0.00005	0.00181***
	(0.00025)	(0.00022)	(0.00015)	(0.00034)
Observations	45238	43248	45444	45665
Establishments with ≤ 20 employees:				
Establishment size	−0.0133***	0.0402***	0.0122***	0.0151***
	(0.00461)	(0.00356)	(0.00345)	(0.00450)
Observations	22569	21515	22697	22816
Establishments with > 20 employees:				
Establishment size	−0.00118***	0.00174***	−0.00031**	0.00099***
	(0.00022)	(0.00018)	(0.00014)	(0.00029)
Observations	22669	21733	22747	22849

Notes: The table reports point estimates of an ordered Logit regression for establishments with $0 \leq n < 500$, $n \leq 20$ and $20 < n \leq 500$, where number of full-time employees is the independent variable. Dependent variables in columns (1) and (3) are whether access to finance and crime are not an obstacle, a minor, moderate, major or severe obstacle to business operation ($0 - 4$ scale). The dependent variable in column (2) is the percentage of working capital borrowed from banks ($0 - 4$ scale), and in column (4) is whether an establishment faced crime in the last year (yes/no). Categories for percentage of working capital borrowed from banks are 0%, $1 - 25$%, $26 - 50$%, $51 - 75$% and > 75%. All estimates include industry, city, country, and continent-level fixed effects, as well as time fixed effects to account for differences in survey year. Industry-level controls are manufacturing, services and core industries, and city-level controls are related to population size. Standard errors are clustered at the country-level. ***, ** and * denote significance at the 1, 5 and 10 percent level.

size.

A.3 Data moments

In Section 4.2 we use the most recent year from the WBES 2006-17 for Colombia, which is the 2010 Survey, to obtain relevant moments in the data to discipline our quantitative analysis. Here we provide more detail on how these moments are calculated. We exclude establishments that report negative values for number of full-time employees and sales (value-added), and set losses from crime and external finance equal to zero for non-responses. We also exclude establishments whose responses to subjective questions are deemed not truthful and for objective questions that are deemed unreliable, as reported in the WBES. To ensure our moments are not sensitive to outliers, particularly for the crime and protection shares

we target, we exclude the top one percent of establishments in sales, employees, protection and crime. We are left with a sample of 803 establishments for Colombia.

Establishments report whether they experienced losses as a result of crime (yes or no, question $i3$ in the Surveys). Summing over establishments that report yes relative to all establishments gives us the percentage of establishments that face crime.[32] Also reported are annual losses from crime as a percentage of sales ($i4a$) and sales ($d2$); the product of these two variables determines monetary losses from crime. Similarly the product of annual spending on security as a percentage of sales ($i2$) and sales determines annual protection expenditure. The aggregate crime to output ratio is the sum of monetary losses from crime across establishments divided by the sum of value-added sales across establishments. Value-added sales is calculated as annual sales less intermediate inputs in production ($n2b$, $n2e$, $n2f$, $n2j$ and $n2i$). Following a similar approach, we use establishment spending on security to obtain aggregate spending on protection relative to output. To target the share of monetary losses from crime among the top decile of the distribution, we take the sum of losses from crime in the top decile (by employees) and divide by aggregate losses from crime; similarly for the share of protection expenditure across the top decile. The sum of losses from crime and spending on protection, relative to value added sales, among the top 50 percent of establishments (by employees) is calculated in a similar manner. For value of capital, we use the replacement cost of machinery/equipment and land/buildings ($n7a$ and $n7b$). The WBES also reports the percentage of working capital financed by external sources (commercial banks, state-owned banks and non-bank financial institutions; $k3bc + k3e$). We assume that all establishment capital is financed based on this percentage. Hence, the product of capital and percentage of capital financed by external sources, summed across all establishments and divided by aggregate capital is the external finance to capital ratio. Using fixed assets financed instead of working capital financed by external sources, generates a slightly higher external finance to capital ratio (0.385). We also note here that our calibrated economy for Colombia generates an external finance to *output* ratio that is very close to what is reported by the World Bank (Beck et al., 2000).

In Section 4.3 we follow the same procedure described above to determine the probability of facing crime and the external finance to capital ratio across countries. The sample is restricted to countries that have at least 100 observations for external finance and crime, and we exclude countries whose implied external finance to capital ratio is below 1 percent (Congo, Ethiopia and Pakistan), as well as Sweden which is the only high income country in the sample. After applying this criteria, we are left with 34 countries. We then find the values of ϕ and λ that generate external finance to capital ratios and probability of facing crime in these 34 countries. Table A.5 reports information for this sample of countries.

A.4 Robustness

We calibrate our model to the Brazil and Peru economies to evaluate the sensitivity of our quantitative results. We choose Brazil because it has a similar external finance to capital

[32]Since we clean the data and drop outliers, each observation is weighted equally for consistency. Using weights generates a slightly higher target value for incidence of crime.

Table A.5: Country level values for ϕ and λ

Country	ISO Code	Year	Observations for External Finance	Observations for Faced Crime	Ext. Finance to Capital	Prob. of Crime	Value of ϕ	Value of λ
Argentina	ARG	2010	413	799	0.22	0.31	0.22	0.45
Bangladesh	BGD	2013	937	1277	0.22	0.09	0.24	0.76
Brazil	BRA	2010	985	1402	0.33	0.31	0.41	0.42
Cambodia	KHM	2016	105	231	0.03	0.20	0.20	0.60
Chile	CHL	2010	584	910	0.27	0.37	0.32	0.41
China	CHN	2012	1155	2482	0.17	0.04	0.17	0.86
Colombia	COL	2010	489	803	0.35	0.24	0.37	0.50
CostaRica	CRI	2010	139	332	0.11	0.40	0.16	0.39
Ghana	GHA	2013	105	458	0.44	0.15	0.48	0.60
Guatemala	GTM	2010	186	338	0.14	0.47	0.18	0.35
India	IND	2014	2515	7926	0.34	0.03	0.36	0.88
Indonesia	IDN	2009	115	290	0.09	0.05	0.07	0.82
Iraq	IRQ	2011	393	612	0.02	0.07	0.02	0.80
Jordan	JOR	2013	200	433	0.26	0.01	0.27	0.98
Kenya	KEN	2013	224	585	0.34	0.27	0.38	0.47
Lebanon	LBN	2013	105	415	0.19	0.05	0.20	0.84
Madagascar	MDG	2013	114	304	0.09	0.15	0.11	0.55
Malaysia	MYS	2015	238	591	0.29	0.21	0.30	0.48
Mauritius	MUS	2009	122	356	0.44	0.21	0.53	0.51
Mexico	MEX	2010	974	1242	0.11	0.31	0.09	0.46
Mozambique	MOZ	2007	332	466	0.02	0.35	0.03	0.43
Nepal	NPL	2013	163	425	0.14	0.09	0.14	0.72
Nigeria	NGA	2014	308	1661	0.05	0.18	0.07	0.63
Peru	PER	2010	348	837	0.13	0.25	0.14	0.51
Philippines	PHL	2009	271	865	0.26	0.21	0.27	0.55
Russia	RUS	2012	302	2606	0.17	0.17	0.16	0.60
South Africa	ZAF	2007	652	907	0.12	0.42	0.14	0.38
Sril Lanka	LKA	2013	226	496	0.27	0.09	0.29	0.77
Tanzania	TZA	2013	113	377	0.08	0.19	0.08	0.58
Thailand	THA	2016	505	771	0.19	0.01	0.19	0.97
Tunisia	TUN	2013	248	522	0.22	0.09	0.24	0.76
Turkey	TUR	2013	292	713	0.17	0.03	0.17	0.89
Vietnam	VNM	2009	480	901	0.39	0.16	0.42	0.62
Zambia	ZMB	2013	129	552	0.03	0.24	0.04	0.52

Table A.6: Calibration parameters for Brazil and Peru Economies

		Brazil	
Target Moments	Data	Model	Parameter
External finance to capital	0.33	0.34	$\phi = 0.376$
Prevalence of crime	0.31	0.29	$\lambda = 0.479$
Crime share (top emp. decile)	0.42	0.37	$\rho = 1.092$
Crime loss to output	0.003	0.001	$h = 18.97$
Protection share (top emp. decile)	0.59	0.57	$\psi = 1.932$
Protection spending to output	0.010	0.014	$b = 7.361$
(protection+crime)/sales (top 50% of emp. decile)	0.014	0.018	$\theta = 0.244$
		Peru	
Target Moments	Data	Model	Parameter
External finance to capital	0.13	0.15	$\phi = 0.151$
Prevalence of crime	0.25	0.25	$\lambda = 0.496$
Crime share (top emp. decile)	0.40	0.29	$\rho = 1.19$
Crime loss to output	0.002	0.002	$h = 19.42$
Protection share (top emp. decile)	0.46	0.47	$\psi = 2.03$
Protection spending to output	0.015	0.011	$b = 7.72$
(protection+crime)/sales (top 50% of emp. decile)	0.017	0.014	$\theta = 0.238$
		Colombia	
Target Moments	Data	Model	Parameter
External finance to capital	0.35	0.34	$\phi = 0.369$
Prevalence of crime	0.24	0.23	$\lambda = 0.496$
Crime share (top emp. decile)	0.28	0.27	$\rho = 1.174$
Crime loss to output	0.002	0.002	$h = 19.35$
Protection share (top emp. decile)	0.54	0.50	$\psi = 1.985$
Protection spending to output	0.01	0.01	$b = 7.422$
(protection+crime)/sales (top 50% of emp. decile)	0.012	0.014	$\theta = 0.228$

ratio as Colombia but higher probability of crime; Peru has a similar probability of crime as Colombia but a lower external finance to capital ratio. Target moments for Brazil and Peru are calculated similarly to those for Colombia. Table A.6 reports target moments from the data, corresponding moments in the model and parameter values for the Brazil and Peru economies. The Colombia economy in Section 4.2 is included for comparison. The calibrated parameters imply a lower value for ϕ in Peru, relative to Colombia, and a lower value of λ in Brazil (though the model under-predicts the probability of facing crime and aggregate crime relative to output in Brazil). Table A.7 reports the quantitative effects from the lack of finance and crime for the calibrated economies of Brazil and Peru. For Brazil, adding crime to a model with financial frictions generates an additional 50, 42 and 84 percent reduction in output, TFP and consumption; in Peru these values are 30, 29 and 50 percent.

Table A.7: Isolating the effects of crime and access to finance

	Brazil Economy ($\lambda = .48, \phi = .38$)			Peru Economy ($\lambda = .5, \phi = .15$)		
	Total	Crime ($\phi = 1$)	Finance ($\lambda = 1$)	Total	Crime ($\phi = 1$)	Finance ($\lambda = 1$)
Relative output Y	0.70	0.96	0.80	0.65	0.96	0.73
Relative TFP	0.83	1.01	0.88	0.78	1.00	0.83
Relative capital K	0.61	0.87	0.76	0.56	0.89	0.68
Relative consumption C	0.65	0.94	0.81	0.61	0.95	0.74
Relative FOE	0.88	0.88	1.30	0.94	0.97	1.43
Relative wage	0.69	0.95	0.82	0.64	0.97	0.76
Relative avg. k/n ratio	0.60	0.86	0.78	0.56	0.90	0.70

Notes: Statistics are reported relative to the undistorted economy. Total reports the effects of access to finance and crime in each economy. Crime reports the effects if only crime is present (i.e. $\phi = 1$) and Finance reports effects if only weak access to finance is present (i.e. $\lambda = 1$).