Financial Frictions and the Rule of Law

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Abstract

Using micro-level data we document that crime and access to finance are two major obstacles to business operation in many parts of the world. To account for their effects we present an integrated framework that features under-developed financial markets which affects access to finance, and the rule-of-law which affects the potential for crime. Using novel features of this framework we evaluate the joint effects of these distortions and assess their implications for economic development. Crime and access to finance have substantial amplification effects, more than doubling output losses, and our theory provides key insight into its cause. We also show that gains from liberalizing financial markets are fundamentally related to the rule-of-law. Our quantitative results confirm that while financial markets are crucial for development, a necessary condition is that property rights are secure.

JEL: 01, 04
Key Words: misallocation, financial frictions, rule of law, crime

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1 Introduction

Understanding the causes of cross-country income differences are central questions in the macro-development literature. Recent work has emphasised that the allocation of resources across establishments is important for understanding these differences (Restuccia and Roger-son, 2008; Hsieh and Klenow, 2009; Bartelsman et al. 2013). While much work has focused on policy related factors that misallocate resources, less understood are the institutional features that contribute to them. We focus on two forms of institutional development and the distortions they generate; namely, the rule-of-law which affects the potential for crime and financial market development which affects access to finance. Our aim is to evaluate the relevance of these institutional differences jointly for understanding resource misallocation, output differences and the broad implications they have for economic development within a quantitative setting.

The emphasis on the rule-of-law and financial market development is motivated by its importance for development as highlighted across separate strands in the literature (Shleifer and Vinshy, 1998; King and Levine, 1993) and because these institutions are closely linked to crime and access to finance, 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.\(^1\) We document that crime is a severe obstacle to business operation, on par with access to finance across a host of countries in several sub-continents. For example, in South America 40 and 24 percent of establishments report that crime and access to finance are major obstacles to business operation; these values are 27 and 42 percent in Africa, respectively. To put these values in context, in a rich country such as Germany less than 5 and 15 percent of establishments report that crime and access

\(^1\)The macro literature on financial frictions is vast and expanding. Several contributions include, but are not limited to, Jeong and Townsend (2007), Amaral and Quintin (2010), Greenwood et al. (2010), Buera et al. (2011), Buera and Shin (2013), Caselli and Gennaioli (2013), Midrigan and Xu (2014) and Moll (2014). There are fewer studies that examine the macro effects of crime, an exception being Ranasinghe (2014) who studies the effects of extortion in Eastern Europe. See also, Oguzoglu and Ranasinghe (2014) who estimate the effects of crime on establishment sales in South America.
to finance are major obstacles to operation.

To understand importance of these differences, we present an integrated framework that features differences in the rule-of-law which affects the potential for crime, and underdeveloped financial markets which restricts access to finance (financial frictions). We find crime and financial frictions produce substantial amplification effects, more than doubling the output losses produced from evaluating either of these distortions in isolation. We then use our framework to evaluate the implications they have for economic development. In particular, we evaluate the effects from a hypothetical policy reform that improves financial market development and/or the rule-of-law, across economies that differ along these measures of institutional development. Our quantitative results confirm the findings across separate strands in the literature and provides context for their interpretation: financial markets are crucial for development but a necessary condition is that property rights are secure (McMillan, 1997; Johnson et al. 2002).

The model we examine is a variant of a Lucas (1978) span-of-control framework. Individuals differ along entrepreneurial ability and asset holdings, and choose either to operate as an entrepreneur or supply labor to hiring entrepreneurs. We introduce two market imperfections that are central to the 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 an entrepreneur’s 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 buys. Differences in the rule-of-law and financial market development affect entrepreneur production and have the potential to amplify the effects arising from crime and access to finance, as we elaborate below. Our goal is to quantify these effects and assess their implications for output differences.
We discipline the quantitative analysis using data from the World Bank Business Environment and Enterprise Performance Survey (BEEPS 2010) which contains establishment-level data related to crime and external finance at the establishment-level. 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 relating 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. We choose Colombia for the calibration because crime and access finance are equally important obstacles to business operation in this country. We could instead target other countries where data is available and show that nothing central to our results hinge on choosing Colombia.

The long-run effects of crime and access to finance are quantitatively important. Differences in institutional development between Colombia and the US – financial market development which affects access to finance and the rule-of-law which affects crime – accounts for a 40 percent lower capital stock in Colombia and 20 percent lower output and consumption. Inequality is also higher: the earnings share going to the top 1 percent rises from 12 to 18 percent. This is due to general equilibrium effects which enable wealthy high ability entrepreneurs, who face minimal distortions, to increase production. Since institutional development is uniquely identified through separate parameters in the model, we can assess the importance of crime and financial frictions in isolation. Crime lowers output by 6 percent in Colombia relative to the US, and financial frictions lower output by 11 percent. Their joint effects exceed the sum of their individual effects (21 vs. 17 percent) implying substantial amplification effects on output.

The intuition for the amplification effect is straight-forward when viewed through the lens

\footnote{The dataset contains detailed information related to robbery, theft, arson and vandalism on the establishment’s premises, which we interpret as 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.}
of the model. In models that feature financial frictions, constrained entrepreneurs can overcome the financing constraint they face by reinvesting profit in their business and gradually expanding – the motive to self-finance (Buera and Shin 2011a; 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. In equilibrium the number of constrained entrepreneurs increase and is reflected through a wealth distribution that is positive skewed. 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 potential 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. 2000, among others), 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). Our framework, which incorporates these measures of institutional development is able to assess the importance of each of these factors. Specifically, we consider the long-run effects on output from a hypothetical reform that improves the rule-of-law and/or financial market development.

Our quantitative simulations provide two main insights. First, the gains in output from improving financial market development are hump-shaped in the rule-of-law. Put differently, policies that improve access to finance have the biggest effect on output in economies that have a ‘moderate’ rule-of-law (such as Colombia), and lesser effects in economies that have a weak
or strong rule-of-law.\textsuperscript{3} Second, when both the rule-of-law and financial market development are weak, a policy reform that improves the rule-of-law has a bigger effect on raising output than a reform that improves financial markets. However, once the rule-of-law is above a certain threshold, policies that improve access to finance have a bigger effect on output than those that improve the rule-of-law.\textsuperscript{4} Hence, our quantitative results imply that policies should favour financial market development but only once the rule-of-law is sufficiently strong.

This paper is also related to the misallocation literature as in Restuccia and Rogerson (2008) and Hsieh and Klenow (2009), and more closely to the literature on financial frictions and crime. The framework we propose is essentially a model with two distortions, which embeds a channel for financial frictions, as in Buera \textit{et al.} (2011), Midrigan and Xu (2014), Moll (2014) among others, and a channel for crime through expropriation of entrepreneur capital, as in Ranasinghe (2014), into an otherwise standard span-of-control model. Our paper focuses on the interaction of these distortions, their potential to amplify output losses and their implications for economic development. Closely related is Buera and Shin (2011b), who study financial frictions in a setting with idiosyncratic distortions to understand capital flows and transition dynamics from a policy reform. Our framework endogenizes this second distortion and emphasizes establishment-level crime, which is a highly relevant and severe distortion in many parts of the world as we document.

This paper is also relates to the more recent empirical studies related on micro-finance programs. Results from this literature are mixed and lacks consensus whether micro-finance programs are an effective tool for promoting development.\textsuperscript{5} This paper provides an explanation, albeit through one channel, by highlighting that expropriation can influence whether micro-finance programs can have viable long-run effects. In particular, we show that po-

\textsuperscript{3}In economies that have a weak rule-of-law entrepreneurs operate at a sub-optimal scale, even when finance is available, due to the severity of crime (Johnson \textit{et al.} 2000). In economies that have a strong rule-of-law entrepreneurs have motive to self-finance which lowers the gains from improving financial markets. Obviously, defining whether an economy has weak, moderate or strong property rights is critical, which the model provides a gauge for.

\textsuperscript{4}Clearly, these considerations must take into account the cost and implementation of such policies which this paper abstracts from.

\textsuperscript{5}See for example Udry (2012) for a survey of literature related to micro-finance and entrepreneurship.
lices that liberalize financial markets have large effects on production in economies where the rule-of-law is moderate, but lesser effects when the rule-of-law is weak. Also related is Buera et al. (2014) who evaluate the long and short-run effects of micro-finance programs in a quantitative macro model.

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 Section 5 provides our quantitative results. Section 6 concludes.

2 Facts

It is well documented that access to finance is a major constraint among entrepreneurs in developing economies. Less known is the prevalence of crime in developing countries, notably its frequency and severity to doing business. We use data provided in the World Bank Enterprise Surveys to document the prevalence of crime across countries and relative to other distortions frequently examined in the literature. Crime is restricted to activities related to arson, robbery, theft and vandalism on the establishment’s premises. Ideal for our analysis is the Enterprise Survey contains establishment-level data related to the frequency of crime, losses attributable to it and whether crime is a major, moderate, minor or non-obstacle to business operation. Also included is information related other distortions establishments encounter – access to finance, functioning of the courts, tax administration and the informal sector, among others – and a ranking of their importance for business operation.

Table 1 reports the percentage of establishments that state a given distortion is a 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 severe obstacles to business operation in poor countries: practises of the informal sector
Table 1: Obstacles to doing business across sub-continents

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Africa</td>
<td>42.3</td>
<td>26.9</td>
<td>37.7</td>
<td>26.2</td>
</tr>
<tr>
<td>Asia</td>
<td>16.5</td>
<td>16.8</td>
<td>16.3</td>
<td>12.2</td>
</tr>
<tr>
<td>Caribbean</td>
<td>33.8</td>
<td>31.6</td>
<td>27.3</td>
<td>22.0</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>16.8</td>
<td>9.1</td>
<td>19.5</td>
<td>15.2</td>
</tr>
<tr>
<td>Europe</td>
<td>13.2</td>
<td>7.5</td>
<td>-</td>
<td>18.4</td>
</tr>
<tr>
<td>Middle East</td>
<td>34.7</td>
<td>17.6</td>
<td>32.2</td>
<td>22.3</td>
</tr>
<tr>
<td>South America</td>
<td>24.3</td>
<td>40.2</td>
<td>36.1</td>
<td>23.7</td>
</tr>
<tr>
<td>South Asia</td>
<td>11.6</td>
<td>19.4</td>
<td>22.9</td>
<td>10.2</td>
</tr>
</tbody>
</table>

This table reports the percentage of establishments that report a given obstacle is a major obstacle to doing business.

and tax administration.\(^6\) 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, with over 40 percent of establishments in Africa reporting as such. Second, crime is also major obstacle to business operation. In fact, crime is on par with access to finance, practises of the informal sector and tax administration as an obstacle to doing business. For example, in Africa and South America over 25 and 40 percent of establishments report that crime is a major obstacle to business operation. Crime as an obstacle to doing business is negatively related with GDP per capita across these sub-continents and has a correlation coefficient equal to \(-0.46\). Crime is least disruptive to business in Europe, Eastern Europe and the Middle East where measures of institutional development tend to be higher. While we present results across sub-continents, the general pattern holds across a more disaggregated list of countries as well.

To further highlight the relevance of crime, Table 2 reports additional descriptive statistics on the percentage of establishments that report incidences of crime and losses that are attributed to them. We present these statistics for countries in South America where crime is most severe according to the data. The proportion of establishments that report incidences

\(^6\)For work related to access to finance see Banerjee and Duflo (forthcoming) and Udry (2012). Related to tax administration or the informal sector see Moscoso-Boedo and Mukoyama (2012) and La Porta and Shleifer (2014) and references therein, as well early contributions by De Soto. While these distortions are severe, corruption is often listed as the biggest obstacle to business operation.
Table 2: Crime across South American Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence of crime (% of firms)</th>
<th>Major obstacle (% of firms)</th>
<th>Avg. losses (% of sales)</th>
<th>Avg. losses (if &gt; 0) (% of sales)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>33</td>
<td>29</td>
<td>0.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Bolivia</td>
<td>31</td>
<td>45</td>
<td>0.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Brazil</td>
<td>38</td>
<td>69</td>
<td>2.5</td>
<td>6.9</td>
</tr>
<tr>
<td>Chile</td>
<td>48</td>
<td>38</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Colombia</td>
<td>29</td>
<td>33</td>
<td>0.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Ecuador</td>
<td>31</td>
<td>35</td>
<td>1.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Guyana</td>
<td>43</td>
<td>36</td>
<td>1.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Paraguay</td>
<td>39</td>
<td>37</td>
<td>1.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Peru</td>
<td>24</td>
<td>28</td>
<td>0.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Uruguay</td>
<td>38</td>
<td>35</td>
<td>0.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Venezuela</td>
<td>44</td>
<td>59</td>
<td>1.4</td>
<td>3.6</td>
</tr>
</tbody>
</table>

The second through fifth columns report the fraction of establishments that report incidences related to crime on their premises in the past year, the fraction of establishments that report crime is a major obstacle to business operation, average losses due to crime as percentage of sales for all firms and average losses due to crime as percentage of sales for those firms that report facing crime. All country statistics are from 2010 except for Brazil which is from 2009 (BEEPS, World Bank).

related to crime is lowest in Peru (24 percent) and highest in Chile (48 percent). As an obstacle to doing business, Brazil and Venezuela score the highest, with 69 and 59 percent of establishments that report crime is a major obstacle to business operation. Not surprisingly, losses attributed to crime are the highest in these countries and account on average for about 1.4 to 2.5 percent of all sales, and 3.6 to 6.9 percent of sales amongst establishments that face crime (last column). Given the magnitude of these numbers, crime together with access to finance may have important implications for understanding cross-country income differences.

3 Model

Our focus is to evaluate the joint effects of crime and financial frictions on establishment behaviour and aggregate outcomes. To this end, we imbed a channel that accounts for institutional differences in the rule-of-law and access to finance into an otherwise standard span-of-control framework as in Lucas (1978). In the model, individuals differ in entrepreneurial
ability and choose between working as an entrepreneur or as a worker. Differences in the rule-of-law affect the potential for crime which affects the returns to entrepreneurship. Financial market development is modelled in the form of a collateral constraint which restricts that the size of an entrepreneurs’ establishment is proportional to his wealth. Hence, in our framework establishment size is distorted by the potential for crime and access to finance. Our aim is to evaluate the importance of these effects jointly and to understand the implications they have for economic development.

3.1 Environment

The economy is populated by a measure-one of infinitely lived individuals who differ in entrepreneurial ability $s \in S$ and asset holdings $a \in A \equiv [0, \infty)$. Entrepreneurial ability is stochastic over time to capture changes in demand/taste shocks for goods produced by the entrepreneur, but is inalienable within a period. Ability evolves according to an exogenous Markov process $M(s, s')$ and the cumulative distribution over assets and ability 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 against ability shocks. Preferences are over streams of consumption, $\sum_{t=0}^{\infty} \beta^t u(c_t)$, which is time separable and $\beta \in (0, 1)$ represents the per-period discount rate.

Individuals are endowed with one unit labor every period and is supplied inelastically. They can operate an individual specific technology, which we refer to as entrepreneurship, or work for a wage for entrepreneurs. Each occupation requires one unit of labor, which means individuals select into one occupation every period. The economy also features two distinct distortions. The first is related to access to finance arising from underdeveloped financial markets and the second is related to crime on entrepreneur capital arising from imperfections in the rule-of-law. We describe these in turn.
### 3.2 Technology and Rental Markets

Economies differ in the level of financial market development which we denote by $\lambda_f \in [1, \infty)$. In particular, due to imperfections in the financial market – say due to limited enforcement or monitoring technology – entrepreneurs face a collateral constraint and can borrow capital up to a factor proportional to their wealth. Specifically, entrepreneurs can borrow capital, $k \leq a\lambda_f$, where $k$ represents capital used in production. This formulation has the intuitive appeal that how much is borrowed is dependent on the entrepreneur’s assets, $a$, and is proportional to $\lambda_f$. In this setup, $\lambda_f$ serves as a measure of financial market development with higher values representing more developed financial markets. When $\lambda_f = \infty$ financial markets are fully developed, collateral constraints are non-existent and independent of an entrepreneur’s assets. Conversely, when $\lambda_f = 1$ financial markets are non-existent and entrepreneur capital is restricted to equal his assets. Thus, values of $\lambda_f \in [1, \infty)$ capture the degree of financial market development. See for example, Buera et al. (2011), Moll (2014) and Midrigan and Xu (2014) who model financial market development in a similar way.

We note here the collateral constraint is the only source of 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 features that are central to our analysis: entrepreneur borrowing depends on wealth and financial market development.

The second source of friction arises from the potential for crime against an entrepreneur, which is linked to the rule-of-law in the economy. We describe the details in what follows and note here that there is an endogenous probability that entrepreneur capital is expropriated by a stand-in Criminal Group, as in Ranasinghe (2014).\(^7\) We focus on crime at the entrepreneur level and abstract from crime related to an individual’s assets. There are several reasons for

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\(^7\)We could instead impose that crime is related to output with little consequence to our central results. Since access to finance is related to capital, for consistency crime is also modelled as dependant on entrepreneur capital.
this. The data we have on crime is at the establishment-level and not at the individual level, hence we restrict attention to the effects of crime on entrepreneur behaviour. Furthermore, in the model individuals that have the most assets tend to be entrepreneurs, and hence, asset accumulation and capital are closely linked.

The production process is standard. Entrepreneurs use capital $k$, labor $n$ and their ability $s$ to produce output. We denote output by $f(s, k, n)$, which is decreasing returns to scale and increasing in all three inputs. Due to institutional under-development, entrepreneur profit depends on access to finance (from the collateral constraint) and the potential for crime. For an entrepreneur of type $(a, s)$ that does not face crime, his profit is

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

where $w$ is the wage paid to a worker, $r$ is the real interest rate and $\delta \in (0, 1)$ is the depreciation rate. If an entrepreneur faces crime, his profit is

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

where $e \in (0, 1)$ is the fraction of capital that is lost due to crime, or alternatively, expropriated by the Criminal Group (CG). In each of these scenarios, an entrepreneur's choice of capital is constrained by the collateral constraint, $k \leq a\lambda f$. There are two distortions to entrepreneur capital demand: crime raises the effective cost of renting capital and the collateral constraint restricts how much capital is borrowed.
3.3 Rule-of-Law

The rule-of-law in an economy is exogenous, common across agents and denoted by $\lambda_l$. We model the rule-of-law as the probability with which the state can prevent criminal activity, $\lambda_l \in [0, 1]$. Higher values of $\lambda_l$ imply a stronger rule-of-law and is synonymous with a lower likelihood the CG can successfully expropriate entrepreneur capital (i.e. crime in the model). Entrepreneurs can reduce the potential for crime through the purchase of private protection, $p$.\(^8\) We assume that private protection supplements the existing rule-of-law. Specifically, an entrepreneur’s overall protection is denoted by $F(\lambda_l, p) = \lambda_l(1 + p^\theta) \in [0, 1]$ where $\theta > 0$.\(^9\) The probability an entrepreneur faces crime is $1 - F(\lambda_l, p)$.

When $\lambda_l = 1$ there is no opportunity for expropriation and when $\lambda_l = 0$ the rule-of-law is non-existent and criminal activity occurs un-impeded. Values of $\lambda_l \in [0, 1]$, therefore, capture institutional differences that affect the potential for crime across economies. Moreover, holding $\lambda_l$ fixed, $p$ captures differences in the potential for crime within an economy, that is across entrepreneurs, due to differences in protection spending. Entrepreneurs who operate in an economy that have a strong rule-of-law (high $\lambda_l$) or spend more on protection are less susceptible to crime (expropriation by the CG).

*Criminal Group*: We consider a stand-in CG that chooses a fraction of capital to expropriate from each entrepreneur in the economy. In particular, the problem of the CG is

$$\Pi_{CG}(a, s) = \max_{e \in [0, 1]} (1 - F(\lambda_l, p))ek - \frac{he^\rho}{\rho}.$$ \hspace{1cm} (3)

Equation (3) states, the CG is successful in engaging in crime with a probability $F(\lambda_l, p)$, and earns $ek$, where it should be noted that $p$, $e$ and $k$ are dependant on an entrepreneur’s

\(^8\)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.

\(^9\)It follows that $p \in [0, \bar{p}]$ where $\bar{p} = \left(\frac{1-\lambda_l}{\lambda_l}\right)^{\frac{1}{\theta}}$, which ensures that $F(\lambda_l, p) \leq 1$. Moreover, the functional-form for $F(\lambda_l, p)$ implies that private protection and the rule-of-law are complimentary, lowers the probability of crime and that $\lambda_l$ is the minimum protection an entrepreneur can have.
type. With a probability $F(\lambda_t, p)$ the CG is unsuccessful in engaging in crime and earns a return equal to zero. The cost of engaging in crime is related to monitoring, collection and ‘flying under the radar’. The cost function is $\frac{h e^\psi}{\rho}$, where $h > 0$ is a scale parameter and $\rho$ is the elasticity term.

### 3.4 Entrepreneur Decisions

Entrepreneur decisions are to choose how much protection to buy, which reduces the potential of crime, and how much capital and labour to use in production. These decisions are influenced by the collateral constraint the entrepreneur faces, $k \leq a\lambda_f$. Since entrepreneurs anticipate that a fraction $e \in (0, 1)$ of capital is expropriated, capital, labour and protection are chosen to maximize expected profits. In particular, the problem facing an entrepreneur is

$$\tilde{\pi}(a, s) = \max_{0 \leq k \leq a\lambda_f, n \geq 0} \hat{\pi}(a, s, k, n),$$

where

$$\hat{\pi}(a, s, k, n) = \max_{p \in [0, p]} F(\lambda_t, p)\pi(a, s, k, n) + (1 - F(\lambda_t, p))\pi_e(a, s, k, n) - \frac{bp^\psi}{\psi},$$

$$= \max_{p \in [0, p]} \pi(a, s, k, n) - (1 - F(\lambda_t, p))ek - \frac{bp^\psi}{\psi}.\hspace{1cm}(5)$$

Equation (5) states that with a probability $F(\cdot)$ an entrepreneur of type $(a, s)$ does not experience crime and earns profit $\pi(a, s, k, n)$, and with probability $1 - F(\cdot)$ faces crime and earns profit $\pi_e(a, s, k, n)$. This expression simplifies to imply the entrepreneur earns his full profit from production less the fraction of capital lost due to crime, $ek$, which occurs with a probability $1 - F(\cdot)$. The cost of buying protection is $\frac{bp^\psi}{\psi}$.\hspace{1cm}(10)

Finally, capital and labor

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The cost function for protection is independent of entrepreneur capital. Protection spending is typically related to an establishment’s physical location. Of course, establishments that have more capital are likely to spend more on protection, which is an outcome our framework accurately captures. A similar logic follows for the cost function for crime. For crime, it is likely that the cost of expropriating from high capital estab-
are chosen to maximize $\tilde{\pi}(a, s, k, n)$, which is restricted by the collateral constraint as shown in (4). Expected profit from entrepreneurship for an individual of type $(a, s)$ is $\tilde{\pi}(a, s)$.

Timing wise, entrepreneurs move first and make decisions related to production. The CG moves second and chooses the fraction of capital to expropriate taking into consideration the entrepreneur’s stock of capital and protection. Therefore, entrepreneur decisions related to capital, labor and protection are made in anticipation of the CG’s decisions, or put differently, factoring in the CG’s best-response.

There are two sources of distortions that misallocate resources. Financial frictions, in the form of a collateral constraint, imply that an entrepreneur’s scale of operation is constrained by his wealth. When $\lambda_f = \infty$, the size of an establishment depends solely on entrepreneur ability; when $\lambda_f < \infty$, establishment size depends on both ability and assets, $k(a, s) \leq k(s)$. Furthermore, when $\lambda_l < 1$, crime distorts the amount of capital used in production. As seen in (4), capital is chosen to maximize expected profit which accounts for the potential for crime. Specifically, since capital (and protection) is chosen in anticipation of potential crime, entrepreneurs who are most vulnerable to crime choose capital below the optimal scale. Hence, access to finance restricts how much capital can be borrowed and crime affects how much capital an entrepreneur wants to borrow. Moreover, financial frictions and crime can amplify the distortionary effects on capital. While we evaluate these effects quantitatively, we discuss the underlying mechanisms that generate them after describing the equilibrium.

### 3.5 Recursive Formulation and Occupation Choice

The individual’s problem can be written using the Bellman equation as

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

lishments is more costly for the CG. By allowing for protection, which is increasing in establishment capital, it follows that expropriating from high capital establishments is more costly through a lower probability of success $F(\cdot)$. See Ranasinghe (2014) for the implications if these cost functions are dependant on capital.
\[ s.t. \ c + a' \leq \max\{w, \pi(a, s)\} + (1 + r)a. \]

The expectation operator accounts for shocks to ability as governed by the Markov process \( M(s, s') \). Individuals make two decisions. The first is an inter-temporal choice related to consumption-savings and the second is related to occupation choice. Since there are no frictions related to capital irreversibility or adjustment costs, occupation choice is a static decision which we represent by \( o(a, s) \in \{E, W\} \) to denote an entrepreneur or a worker.

\( \lambda_l = 1 \) and \( \lambda_f = \infty \) is the first-best, distortion free economy; crime is non-existent and collateral is not required to borrow capital. In this scenario, entrepreneurial ability is the sole determinant of an individual’s occupation. As both \( \lambda_f \) and \( \lambda_l \) fall, collateral constraints tighten and the potential for crime increases. As such, occupation choice is affected along two margins. An individual of a given ability becomes an entrepreneur only if he has sufficient wealth/assets to borrow and operate at a profitable scale; occupation choice depends on ability and wealth. Second, crime reduces the returns to entrepreneurship. Occupation choice depends on the outside wage \( w \) relative to \( \pi(a, s) \), instead of \( \pi(a, s) \). Hence, individuals who are vulnerable to crime will forgo selection into entrepreneurship when \( \pi(a, s) \leq w \leq \pi(a, s) \).

### 3.6 Stationary Competitive Equilibrium

A stationary competitive equilibrium consists of an invariant distribution over individual assets and ability \( G(a, s) \), policy functions for individuals \( \{c(a, s), a'(a, s), o(a, s)\} \), policy functions for entrepreneurs \( \{k(a, s), n(a, s), p(a, s)\} \), a policy function for the CG \( e(a, s) \), a transition function for ability \( M(s, s') \) and prices \( \{w, r\} \), such that:

1. given prices, \( c(a, s), a'(a, s) \) and \( o(a, s) \) solves the individual’s problem described in (6).

2. given prices, entrepreneurs choose \( k(a, s), n(a, s) \) and \( p(a, s) \) to maximize expected profit, as described in (4).

3. the CG group chooses \( e(a, s) \) to maximize (3) from each entrepreneur of type \( (a, s) \).
4. labor, capital and goods markets clear:

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

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

\[ \int c(a,s)G(da,ds) + \delta K + P + E = \int f(s,k,n)G(da,ds) \]

where \( P \equiv \int_{o(a,s)=E} \frac{b_1 p(a,s)^\psi}{\psi} G(da,ds) \) is aggregate spending on protection and

\( E \equiv \int_{o(a,s)=E} (1 - F(\lambda_r,p(a,s))) e(a,s)k(a,s)G(da,ds) \) is aggregate losses from crime.

5. an invariant distribution over assets and ability

\[ G(a,s) = \int_{\hat{s} \leq s} \int_{a'(\hat{a},\hat{s}) \leq a} M(\hat{s},d\hat{s})G(d\hat{a},d\hat{s}) \]

The non-standard items includes the CG’s expropriation of capital (crime) and entrepreneur protection. The goods market clearing condition accounts for resources that are lost due to crime \( (E) \) and resources that are used towards protection \( (P) \). The supply of protection is exogenous and can be assumed to earn zero profit. CG profit is treated as dead weight loss and not included in the goods market. Equilibrium prices are pinned down by the labor and capital market clearing.

### 3.7 Discussion

Prior to evaluating the quantitative implications of crime and financial frictions we discuss some of the key insights from the model. When \( \lambda_f = \infty \) and \( \lambda_l = 1 \), the economy collapses to the first-best economy, where selection into entrepreneurship and production are non-distorted. As \( \lambda_f \) and \( \lambda_l \) are lowered, financial frictions and crime take effect and have the potential to misallocate resources. A convenient feature of our framework is that each distortion is uniquely identified which enables us to analyze their effects jointly and in iso-
lation. While these effects are evaluated numerically, we consider a simpler version of the model to highlight the underlying mechanism at work.

First, consider the case when crime is the only distortion ($\lambda_f = \infty$ and $\lambda_l < 1$). This environment is identical to Ranasinghe (2014) and a closed-form solution for crime and protection exists when $\theta = \frac{\psi(\rho - 1)}{\rho}$. Protection spending and crime depend solely on entrepreneur ability and is depicted in Figure 1 – asset holdings become irrelevant when financial markets are fully developed. Crime, or the expropriation of capital, is hump-shaped in entrepreneur ability because protection spending rises with ability – $F(\lambda_l, p)$ is also rising in ability. High ability entrepreneurs have high capital demand and buy sufficient protection to lower the probability they face crime. In contrast, low ability entrepreneurs use little capital in production and since engaging in crime is costly, the CG expropriates little capital from them. Moderate ability entrepreneurs face the most crime because they are not sufficiently profitable to incur adequate protection expenditure. As the rule-of-law weakens, the fraction of capital expropriated increases and the ‘hump-shape’ expands outward. That is, holding ability fixed, operating in an economy that has a weak rule-of-law increases the likelihood of crime which distorts capital demand.

Now consider the case when financial frictions are introduced into this environment ($\lambda_f < \infty$ and $\lambda_l < 1$). The potential for crime increases, especially among high ability entrepreneurs. When financial frictions are present, a constrained entrepreneur’s profit falls which lowers how much protection is bought (see (4)). This increases the potential for crime and entrepreneurs respond by lowering capital demand.

Crime, as well, amplifies the effects from financial frictions. As highlighted in Buera and Shin (2011a) and Moll (2014), constrained entrepreneurs can gradually overcome their collateral constraint through self-financing. By re-investing profit in their business, entrepreneurs loosen the collateral constraint they face which enables them to operate on a larger scale in subsequent periods. The presence of crime, however, severely hinders and/or delays this process. Note from Figure 1, crime initially rises with capital (since capital rises with abil-
An entrepreneur with low wealth faces this situation since they use little capital in production. While re-investment and gradual expansion is necessary to overcome the collateral constraint, doing so increases the potential for crime. As these entrepreneurs expand more resources are spent on protection and/or lost to crime, which lowers the speed at which the collateral constraint is overcome. These effects are especially severe when the rule-of-law is weak because the potential for crime is higher which can further dampen the motive to self-finance. Our aim is to analyze the quantitative importance of these effects.

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 institutional development: $\lambda_f$, the measure of financial market development and $\lambda_l$ the measure for the rule-of-law. While countries
differ along additional dimensions, this stance enables us to isolate the quantitative effects attributable to differences in financial market development and the rule-of-law across countries.

The model is calibrated in two steps. First, the US economy is treated as one that has the strongest rule-of-law, \( \lambda_l = 1 \). Doing so allows us to pin down standard parameters related to preferences and technology that are well established in the literature. In the second stage of the calibration, we hold the calibrated parameters in the US constant and calibrate the remaining parameters to match key features related to crime and access to finance in Colombia. Throughout the analysis, an entrepreneur represents an establishment unit in the data.

We use an analogous continuous time framework for our numerical results (see Achdou et al. (2014) for more details). This is computationally convenient without altering anything central to our analysis. We explain where subtle differences exist and how we account for them.

4.1 Preference and Technology Parameters

To parameterize the model we follow the standard practise in the literature, where possible. Individual preferences have constant relative risk aversion, \( u(c) = \frac{c^{1-\nu}}{1-\nu} \) and the future is discounted at a rate \( \beta \in (0, 1) \). For the entrepreneurial production technology, we assume \( f(s, k, n) = s(k^\alpha n^{1-\alpha})^{1-\nu} \) where \( 1-\nu \) is the share of output going to inputs used in production. Of this, \( \alpha \) is the share going to capital and \( 1-\alpha \) is the share going to labor. We assume shocks to entrepreneurial ability follows a continuous time analogue of a Markov process with persistence and variance parameters \( \rho_s \) and \( \sigma_s \).\(^{11}\)

In total there are 14 parameters to calibrate: seven related to preferences, technology and ability shocks \( \{\nu, \delta, \alpha, \upsilon, \rho_s, \sigma_s, \beta\} \), five related to crime and protection \( \{\rho, \psi, h, b, \theta\} \) and two

\(^{11}\)To be precise, the continuous Markov process is \( ds_t = \mu(s_t)dt + \sigma(s_t)dW_t \) where \( \mu(s) \) is the drift and \( \sigma(s) \) is the diffusion. This is similar to picking persistence \( \rho_s \) and variance \( \sigma_s \) for an AR(1) process in discrete time.
related to institutional development, $\lambda_f$ and $\lambda_l$. The first seven parameters together with $\lambda_f$ are chosen to target key statistics in the US economy. We take the stance that $\lambda_l = 1$ in the US economy which implies there is no opportunity for crime. This allows us to pin down standard parameters in the US without having to take a stance on the parameters related to crime. Recall, when $\lambda_l = 1$, $1 - F(\lambda_l, p) = 0$ and the model reduces to a standard span-of-control model where financial frictions are the only source of distortion – crime and protection are zero across all entrepreneurs. We take this stance not because we think the US is a crime-free economy but rather because the data on establishment-level crime is mostly for developing economies and does not include the US.\(^\text{12}\)

We set $\nu = 1.5$, $\alpha = 1/3$, $\delta = 0.06$ and $\rho_s = 0.95$ which are standard in the literature. We choose the level of financial market development $\lambda_f = 4.2$ in the US which implies an external finance to GDP ratio of 1.15, close to the value reported in Beck et al. (2000).\(^\text{13}\) This implies an entrepreneur can borrow close to four times his wealth. The remaining parameters, $\nu$, $\beta$ and $\sigma_s$ are jointly calibrated to match three relevant moments in the US data: the fraction of entrepreneurs in the US economy, which we target at 7.5 percent (Cagetti and DeNardi, 2006); the real interest rate which we target at 5 percent; and the income share going to the top five percent of earners, which is about 30 percent as per The World Top Income Database in 2002. Table 3 presents the model fit for the US economy relative to the data and the last column presents the parameter that is most closely associated with the moment we target.

<table>
<thead>
<tr>
<th>Target Moments</th>
<th>US Data</th>
<th>Model</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction of entrepreneurs (FOE)</td>
<td>0.075</td>
<td>0.075</td>
<td>$\nu = 0.25$</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.05</td>
<td>0.05</td>
<td>$\beta = 0.90$</td>
</tr>
<tr>
<td>Income share (top 5%)</td>
<td>0.30</td>
<td>0.28</td>
<td>$\sigma_s = 0.37$</td>
</tr>
</tbody>
</table>

\(^\text{12}\)The data we use is from the Enterprise Survey by the World Bank which focuses primarily on developing countries and a few developed countries in Europe. The Survey does not contain data pertaining to the US. Alternatively, we could calibrate the model to more developed economies in Europe where establishment-level data related to crime is available. However, we think that calibrating the model to the US is the better approach where values for standard parameters are more accepted in the literature.

\(^\text{13}\)Our measure of external financing is $EF = \int_{(a,s) E} \mathbb{1} (k(a,s) - a > 0) G(da, ds)$, where the Indicator function is over those individuals who borrow, $k(a,s) - a > 0$.
4.2 Parameters related to institutional development

We now turn to the parameters related to institutional development, crime and protection. We use data from the Business Environment and Enterprise Performance Survey (BEEPS) 2010 which contains information related to major obstacles establishments encounter in day-to-day business operation. There are several questions in the survey devoted to understanding crime at the establishment-level, which is ideal for our analysis. In particular, establishments are asked whether they experienced arson, robbery, theft or vandalism on their premises in the past year, which we interpret as crime against the establishment. Losses attributable to crime as a proportion of sales are also reported. Hence, we know whether an establishment faced crime and the share of sales this accounts for, which provides a gauge for the frequency and severity of crime. The BEEPS also contains information whether an establishment paid for private security and the share of sales it accounts for.

Also included in the survey are questions related to the establishment’s financing practises. Of relevance to our analysis is the establishment’s ability to access finance. Establishments report what fraction of working capital is financed through external and internal sources. We use the proportion of working capital financed through external sources as a proxy for financial market development.\(^{14}\)

We choose South America, more broadly, and Colombia specifically to target our calibration. South America is unique because it is a continent in which crime is as severe, if not more severe an obstacle to doing business than is access to finance. We focus on Colombia because crime and access to finance are equally severe obstacles to business operation – 33 (41) percent of establishments report that crime (access to finance) is a major obstacle to business operation.\(^{15}\)

The data described above is used to discipline our quantitative analysis. We assume

\(^{14}\)Working capital financed from external sources are defined as those from private commercial banks, state-owned banks or government agencies, non-bank financial institutions and from informal sources such as money lenders (variables \(k3b, k3c, k3e\) and \(k3g\) in the BEEPS).

\(^{15}\)For other countries in South America the gap between the proportion of establishments that report crime and access to finance are major obstacles to operation is more spread. After ‘cleaning’ the data and dropping outliers we are left with 751 observations in Colombia. The target moments are weighted by \(w\)-median.
countries are identical along all dimensions except for the level institutional development, \( \lambda_f \) and \( \lambda_l \). In so doing, our framework can isolate the importance of crime and access to finance for understanding cross-country income differences. Hence, we hold all parameters from Section 4.1 fixed, except for \( \lambda_f \), and calibrate all remaining parameters to match key moments in Colombia.

There remain seven parameters to calibrate: two related to institutional development, \( \lambda_f \) and \( \lambda_l \), and five related to crime/protection \( \{b, \psi, \rho, h, \theta\} \). While each of these parameters are closely related to a particular target, we nonetheless calibrate them jointly since they are all inter-connected to the targets. To determine \( \lambda_f \), the level of financial market development, we target the proportion of capital financed through external sources in Colombia, which is about 32 percent.\(^{16}\) This target closely mimics the collateral constraint in the model, with higher values of \( \lambda_f \) implying a higher proportion of capital financed through external sources.

To determine \( \lambda_l \), the rule of law, we target the percentage of establishments that report facing crime in Colombia, which is 29 percent. Recall, in the model the probability an establishment faces crime is \(1 - F(\lambda_l, p)\). Higher values of \( \lambda_l \) lower the probability of crime and lower values increase it. Hence, the fraction of establishments that face crime is a reasonable gauge for \( \lambda_l \) in Colombia.

The data on crime is used to determine parameters for the cost function of crime, \( \rho \) and \( h \). \( \rho \) is the elasticity parameter for engaging in crime, with higher values implying that expropriating a larger share of entrepreneur capital is increasingly costly. Hence, \( \rho \) is informative of the share of crime among the top decile of entrepreneurs (by capital), which is about 13 percent. \( h \) is a scale parameter which is useful to target aggregate losses from crime relative to aggregate output, which is 0.3 percent. We pin down parameters for the protection cost function, \( \psi \) and \( b \), similar to the approach used for the crime cost function. \( \psi \) is the elasticity term with higher values implying that buying additional protection is increasingly

\(^{16}\)An alternative is to target the debt-to-GDP ratio reported by the World Bank which is about 18 percent in Colombia. Since the targets for crime are from the BEEPS, for consistency, we restrict our target for financial market development to be from this source as well.
costly, and $b$ is the scale parameter. Therefore, $\psi$ is chosen to target the share of protection spending among the top decile of establishments (by capital), which is about 22 percent, and $b$ is chosen to target aggregate protection spending relative to output, which is 0.9 percent. Finally, we restrict $\theta = \frac{\psi(\rho - 1)}{\rho}$ which is the case where closed-form solutions for crime and protection exist when $\lambda_f = \infty$.

Table 4 presents the target moments from the model and data, and parameter values. The model does extremely well in matching all of the targets except for the protection share among the top decile of establishments. In the model high ability/asset entrepreneurs buy the most protection (since they use the most capital), and when crime is prevalent they account for the majority of protection expenditure.\(^{17}\) To target the share of capital financed through external sources the model implies $\lambda_f = 1.67$ in Colombia. Hence, an entrepreneur can borrow close to 70 percent of their asset holdings. The parameter for the rule-of-law is $\lambda_l = 0.52$. In the absence of protection, the probability of facing crime is 48 percent ($1 - \lambda_l$). However, after accounting for protection expenditure, on average close to 29 percent of entrepreneurs face crime. It is important to note this average masks considerable heterogeneity across ability and wealth: crime rates are hump-shaped in ability and decreasing in asset holdings. In fact, entrepreneurs of high ability and high wealth face crime rates below 1 percent. The elasticities on the cost function for crime and protection are greater than one, $\rho, \psi > 1$, implying that expropriating a larger share of capital and buying additional protection is increasingly costly. The scale parameters on the cost functions are high, especially for crime. This is to ensure the share of output going to crime and protection is in line with the evidence.

5 Results

We now evaluate the implications of crime and financial frictions in our calibrated model economy. We study their effects jointly and in isolation, to identify the importance of each

\(^{17}\)The model is unable to simultaneously match the protection share amongst the top decile and the targets that are related to crime.
channel and the amplification effects they generate. We then evaluate the effects from a hypothetical policy reform that improves the rule-of-law and/or financial market development across economies that differ along these measures of institutional development in order to understand the implications they have for economic development.

### 5.1 Quantitative effects: crime and financial frictions

Table 5 presents the effects of crime and financial frictions in the US economy and in Colombia (columns 2 and 3). Recall, the US economy has a perfect rule-of-law $\lambda_l = 1$ and highly developed financial markets $\lambda_f = 4.2$. In fact, moving the US economy from its calibrated level of financial market development to a perfectly developed one (i.e. $\lambda_f = \infty$) raises aggregate output by less than six percent. We treat Colombia as a small open economy where the wage is determined in equilibrium and the interest rate is exogenous – individuals face a world interest rate of 5 percent and excess capital is supplied in international markets.\(^{18}\)

The fourth column, $\Delta_{total}$ in Table 5 presents the effects of crime and financial frictions, arising from institutional development in Colombia relative to the US economy. Aggregate output falls by over 20 percent, relative to the US economy, capital demand falls by over 40 percent and consumption by 20 percent. The reduction in these variables are attributed to effects along the intensive and extensive margins. Along the intensive margin, entrepreneur capital demand falls both due to the collateral constraint and anticipated losses from crime.

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\(^{18}\)We also consider a closed economy version of the model with general equilibrium effects. The results are qualitatively similar, though in the closed economy the real interest rate is often close to or below zero, especially since there are two distortions at play.
Table 5: Quantitative effects of crime and access to finance

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Colombia</th>
<th>Δ_total</th>
<th>Δcrime</th>
<th>Δfinance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output, $Y$</td>
<td>2.77</td>
<td>2.20</td>
<td>0.79</td>
<td>0.94</td>
<td>0.89</td>
</tr>
<tr>
<td>Capital, $K_d$</td>
<td>5.33</td>
<td>3.02</td>
<td>0.57</td>
<td>0.85</td>
<td>0.72</td>
</tr>
<tr>
<td>Consumption, $C$</td>
<td>2.45</td>
<td>1.99</td>
<td>0.81</td>
<td>0.90</td>
<td>0.96</td>
</tr>
<tr>
<td>FOE</td>
<td>7.5%</td>
<td>5.84%</td>
<td>0.78</td>
<td>0.75</td>
<td>1.08</td>
</tr>
<tr>
<td>wage</td>
<td>1.69</td>
<td>1.318</td>
<td>0.78</td>
<td>0.92</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Along the extensive margin, crime and financial frictions lower the returns to entrepreneurship, which lowers the fraction of entrepreneurs (FOE) and thus aggregate output. Note, these effects are despite a drop in the equilibrium wage of over 20 percent. The lower wage raises inequality as the fraction of income going to the top one percent rises from 12 percent to over 16 percent. Average establishment size (in capital) is 17 percent lower in Colombia, relative to the US.

Next, we isolate for the effects attributable to crime and financial frictions. The column labelled $\Delta_{crime}$ presents the scenario where Colombia maintains its rule-of-law and adopts the level of financial market development in the US – or alternatively, if the US economy adopts the rule-of-law in Colombia but maintains its level of financial market development. In this scenario, differences in aggregate outcomes between Colombia and the US are solely attributable to differences in the rule-of-law, thereby isolating the importance of crime. All results are presented relative to the US economy. Crime reduces output by 6 percent, capital by 15 percent and consumption by 10 percent. These effects are substantial considering that crime accounts for only 0.3 percent of aggregate output. The severity of crime induces entrepreneurs to strategically under-produce and lowers the number of individuals that select into entrepreneurship.

The last column, $\Delta_{finance}$ isolates the effects arising from financial frictions. To do so, we consider the case where Colombia maintains its level of financial market development and improves its rule-of-law to the value in the US economy. Aggregate output falls by over 10 percent, capital by close to 30 percent and consumption by four percent. Access to finance has a bigger effect on output and capital than crime, however, the effects on consumption
are smaller. When crime is present resources are spent on protection which lowers what is left over for consumption. FOE rises by over 10 percent when access to finance is the only distortion. Wages fall, however, there is a small effect on income inequality – the income share going to the top one percent rises from 12 to 13 percent.

5.2 Amplification

Of importance are the amplification effects that arise from the interaction of financial frictions and crime. As shown in Table 5, the joint effects from these distortions are greater than the sum of their individual effects. For example, when examined in isolation crime reduces output by 6 percent and financial frictions reduce output by 11 percent. When examined jointly output falls by 21 percent, which exceeds the sum of their individual components.

The amplification mechanism is straightforward to understand when viewed through the lens of the model. In models that feature collateral constraints the full force of financial frictions can be muted through an entrepreneur’s motive to self-finance. Central to this mechanism is that entrepreneur profit increases savings which loosens the collateral constraint they face and enables them to operate on a larger and more profitable scale. This repeats in subsequent periods gradually undoing the severity of the collateral constraint. The presence of crime serves an obstacle to this process. As constrained entrepreneurs gradually expand they become a bigger target for crime (recall, crime is hump-shaped in capital demand). Entrepreneur profit rises at a slower rate, both due to crime and spending on protection, which reduces the speed at which the collateral constraint is overcome. In equilibrium, the proportion of individuals with low wealth increases and the wealth distribution is positive skewed.

Financial frictions magnify the severity of crime, as well. In the model, high ability unconstrained entrepreneurs buy sufficient protection to reduce the potential of crime and operate close to optimal capacity. Constrained high ability entrepreneurs, however, operate on a smaller scale, spend less on protection and face more crime. Figure 2 shows protection
Figure 2: Crime across entrepreneurs who differ in wealth, Colombia and the fraction of capital lost due to crime across entrepreneur ability in the Colombian economy ($\lambda_{Col}^{C} = 1.67$ and $\lambda_{Col}^{F} = 0.52$). The solid line in the left panel shows overall protection, $1 - F(\lambda, p)$, for high asset (or unconstrained) entrepreneurs. The corresponding line on the right panel shows the fraction of capital expropriated, contingent on entrepreneurs facing crime. This curve is hump-shaped in ability implying that unconstrained, high ability entrepreneurs face minimal losses from crime. The dashed and dotted lines show crime and overall protection across ability for entrepreneurs that have lower asset holdings. For these entrepreneurs, financial frictions increase the severity of crime among those with high ability. These entrepreneurs operate at their collateral constraint, which lowers profit and how much is spent on protection, thus raising the fraction of capital expropriated. Low to moderate ability entrepreneurs of this asset level are not financially constrained because they demand lower capital in production. These entrepreneurs face the same probability of crime and losses associated with it as those of similar ability that have higher wealth holdings.

Figure 3 shows capital demand in the US and Colombian economy across entrepreneur ability for a given value of asset holdings. The left, middle and right-hand panels show capital demand in Colombia when crime is the only distortion, when financial frictions are
Figure 3: Capital demand – crime and financial frictions

This figure shows capital demand in the US economy against capital demand in Colombia when crime is the only distortion (panel 1), financial frictions are the only distortion (panel 2) and when both distortions are combined (panel 3), for entrepreneurs of a given asset level. In each of these simulations we hold the wage and interest rate fixed at the values in the US economy, to isolate the full effect of the distortion.

In the left panel, crime reduces capital demand to varying degrees across ability and is most evident amongst those of moderate ability. In the middle panel, where financial frictions are the only distortion, entrepreneur capital demand is identical to entrepreneurs in the US except amongst those of high ability who are wealth constrained. These constrained entrepreneurs borrow to capacity and operate considerably below optimal scale. The right-hand panel presents the combined effects of crime and financial frictions.

When evaluated under a general equilibrium setting we find similar quantitative effects, however, inequality rises. Specifically, due to lower equilibrium prices, unconstrained high ability entrepreneurs earn relatively more from entrepreneurship when crime and financial frictions are present, plotted against capital demand in the US economy. To isolate the true effect of each distortion, capital demand for the Colombian economy is based on prices in the US.\textsuperscript{19} In the left panel, crime reduces capital demand to varying degrees across ability and is most evident amongst those of moderate ability. In the middle panel, where financial frictions are the only distortion, entrepreneur capital demand is identical to entrepreneurs in the US except amongst those of high ability who are wealth constrained. These constrained entrepreneurs borrow to capacity and operate considerably below optimal scale. The right-hand panel presents the combined effects of crime and financial frictions.

\textsuperscript{19} The general equilibrium effects have a similar story to Figure 3 however the effects are more convoluted due to lower prices.
frictions are present. In contrast, all remaining entrepreneurs and workers are worse off. The income share going to the top 1 percent rises by as much as 50 percent.

### 5.3 Policy reform

A long standing question in economic development surrounds which institutional factors are most crucial for development. One line of argument stresses a strong rule-of-law is critical to incentivize investment and expansion by businesses, thereby spurring development (Besley, 1995; Shleifer, 1997; Acemoglu et al. 2000). Similarly, financial markets are essential for the efficient allocation of resources across establishments and is a key component for economic development (King and Levine, 1993; Levine 1997, among others). While both are important, which institutional factor is most relevant for development and the circumstances under which are not overly clear. The key features in our framework allow us to provide some insight to this question. In particular, since financial market development and the rule-of-law are unique parameters in the model we can assess the relative importance of each institutional factor for development, and thereby side-step issues that relate to identification often encountered in empirical work in this area.\(^{20}\)

Our approach is to consider an economy that has under-developed financial markets and a weak rule-of-law. We then evaluate the long-run effects from a hypothetical policy reform that improves financial markets and the rule-of-law separately, all the while taking an agnostic stance as to the source of the reform, its cost and implementation.\(^{21}\) Since \(\lambda_i \in (0, 1)\), it is convenient to normalize the degree of financial market development to take values in \((0, 1)\) for easy comparison. By doing so, we can evaluate the effects of improving the rule-of-law by \(x\) percent relative to improving financial market development by the same proportion. Notice,

\(^{20}\)Answering this question within an empirical context is challenging since improvements in one source of institutional measure often triggers an improvement in another institutional measure, preventing sound identification. An exception to this 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.

\(^{21}\)There are many examples of large scale, economy wide reforms. Related to access to finance, a major reform in India in 1998 (Banerjee and Duflo, forthcoming) and Mexico in January 2014 are recent examples. Mexico’s stance on the drug war in 2010 is an example of a policy reform that aims to improve the rule-of-law.
one can redefine the collateral constraint from \( k \leq a\lambda_f \) to \( (1 - \phi)k \leq a \) without any change to the framework. \( \phi \in (0, 1) \) is the reciprocal measure of financial market development for \( \lambda_f \) and represents the fraction of capital that can be recouped by financial intermediaries in the event an entrepreneur defaults.\(^{22}\)

Table 6 presents values for aggregate output across economies that differ in the rule-of-law and financial market development, \( \lambda_l \) and \( \phi \). We begin with an extreme case of financial market reform, when access to finance improves from \( \phi = 0.3 \) to \( \phi = 0.9 \), across economies that differ in the rule-of-law. The last column, \( \Delta \phi \), reports the percentage change in output from this experiment. While the reform increases output by over 25 percent in each case, the largest effects occur in the economy that has a moderate rule-of-law (\( \lambda_l = 0.5 \)) where output increases by close to 35 percent. In fact, the returns to improving financial market development is hump-shaped in the rule-of-law. This is due to the amplification effects that arise within the model. When access to finance improves, moderate to high ability entrepreneurs in the \( \lambda_l = 0.5 \) economy become more profitable and can buy sufficient protection to reduce the potential for crime, which amplifies the gains in output. In the economy where \( \lambda_l \) is higher than 0.5, the rule-of-law is reasonably strong and entrepreneurs require little expenditure on protection to deter crime, which is not overly affected by the lack of finance. The gains in output are not as large because the motive to self-finance was already strong. Conversely, when \( \lambda_l \) is below 0.5, protection spending required to deter crime is too large to profitably incur, such that improving access to finance has a limited effect entrepreneur motives to self-finance and increase production. This quantitative result is complimentary to Johnson et al. (2002) who find that firms in post-Communist countries re-invest profit only if the rule-of-law is reasonably strong.

The last row in Table 6 presents the effects from a hypothetical reform that improves the rule-of-law from \( \lambda_l = 0.3 \) to \( \lambda_l = 0.9 \) across economies that differ along financial market

\(^{22}\)Note that \( \lambda_f = \frac{1}{1-\phi} \). When \( \phi = 0 \), financial intermediaries are unable to recoup any capital from the entrepreneur and therefore do not lend \( (\lambda_f = 1) \). As \( \phi \rightarrow 1 \), \( \lambda_f \rightarrow \infty \) which represents a perfectly functioning financial market.
Table 6: Policy reform on aggregate output

<table>
<thead>
<tr>
<th>$\phi$ = 0.3</th>
<th>$\phi$ = 0.5</th>
<th>$\phi$ = 0.7</th>
<th>$\phi$ = 0.9</th>
<th>$\Delta \phi$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda_l$ = 0.3</td>
<td>1.64</td>
<td>1.76</td>
<td>1.91</td>
<td>2.11</td>
</tr>
<tr>
<td>$\lambda_l$ = 0.5</td>
<td>2.10</td>
<td>2.27</td>
<td>2.49</td>
<td>2.81</td>
</tr>
<tr>
<td>$\lambda_l$ = 0.7</td>
<td>2.27</td>
<td>2.43</td>
<td>2.65</td>
<td>2.93</td>
</tr>
<tr>
<td>$\lambda_l$ = 0.9</td>
<td>2.34</td>
<td>2.49</td>
<td>2.69</td>
<td>2.95</td>
</tr>
<tr>
<td>$\Delta \lambda_l$</td>
<td>43%</td>
<td>42%</td>
<td>41%</td>
<td>40%</td>
</tr>
</tbody>
</table>

$\Delta \lambda_l$ reports the percentage change in output from this experiment. Output rises by over 40 percent in each economy, which is higher than the reform on financial markets just considered. In fact, when $\lambda_l = 0.3$ improving the rule-of-law has a bigger effect on raising output than improving financial market development. There are two ways to see this. Consider the economy where $\lambda_l = \phi = 0.3$. Holding all else constant, improving the rule-of-law (access to finance) from 0.3 to 0.9 raises output by 43 (28) percent. Alternatively, consider the case when $\lambda_l = 0.3$ across economies with different values of $\phi$. Suppose the economy can improve the rule-of-law by $x$ percent (move down a row in the table) or improve access to finance (move to a column across) by the same proportion. In either scenario, improving the rule-of-law has a bigger effect on output than improving access to finance.

Now consider the case when $\lambda_l > 0.3$. In this instance, our results imply that improving financial market development has a bigger effect on output than improving the rule-of-law. For example, suppose $\phi = \lambda_l = 0.5$. Improving $\phi$ from 0.5 to 0.7 raises output by 10 percent (from 2.27 to 2.29), while improving $\lambda_l$ to 0.7 raises output by 7 percent. In fact, when $\lambda_l$ is approximately greater than 0.4, an equivalent proportional increase in $\phi$ has a bigger effect on output than an increase in $\lambda_l$. Within the context of the model, for a country such as Colombia improving financial markets have a bigger effect on output, while for a country such as Venezuela where crime rates are higher, improving the rule-of-law will have larger effects on output.

Our main findings from this analysis are as follows. Both financial market development and a strong rule-of-law are key for development. Our framework allows us to provide context around this. When the rule-of-law is weak (for example $\lambda_l = 0.3$), improving the rule-of-law
is more important for development than improving access to finance. This result is consistent with the literature that emphasizes a strong rule-of-law is crucial for development. However, when the rule-of-law of passes some threshold, improving financial markets become more relevant for development, along the lines King and Levine (1993).

6 Conclusion

In this paper we propose an integrated framework to evaluate the effects of two highly relevant distortions that are common in developing countries: access to finance and crime. We imbed a channel for financial frictions and a channel for crime into an otherwise standard model of occupation choice and entrepreneurship. We obtain several key insights by doing so. First, we find the amplification effects of crime and access to finance on macro variables to be substantial. According to our theory, output losses are amplified because lack of financing lowers an entrepreneur’s potential to buy protection thereby raising the possibility for crime. Likewise, crime deters the self-finance motive which exacerbates the effects on output from financial frictions. We then use our framework to examine the implications it has for economic development. When both financial market development and the rule-of-law are weak, policies that improve the rule-of-law have a bigger effect on output than those that improve financial market development. However, when the rule-of-law is sufficiently stable, polices that liberalize financial markets become more relevant for development. That is, financial markets are crucial for development, but a necessary condition is that property rights are secure.
References

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