Property Rights, Extortion and the Misallocation of Talent

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Abstract

Extortion is a severe obstacle to doing business in many countries, varies both in its frequency and magnitude across establishments. This paper presents a model of extortion to account for these features and assess its quantitative effects. In the model, entrepreneur capital is subject to extortion which affects both the extensive and intensive margins of entrepreneurship. Despite common property rights, extortion rates arise endogenously and are hump-shaped in entrepreneur ability. To discipline the quantitative analysis, the model is calibrated to match establishment-level evidence related to extortion in Poland and yields a number of implications broadly consistent with establishment-level facts in developing economies. For measures of property rights within a plausible range, output losses can be upwards of 10 percent.

JEL: O1, O4
Key Words: extortion, misallocation, establishment size

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1 Introduction

A large literature has emphasized that how resources are allocated across establishments is important for understanding output differences across countries.[1] While the literature has examined how broad, generic policies can be distortionary, understanding the sources of these distortions and how they materialize remains an active area of research. The focus of this paper is to highlight the important role that institutions play in enabling and perpetuating distortions that are idiosyncratic across establishments. I examine a particular class of institutions, namely property rights, their link to acts of extortion and the implications they have for understanding cross country income differences.

For the purposes of this paper, I define extortion as "...a racket in which a local strong man forces merchants to pay tribute in order to avoid damage; damage the strong man himself threatens to deliver" (Charles Tilly, 1985). Though less common in the western world, both empirical and anecdotal evidence verify that extortion is a major hindrance to business operation in developing economies. As shown in Table 1 (see Section 2), extortion is a severe obstacle to doing business, occurs frequently and varies in magnitude across establishments. Notably, some establishments do not face extortion, while for others, extortion payments can be as much as 10 percent of annual sales. Moreover, average extortion payments vary across countries and these payments are inversely related to indices of property rights. The goal of this paper is to assess the importance of extortion for understanding resource misallocation and quantify its effect on aggregate output.

To see why output losses can be substantial, consider an environment in which individuals choose between starting their own enterprise (entrepreneurship) and working for an outside wage, and where a criminal group (CG) can extort a share of proceeds from entrepreneur production.[2] In an environment where there is no opportunity for extortion only the most productive individuals become entrepreneurs and production is at optimal capacity, yielding the first-best outcome. Conversely, in an environment where extortion is possible, individuals may alter decisions related to entrepreneurship, both along the extensive and intensive margin. Consider the case when prop-

[1] See, for example, Restuccia and Rogerson (2008), Hsieh and Klenow (2009), and Bartelsman *et al.* (2012).

[2] Typically, the mafia or criminal organization approaches the potential victim (entrepreneur) and demands a payment, where failure to comply can result in physical harm or damage to property. I refer to such payments as extortion. How successful extortion is and the magnitude of the extortion fee depend on the strength of property rights (for example policing) and the ability of the victim to pay the fee. Related to extortion see Gambetta (1996, 2000), Lotspeich (1997) and Volkov (1999).

erty rights are imperfect and a CG can extort a share of proceeds from entrepreneur production. Output and productivity losses can arise due to misallocation and selection. An entrepreneur who anticipates a high probability of extortion may decrease production to lower potential losses and/or to become less of a target for extortion. Alternatively, the entrepreneur may increase production to recoup losses incurred from extortion. In either situation, the marginal product of inputs used in production will not equal the marginal cost of those inputs, leading to an inefficient outcome. The second source of output losses can arise through selection into entrepreneurship. In an environment that features extortion, forward-looking individuals select an occupation accounting for the possibility of extortion. This decision depends on an entrepreneur's post-extortion profit, instead of first-best profit, and thus has the potential to produce distortionary effects along this margin.

To examine the effects of extortion on the aggregate economy, I present a model that accounts for key features related to extortion, both across and within countries. The model is a variant of Lucas (1978), where individuals differ in entrepreneurial ability and choose between starting their own establishment (entrepreneurship) or working for existing establishments (worker). There is a criminal group (CG) with monopoly power that can extort a share of capital entrepreneurs use in production. The success of this depends on the strength of property rights and the amount of protection an entrepreneur buys. The CG observes the entrepreneur's choice of capital and protection, and chooses a fraction of capital to extort. A central prediction of the model is that losses from extortion are hump-shaped across individual ability despite common property rights. High-ability individuals buy sufficient protection and become less prone to extortion, consistent with the evidence. Low-ability individuals also face little extortion, but this is because they use little capital in production. Moderate ability individuals face the most extortion: they use sufficient capital to warrant extortion by the CG but cannot afford high levels of protection. Variation in extortion rates imply there are heterogeneous responses to production as inputs are chosen to maximize post-extortion (or expected) profit. Entrepreneurs who face little extortion produce close to optimal capacity while entrepreneurs who face high rates of extortion act pre-emptively and produce below optimal capacity. In economies characterized by weak property rights, extortion rates are higher and generate larger distortions to production, amplifying the degree of misallocation.

To discipline the quantitative analysis I use data from the World Bank Business Environment and Enterprise Performance Survey (BEEPS) 2005. The BEEPS contains establishment-level sur-

vey data on the frequency and magnitude of payments related to extortion, mostly for countries in Europe. The calibration of the model is grounded on macro and micro-level evidence related to extortion in Poland. In particular, the frequency of extortion related activity, the share of extortion across establishments and the aggregate extortion to output ratio are used to pin down key parameters in the model. Poland is chosen for the calibration because it has the most observations related to extortion.

In the calibrated model, aggregate capital is 3 percent lower than in the first-best economy (an economy without extortion) and output is 1 percent lower. This is substantial noting that extortion accounts for 0.2 percent of aggregate output—a five-fold amplification on output. The model is then used to consider experiments that lower the value of property rights to match the evidence in more extortion prone economies (Macedonia, Slovakia, Turkey). Extortion rates observed in these countries imply output losses in the range of $5-7$ percent and average productivity falls by over 3 percent.

A model of extortion also has key implications for the size distribution of establishments. When property rights are weak the potential for extortion is higher and entrepreneurs respond by lowering production. Since capital and labor are complementary in production, lower capital demand reduces the equilibrium wage. The returns to working falls and individuals trickle into entrepreneurship raising the fraction of entrepreneurs in the economy.[3] Taken together, extortion reproduces several striking features related to the size distribution of establishments in developing countries: high rates of entrepreneurship, low productivity and many of these establishments are exceptionally small (average establishment size can fall upwards of 25 percent). In fact, when property rights are extremely weak extortion produces a 'missing middle' in the size distribution of establishments. Viewed through the lens of the model, a missing middle exists because extortion induces low to mid ability entrepreneurs to operate considerably below optimal scale and high ability entrepreneurs, who are less prone to extortion, operate on a larger scale due to a lower wage.

This paper relates to the literature that examines measured output and productivity losses that arise from resource misallocation (Restuccia and Rogerson, 2008; Guner *et al.* 2008; Hsieh and Klenow 2009; Bartelsman *et al.* 2012). Previous work has focused on the role that policy

[3]For example Poschke (2013) and Donovan (2014) show that low ability individuals pursue entrepreneurship often due to a lack of suitable employment opportunities. See also Gollin (2008).

distortions can have in misallocating resources.[4] A common feature of these distortions are that they are operative among a sub-set of establishments in the economy. Extortion is distinct in that it has the potential to affect *all* establishments either by altering production or the decision to operate. There is also a growing literature that studies how financial frictions, channeled through weak property rights, can generate resource misallocation.[5] This paper is complementary to that literature by focusing on the inherent role property rights can have in perpetuating resource misallocation. It differs, however, by highlighting the importance of extortion for understanding resource misallocation.

The results in this paper also relate to Hsieh and Klenow (2009) and (2014), who find large gaps in the marginal product of capital and labor across establishments (in China and India), and that these establishments exhibit little growth (in India). Extortion can be an important channel for understanding these features. Entrepreneurs choose capital and labor to maximize post-extortion profit and since extortion varies by ability, the marginal product of capital and labor differ across entrepreneurs. Moreover, the capital to labor ratio varies by individual ability and can be up to 20 percent lower in countries that have high extortion rates. Though I do not explicitly model establishment growth, an implication of the model is that small to mid-size establishments, who typically generate the bulk of establishment-level growth, are less likely to expand because increasing their size makes them vulnerable to extortion.

Finally, this work also relates to an earlier literature on extortion/predation.[6] A distinction is that I examine the macroeconomic implications of extortion in a calibrated general equilibrium model that is disciplined by the recent availability of micro-level data related to extortion. The model is tractable and quantifies the discriminate impact extortion can have across the size distribution of establishments and on aggregate. Also related is Johnson *et al.* (2002), and references therein, who find evidence that weak property rights lead to lower re-investment by establishments

[4]For policy distortions related to entry costs see Barseghyan and DiCecio (2011), Moscoso Boedo and Mukoyama (2011), related to firing costs see Poschke (2009) and Hopenhayn and Rogerson (1993), and related to establishment size see Guner *et al.* (2008) and Samaniego (2006).

[5]See for example Amaral and Quintin (2010), Greenwood, Sanchez and Wang (2010), Buera *et al.* (2011), Midrigan and Xu (2014) and Moll (2014) who show that financial frictions can generate considerable productivity losses. Also related is D'Erasmo and Moscoso Boedo (2011) who examine how an informal sector might arise when property rights are weak.

[6]Such papers include Murphy *et al.* (1993), Acemoglu (1995), Grossman and Kim (1995, 1997), Bliss and Ditella (1997), Konrad and Skaperdas (1998), Choi and Thum (2004) and Dal Bo and Dal Bo (2006). See also Olivella (2010), who examines government expropriation of firm capital via a contracting problem.

in several Eastern European countries.

The remainder of this paper is organized as follows. Section 2 presents some key facts related to extortion and Section 3 presents a model that can account for these facts. Section 4 is the calibration of the model and Section 5 presents the quantitative results. Section 6 examines the effects produced by models with simpler distortions (i.e. taxes) relative to those produced by extortion, and examines policies that might be implemented to reduce the effects of extortion. Section 7 concludes.

2 Facts related to Extortion

I use data from the World Bank Business Environment and Enterprise Performance Survey (BEEPS) 2005 to examine the severity of extortion on businesses. The survey is typically conducted via face-to-face interviews with a view to understand the major obstacles businesses face in their day-to-day operation. The 2005 Surveys are particularly relevant because it contains questions related to extortion at the establishment-level for several countries in Europe (mostly post-Communist countries). In particular, establishments are asked whether payments to criminal groups are common in their industry—which I interpret as reflective of an establishment's own experience with extortion following Johnson *et al.* (2002)—and the share of sales it accounts for.[7] Establishments are also asked to rate whether extortion (organized crime/mafia) is an obstacle to business operation and is coded on a scale of 1 to 4 (possible responses include not a problem, a minor problem, a moderate problem or a major problem).

Table 1 summarizes the prevalence of extortion for a select group of countries (statistics are for illustrative purposes and are not particular to the set of countries presented). There are three main facts that stand-out: extortion occurs frequently, it is an obstacle to doing business, and is a non-trivial share of sales. For instance, 23 percent of establishments surveyed in Turkey report incidences related to extortion in the past year, and Slovakia has the highest percentage at 26 percent; in Germany, a country that has strong property rights, only 4 percent of establishments report incidences related to extortion. Though extortion occurs frequently, how much of a constraint

[7]The BEEPS 2005 is one of the few, if not only, dataset that contains establishment-level information related to extortion—more recent surveys do not include questions related to extortion. Establishments are not asked whether *they* make payments to criminal groups but rather whether such payments are common in their industry. Given the nature of such questions—payments to criminal organizations—this is a sensible approach to glean such sensitive information. See Johnson *et al.* (2002) for a discussion underlying the merit for this approach.

Table 1: Extortion in Europe (BEEPS 2005, World Bank)

	Faced extortion (%)	Obs.to Operate (%)	Extortion as % of sales (avg., all)	Extortion as % of sales (avg., if > 0)
Germany	4	7	0.07	0.64
Greece	13	6	0.06	0.90
Hungary	5	6	0.03	1.95
Poland	13	24	0.21	3.43
Portugal	12	35	0.09	0.82
Romania	12	24	0.16	2.53
Russia	17	20	0.29	2.75
Turkey	23	32	0.60	3.15

The BEEPS 2005 contains data related to extortion in over 15 European countries (and a few countries in South East Asia). This table reports, for select countries in Europe, the prevalence of extortion: the percentage of establishments that report incidences related to extortion in the past year, the percentage of establishments that report extortion is a major or moderate obstacle to business operation, and average losses from extortion as percentage of sales, for all establishments and those establishments that faced extortion. Slovakia and Macedonia and have the highest proportion of establishments reporting incidences related to extortion ($24 - 26$ percent). Descriptive statistics are based on the author's calculations. Further details are provided in the Appendix.

is it to doing business? The third column in Table 1 provides such evidence by reporting the percentage of establishments that indicate extortion is a major or moderate obstacle to business operation.[8] In Poland, close to 25 percent of establishments report extortion is a major or moderate obstacle to business operation, and in Portugal 35 percent of establishments report as such. To put this in context, in Germany only seven percent of establishments report extortion is a major or moderate obstacle to business operation. The last two columns in Table 1 report the average extortion to sales ratio, for the economy as a whole and among establishments that faced extortion. Extortion is a non-trivial portion of sales, accounting for about 0.3 percent in Russia, and almost 3 percent of sales among establishments that are victims of extortion.

The link between extortion and measures related to property rights is fairly clear. Figure 1 shows the correlation between country level property rights (as measured by the International Property Rights Index) and the percentage of establishments that report extortion is a major or moderate obstacle to doing business. Figure 1 also includes the correlation between GDP per capita (in logs) and extortion. Not surprisingly, countries where extortion is a bigger obstacle for business operation are synonymous with weak property rights (correlation of -0.48) and low GDP per capita (a correlation of -0.51).

[8]This is an ideal measure for its severity because the potential for extortion can affect establishment behaviour even though the establishment may not subsequently face extortion. This may explain why values in column 3 exceed those in column 2.

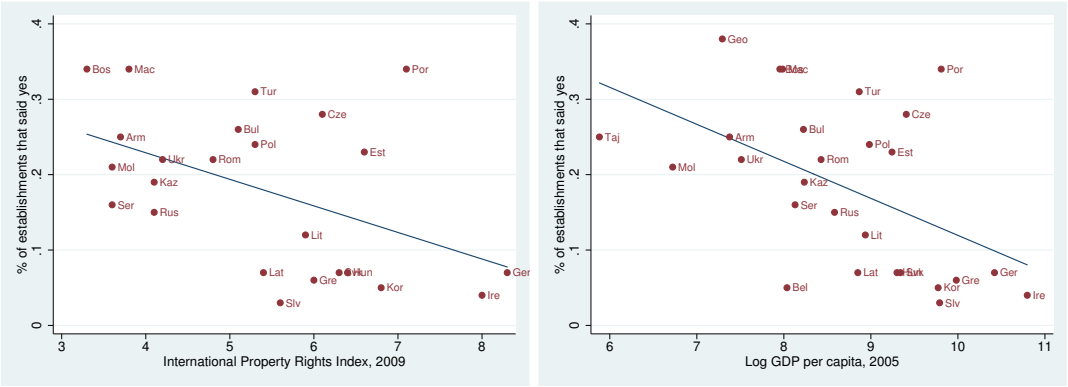

Figure 1: This figure plots the correlation between the percentage of establishments that state extortion is a major or moderate obstacle to business operation against indices related to property rights and GDP per capita (logs).

Table 2: Extortion by Establishment Size

	(1) Faced Ext.	(2) Obstacle	(3) Ext/Sales	(4) Security ($)
All establishments:				
Size	−0.060***	−0.036**	−0.101***	17.56***
	(0.02249)	(0.0166)	(0.0224)	(1.7167)
Observations	4254	3976	4255	4255
Less than 10 employees:				
Size	−0.021	0.070*	−0.053	1.518***
	(0.0510)	(0.0394)	(0.0766)	(0.3521)
Observations	1803	1684	1803	1803
10 or more employees:				
Size	−0.071**	−0.042*	−0.107***	21.14***
	(0.0514)	(0.0244)	(0.0321)	(2.201)
Observations	2451	2292	2452	2452
Country-level controls	Y	Y	Y	Y
Industry-level controls	Y	Y	Y	Y

Notes: Each cell reports point estimates from a separate regression. Column (1) and (2) are results from an Ordered Probit where the dependent variable is whether the establishment has faced extortion (yes/no) and whether extortion is a non-obstacle, a minor, moderate or major obstacle to business operation. Marginal effects are significant (results not reported). Column (3) and (4) are results from OLS regressions where the dependent variable is extortion relative to sales, and spending on security (equipment, personnel) in dollars. Size is a categorical variable based on number of employees: For 'All establishments', size categories are less than 10, $10-49$, $50-99$, $100-249$ and greater than 249, and for '10 or more employees' the first category is excluded. For '10 or fewer employees', size categories are less than 4, $4-7$ and $8-10$. The broad patterns from these regressions are robust to alternate size categories and using number of employees as a regressor. Results exclude countries that have fewer than 200 establishment-level observations related to extortion. ***, **, * denote significance at the 1, 5 and 10 percent level.

Next I examine how extortion varies across establishment size within a country. While there is considerable variation in losses due to extortion across size, a general pattern is that extortion is less burdensome among large establishments (more than 50 employees) than small and medium size ones. Table 2 reports regression estimates to illustrate this point, controlling for country and industry level fixed effects. In Column (1) and (2) the independent variables are whether an establishment faced extortion and whether extortion is not an obstacle, a minor, moderate or major obstacle to business operation (Probit regressions); in Columns (3) and (4) the independent variables are losses due to extortion relative to sales and spending on security (OLS regressions). The dependant variable, size, is a categorical variable based on number of employees and is robust to alternate specifications (more details are provided in the table footnote). The first row includes all establishments and there is a clear negative correlation between size (employees) and measures related to extortion: as size increases the probability of facing extortion, extortion as an obstacle to doing business and losses due extortion as a percentage of sales falls. Spending on security rises with establishment size.

There is also evidence that extortion is less burdensome among very small establishments. This is shown in the second row of Table 2 which reports estimates for establishments that have fewer than 10 employees. Notable is that size has a positive coefficient when extortion as an obstacle to doing business is the dependant variable, implying that very small establishments are not as severely affected by extortion as larger ones. Spending on protection remains positively correlated with size among these small establishments. For establishments that have 10 or more employees, the coefficients on the dependant variables are similar to those reported in the first row and are significant.

To summarize, there are several key facts related to extortion based on data from the BEEPS 2005. Extortion occurs frequently, is an obstacle for business operation, and its severity is negatively correlated with property rights. Across the size distribution, incidents related to extortion decreases with size and protection expenditure rises with size. As an obstacle to doing business, extortion is initially rising with size and falls thereafter. In what follows, a model that can account for these broad patterns is presented followed by a quantitative evaluation of its effects.

3 A Model of Extortion

The model is a variant of Lucas (1978), where individuals differ in entrepreneurial ability and choose whether to be a worker or entrepreneur. I incorporate extortion into the model in two distinct ways. First, I introduce a Criminal Group (CG) that optimizes by choosing how much to extort from an entrepreneur. Second, how much is extorted is intricately related to the level of property rights in the economy and the amount of protection an entrepreneur buys. Together, these features affect individual behaviour in regards to entrepreneurship, both along the extensive and intensive margin. Throughout the paper, I abstract from the provision of protection and those involved in extortion in order to highlight the effects of extortion on entrepreneur behaviour.

3.1 Environment

There is a measure one of infinitely lived individuals that have heterogeneous entrepreneurial ability, $s \in S$. Entrepreneur ability is inalienable, constant (i.e. non-stochastic) over time and has a cumulative distribution $\mu(s)$. Since ability is constant, I describe a static version of the environment noting that subsequent periods are identical.[9]

Individuals supply one unit of labor inelastically every period and choose between two occupations: operating an individual specific technology as an entrepreneur or working for a wage for hiring entrepreneurs. Each occupation requires one unit of labor so that individuals can select into one occupation every period. There exists an exogenous criminal group (CG) that can extort from entrepreneurs in the economy. I assume that extortion is on entrepreneur capital and that workers do not face extortion. I do this for two reasons. First, entrepreneur capital is typically tied to a physical location and can be monitored. Capital therefore serves as a signal for profitability and because it is tangible, can be used as leverage for extortion.[10] Second, the data on extortion is at the establishment level and so I restrict attention to its effects on entrepreneurs. Moreover, extortion can occur only among those that have something to extort, which in the model are entrepreneurs.

Entrepreneurs operate in perfectly competitive markets, rent capital (k) and labor (n) to use in

[9] I model extortion as a static relationship because there is little evidence to guide how subsequent extortion payments evolve after an initial payment is made. Since I assume perfectly competitive markets in what follows, including a stochastic process for productivity will add little to the analysis.

[10] Whether extortion is on output or capital does not alter the central predictions that follow because there is a direct mapping from capital to output in the model.

production taking prices as given. Production is $f(s,k,n)$ and is strictly increasing in each argument. Entrepreneurs can also buy protection to lower the likelihood of facing extortion (description to follow). If an individual with ability s becomes an entrepreneur and is not extorted by the CG, her profit from production is

$$\begin{aligned}\pi(s,k,n) &= f(s,k,n) - wn - (1+r)k + (1-\delta)k \\ &= f(s,k,n) - wn - (r+\delta)k, \end{aligned} \tag{1}$$

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, however, the entrepreneur is extorted by the CG, her profit is

$$\begin{aligned}\pi_e(s,k,n) &= f(s,k,n) - wn - (1+r)k + (1-\delta-e)k, \\ &= f(s,k,n) - wn - (r+\delta)k - ek, \end{aligned} \tag{2}$$

where $e \in (0,1)$ is the fraction of capital extorted by the CG after production has taken place.[11] e is the premium entrepreneurs pay for borrowing capital when there is extortion; if e varies by ability the effective interest rate for borrowing capital $(r+\delta+e)$ will also vary.

3.2 Property Rights

Property rights are exogenous, provided by the state and common across individuals within an economy. I model property rights as a probability, $\lambda \in (0,1)$, with which the state can prevent extortion. Higher values of λ represent better legal institutions which decrease the possibility of extortion. Individuals can supplement the existing level of property rights by buying private protection z, and thereby further reduce the likelihood of extortion.[12] Together with protection, an individual's effective rate of protection (ERP) is $F(\lambda,z) \equiv \lambda + \lambda z^{\theta} \in [0,1]$ where $\theta > 0$ and $z \in [0,\overline{z}]$.[13] The CG successfully extorts capital from an entrepreneur with probability $1 - F(\lambda,z)$.

[11] It is assumed the CG's threat of extortion is credible; in that it is always optimal for the entrepreneur to surrender the capital demanded by the CG. Dal Bo and Dal Bo (2007) and Konrad and Skaperdas (1997) consider environments where an illegal organization's threat of extortion is not credible.

[12] Protection bought by the entrepreneur is of the legitimate type—legal, private security—and not extortion in disguise. That is, when entrepreneurs buy protection it is not to 'buy-off' the threat of extortion where the payment ultimately arrives in the hands of the would-be extorter.

[13] Since the ERP cannot be greater than one, the maximum amount of protection an individual can buy is $\overline{z} = \left(\frac{1-\lambda}{\lambda}\right)^{\frac{1}{\theta}}$, which is a non-binding constraint in equilibrium.

Variation in λ captures cross country differences in potential for extortion and variation in protection expenditures (holding λ constant) capture differences in vulnerability to extortion within countries. Finally, when $\lambda = 1$ there is no opportunity for extortion, which I refer to as the first-best economy.

The ERP technology I have assumed satisfies four key properties. First, the ERP is increasing in both property rights and protection. Individuals in economies that have strong property rights or those that buy more protection are less susceptible to extortion. Second, property rights and protection are complementary; protection is more effective at reducing extortion when property rights are stronger. The last two properties imply that $F(\lambda, 0) = \lambda$ and $F(0, z) = 0$. The former implies that λ is the minimum level of protection an entrepreneur can have and the latter states that when there is complete anarchy ($\lambda = 0$, i.e., no rule of law), protection is ineffective towards reducing extortion.

3.3 Entrepreneur and Criminal Group Decisions

Timing wise, individuals choose whether to be an entrepreneur or worker.[14] Workers supply labor to hiring entrepreneurs and entrepreneurs make decisions related to production and protection expenditure. The CG perfectly observes this information and chooses a fraction of capital to extort from each entrepreneur.

Entrepreneur Decisions: Entrepreneurs choose capital and labor in production, and protection expenditure to limit the possibility of extortion. Since the CG can extort a fraction $e \in [0, 1]$ of capital, capital and labor are chosen to maximize *post*-extortion profit (or expected profit), $\widetilde{\pi}(s)$.[15] Specifically, the problem of a potential entrepreneur with ability s is

$$\widetilde{\pi}(s) = \max_{k,n \geq 0} \widehat{\pi}(s, k, n), \tag{3}$$

[14] I abstract from an individual's decision to become an extorter for several reasons. The first is a matter of emphasis. It is well known that CGs extract resources from businesses and the focus of this paper is to understand how extortion affects *entrepreneur* behaviour and quantify its effects. For papers that examine the decision to become an extorter, see Acemoglu (1995), Grossman and Kim (1995, 1997). Second, there is no data available to guide the quantitative analysis in regards to the population share that engages in extortion related activity and how it varies across countries. Finally, there is limited understanding on the returns to working in extortion related activity. Note however, if earnings from becoming an extorter is independent of ability, then in equilibrium those earnings must equal the wage of a worker—or else all workers will select into the occupation that pays the highest income.

[15] For exposition the problem is presented as the entrepreneur choosing protection first, followed by capital and labor. However this set-up is equivalent to the entrepreneur making these decisions simultaneously.

where

$$\begin{aligned}\widehat{\pi}(s,k,n) &= \max_{z\in[0,\bar{z}]} F(\lambda,z)\pi(s,k,n) + (1-F(\lambda,z))\pi_e(s,k,n) - \frac{bz^{\psi}}{\psi}, \\ &= \max_{z\in[0,\bar{z}]} \pi(s,k,n) - (1-F(\lambda,z))ek - \frac{bz^{\psi}}{\psi}.\end{aligned} \tag{4}$$

Equation (4) states that an entrepreneur is not extorted with probability $F(\cdot)$ and earns profit $\pi(s,k,n)$, and with probability $1-F(\cdot)$ is extorted and earns profit $\pi_e(s,k,n)$. This expression simplifies to imply the entrepreneur earns her full profit from production less the fraction of capital extorted, $e(s) \in [0,1]$, which occurs with probability $1-F(\cdot)$. Protection z is chosen to maximize (4) and has a cost equal to bz^{ψ}/ψ, $\psi, b > 0$, in units of output. Post-extortion profit for an entrepreneur of type s is denoted by $\widetilde{\pi}(s)$.

When $\lambda = 1$, there is no opportunity for extortion and the model collapses to the first-best case where capital and labor are chosen to maximize $\pi(s,k,n)$ (when $\lambda = 1$, $\bar{z} = 0$ and $1-F(\lambda,z) = 0$). However, when $\lambda < 1$, capital and labor are chosen maximize post-extortion profit. There is potential for misallocation and the first-best outcome may be infeasible.

The second channel which generates inefficiency arises through selection—the decision to become an entrepreneur. Occupation choice for an individual of type s is based on $\max\{\widetilde{\pi}(s), w\}$: selection into entrepreneurship depends on post-extortion profit, instead of first-best profit, and the outside wage. Inefficiency can arise through the selection channel when occupation choice is altered as a result of extortion.

The cost function for protection is assumed to be independent of entrepreneur capital. I take this stance due to the nature of protection being considered, that is, protection with the purpose of reducing extortion. This sort of protection has much to do with the affiliation and reputation of the protection provider (i.e. the quality of protection). In much of the extortion related literature, establishments that are associated with reputable security providers, politicians, or those that have 'roofs' are bypassed by groups that engage in extortion.[16] Establishments that buy more protection are in essence buying a stronger association with the security provider and thereby become less susceptible to extortion. In the equilibrium of the model, protection expenditure is rising in

[16] While some of these security payments can be extortion payments in disguise, many of them are legitimate, private forms of security that are not related to extortion. See for example Lotspeich (1997), and references therein, for an excellent discussion of the prevalence and nature of the extortion racket in Russia.

establishment size. Nonetheless, in the Appendix I examine a scenario where the cost of buying protection depends on entrepreneur capital.

Criminal Group Decisions: The Criminal Group has monopoly power and complete information about entrepreneur capital and protection decisions.[17] Extortion is costly since the CG has to spend time initiating contact, monitoring and collecting extortion rents. The fraction of capital extorted from an entrepreneur with ability s is chosen to maximize

$$\Pi_{CG}(s) = \max_{e \in [0,1]} (1 - F(\lambda, z))ke - \frac{ae^{\rho}}{\rho}. \tag{5}$$

The CG successfully extorts a fraction $e(s)$ of entrepreneur capital with probability $1 - F(\cdot)$. While the CG can extort from every entrepreneur, it is more difficult to do so in economies that have stronger property rights. Put differently, extortion has limited effect on entrepreneur behaviour when property rights are strong, but can influence entrepreneur behaviour as property rights weaken by altering production and/or the need for protection. Within an economy, that is holding λ fixed, variation in entrepreneur capital and protection imply the severity of extortion will differ across entrepreneurs. The cost of extorting from an entrepreneur is $ae(s)^{\rho}/\rho$, $\rho, a > 0$. As the fraction of capital extorted increases, more persuasion, monitoring and collection is required, which raises the cost of extortion for the CG.

The cost function for extortion I have assumed is independent of capital, which implies that it is equally costly for the CG to extort from a high or low capital entrepreneur. Again, this has much to do with the nature of extortion. The power to extort is legitimized through the threat of violence often extending to one's family. Therefore, I take the stance that entrepreneurs are equally willing to surrender x percent of their capital to avert violence. (see Appendix for when this assumption is relaxed). Notwithstanding, these concerns are out-of-equilibrium considerations. In the equilibrium of the model, high capital entrepreneurs do not pay the most in extortion rents because they buy sufficient protection and become difficult to extort (see Figure 2).

[17] The monopoly power assumption is a modelling convenience. Typically, mafia groups operate under the 'king of the jungle' paradigm: the incumbent group battles new entrants with the triumphant group gaining exclusive access to extortion related activity in the territory. See for example Gambetta (2000). Complete information is to capture that the CG can gauge the approximate gains from extortion and the difficulty in successfully doing so.

3.4 Representative household

There is an infinitely lived, representative household that consists of all individuals in the economy. The household instructs individuals to choose an occupation at the start of the period and makes consumption and savings decisions at the end of the period. Preferences are over streams of consumption and are given by

$$\sum_{t=0}^{\infty} \beta^t U(C_t), \tag{6}$$

where C_t is aggregate consumption at time t, $\beta \in (0,1)$ is the discount factor and $U(\cdot)$ is the per-period utility function that has the usual Inada properties. The household is endowed with $K_0 > 0$ units of capital at date $t = 0$. The per-period budget constraint is

$$C_t + K_{t+1} - (1-\delta)K_t \leq w_t N_t^s + \widetilde{\Pi}_t + (r_t + \delta)K_t, \tag{7}$$

where N^s is the measure of individuals that work for entrepreneurs and $\widetilde{\Pi}$ is the sum of post-extortion profit earned by entrepreneurs. Losses from extortion and costs related to buying protection are subsumed in $\widetilde{\Pi}$. Since the CG operates as a distinct entity, extortion rents are treated as dead-weight-loss and not included in the household's budget constraint.

3.5 Comparative Statics

Given the timing sequence, entrepreneurs choose capital, labor and protection in anticipation of the CG's best response for extortion. If $\theta = \frac{\psi(\rho-1)}{\rho}$, a closed form solution for protection and extortion exists and is dependant on entrepreneur ability:

$$z(s) = \left(\frac{\Omega^{\rho-1}\lambda^{\rho-1}(1-\lambda)k(s)^{\rho}}{a + \Omega^{\rho-1}\lambda^{\rho}k(s)^{\rho}} \right)^{\frac{1}{\theta}} \text{ and } e(s) = \left(\frac{(1-\lambda)k(s)}{a + \Omega^{\rho-1}\lambda^{\rho}k(s)^{\rho}} \right)^{\frac{1}{\rho-1}}, \tag{8}$$

where $k(s)$ is capital for an entrepreneur of type s and $\Omega \equiv \frac{\theta}{b}\frac{\rho}{\rho-1} = \frac{\psi}{b}$. It follows that $z(s) < \overline{z}$, $\forall s$. From (8) one can verify that as property rights fall, the share of capital extorted rises and entrepreneurs respond by buying more protection. Given $z(s)$ and $e(s)$, capital and labor are chosen to solve (3) (which is determined numerically).

Proposition 1: *Capital and post-extortion profit are non-decreasing in entrepreneur ability which implies there is an ability threshold s^* such that individuals with ability $s \geq s^*$ select into entrepreneurship and all others work for entrepreneurs.*

Noting that extortion is on capital, a high ability entrepreneur can choose the same inputs in production (and protection) as a low ability entrepreneur and earn more from entrepreneurship since she has higher ability. Hence, a situation where a low ability entrepreneur uses more capital in production or earns more from entrepreneurship is never an equilibrium outcome. Since the returns to entrepreneurship are increasing in ability, it follows that there is an ability threshold for selection into entrepreneurship.

The model also has key implications for how extortion and protection decisions vary across entrepreneur ability and property rights in an economy. If $\rho > 1$ and $\theta > 0$, the model implies the following:

(i) Protection is increasing in entrepreneur ability. Moreover, there is an ability threshold $\hat{s}$, such that entrepreneurs of ability $s \leq \hat{s}$ buy protection at an increasing rate and all other entrepreneurs buy protection at a decreasing rate (i.e. protection is a 'S-like' shape in ability).

(ii) There is a critical level of property rights, $\lambda^c \equiv \frac{\rho-1}{\rho}$, such that when $\lambda \geq \lambda^c$, protection and property rights are substitutes. When property rights are below this critical level, protection and property rights are complementary for low ability individuals (those below some threshold) and substitutes for all others.

(iii) There is an ability threshold $s_x(\lambda)$ such that extortion is increasing in ability for all $s \leq s_x(\lambda)$ and decreasing otherwise. Moreover, this ability threshold is decreasing in property rights, that is $\frac{\partial s_x(\lambda)}{\partial \lambda} \leq 0$.

These comparative statics are depicted in Figure 2. Here, I focus on the intuition underlying (iii). When $\lambda = 1$, there is no opportunity for extortion and all individuals have an $ERP = 1$. However, when $\lambda < 1$ extortion is 'hump-shaped' in ability and expands outward as property rights fall. This is driven by the role that protection plays in the model—in an environment without protection, extortion is non-decreasing in ability. For a given value of property rights, low ability entrepreneurs

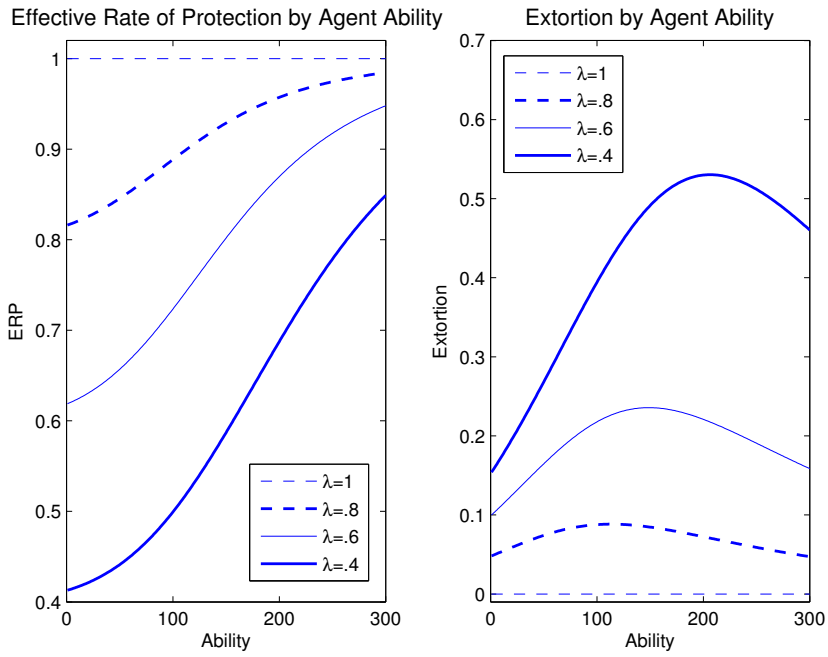

Figure 2: Protection and extortion across individual ability for varying levels of property rights.

use little capital in production which makes them less of a target for extortion. As entrepreneurial ability increases, capital demand rises which makes extortion more attractive for the CG. However, high ability entrepreneurs buy sufficient protection (because they are more profitable) which reduces the potential for the CG to extort them. Moderate ability entrepreneurs, in contrast, cannot afford as much protection and are most prone to extortion. Hence, misallocation is primarily driven by these individuals, a topic I return to after describing the equilibrium. Finally, the ability level of the entrepreneur that faces the most extortion is decreasing in the level of property rights. That is to say, in economies that have weaker property rights, higher ability entrepreneurs face the most extortion which raises the degree of misallocation (see Figure 2).

3.6 Equilibrium

I now describe a steady-state, competitive equilibrium for this economy. Many of the features are standard except for the incorporation of extortion and protection.

A steady-state, competitive equilibrium consists of a distribution over individual ability $\mu(s)$, a decision related to occupation choice, policy functions for entrepreneurs $\{k(s), n(s), z(s)\}$, a policy function for the CG $e(s)$, aggregate levels of consumption (C) and savings (K'), and prices $\{w, r\}$,

such that:

1. given prices, C and K' are chosen to maximize (6) subject to the constraint in (7). In a steady-state, the standard Euler condition implies that $r = \frac{1}{\beta} - 1$.

2. given prices, occupation choice is based on $\max\{\widetilde{\pi}(s), w\}$ and entrepreneurs choose $k(s)$, $n(s)$ and $z(s)$ to maximize post-extortion profit, as described in (3).

3. the CG group chooses $e(s)$ according to (5).

4. labor, capital and goods market clears

$$\int_{s^*} n(s)d\mu(s) = \int_{s}^{s^*} d\mu(s)$$

$$\int_{s^*} k(s)d\mu(s) = K$$

$$C + \delta K + Z + E = \int_{s^*} y(s)d\mu(s) \equiv Y$$

   where $Z = \int_{s^*} \frac{bz(s)^\psi}{\psi} d\mu(s)$, $E = \int_{s^*} (1 - F(\lambda, z(s)))e(s)k(s)d\mu(s)$, and s^* is the ability threshold for selection into entrepreneurship.

Non-standard items are the CG's choice of extortion and the entrepreneur's choice of protection. The goods market clearing condition accounts for aggregate spending on protection (Z) and aggregate losses from extortion (E). Supply of protection is exogenous in the model and can be assumed to earn zero profit. CG profit is treated as dead-weight-loss and not included in the goods market. The equilibrium wage is pinned down by the labor market clearing condition.

3.7 Special Case

To examine explicitly how misallocation arises in the model I consider a special case when $\rho = \psi = b = 2$. This simplifies the expressions for protection and extortion, and allows for a characterization of entrepreneur capital demand. By substituting values for ρ, ψ and b, the problem for an entrepreneur simplifies to

$$\widetilde{\pi}(s) = \max_{k,n \geq 0} \pi(s, k, n) - \frac{(1 - \lambda)^2 k(s)^2}{a + \lambda^2 k(s)^2}. \tag{9}$$

Proposition 2: *When $\lambda < 1$ but not too close to zero, all entrepreneurs, except for the highest ability ones, choose capital below the optimal level. Moreover, the degree of misallocation is hump-shaped in individual ability and decreasing in the level of property rights.*

To see this, differentiate (9) with respect to capital which yields

$$\begin{aligned} \frac{\partial \pi(s)}{\partial k(s)} - \xi(\lambda, k) &= 0, \\ MPK &= r + \delta + \xi(\lambda, k), \end{aligned} \tag{10}$$

where $\xi(\lambda, k) = \frac{2a(1-\lambda)^2 k(s)}{(a+\lambda^2 k(s)^2)^2} \geq 0$ is a wedge to renting capital arising from extortion and one that varies across entrepreneurs. Following Hsieh and Klenow (2009), there is capital misallocation when the marginal product of capital (MPK) is not equal to the rental cost of capital. From (10), when $\lambda < 1$, $\xi > 0$ and the $MPK > r + \delta$, which implies all but the highest ability entrepreneurs produce below optimal scale ($k \to \infty$, $\xi \to 0$). Moreover, deviation from optimal scale is hump-shaped across ability: misallocation of capital rises with ability up to a certain threshold ($s_x(\lambda)$) and falls thereafter. These effects are magnified as property rights fall.

4 Calibration

For the quantitative analysis I assume that all parameters are common across countries except for the one related to property rights, λ. By treating λ as the only source of variation across countries I am able to isolate and quantify the effects arising from extortion. Of course countries vary along additional parameters, particularly in relation to technology and the distribution of ability, which have the potential to amplify the effects implied by a model of extortion.

I calibrate the model in two stages. First, I treat the US as the first-best economy and calibrate a set of standard parameters to the US economy. In the second stage, I hold the calibrated parameters in the US constant and calibrate the remaining parameters—those related to extortion—to match key moments related to extortion in Poland.

4.1 Preference and Technology Parameters

In regards to the parameterization of the model, I follow the standard practise in the literature where possible. For the entrepreneurial production technology, I assume that $f(s,k,n) = s(k^{\alpha}n^{1-\alpha})^{1-v}$, where $1-v$ is the span of control parameter, the share of output going to inputs used in production. Of this share, α is the share going to capital and $1-\alpha$ is the share going to labor. I assume ability is Pareto distributed and has a distribution $\mu(s) = 1 - s^{-\eta}$, where η controls the dispersion over ability.

There are 11 parameters to calibrate: five related to preferences and technology $\{\beta, \delta, \alpha, v, \eta\}$ and six related to extortion $\{\lambda, \rho, \psi, a, b, \theta\}$. I calibrate the former set of parameters to match key features in the US, which serves as the first-best economy where property rights are perfect (i.e. $\lambda = 1$). When $\lambda = 1$, both protection and extortion are zero irrespective of the values for $\{\rho, \psi, a, b, \theta\}$. Therefore, I can calibrate the model to the US where standard parameters are well established in the literature, without having to take stance on parameters related to extortion.[18]

The discount factor β is chosen to target a four percent real return. As is standard in the literature, I set $\alpha = 1/3$ and the depreciation rate to six percent (i.e. $\delta = 0.06$). The remaining parameters, v and η, are jointly calibrated to match two relevant moments in the US: 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; and the fraction of entrepreneurs (FOE) in the economy, a critical variable in the analysis that follows, which is 10 percent.[19] Table 3 presents moments from the model and US data, and the last column reports the parameter most closely associated with the targeted moment. The model does reasonably well in matching other moments that are not targeted in the calibration, including the capital to output ratio (2.4), the employment share among the top 30 percent of establishments (53 percent) and the output share among the top 5 percent of establishments (40 percent).

[18] This is not to say the US is an extortion free economy but rather due to a lack of establishment level data. The BEEPS primarily focuses on developing economies and data related to extortion is mainly for European countries.

[19] Cagetti and De Nardi (2006) show that the share of entrepreneurs in the US economy can range from $7-17$ percent depending on the criteria used to define an entrepreneur. Active business owners, which is the relevant group for extortion, is about 11.5 percent. I chose a target equal to 10 percent to take a conservative stance (a higher fraction of entrepreneurs in the first-best economy imply larger effects from extortion).

Table 3: Calibration: US Economy

Target Moments	US Data	Model	Parameter
Income share (top 5%)	0.30	0.30	$v = 0.26$
FOE	0.10	0.10	$\eta = 3.75$

4.2 Parameters related to Extortion

To pin down parameters related to extortion I use data from the BEEPS 2005. The survey includes information related to key parameters in the model: (i) whether payments are made to organized crime to avert violence or property damage, and if yes, the percentage of sales it accounts for, (ii) whether payments are made for private security, and if yes, what percentage of sales it accounts for. I use the former as a proxy for the frequency of and losses attributable to extortion and the latter as a proxy for protection expenditures. This provides a guide for how extortion and protection varies across establishments and its share relative to output, key micro and macro statistics used to discipline the quantitative analysis. The Appendix contains a more in-depth discussion of the dataset and its relevance to the model.

Since λ is treated as the only source of variation across countries, I hold the calibrated parameters from Section 4.1 fixed and calibrate the remaining parameters to match key features related to extortion and protection in Poland. I choose Poland because it has the most observations related to extortion (though not the country most prone to extortion in the data).[20]

There remain six parameters determine: the measure of property rights (λ), the cost of extortion for the CG (ρ and a), the cost of buying protection (ψ and b), and the complementarity between protection and property rights (θ). These parameters are jointly calibrated to match a set of relevant moments related to protection expenditures and extortion. Even though these parameters affect the value of all moments, each moment is primarily influenced by a particular parameter(s), as I explain below.

Property rights, λ, is a critical parameter that affects the likelihood of extortion. In the model, the probability an entrepreneur faces extortion is $1 - F(\lambda, z(s))$. Higher values of λ reduce the

[20]There are over 700 establishments surveyed in Poland, the second most in the dataset, of which about 13 percent report incidences related to extortion. Germany has the most establishments surveyed in the dataset but has too few observations related to extortion. There are several countries that have a higher percentage of establishments that report incidences related to extortion than in Poland—e.g. Bosnia, Macedonia, Slovakia, Turkey—but they have too few observations (less than 200) to use for the calibration.

Table 4: Parameters related to extortion – Polish economy

Target Moments	Data	Model	Parameter
Avg. extortion rate	0.130	0.130	$\lambda = 0.52$
Extortion share (top decile)	0.135	0.128	$\rho = 1.54$
Extortion to Output ratio	0.002	0.002	$a = 31.4$
Protection share (top decile)	0.510	0.510	$\psi = 1.75$
Protection to Output ratio	0.004	0.004	$b = 2.04$
(Extortion+Protection)/Output (top 50%)	0.006	0.006	$\theta = 0.20$

Non-targeted Moments:	Data	Model
Extortion share (top 20%)	0.34	0.34
Extortion share (top 30%)	0.53	0.51
Protection share (top 30%)	0.83	0.84
Protection share (top 50%)	0.95	0.93
(Extortion+Protection)/Output (top 20%)	0.005	0.006
Output share (top 10%)	0.61	0.54

Notes: Calibration targets are from the BEEPS 2005. Deciles are based on establishment size (employees).

likelihood of extortion and lower values increase its likelihood. Therefore, the probability of facing extortion is primarily affected by λ. Based on the BEEPS 2005, about 13 percent of establishments in Poland faced extortion, which is used to pin down λ. θ also influences the probability of extortion by affecting the returns to protection spending through its complementarity with property rights. I therefore choose θ to target the total distortion (extortion + protection) relative to sales among the top 50 percent of establishments (measured by employees). The parameters for the extortion cost function are ρ and a which affect how much is extorted by the CG. ρ is the elasticity term that controls how increasingly costly it is to extort a larger share of entrepreneur capital and a has a level effect on the cost. ρ is therefore useful to target the share of extortion among the top decile of entrepreneurs (14 percent) and a is useful to target the aggregate extortion to output ratio (0.002). The parameters related to protection expenditures are ψ and b which control how much entrepreneurs spend on protection. ψ is the elasticity parameter which affects how increasingly costly it is to buy protection and b has a level effect on the cost. Therefore, ψ and b are chosen to target the share of protection spending among the top decile of entrepreneurs (51 percent) and the aggregate protection to output ratio (0.004).

Table 4 presents target moments from the model and data, and accompanying parameter values. The property rights value in Poland is $\lambda = 0.52$ which implies that without protection expenditure

the average extortion rate is 48 percent $(1-\lambda)$. Protection plays a crucial role in the model as after accounting for protection expenditure the average extortion rate falls to 13 percent. The elasticity for the cost functions for extortion and protection imply that both are increasingly costly ($\rho > 1$, $\psi > 1$). The scale parameter for the extortion cost function is sufficiently high ($a = 20$) to ensure a low aggregate extortion to output ratio. Overall the model does well in matching the target moments as well as other moments that are not targeted in the calibration. For instance, the model does remarkably well in matching extortion and protection shares across various deciles in the size distribution, as well as its sum relative to sales.

5 Results

I now evaluate the quantitative implications of extortion. In the experiments I consider, all parameters are held fixed except for the one related to property rights. Varying the level of property rights affects the probability of facing extortion and thus highlights the importance of this channel on entrepreneur behaviour and its aggregate implications. I begin by discussing the effects across entrepreneurs and then discuss the aggregate implications of the model.

5.1 Individual-level effects

Figure 3 shows the effects of extortion across individuals and across economies for select values of property rights: the first-best economy ($\lambda = 1$), the calibrated economy for Poland ($\lambda_{Pol} = 0.52$) and $\lambda = 0.45$. The top row depicts the effective rate of protection, which is increasing in entrepreneur ability and property rights, and expected losses from extortion as percentage of output, is hump-shaped in entrepreneur ability and expands outward as property rights fall.[21] These effects are similar to the discussion in Section 3.5, and so here I focus on the effects of extortion on capital demand (second row of Figure 3).

When $\lambda < 1$, extortion induces entrepreneurs to produce below optimal capacity where the $MPK > r + \delta$ (high ability entrepreneurs use more capital in production than individuals of similar ability in the first-best economy due to a lower equilibrium wage). Entrepreneurs who expect significant losses from extortion, typically those of moderate ability, act pre-emptively and choose

[21] The hump-shape feature holds for the fraction of capital extorted $e(s)$, the expected fraction of capital extorted $e(s)(1 - ERP)$ and expected losses from extortion $e(s)(1 - ERP)k(s)$.

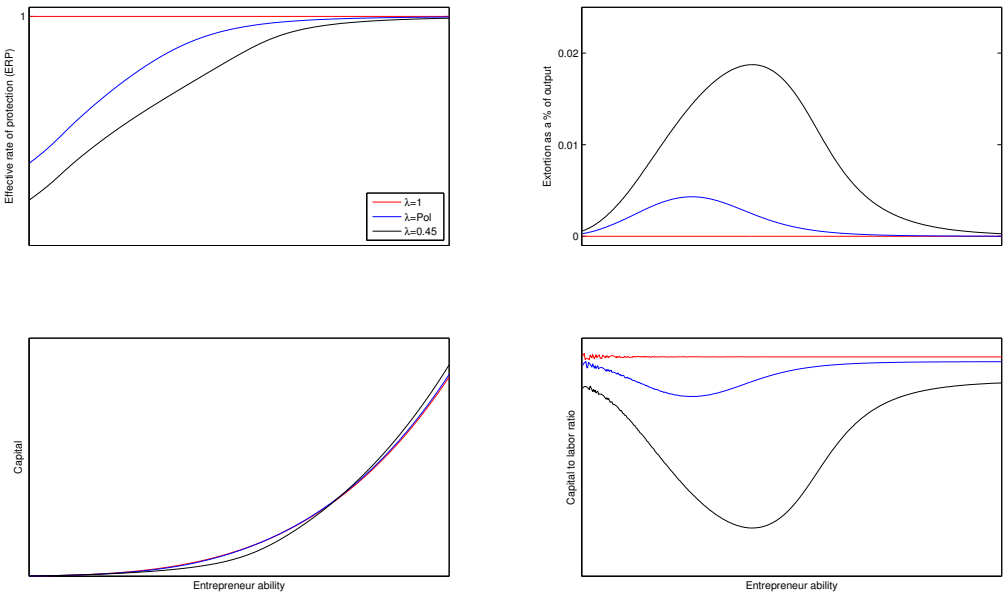

Figure 3: This figure plots the effects of extortion across individuals for select values of property rights

capital considerably below the optimal level (Figure 4 includes economies that have lower property rights where these effects are more noticeable). Heterogeneous responses to capital demand imply the capital to labor ratio varies across entrepreneurs and is below the first-best value. In particular, the capital to labor ratio is inversely related to extortion: entrepreneurs that anticipate highest rates of extortion have the lowest capital to labor ratios in production. As property rights decrease these effects are amplified.

These effects have implications for the size distribution of establishments as well. As shown in Figure 4, when $\lambda = 0.4$ extortion produces an economy with a dis-proportionally high number of small establishments (measured in capital, but also holds for labor since production technology is complementary in both inputs). In fact, when property rights are extremely weak, extortion generates a size distribution that exhibits a 'missing middle'. This is because the majority of entrepreneurs operate at an exceptionally small scale while the very high ability entrepreneurs, who face little extortion, operate as mega-size establishments due to a low equilibrium wage.

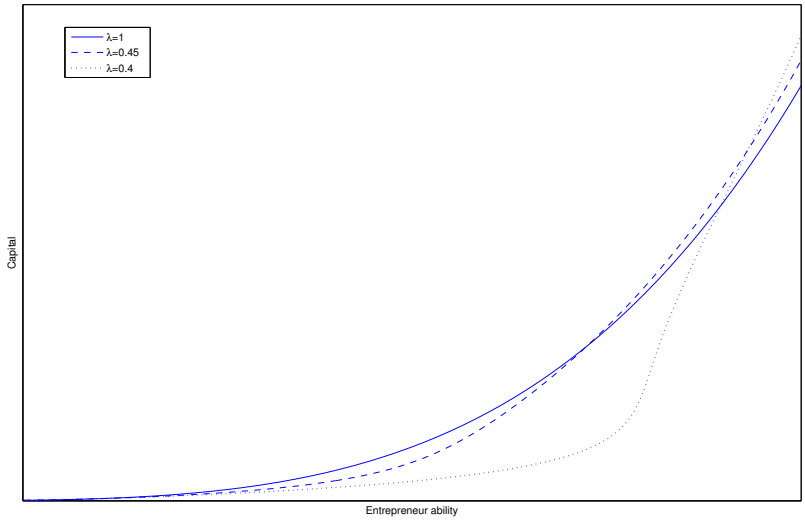

Figure 4: Property rights, extortion and capital demand

5.2 Aggregate Effects

Table 5 presents the effects of extortion on aggregate variables for select values of λ. All variables, except for the last two rows, are presented relative to the first-best economy ($\lambda = 1$). I begin with the calibrated economy for Poland. When $\lambda_{Pol} = 0.52$, the average extortion rate is 13 percent. Entrepreneurs use less capital in production which lowers aggregate capital by 3 percent and aggregate output by 1 percent. This is substantial noting that extortion accounts for two-tenths of a percent of aggregate output in the calibrated economy—a five-fold amplification on output. Consumption falls by 1 percent since resources are now allocated to cover protection expenditure. There are no effects along the extensive margin as the fraction of entrepreneurs (FOE) remains unchanged, which implies average establishment productivity is also unaltered. Average capital to labor ratio is 3 percent lower.

The effects of extortion in the calibrated economy are modest because the most productive entrepreneurs, who account for the majority of production, become immune to extortion by spending on protection. What are the quantitative effects in economies where the potential for extortion is higher? To evaluate this, I lower the value for property rights λ—which increases the potential for extortion—while holding all other parameters from the calibration fixed. This experiment can be viewed as the effects of extortion in Poland from an exogenous change in property rights that

Table 5: Quantitative effects from Extortion

Variable	$\lambda_{Pol} = 0.52$	$\lambda = 0.45$	$\lambda = 0.4$	$\lambda = 0.35$
Capital	0.97	0.85	0.62	0.44
Output	0.99	0.96	0.88	0.78
Consumption	0.99	0.95	0.86	0.80
FOE	1.00	1.07	1.28	1.58
Avg. productivity	1.00	0.98	0.94	0.89
Avg. capital/labor ($\frac{k}{n}$)	0.97	0.85	0.64	0.46
Avg. size (n)	1.00	0.93	0.76	0.59
Avg. extortion rate	13%	22%	32%	41%
Extortion-Output ratio	0.002	0.010	0.025	0.038

Notes: This table reports the effects of extortion on variables of interest for economies that differ across values of λ. All results, except for the last two rows, are presented relative to the first-best economy ($\lambda = 1$).

leaves other factors/parameters unchanged, or in a broader context, the importance of extortion for understanding cross-country income differences if property rights are a key dimension along which countries vary.

As shown in Table 5, a general pattern is that as property rights fall, extortion becomes more severe and is reflected through larger decreases in aggregate output, capital and consumption, as well as average establishment size (employees), capital to labor ratio and productivity. The $\lambda = 0.45$ economy is particularly relevant because it closely resembles extortion in Turkey—based on the BEEPS 2005 the average extortion rate is 21 percent and extortion as a share of output is 0.6 percent in Turkey, close to the values in the $\lambda = 0.45$ economy. Treating λ as the only source of variation across countries, extortion lowers output in Turkey by 4 percent, average establishment size and average capital to labor ratio by 7 and 15 percent.

As property rights are lowered a model of extortion also replicates several striking features related to the establishment size distribution in poor countries: high rates of entrepreneurship that are characterized by exceptionally small scales of operation and low productivity. For instance, when $\lambda = 0.35$ (an economy that has 3 times the probability of facing extortion that Poland has), the threshold for entry into entrepreneurship falls raising the fraction of entrepreneurs by close to 60 percent. The reason for this is as follows: When property rights are weak, extortion is ubiquitous which induces entrepreneurs to use minimal capital in production.[22] Since capital and labor

[22]This is also why aggregate variables decrease at a faster rate as property rights fall. When property rights are reasonably strong (say λ_{Pol}) entrepreneurs need only limited protection to produce close to optimal scale. As property rights fall, and noting that protection and property rights are complementary, the amount of protection required to

are complementary in production, demand for labor falls driving down the equilibrium wage. As a result, more individuals, specifically those of lower ability, select into entrepreneurship due to a weak outside option. Average productivity falls by 11 percent, average establishment size by 40 percent, and average capital to labor ratio by 54 percent.

Assessing values for property rights: The model generates substantial losses in output and productivity for values of $\lambda \leq 0.45$. Are values for λ in this range consistent with evidence? The approach I take is to find the value of λ that can rationalize the frequency of extortion observed in countries that data is available for. The BEEPS dataset provides establishment-level data related to extortion in over 15 countries. In Europe, Macedonia and Slovakia report the highest incidences related to extortion ($24-26$ percent) and it accounts for about 1 percent of aggregate output.[23] Values for λ between $0.44-0.45$ generate extortion rates in this range with output losses of 5 percent in Macedonia and 7 percent in Slovakia. Cambodia reports the highest incidences related to extortion at 32 percent. As shown in Table 5, $\lambda = 0.4$ generates this statistic implying output losses of 12 percent and average establishment size and productivity that is 24 and 6 percent lower.

Countries in Africa, particularly Sub-Saharan Africa, are also an obvious consideration since they are characterized by a history of poor institutions and weak 'rule of law' (Acemoglu *et al.*, 2001). In fact, most measures related to property rights or institutional development consistently rank African countries at the lower end of the spectrum (see for example the International Property Rights Index or the property rights and ruled-based governance index by the World Bank). While the BEEPS dataset does not contain data related to extortion in these countries, it does contain establishment-level data related to theft, robbery, vandalism and arson (henceforth crime). Using a broader interpretation of extortion to include crime, the probability of facing extortion can range from $30-50$ percent with extortion to output ratios between $1.8-2.7$ percent (Cameroon, Botswana and Lesotho). Using the model, values of λ between $0.45-0.35$ are consistent with these facts and imply output losses as much as 20 percent in these countries.

operate close to optimal scale cannot be profitably incurred by many entrepreneurs.

[23]The number of observations is limited however— about 150 and 100 establishments are surveyed in Slovakia and Macedonia.

6 Discussion

Extortion distorts entrepreneur behaviour by affecting production and selection into entrepreneurship. The focus of this section is to examine the importance of extortion for understanding misallocation. First, I compare the quantitative effects implied by a model of extortion relative to a model that features a simpler distortion: a proportional tax on the rental cost of capital. Second, I examine the effects of a redistribution policy that aims to undo the effects of misallocation created by extortion.

6.1 Extortion and taxes on capital: Quantitative comparison

Extortion serves as an implicit tax on the cost of renting capital. To assess the importance of extortion for understanding resource misallocation, I compare its quantitative effects relative to a model that has an explicit tax on the rental cost of capital. The tax is the only distortion in the economy ($\lambda = 1$). The problem of the establishment is

$$\pi(s) = \max_{k,n \geq 0} f(s,k,n) - wn - (r + \delta + \tau_k(s))\, k, \tag{11}$$

where $\tau_k(s)$ is the tax rate imposed on an entrepreneur of type s. I examine two policies where the tax is related to the effective rate of extortion ($x(s) \equiv e(s)[1 - F(\lambda, z(s))]$) an entrepreneur faces in the extortion economy when $\lambda = 0.45$. The effective rate of extortion is the percentage of capital an entrepreneur can expect to lose from extortion, or alternatively, the additional cost of renting capital due to extortion. In the first policy, I set the tax equal to the average, effective extortion rate $\tau_k(s) = \bar{x}\ \forall s$ (i.e. homogenous across entrepreneurs) and in the second policy, the tax is heterogeneous and set equal to $\tau_k(s) = x(s)$.

Table 6 presents the results for the tax economy under the two policies, as well as the extortion economy when $\lambda = 0.45$ (where there are no taxes) for comparison. Results are presented relative to the first-best economy ($\lambda = 1$ and $\tau_k(s) = 0\ \forall s$). Under the first policy, the tax is homogeneous across entrepreneurs and equal to 0.57 percent (0.0057). The tax lowers aggregate capital, output and consumption but not to the same extent as in the extortion economy.[24] Recall, when $\lambda < 1$

[24] Since I treat extortion as a dead weight loss, for consistency, I assume the aggregate value of the tax is *not* rebated back to the household.

Table 6: Extortion and taxes on capital

	Extortion Economy $\lambda = 0.45$	Policy 1 $\tau_k = \bar{x}$	Policy 2 $\tau_k(s) = x(s)$
Capital	0.848	0.931	0.938
Output	0.959	0.980	0.986
Consumption	0.946	0.974	0.979

Notes: This table compares the effects of extortion when $\lambda = 0.45$ relative to two tax policies on capital applied in an economy where there is no extortion ($\lambda = 1$). In Policy 1 the tax is homogeneous across entrepreneurs and equal to the average, effective rate of extortion, and in Policy 2 the tax is heterogeneous and equal to the effective rate of extortion. Results are presented relative to the first-best economy.

extortion is more distortionary for moderate ability entrepreneurs than high ability entrepreneurs. Moderate ability entrepreneurs are therefore better off in the tax economy than in the extortion economy while high ability entrepreneurs are worse off in the tax economy.

For Policy 2, the tax on capital is heterogeneous across entrepreneurs ($\tau_k(s) = x(s)$). This policy has a lesser effect on capital, output and consumption than the first policy. Even though the tax is heterogeneous and chosen to equal the effective rate of extortion, the model predicts about one-third of the output losses predicted in the extortion economy. This heterogeneous tax misses the full distortionary effect arising from extortion in an important way: it does not account for the additional costs (in this instance, protection) that entrepreneurs incur to avert the distortion they encounter (in this instance, extortion). This points to the importance of examining particular distortions in isolation as they can highlight strategic effects that generic taxes overlook.[25] This is particularly relevant for policies that aim to compensate or undo the effects arising from a particular distortion, as I show next.

6.2 Tax policy in an extortion economy

Extortion has unequal effects across entrepreneurs. Mid-ability entrepreneurs are the most constrained by extortion and they pre-emptively produce below optimal capacity, while production for high ability entrepreneurs is not as severely affected by extortion. Outside of improving property rights, I consider whether two specific tax/subsidy policies—both revenue neutral—can reduce the overall burden of extortion in the $\lambda = 0.45$ economy. The first is a redistributive policy related to

[25] A homogenous tax rate that generates the same aggregate stock of capital as in the extortion economy is $\tau = 0.0135$ or (1.35 percent). However, this tax cannot reproduce key differences at the micro-level, particularly in relation to output shares across entrepreneurs, establishment size distribution and selection into entrepreneurship.

the rental cost of capital (Policy A): the top 10 percent of entrepreneurs face a tax on the rental cost of capital and all other entrepreneurs, with a view to increase production, receive a subsidy. In the second policy (Policy B), entrepreneur profit is taxed and the cost of buying protection is subsidized, at rates that are common across all entrepreneurs.[26]

Table 7 presents the results relative to the first-best economy. The second column presents the extortion economy when $\lambda = 0.45$ absent of a tax policy, and the last two columns present the two tax policies applied to this economy. For Policy A, I set the capital tax equal to five percent for the top ten percent of entrepreneurs—for the policy to be revenue neutral a 2 percent subsidy for renting capital is provided to all remaining entrepreneurs. This policy fails considerably: aggregate capital, output and consumption are lower under the policy than without. This is due to the unique feature of an extortion economy which amplifies the effects of a tax on high ability entrepreneurs and mitigates the benefits of a subsidy on low/moderate ability entrepreneurs. When the tax is applied to the top decile of entrepreneurs it lowers profit and therefore how much protection is bought, which raises the potential for extortion. As a result, these entrepreneurs respond by using less capital in production, increasing the degree of misallocation among the most productive entrepreneurs. The subsidy provided to the remaining entrepreneurs increases demand for capital, but marginally. These entrepreneurs still cannot afford sufficient protection to prevent extortion, and despite the subsidy continue to produce at a low scale.

Policy B presents the scenario where the cost of buying protection is subsidized by 25 percent for all entrepreneurs. To ensure the policy is revenue neutral, all entrepreneurs pay a tax on profit equal to 1.75 percent. The subsidy increases the capacity for entrepreneurs to buy protection which reduces the potential for extortion. This policy raises aggregate capital, output and consumption, and because the tax is applied to entrepreneur profit there is minimal distortion to capital demand. I also examine whether further increases to the subsidy can steer the economy closer towards the first best economy. This does not happen because as the subsidy rises so does the tax on profit to ensure the policy is revenue neutral. There is a threshold, where sustained increases in the subsidy (with accompanying increases in the tax rate) lowers spending on protection due to declining profit

[26]The problem for the entrepreneur becomes,

$$\widehat{\pi}(s,k,n) = \max_{z\in[0,\overline{z}]} (1-\tau_\pi)\pi(s,k,n) - (1-F(\lambda,z))ek - (1-\tau_s)\frac{bz^\psi}{\psi},$$

where τ_π, $\tau_{sub} \in (0,1)$ is the tax on profit and subsidy for buying protection.

Table 7: Tax policy in the extortion economy, $\lambda = 0.45$

	No tax policy	Policy A	Policy B
Capital	0.85	0.77	0.87
Output	0.96	0.92	0.97
Consumption	0.95	0.92	0.95
τ_k^{tax}	—	5%	—
τ_k^{sub}	—	2%	—
τ_π	—	—	1.75%
τ_s	—	—	25%

This table presents the results for two revenue neutral, government tax policies that aim to undo the effects of misallocation in the $\lambda = 0.45$ economy. Policy A taxes the rental cost of capital at 5 percent for the top decile of entrepreneurs and uses the proceeds to subsidize all other entrepreneurs. Policy B applies a uniform subsidy for buying protection which is funded through a uniform tax on profit. All results are relative to the first-best economy.

and undoes the increase in capital demand.

7 Concluding remarks

This paper presents a model of extortion to highlight its effects on entrepreneur behaviour, both along the extensive and intensive margins. The model makes key predictions—extortion is hump-shaped across establishment size, increases as property rights weaken, and protection spending rises with size—that are broadly consistent with the evidence. An implication of the model is that in economies characterized by weak property rights, entrepreneurs strategically produce below optimal scale to negate the threat of extortion. The quantitative analysis is guided by establishment-level data related to extortion in Poland and predicts fairly modest aggregate effects but considerable heterogeneous effects along size distribution of establishments. Using the model to rationalize the frequency of extortion in more extortion plagued economies can imply output losses in the range of $5 - 10$ percent. Importantly, extortion has key effects along size distribution, lowering average establishment productivity, size and capital to labor ratio by as much as 5, 25 and 35 percent.

Property rights play a critical role in influencing entrepreneur behaviour. While they are treated as exogenous in the model, property rights are persistent over time, evolve gradually and require resources to sustain or improve their quality. From the perspective of a benevolent government, taxes must be collected to maintain or improve property rights. In a model of extortion a government

faces a dilemma: raising taxes distort establishment behaviour but can benefit establishments in the long-run if used to improve property rights. It naturally follows to ask whether a tax used to fund improvements in property rights is welfare improving. While an in-depth analysis of such a question is beyond the scope of this paper, I offer several insights based on the model presented in Section 3.

Consider the case where a proportional tax on profit is imposed on all individuals in an extortion economy and are used improve property rights. Improved property rights benefit all entrepreneurs but taxes will have heterogeneous effects because the severity of extortion varies across entrepreneurs. Based on the model, high-ability entrepreneurs can be made worse off through higher extortion rates because taxes lower the profit margin and the ability to buy protection. These effects can be especially severe and have dynamic implications if improving property rights is a slow process. In contrast, low-ability entrepreneurs buy little protection and face high rates of extortion, especially if they produce at optimal capacity. Improved property rights can outweigh the tax burden on profit since production is quite low among these individuals.

The welfare gains from a tax used to fund property rights will depend on the existing level of property rights and whether government takes a short or long run view to improving welfare. A country's initial level of property rights is crucial for determining this. For instance, in countries where property rights are moderate, distortions created by taxes maybe short-lived if improvements in property rights are prompt and enable the economy to operate extortion-free in the future. Conversely, in countries where property rights are weak, the taxes required maybe too onerous and improvement in property rights too gradual that short run costs may exceed long run gains, trapping these economies in a cycle of inferior property rights.

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Appendices

A Derivations

Closed-form solution for protection: Substituting the CG's best-response function for extortion into equation (4) and maximizing with respect to z yields,

$$az^{(\psi-\theta)(\rho-1)} + \Omega^{\rho-1}\lambda^{\rho}k^{\rho}z^{\theta} = \Omega^{\rho-1}\lambda^{\rho-1}(1-\lambda)k^{\rho}.$$

A closed form solution for z exists when $\theta = \frac{\psi(\rho-1)}{\rho}$. When $a \geq 0$, which holds by assumption, $z^*(s) \leq \overline{z}\ \forall s$.

Proof of Proposition 1: Consider the case when $\widetilde{\pi}(s_1) < \widetilde{\pi}(s_2)$, where $s_1 > s_2$. Noting that $z(s)$ and $e(s)$ are functions of $k(s)$, and that $\pi(s)$ is increasing in ability, an entrepreneur of type s_1 can choose $k = k(s_2)$ and $n = n(s_2)$ and earn a post-extortion profit of $\widetilde{\pi} \geq \widetilde{\pi}(s_2)$. Hence, $\widetilde{\pi}(s_1) < \widetilde{\pi}(s_2)$ is never an equilibrium outcome.

Comparative statics:

(i) If capital is increasing in ability, it follows that $\frac{\partial z(s)}{\partial s} \geq 0$. Protection is increasing at a faster rate in individual ability when $\frac{\partial^2 z(s)}{\partial s \partial s} > 0$, which is true when $(\rho-\theta)a - \theta\Omega^{\rho-1}\lambda^{\rho}k(s)^{\rho}(1+\rho) > 0$ or alternatively, when $\rho > \theta$ and $k(s)$ is small. $\frac{\partial^2 z(s)}{\partial s \partial s} > 0$ for all individuals with ability $s < \widehat{s}$, where $\widehat{s} = k^{-1}\left(\left[\frac{(\rho-\theta)a}{\theta(1+\rho)\Omega^{\rho-1}\lambda^{\rho}}\right]^{\frac{1}{\rho}}\right)$, and less than or equal to zero, otherwise.

(ii) This requires examining how protection varies with property rights. When $\lambda \geq \frac{\rho-1}{\rho} \equiv \lambda^c$, $\frac{\partial z(s)}{\partial \lambda} \leq 0\ \forall s$, implying protection and property rights are substitutes. When $\lambda < \lambda^c$, $\frac{\partial z(s)}{\partial \lambda} \leq 0$ for individuals with ability $s \geq k^{-1}\left(\left[\frac{a(\rho-\lambda\rho-1)}{\Omega^{\rho-1}\lambda^{\rho}}\right]^{\frac{1}{\rho}}\right)$, and positive otherwise.

(iii) $\frac{\partial e(s)}{\partial s} \geq 0\ \forall s \leq s_x$ and decreasing otherwise, where $s_x \equiv \frac{a}{(\rho-1)\Omega^{\rho-1}\lambda^{\rho}}$. Differentiating s_x with respect to λ implies $\frac{\partial s_x}{\partial \lambda} < 0$.

Proof of Proposition 2: $\xi(\lambda,k) > 0$ when $\lambda < 1$, implying the $MPK > (r+\delta)$. $\frac{\partial \xi(\lambda,k)}{\partial \lambda} < 0$, implying that as property rights decrease the degree of misallocation rises. Finally, $\frac{\partial \xi(\lambda,k)}{\partial s}$ is positive for values of k below a threshold $\bar{k}$ and decreasing otherwise.

B Extortion and Protection functional forms

In Section 3.3 the cost functions for buying protection and extortion are independent entrepreneur capital. I now examine the effects when costs associated with protection and extortion are dependant on capital. The problem of the entrepreneur becomes:

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

where

$$\hat{\pi}(s,k,n) = \max_{z \in [0,\bar{z}]} \pi(s,k,n) - (1-\lambda-\lambda z^{\theta})ek - b\frac{z^{\psi}g(k)}{\psi},$$

and the problem of the CG becomes

$$\Pi(s) = \max_{e \in [0,1]} (1-\lambda-\lambda z^{\theta})k(s)e(s) - a\frac{e^{\rho}g(k)}{\rho},$$

where $h(k)$ and $g(k)$ are functions increasing in k. When a closed form solution for protection exists (i.e. when $\theta = \frac{\psi(\rho-1)}{\rho}$), optimal protection and extortion decisions are:

$$z(s) = \left(\frac{\lambda^{\rho-1}\Omega^{\rho-1}(1-\lambda)k^{\rho}}{ag(k)h(k)^{\rho-1} + \lambda^{\rho}\Omega^{\rho-1}k^{\rho}} \right)^{\frac{1}{\theta}}$$

$$e(s) = \left(\frac{(1-\lambda)h(k)^{\rho-1}k}{ag(k)h(k)^{\rho-1} + \lambda^{\rho}\Omega^{\rho-1}k^{\rho}} \right)^{\frac{1}{\rho-1}}$$

Table 8 shows how protection and extortion varies by individual ability for various functional forms considered. $h(k) = g(k) = 1$ is the environment in Section 3.3. In the second column the cost of protection and extortion are linear in capital. In this setting, extortion and protection are a constant value that does not vary across entrepreneurs. Finally, the last column considers a case where the cost of protection and extortion are non-linear in capital; in particular $b\frac{(zk)^{\psi}}{\psi}$ and $a\frac{(ek)^{\rho}}{\rho}$. Under strict conditions extortion is hump-shaped in individual ability and when these

conditions are relaxed, extortion is decreasing in ability. Protection is always decreasing ability. Given the functional forms, the parameterization of $h(k) = g(k) = 1$ is most consistent with the evidence—protection expenditure is increasing in size and extortion is less burdensome among small and large establishments.

Table 8: Protection and Extortion functional forms

	$f(k) = g(k) = 1$	$f(k) = g(k) = k$	$f(k) = k^{\psi}$, $g(k) = k^{\rho}$
$z(s)$	$\uparrow$ in s	constant in s	$\downarrow$ in s
$e(s)$	hump-shape in s	constant in s	$\downarrow$ or hump-shape in s

C Data

The data I use is from the Word Bank Business Environment and Enterprise Performance Survey (BEEPS) 2005. The 2005 wave is particularly relevant because it includes questions related to extortion—subsequent waves focus on questions related to crime, in part due to a higher response rate, and have omitted questions pertaining to extortion. The survey is conducted among establishments that have between 2 and 10,000 employees. About 45 percent of establishments surveyed have fewer than 10 employees and 75 percent of establishments have fewer than 50 employees. Establishments are classified as either Industry (mining, construction and manufacturing) or Service (transport, trade, real estate, restaurant/hotels, and other services) and they each account for about half of the observations.

Establishments are asked whether firms in their line of business make payments to organized crime to prevent violence or property damage, which I treat as an establishment's own experience with extortion, and what share of sales it accounts for. This is a round-about and sensible way to ascertain such sensitive information and ensure adequate response. See Johnson *et al.* (2002) who argue for the merit of this approach using an earlier version of the survey.

For the statistics in Table 1, the probability of facing extortion is determined by calculating the percentage of establishments that report facing extortion in the last year. Establishments are also asked to rate whether organized crime/mafia is a major, moderate, minor or non obstacle to business operation (question q54s). This question gets at the direct and indirect effects of extortion—an establishment may not face extortion but may still be adversely affected by it. Table 1 reports the

percentage of establishments that state extortion is a major or moderate obstacle to operation. In reporting these statistics I exclude establishments that do not report sales data or use capital in production since this information maps closely to the model. I also exclude establishments that were deemed untruthful in their responses by the interviewer. The last two columns report average extortion as a percentage of sales, among all establishments and those who faced extortion, by country. For sales I use value added sales. I also exclude establishments that are in the top two percent in sales, losses due to extortion and protection spending to remove outliers. The calibration targets exclude these outliers as well.

For the regression results reported in Table 2, industry-level fixed effects are based on the eight classifications noted above. Only countries that have more than 200 establishment-level observations are included: Armenia, Greece, Hungary, Moldova, Poland, Portugal Romania, Russia, Turkey and Ukraine. Germany, which has the most observations, is excluded because it would account for about 1/3 of all observations. However, the general patterns reported in the table are consistent when Germany and/or countries that have fewer than 200 observations (Bosnia, Macedonia, Slovakia and Slovenia) are included.