

# Crime Induced Poverty Traps<sup>1</sup>

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## Abstract

Poverty makes thieves and thieves hamper economic growth. We study these linkages in a model of modern sector job creation. Job creation has two effects. Higher labor demand tends to lower crime while higher output gives more to steal, tending to increase crime. At low levels of modernization the second effect dominates and, as a consequence, the model has decreasing returns to scale. At higher levels of modernization there is increasing returns to scale due to declining crime. The economy may end up in a poverty trap with high crime and low production or obtain full modernization with low crime rates. The danger of ending up in a poverty trap has implications for economic policies. We show, for instance, that a reform, intended to improve efficiency, may throw the economy into a vicious circle of increasing crime and stagnation if implemented too fast.

**Keywords:** *Weak property rights, crime, multiple equilibria, economic reform, and growth*

**JEL Classification Numbers:** *O11, P20, K00*

## 1 Introduction

When groups are left behind in poverty, economic development may create serious social tensions. Crime, riots and social disruption may follow which in turn can derail the development process. Traditional development theories, however, do not incorporate a coherent view of social and economic factors. In standard models, modernization has no disruptive social implications. Agents are implicitly assumed to be acquiescent and law-obedient even in situations where there is high relative deprivation and where crime pays.

This optimistic description is not borne out by the facts. Many labor surplus economies seem to be trapped in situations of social unrest and disruption. A typical growth loser is a country where crime rates are increasing while growth winners tend to experience declining crime rates. This regularity is illustrated in Figure 1 where we show the association between annual economic growth and changes in crime for 39 countries in the period 1986 to 1994.<sup>1</sup> The Figure supports an assertion stating that poverty makes thieves and thieves hamper economic growth.

In this paper we explore how such a two-way relationship between social conditions and economic performance may lead the economy into either a poverty trap, with high crime and low production, or on to a sustainable modernization path with low crime. The aim of the paper is to demonstrate how social disruption, in the form of criminal theft, significantly modifies well-known growth mechanisms. The model contains two social externalities of modern sector expansion. A negative externality follows as modern production stimulates theft and therefore the need for guarding

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<sup>1</sup>We have combined data from the World Bank (1998) on economic growth with crime data from United Nations (1999) in the period 1986 to 1994.

of property. A positive externality follows as more jobs within each modern firm absorb the labor surplus and lower the number of potential criminals.

The interaction between social and economic mechanisms determines the overall scale properties of modern sector expansion. To emphasize the social mechanism we keep the rest of the model as simple as possible with a constant returns production technology and no market size effects. Hence, the overall scale properties that we derive follow exclusively from the social mechanisms.

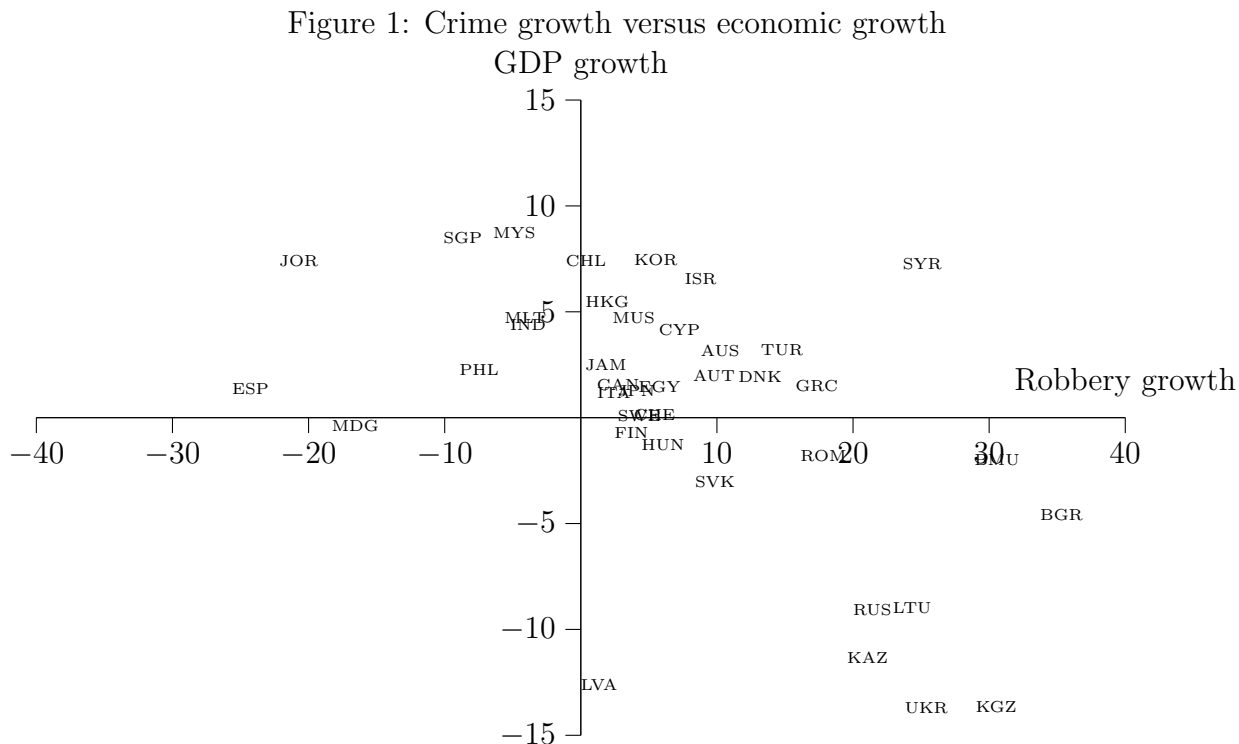
Our model exhibits decreasing social returns in early stages of modernization, as the negative externality dominates the positive. In later stages of modernization the opposite is true and the model exhibits increasing social returns to modernization. These shifting scale properties may lead the economy into a crime induced poverty trap.

Incorporating social mechanisms also alter policy implications. We show how policies intended to improve efficiency by downsizing the public sector can be counterproductive when some of those who are laid off get involved in socially disruptive activities. This fits the observation in Figure 1, that the cluster of countries that perform particularly poorly are countries that recently have been through dramatic reform programs (Russia, Lithuania, Kazakhstan, Ukraine, and Kyrgyzstan).<sup>23</sup>

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<sup>2</sup>The 39 countries selected are all the countries that had sufficient information of the crime development over the specified time span. The countries are: Bermuda (BMU), Bulgaria (BGR), Spain (ESP), Jordan (JOR), Madagascar (MDG), Singapore (SGP), Philippines (PHL), Malaysia (MYS), Malta (MLT), India (IND), Chile (CHL), Latvia (LVA), Jamaica (JAM), Hong Kong (HKG), Italy (ITA), Canada (CAN), Finland (FIN) Mauritius (MUS), Japan (JPN), Sweden (SWE), Switzerland (CHE), Rep Of Korea (KOR), Egypt (EGY), Hungary (HUN), Cyprus (CYP), Israel (ISR), Austria (AUT), Slovakia (SVK), Australia (AUS), Denmark (DNK), Turkey (TUR), Greece (GRC), Romania (ROM), Kazakhstan (KAZ), Russian Federation (RUS), Lithuania (LTU), Syrian Arab Rep (SYR), Ukraine (UKR), Kyrgyzstan (KGZ).

<sup>3</sup>In several countries stagnation and rising crime can be attributed to failing economic reform programs. In other countries, such as those in Africa, the causes are more diverse, although some common features emerge. Azam, Berthélemy, and Calipel (1996), Easterly and Levine (1997), Temple (1998), and Collier and Gunning (1999) investigate the causes of growth in Africa and all find that violence and unrest affect growth negatively. Ayres (1998) reports similar results for



Our model incorporates two main linkages between economic and social conditions:

- Economic stagnation and more poverty leads individuals into crime.
- Crime and violence lower business profitability, reduce the effectiveness of the economy and therefore reduce economic growth.

The first linkage represents an old theme, passionately described by Thomas More in *Utopia* (1518) “[L]eave fewer occasions to idleness;[...] so there may be work found for those companies of idle people whom want forces to be thieves, or who now, being idle vagabonds or useless servants, will certainly grow thieves at last.” Later Georg von Mayr found that crime rates in Bavaria in the period 1835-1865 depended positively on the cost of living of the poor (von Mayr 1917).

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Latin America and concludes that “Crime and violence have emerged in recent years as major obstacles to development objectives in Latin American and Caribbean countries”.

Sociologists and criminologists have emphasized how poverty and idleness explain high crime rates (Allan and Steffensmeier 1989 and Currie 1997). The connection between crime and poverty has also caught renewed attention among economists. Applying panel data for 45 developed and developing countries over the period 1965 to 1995, Fajnzylber et al. (2001) find that violent crime rates decline when economic growth improves (See also Fajnzylber et al. 2002 and Miguel 2002).

The second linkage, from crime to economic performance, is documented by many recent observers. Bourguignon's (2001) survey concludes that social costs of crime are substantial in countries with more than the average level of criminality. In Latin America, for example, the costs of crime are in several cases above seven per cent of GDP (Londoño and Guerro 2000). The Economist (1996) provides an even more dramatic assessment of Latin America: "[T]he region spends an astonishing 13-15% of GDP on security expenses (both private and public). That is more than total welfare spending. It represents a crippling burden on the economy". Crime is also seen as an important deterrent to doing business in countries like South Africa and constitutes one of the biggest challenges to economic growth in Africa (EIU 1998). Russia has also experienced escalating crime and violence spirals in the 1990s with bad economic consequences (Ledeneva and Kurkchiyan 2000). Finally, the negative impact of crime on economic performance is also evident from cross-country regressions (Barro and Sala-I-Martin 1995 ch 12).

Put together, the two linkages between crime and growth are damaging as they generate a vicious circle that can result in a poverty trap. Economic stagnation explains rising crime and rising crime, in turn, explains the economic stagnation. Some countries may therefore end up in an equilibrium state characterized by persistently

low or negative growth rates and high or rising crime levels. Other countries, where crime is prevented and labor demand is not allowed to plummet, may take off on a sustainable path of social and economic development where high growth produces low crime rates, which leads to further economic growth and development.

We build on Gordon (1971) who points out the two way relationship between social conditions and economic performance.<sup>4</sup> Our paper is also inspired by Bourguignon (1999) who points out that inequality and poverty may have substantial costs as “violence undermines the social and economic climate, and weakens economic incentives and development factors, which in turn leads to more violence” (p.2). Our policy implications resemble those of Sala-I-Martin (1997) who claims that public welfare programs “are a way to bribe poor people out of activities that are socially harmful” (p.83). Finally, our paper is closely related to Usher (1989) who studies a model of farmers, bandits, and rulers, and to Lloyd-Ellis and Marceau (2003) who study the linkages between crime, insecure property and capital investment. We return to these two contributions in the conclusion.

## 2 The model

In our model, growth stems from modern sector job creation. In the modern sector there is a unit mass of firms that employ  $L$  workers to produce the modern sector output  $X$ . Each worker has a constant productivity  $\beta$ , hence

$$X = \beta L. \tag{1}$$

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<sup>4</sup>We also build on Skaperdas (1992) who study economic interactions when property rights are absent, on Murphy, Shleifer, and Vishny (1993) who study how rent seeking behavior may crowd out legal activities, on Glaeser, Sacerdote, Scheinkman (1996) who provide theory and evidence for why seemingly identical cities (in the US) may have very different crime levels, and on Mehlum, Moene and Torvik (2003) who study venal practices by entrepreneurs and politicians.

New jobs are created by entrepreneurs. The speed of job creation depends on the profitability  $\pi$  in the modern sector. The growth per unit of time in modern sector jobs  $\dot{L}$  is therefore

$$\dot{L} = h(\pi) \quad \text{where} \quad h(0) = 0 \quad \text{and} \quad h' > 0 \quad (2)$$

It follows that jobs are created when profits are positive while jobs are destroyed ( $\dot{L} < 0$ ) when the profits are negative.

**The case without crime** Without crime the net profit  $\pi$  from each job is equal to the marginal productivity of labor  $\beta$  minus the wage  $w$ . In this case, modern sector workers are recruited from the subsistence sector that has  $F$  workers all earning a fixed income  $q$ . Accordingly, when  $F > 0$  the wage in the formal sector is equal to  $q$  and the net return to job creation is the constant  $\pi = \beta - q$ . Two results follow:

- Modernization takes off provided that modern jobs are sufficiently productive; that is  $\beta \geq q$ .
- Modernization goes on with constant growth  $\dot{L}$  as long as there is labor in the subsistence sector; that is as long as  $F > 0$ .

Thus, in the case without crime, our model generates an uninterrupted transition to full modernization once it gets started. With endogenous crime, however, this result does not necessarily hold.

**The case with crime** The central idea in our model is that crime levels go up when the expected return to crime increases relative to the return from other activities. This focus on relative deprivation does not suggest that those who resort



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to crime are recruited systematically from the very poorest segments of society. In developing countries many poor people have a miserable existence, but do not take to crime. Some people break the law if the expected gains are sufficiently large, but others would never take to crime under any circumstance. For simplicity we first assume that all workers are equal and that when they choose between crime and other employment they only consider the expected income. Towards the end of this section we discuss the modifications that follow when people have aversion against committing crimes.

A number  $L$  of workers are employed in the formal sector earning  $w$ , a number  $F$  work in the subsistence sector earning  $q$ . In addition a number  $C$  of the workers become thieves earning  $p$ . With available labor normalized to unity, we have

$$1 = L + C + F \tag{3}$$

As firms are the targets of thieves, crime lowers modern sector profits. Let  $z$  capture the total cost of crime as a share of production then the net return of job creation is

$$\pi = (1 - z)\beta - w \tag{4}$$

The cost of crime  $z$  is made up of two components. First, firms spend resources on protection measures such as guards, fences, alarm systems, and supervision. Second, stealing represents a loss of resources. Protection scares off some criminals, reducing the probability of a criminal attack. Protection also reduces the stealing in each attack. The scaring-off effect for one particular firm is determined by the

firm's protection level compared to the average level of guarding in the other firms.

The two aspects of protection are captured in the following way. Let  $\gamma$  denote the fraction of each job that is in the form of guarding services. In each criminal attack a share  $A - a\gamma$  of production is stolen, where  $0 < a \leq A \leq 1$ .<sup>5</sup> This share is decreasing in the firm's own protection. The scaring-off effect implies that when the firm's own protection,  $\gamma$ , is low relative to the average level of protection,  $\bar{\gamma}$ , the firm attracts a large fraction of the criminals. With a total number of criminals equal to  $C$ , we assume that the number of criminals that approach a firm with protection  $\gamma$  is simply  $(\bar{\gamma}/\gamma)C$ . The total cost associated with crime  $zX$  is therefore the protection costs plus expected stealing

$$zX = \left( \gamma + (A - a\gamma) \frac{\bar{\gamma}}{\gamma} C \right) X \quad (5)$$

Each firm chooses the level of protection that minimizes its total cost of crime. The first order condition for minimum costs is simply  $\gamma^2 = AC\bar{\gamma}$ . Combining this with the requirement that in equilibrium all firms choose the same level of protection ( $\gamma = \bar{\gamma}$ ), yields

$$\gamma = AC \quad (6)$$

$$z = A(2 - aC)C \quad (7)$$

The return from being a criminal  $p$  is the share that each criminal steals ( $A - a\gamma$ )

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<sup>5</sup>The assumption  $0 < a \leq A \leq 1$  follows from the natural requirement that the share each thief steals  $A - a\gamma$  is between zero and one for all possible levels of guarding,  $\gamma \in (0, 1)$ .

times production  $X$ . Inserting  $\gamma = AC$  from (6) we get

$$p = A(1 - aC)X \quad (8)$$

This completes the description of the micro level.<sup>6</sup> Next we move to the aggregates.

The modern sector wage and the level of crime are determined simultaneously. Modern firms bid up their wage until all vacant jobs are filled. As long as we abstract from aversion against being a criminal, equilibrium requires that workers receive the same net return across occupations. Thus in an equilibrium state with crime, the modern sector wage must be equal to the expected return of a criminal. If the modern sector wage exceeds the return to crime, however, there can be no crime in equilibrium. Hence, we have that

$$w = p \text{ when } C > 0$$

$$w > p \text{ when } C = 0$$

Similarly, in an equilibrium where workers find it worthwhile to work in the subsistence sector, the modern sector wage must be equal to the subsistence pay  $q$ . If subsistence sector employment is zero, however, it implies that the modern sector wage is above the subsistence pay. Hence, we have that

$$w = q \text{ when } F > 0$$

$$w > q \text{ when } F = 0$$

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<sup>6</sup>An alternative could be to ignore the scaring-off effect and let the efficiency of guarding be given by the decreasing and concave function  $f(\gamma)$ , such that  $p = f(\gamma)X$  and  $z = \gamma - f(\gamma)C$  giving the first order condition for optimal guarding  $f'(\gamma)C = 1$ . Provided that  $f$  is sufficiently concave such a model would also generate a crime induced poverty trap. A concave  $f$  implies that there are increasing returns to scale in guarding, which is reasonable.

Combining these elements, four regimes emerge as described in Table 1:

Table 1: The labor market regimes

Regime	labor market condition	wage condition
1: Subsistence	$C = 0, F > 0$	$w = q > p$
2: Low income	$C > 0, F > 0$	$w = q = p$
3: Medium income	$C > 0, F = 0$	$w = p > q$
4: High income	$C = F = 0$	$w > p > q$

The economy goes through the four regimes as modern sector employment  $L$  increases in tandem with modern sector production.

In regime one, modern sector employment and production is so low that stealing is not attractive. Accordingly, there is no crime, firms have no guarding, and the modern sector wage is determined by the subsistence pay.

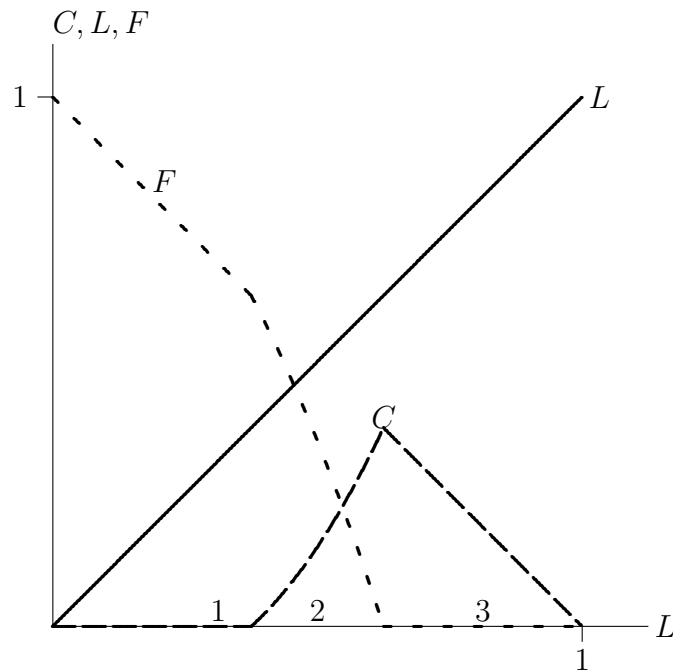
In regime two production has reached the level where crime starts to pay. The number of criminals go up, equalizing the net return to crime,  $p$ , and the subsistence pay,  $q$ . Regime two ends when there are no more workers in the subsistence sector.

In regime three, production is so high that the only attractive alternatives are crime and modern sector employment. Accordingly, the wage in modern sector firms is determined by the return to crime  $p$ .

In regime four all available labor is employed in the modern sector and the modern sector wage is bid up above the expected return of crime. Accordingly, the poorest and richest regimes have no crime, while the low income and medium income regimes both have crime.

The allocation of labor in the four different regimes is shown in Figure 2. When the levels of modern sector employment and production are low, crime is zero and formal sector employment is recruited from the subsistence sector. When regime two starts, the subsistence sector releases labor both to the formal sector and the crime

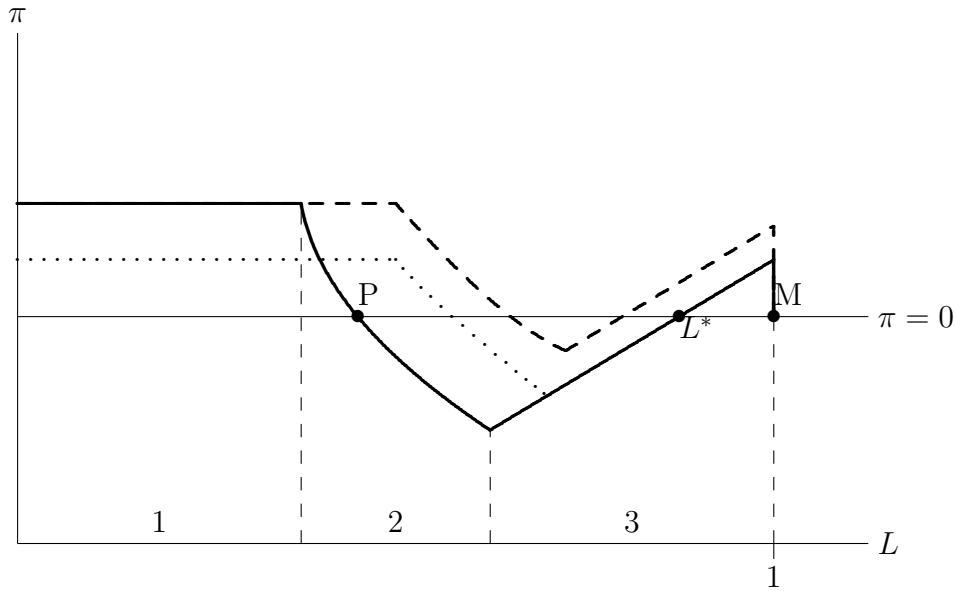
Figure 2: Labor market regimes



sector as formal sector production increases. In regime three the subsistence sector has no more workers. Thus, in this regime, higher formal employment pushes the number of criminals down. Finally, in regime four there is no crime. All available labor is employed in the formal sector.

A transition through the four regimes shows that there is a hump-shaped relationship between modern sector employment and crime; in early stages of formal sector employment growth, crime is increasing, in later stages crime is decreasing. As found by Tugan-Baranowsky (1901) and more recently emphasized again by Lloyd-Ellis and Marceau (2003), such a development finds a striking parallel in the development of crime in 19th century England. In the first half of the century the incidence of crime increased consistently and significantly, while it declined in the second half of the century. The hump-shaped relationship can be interpreted as a result of poverty-generated crime. At the early stage of modernization (regime two) crime becomes a tempting opportunity for some of the poor. At a later stage

Figure 3: The return to job creation



of modernization (regime three) labor becomes scarce and crime decreases as the modern sector employs more workers.

Whether modernization, in the model, stops or not depends on the net profit of job creation during the modernization process. Inserting from (7) into (4) yields the following expression of the profits from modern sector job creation

$$\pi = \beta - \beta AC(2 - aC) - w \quad (9)$$

The return  $\pi$  goes down when either the wage goes up or the number of criminals increases. The wage and crime levels are in turn both determined by the modern sector employment  $L$ . How the return  $\pi$  depends on the level of modernization  $L$  is found by combining (9) with the equilibrium conditions in Table 1 and inserting from (3) and (8). The return to job creation in the different regimes is given in Table 2 and illustrated by the bold curve in Figure 3.

In regime one the return of job creation is constant as there is no crime and

Table 2: The return to job creation

Regime	$\pi$
1: Subsistence	$\pi_1 = \beta - q$
2: Low income	$\pi_2 = \beta - q - \beta A/a + q^2 / (aAL^2\beta)$
3: Medium income	$\pi_3 = \beta - 2A\beta + aA\beta + (1 - a)AL\beta$
4: High income	$\pi_4 = 0$

workers are recruited from the subsistence sector at fixed wage.

In regime two crime pays and higher production in one firm increases the number of criminals and implies a negative externality for all firms. Thus the return of job creation declines.

In regime three the subsistence sector is no longer employing workers and higher production therefore lowers the number of criminals. The positive externality between firms causes the return to job creation to increase as higher employment by one firm lowers the total number of criminals. When crime declines, each firm reduces its level of protection, which raises firms' profitability. The return to crime goes up as well causing a rise in the wage as firms have to pay more to keep and attract workers. In the model the positive effect of less crime and lower protection outweighs the wage rise. Therefore in regime three the return of job creation increases with modern sector employment. This is the increasing return property of the model.

In regime four the wage is bid up until the return of job creation reaches zero, as no more workers are available. Hence we have the following proposition:

**Proposition 1** *Due to crime, the return to modern sector job creation is a V-shaped function of employment. This may produce a crime generated poverty trap.*

In Figure 3 there are three equilibria: M, P, and  $L^*$ . Here M and P are stable equilibria while  $L^*$  is an unstable equilibrium. If the economy starts out with modern

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employment below  $L^*$ , it ends up at the low-income equilibrium P. If the economy starts out above  $L^*$ , it ends up at the high-income equilibrium M. Hence,  $L^*$  is the threshold level of modernization that determines whether the economy ends up in the poverty trap P or enters into a growth process that ends with complete modernization, high income, and no crime in M.

Whether there exists a poverty trap or not depends on the return to modern sector job creation  $\pi$ . With a sufficiently high productivity  $\beta$  in the modern sector, the economy would grow continuously without being trapped at intermediate levels of modernization.

Note that the reason for the increasing return to modern sector job creation in the third regime is different from those in other recent theories. In growth theory, economic geography, and the “Big push” literature increasing returns play an important role. Positive externalities at the micro level produce an aggregate production function with increasing returns to scale.<sup>7</sup> In contrast, our model has a constant returns to scale technology and without crime the return of job creation is constant and independent of the level of modernization. When crime is taken into account, however, the return of job creation becomes a function of the level of modernization, solely as a result of socially disruptive behavior. In regime three a marginal increase in labor demand reduces the number of criminals. Each firm is too small to take this positive externality into account.

In the model, the overall shape of the return to job creation follows the movement in crime levels: As crime declines, the return to job creation increases and vice versa. In regime three the condition for this to happen is that the positive social externality

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<sup>7</sup>See the special issue of the *Journal of Development Economics* (Bardhan ed. 1996), for many interesting contributions.



through crime outweighs the increase in wages. Several reasonable mechanisms, that we have left out from the discussion, would strengthen the increasing returns result of regime three. For example, a constraint on each thief's capacity of stealing would limit the negative effect from the wage rise following higher production levels. The wage rise would also be limited if the probability of being caught as a criminal went up together with modernization. This probability could go up as a result of both tax financed improvements in law enforcement, (more tax income and fewer thieves) or because the probability of being caught increases with the amount being stolen as in Usher (1989).

**Moral scruples** Let us now consider the case where workers have an aversion against committing crime. Consider first the case with an aversion or moral cost of committing crime that is the same for all individuals. This case also captures the effect of more efficient law enforcement or harsher punishment, as studied in the related model by Lloyd-Ellis and Marceau (2003). The effect of incorporating such costs in the model is illustrated by the dashed curve in Figure 3. Aversion against committing crime has no effect in regimes one and four, as there are no criminals in these regimes. In regimes two and three, however, an aversion against committing crimes shifts  $\pi$  upwards. As a result the low level equilibrium P in Figure 3 moves to the right as a higher level of modernization is required for workers to be tempted by crime. For each level of modernization there are fewer thieves. When the aversion is sufficiently high, the poverty trap disappears. Thus, a high aversion or more efficient law enforcement can move an economy, initially stuck in the trap P, onto a sustainable growth path.

An assumption about uniform scruples is too simplistic. Aversion against com-

mitting crimes obviously varies across individuals. Those with the lowest aversion are the first to enter into crime and the marginal aversion against committing crimes increases with the number of criminals. Taking this heterogeneity into account, as exemplified in Figure 3, reduces the steepness of the  $\pi$ -curve in regimes two and three. Otherwise the qualitative effects are similar to the case with uniform scruples.

Another explanation of aversion against committing crime focus on social interaction. As discussed for example in Glaeser et al. (1996): when one agent's decision to become a criminal positively affects his neighbors decision then crime aversion is a decreasing function of  $C$ . This interaction effect works in the opposite direction of the heterogeneity effect and lowers the bottom of the V-shaped  $\pi$ -curve.

Finally, as discussed for instance by Gaviria (2000), there may be hysteresis effects on the individual level such that a history as criminal lowers the moral cost. In that case the  $\pi$ -curve shifts down given a history of high crime.

### 3 Policies

In this section we stick to initial assumptions about the  $\pi$ -curve as stated in Table 2. We consider the impacts of foreign aid that improve conditions in the subsistence sector (higher  $q$ ) and public employment programs. Such external or internal policy changes affect the return of job creation and the possibility of a poverty trap.

**Foreign aid:** The type of foreign aid we consider is a rural development program that increases the subsistence pay  $q$ . The shift in the return of job creation  $\pi$ , that follows from the higher  $q$ , is illustrated by the dotted curve in Figure 3. In regime one the curve shifts down as a higher wage lowers the return of job creation. In regime two a higher  $q$  not only raises the modern sector wage but also improves

the opportunity wage for the criminals. Thus, crime declines and the return of job creation goes up. The simultaneous increase in the wage and the return of job creation is possible due to the reduction both in guarding and stealing. In regimes three and four, however, the modern sector wage  $w$  is already above  $q$  and a change in  $q$  is therefore irrelevant. Formally the effect in regime two is seen by differentiating  $\pi_2$  in Table 2 with respect to  $q$ . In order to determine the sign of the derivative we first use (8) and the arbitrage condition in regime two ( $p = q$ ) to replace  $q$  by  $A(1 - aC)X$ . We then substitute for  $C$  from (3) and use (1) to get

$$\frac{\partial \pi_2}{\partial q} = \frac{aL + 2(1 + aF - a)}{aL} > 0$$

Increasing the subsistence pay lifts the bottom of the V-shaped  $\pi$  curve in Figure 3 and may therefore remove the poverty trap.

**Proposition 2** *Foreign aid that improves living conditions in the subsistence sector lowers crime and may remove the crime induced poverty trap.*

This illustrates the important point that the lack of attractive legal opportunities for the workers is costly for the firms due to crime. Better opportunities for the poor can therefore be beneficial for private business even though it also generates a higher wage bill.

**Public employment programs.** Public employment programs are another way of generating attractive legal opportunities for the workers. Consider for example the case where a number of workers  $L_g$  are employed by the government. As a consequence, in regime three, crime is lowered by an equal number, as  $C = 1 - L - L_g$ . Combining this new labor market condition with (9) and inserting for  $w = p$  from

(8) it is easy to show that the return to job creation increases as  $L_g$  increases. This result is not surprising since the modern sector firms clearly benefits from a reduction in the number of criminals. The critical question, however, is whether the private sector would be willing to finance such an employment program. The financing requirement depends of the productivity of workers in public employment. Consider the extreme case where public workers  $L_g$  are completely unproductive. Assume further that public workers have to be paid the wage  $w$  and that the outlays have to be financed by a proportional production tax. In that case the net return to job creation in regime three is

$$\pi^*(L, L_g) = \pi_3 - wL_g/L$$

Inserting from Table 2 and for  $w = p$  from (8) and using (1) it follows that  $\pi^*$  is

$$\pi^* = \beta - A\beta C(2 - aC) - A\beta L(1 - aC) \left(1 + \frac{L_g}{L}\right)$$

Inserting from the labor market condition,  $1 = L + L_g + C$ , we get

$$\pi^*(L, L_g) = \beta(1 - A) - (1 - a)A\beta(1 - L - L_g) \quad (10)$$

It follows that

$$\frac{\partial \pi^*}{\partial L_g} = A\beta(1 - a) > 0$$

and we have the following result:

**Proposition 3** *In regime three unproductive employment implies higher returns to*

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*private firms even when the program is financed by a tax on production.*

The reason is the following: Firms “pay” the public employees in the form of taxes and “pay” the criminals through the costs of stealing. A criminal obtains the same income as a public employee. In addition stealing represents extra costs through guarding. Hence, increasing the number of public employees leads to an equal reduction in the number of criminals that in turn raises the return to job creation. A public employment program therefore shifts the profit curve upwards and is thus good for growth.

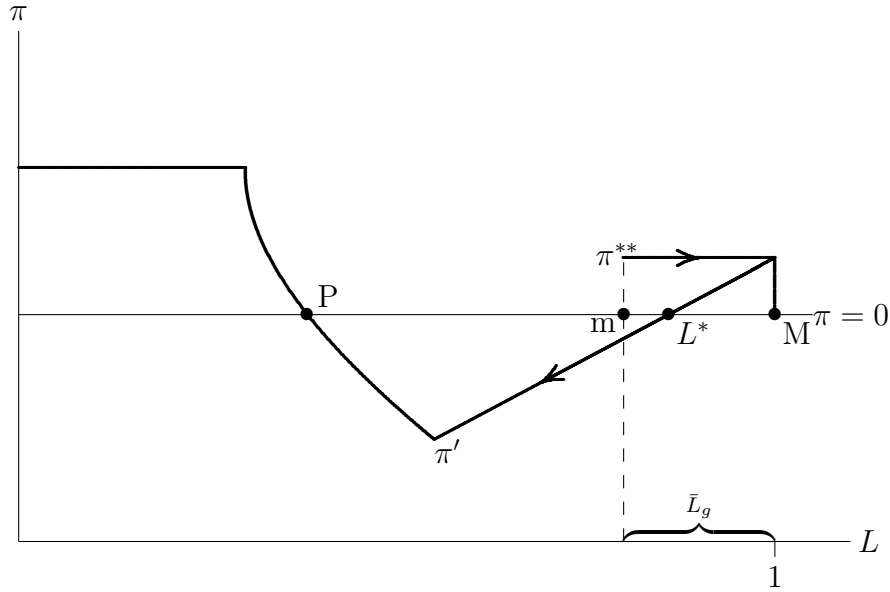
The program that maximizes the return to job creation is one where all potential criminals are in public employment. To see this let  $L_g$  adjust so that  $C$  approaches zero (from above). In that case the economy is still in regime three but now without crime. Inserting  $L = 1 - L_g$  in (10) gives us

$$\pi^*(1 - L_g, L_g) = \beta(1 - A) \equiv \pi^{**} \quad (11)$$

Hence, as long as the public works program employs all but a marginal number of the potential criminals ( $L_g = 1 - L - \varepsilon$ ), the return to job creation is constant and equal to  $\pi^{**}$ . In particular equation (11) holds in the case where the economy is close to full modernization and without an employment program ( $L = 1$  and  $L_g = 0$ ). Therefore  $\pi^{**}$  is also the maximum return to job creation in regime three.

A public employment program is a cure against crime as long as there is excess supply of labor. It hampers growth, however, if labor is in short supply. Hence, if the economy is in regime four a public employment program reduces the pool of workers that can be recruited to modern sector jobs and therefore limits the scope

Figure 4: Gradual versus big bang reform



for growth. Consider the case illustrated in Figure 4 where the economy is in a regime four equilibrium  $m$  where all workers are employed either in modern sector jobs or in a public employment program consisting of  $\bar{L}_g$  workers. If a firm fires a worker the return to job creation would instantly increase to  $\pi^{**}$  as given by (11).

The equilibrium  $m$  implies that resources are wasted compared to full modernization  $M$ , and moving the economy from  $m$  to  $M$  would make everyone better off. Moving the economy to  $M$  requires that the public sector surplus labor is reduced. With endogenous crime, such a transition to the efficient steady state may derail. The success of the reform depends on how the downscaling is implemented.

First, consider a big bang reform where all public sector surplus labor is fired at once, shifting the return of modern sector job creation from  $\pi = 0$  to the return as depicted by the curve  $\pi'$  in the figure. In the illustrated example the return to modern sector job creation drops below zero. Thus, the big bang reform brings the economy on a path with modern sector job destruction and rising crime rates and the economy will tumble downwards to the crime induced poverty trap  $P$ .

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The outcome would be different, however, if the reform program was carried out with a gradual reduction in the public sector surplus labor. In Figure 4 we illustrate a gradual reform as a reform where, at each point in time, excess supply of labor is positive but small implying that equation (11) is satisfied. During this reform process the return to modern sector job creation is equal to  $\pi^{**}$  and remains at that level until all labor is employed in modern sector jobs,  $L = 1$ . The above discussion can be summarized in the following proposition:

**Proposition 4** *A big bang reduction of public sector surplus labor may throw the economy into a crime induced poverty trap. A gradual reduction of public sector surplus labor, that prevents the crime rates from becoming excessive, avoids the poverty trap.*

The social repercussions following from an abrupt downsizing are damaging. Such a development resembles the tragic development in some eastern European countries after their reforms. Instead of improving its efficiency the economy ends up in a crime induced poverty trap. As mentioned, most countries in quadrant II of Figure 1, have gone through considerable reform of the public sector ending up with increasing crime and negative GDP growth just as our model predicts.

Another abrupt reduction in public employment is the scaling down of armies after the end of the Cold War. As military budgets began shrinking in the mid 1980s – in some cases as civil wars were brought to an end – many countries undertook considerable demobilizations. In Africa alone more than 750.000 troops were demobilized (Kingma, 2000). Demobilized personnel and low paid officers found new sources of income as violent entrepreneurs and criminals (Lock, 1998). Also in Russia there has been a drastic downsizing of military forces and security agencies.

A substantial fraction of these men found new engagement in the booming shadow economy. Some went into banditry, preying on the vulnerable private sector.

## 4 Conclusion

In 1901 Tugan-Baranowsky showed that the relationship between industrialization and crime was not monotonic but hump-shaped. What he did not emphasize, however, was that the social forces that produce the hump under some circumstances can lead to a poverty trap long before full industrialization is reached. Depending on the level of modernization, job creation may have negative or positive externalities via criminal behavior. At a low level of modernization job creation by one firm generates increasing crime that reduces the profitability of all firms. At a higher level of modernization, when labor has become more scarce, job creation by one firm reduces crime, enhancing the profitability of all firms. It is the changing sign of the externality at different stages of development that can generate a poverty trap.

The possibility of being caught in a trap has implications for economic policies and the design of reform programs. First, policies that improve law enforcement and raise the expected costs of being a criminal not only reduce crime rates but may also trigger a sustainable economic take off. Second, improving the conditions of the worst off group may have similar growth enhancing effects. Third, downsizing the public sector may generate higher crime levels. In general, a temporary fall in labor demand may kick off social reactions that lead the economy into contraction. Hence, a big bang reform intended to improve the efficiency may actually end up as a reverse big push into a poverty trap.

The model closest to ours is the recent contribution by Lloyd-Ellis and Marceau



(2003). Both models generate a hump-shaped relationship between modernization and crime. The two approaches complement each other as some of the conclusions are similar while the stories told are quite different. In Lloyd-Ellis and Marceau's paper non-convexities and asymmetric information in the credit market generate the results. Our model is more stripped down with neither non-convexities nor information asymmetries. Our results are generated solely by a social externality where job creation affects the extent of crime. The two papers focus on different policy issues. Lloyd-Ellis and Marceau study public punishment and policing while we focus on foreign aid and public employment programs.

The seminal paper by Usher(1989) also has some parallel results to ours. Usher considers the case of despotism where rulers tax farmers and hunt for bandits. Banditry is the outside option for farmers and if the utility of bandits decrease, the farmers can be taxed even harder. We have a similar effect in our model. If producers get more eager in the hunt for bandits the wage of workers drops and producers get an indirect gain. While Usher's rulers internalize such effects, our producers act uncoordinated. It is this lack of coordination that underlies many of our results. For example, a public employment program overcomes the failure to internalize the positive effect of job creation.

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