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By

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CRIME INDUCED POVERTY TRAPS

Halvor Mehlum, Karl Ove Moene, and Ragnar Torvik*

Abstract

A dynamic macroeconomic model is used to analyze the interaction between economic growth, labor demand and crime. Due to endogenous crime, the model exhibits increasing returns to aggregate capital at certain development levels. At other development levels, however, there are decreasing returns to aggregate capital. The linkages determining the outcome work via aggregate labor demand and aggregate production. Hence, the increasing (or decreasing) return is external to the individual firm. The economy has potentially two stable equilibria: a) One where crime rates are high and capital stock, labor demand, and income is low. b) One where crime rates are low and capital stock, labor demand, and income is high. Equilibrium a) has the characteristics of a poverty trap. The existence of a poverty trap has important implications for the implementation of economic reforms. We show that a big bang reform, intended to improve efficiency, may throw the economy into a vicious circle of increasing crime and stagnation.

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1 Introduction

Experience does not confirm the optimistic view that economic liberalization is sufficient to stimulate economic growth. In most, if not all, poor countries the recent trend of market liberalization is associated with persisting deprivation and hence, with social unrest and disruptive behavior. Unequal opportunities easily directs the incentives of unprivileged groups in a counterproductive direction that can be harmful for economic growth. Economic advice from outside does little to help the situation as long as the advice is derived from technocratic conceptions of efficiency where redistribution is a cost and where economic equilibrium mechanisms operate independently of social conditions.

A better understanding of possible developments in poor countries, requires a more comprehensive equilibrium framework where social conditions affect economic behavior and economic conditions affect social behavior. Economic forces cannot be separated from social issues. One example is how poverty induced crime affects economic performance and deprivation. This mutual dependence cannot easily be abstracted from.

South Africa represents a striking case. Inequality of opportunities and widespread poverty give rise to criminal activities that deter economic development and sustain high poverty levels. According to The Economist Intelligence Unit's South Africa country report for 1998: "Crime remains the biggest challenge to economic growth. Investors continue to cite crime as the biggest deterrent to doing business in South Africa."

Russia and Columbia seem trapped in escalating crime and violence spirals that seriously hamper economic progress. 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 et al. (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 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". In an article on Latin America, The Economist (1996) states: "The spiral of violence has produced a spiral of spending on private security, which often contributes to more crime, as private armies turn into paramilitary squads. All told, the 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".

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. Figure 1 illustrates the relationship between annual economic growth and changes in crime for 39 countries.¹ The figure also includes a fitted linear regression line for the relationship. There exists a distinct correlation between economic stagnation and increased crime. Countries that experience low economic growth tend to be countries where crime rates are increasing and countries where crime rates are decreasing tend to be countries that enjoy economic growth. What is more, the cluster of countries that perform particularly bad are countries that recently have been through economic reform (Russia, Lithuania, Kazakhstan, Ukraine, and Kyrgyzstan).

Logically, of course, the negative correlation does not indicate anything about causation. On the one hand, crime and violence may produce stagnation as documented by the authors referred above. On the other hand, bad economic performance may produce violence and crime. Fajnzylber et al. (1998) find that negative economic development

is one of the main causes of growth in violent crime across countries. Sociologists and criminologists have also emphasized the impact of macroeconomic conditions and labor market structures on crime, e.g. Allan and Steffensmeier (1989) and Currie (1997).

Concentrating on economic effects, the linkages above can roughly be hypothesized as follows:

- Crime and violence lower business profitability, reduce the effectiveness of the economy and therefore reduce economic growth.
- Economic stagnation implies decreased labor demand and increased poverty leading individuals into crime as a way of survival.

Each of the two mechanisms can be seriously damaging on their own. Put together they may generate a vicious circle that results in a poverty trap: Economic stagnation explains rising crime and rising crime, in turn, explains the economic stagnation. Some countries may therefore easily 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.

Even though we have found no similar approach to ours in the literature, there are several interesting connections in addition to those already mentioned. Our paper is related to Gordon (1971), who points out the two way relationship between social conditions and economic performance, to Murphy et al. (1993) who study how rent seeking behavior may crowd out legal activities, and to Glaeser et al. (1996) who provide theory and evidence for why seemingly identical cities (in the US) may have very different crime levels.

Moreover, our paper follows Bourguignon (1999) who points out that inequality and poverty may have large costs through crime and the development of illegal activities, and asks (p. 2): "...are the economies caught in some kind of vicious circle whereby violence undermines the social and economic climate, and weakens economic incentives and development factors, which in turn leads to more violence?" Finally, our paper is also related to Sala-I-Martin (1997) who provides an alternative rationale for the existence of public welfare programs and their relationship to economic growth. According to him (p. 83) "transfers and other social safety net mechanisms are a means to buy social peace, a way to reduce social unrest. They are a way to bribe poor people out of activities that are social harmful, such as crimes, revolutions, riots and other forms of social disruption."

Below we explore the linkages between growth, poverty and crime in poor countries within a highly stylized model. Our aim is two-fold. First, we want to demonstrate how a social mechanism significantly modifies well-known growth mechanisms. For that reason we have chosen the simplest possible growth model in which to embed the social mechanism. Second, we want to study how the policy implications of models that incorporate social mechanisms may be qualitatively different from those that follow from more partial models. Among other things, transfers to the worst off group is not necessarily a drag on business profitability, but may on the contrary enhance profits and economic growth. Moreover, we investigate how a reform program that implies a downsizing of the public sector should best be designed when those who are laid off may become involved socially disruptive activities.

2 The model

2.1 Workers

Workers may be employed in the formal sector, public or private, receiving a wage w , or they can work in the subsistence sector where they earn a fixed income equal to q . In addition they can become criminals with an expected return equal to p . A return to criminal activity higher than the best legal opportunity may not be sufficient to go into crime. Workers may have moral costs or perceive a chance of being caught and punished. The expected value of costs like these is denoted $m \geq 0$, implying that the net return to crime is $p - m$. In the following m is given and assumed to be equal for all. Yet none of the conclusions will change if we instead assume that m is distributed over the workforce.

2.2 Firms

Each private firm produces X using capital K and labor L . Normalizing the price level to one, profit Π equals total production minus costs. The costs consists of the wage bill, wL , minus taxes paid, where we assume that profit earners are taxed by a proportional tax, t , on the production and finally minus costs associated with guarding and stealing. Profit earners are the target of crime. Criminal activity implies two types of costs for the profit earners. First, a fraction z of the firms production will be in the form of guarding services and, second, the stealing S in itself represents a cost.

$$\Pi = X - wL - tX - zX - S \quad (1)$$

Each criminal takes a fraction α of the production. This fraction, α , is decreasing in the firms own guarding. The number of criminals approaching the firm is ϕC , where C is the criminal intensity (total number of criminals divided by the number of firms). The factor ϕ decreases with the firms own guarding, z , relative to the average guarding for all the firms, \bar{z} , but at a decreasing rate. When average guarding of other firms is \bar{z} , a firm with guarding z attracts $\Phi(z/\bar{z}) C$ criminals, each of whom steals $\alpha(z) X$. The cost associated with stealing is thus

$$\begin{aligned} zX + S &\equiv zX + \alpha(z) X \phi(z/\bar{z}) C \\ \alpha' < 0, \quad \phi' < 0, \quad \phi'' > 0 \end{aligned} \quad (2)$$

We assume that the marginal productivity of guarding is constant

$$\alpha(z) = A - az \quad 0 < a \leq A \leq \phi$$

where the parameter restrictions follows from the natural requirement $\alpha\phi \in \langle 0, 1 \rangle$ for all possible levels of guarding, $z \in \langle 0, 1 \rangle$. Each firm chooses the extent of guarding to minimize the cost of crime. Combining the first order condition and the fact that in equilibrium all firms choose the same extent of guarding, yields

$$z = \frac{-A\phi'C}{1 - aC(\phi + \phi')} \quad (3)$$

which is increasing in the criminal intensity C . To make the model as simple as possible, we assume in the following that the elasticity $\phi'/\phi = -1$ in the equilibrium $z = \bar{z}$. Then

the optimal level of guarding simplifies to $A\phi C$. In equilibrium all firms will get the same share of the criminals $\phi(1)$. Without loss of generality we set $\phi(1) = 1$. Thus, the optimal choice for each firm is

$$z = AC \quad (4)$$

$$\alpha = A(1 - aC) \quad (5)$$

The amount of stealing given efficient guarding is αCX which can be expressed as

$$S = A(1 - aC)CX \quad (6)$$

The return from being a criminal is S/C , or simply

$$p = A(1 - aC)X \quad (7)$$

2.3 Aggregates

Given an unit mass of firms, X , L , K , C , and S will all correspond to their aggregate values. In equilibrium the total use of labor equals total supply, normalized to unity. Labor is either employed in the private sector L , the subsistence sector, F , they are criminals, C or employed in the public sector. Measured as a fraction of private employment, public employment is denoted g . Hence,

$$1 = L(1 + g) + F + C \quad (8)$$

The wage and the level of crime are determined in the labor market. Equilibrium in the labor market requires that the return in all sectors currently employing workers must be equal. Hence, in an equilibrium state where there is crime, the formal wage will be equal to the expected return for a criminal. If the formal wage exceeds the return to crime, however, there will be no crime. Hence

$$\begin{aligned} w = p - m &= A(1 - aC)X - m && \text{when } C > 0 \\ w > p - m &= AX - m && \text{when } C = 0 \end{aligned}$$

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

$$\begin{aligned} w = q &\text{ when } F > 0 \\ w > q &\text{ when } F = 0 \end{aligned}$$

Given that there is a positive relationship between formal sector production and employment, the conditions above imply that the allocation of workers between legal and illegal activities depends on the level of aggregate production. Four regimes emerge (See Table 1): In the first regime the production is so low that stealing is not attractive even if guarding is zero. Crime will be zero and the equilibrium wage is determined by the wage in the subsistence sector, since formal labor demand is not sufficient to employ the

Table 1: The labor market regimes

Regime	labor market condition	wage condition
1: Subsistence	$C = 0, F > 0$	$w = q > AX - m$
2: Low income	$C > 0, F > 0$	$w = q = A(1 - aC)X - m$
3: Medium income	$C > 0, F = 0$	$w = A(1 - aC)X - m > q$
4: High income	$C = F = 0$	$w > AX - m > q$

whole labor force. When production increases crime will at one point start to pay off. That's where the second regime starts ($X = (q + m)/A$). In this regime the distribution of workers between the subsistence sector and crime will be such that the net return to crime remains equal to q . This continues until no more workers are working in the subsistence sector. That is where the third regime starts. In this regime production is so high that the only attractive alternatives are crime and formal sector employment. In the fourth regime all available labor is employed in the private sector and the wage must be bid up above the expected return of being a criminal. Thus, the poorest and richest countries have no crime, while the low and medium income countries have positive levels of crime.

The government revenue is used to finance public employment, which is assumed not to undertake any production. With a balanced budget and the same wage in the public and the private sector we have

$$tX = wgL \quad (9)$$

In order to close the static part of the model we must specify the production function in the private formal sector. To clarify the new effects in our model, we choose the simplest possible case of a Leontief production function. Given appropriate choice of units

$$X = L = K \quad (10)$$

The allocation of labor in the four different regimes are shown in Figure 2. Formal sector employment grows one to one with the capital stock. When the level of capital (i.e. production) is low, crime is zero and increased formal sector employment is drawn from the subsistence sector. When regime two starts, the subsistence sector releases labor both to the formal sector and the crime sector as production increases. In regime three the subsistence sector have no more workers to offer, and increased formal employment push the number of criminals down. In regime four there is no crime. All available labor is employed either in the formal private sector ($1 - g/(1 + g)$) or in the public sector ($g/(1 + g)$). As seen there is an inverted U-shape between economic development and crime. The downward sloping part in regime 3 fits well to the downward sloping relationship between economic growth and changes in crime displayed in Figure 1.

We assume that the required return to capital at the world market is given by r^* , and that the investment function takes the form.

$$\dot{K} = h(r - r^*), \quad h' > 0$$

where r is the marginal return to capital. The speed of adjustment may depend on

implementation costs or other frictions, but is for simplicity taken as exogenous here, as it will not affect any qualitative results nor the steady state equilibria.²

With constant return to scale production, the marginal return to capital is given by the average return to capital for each individual firm

$$r = \frac{\Pi}{K} = \frac{X - wL - tX - zX - S}{K} \quad (11)$$

Inserting from (10), (6), (4), and (9) in (11) the return to capital can be expressed as the following simple function of the level of crime and the wage level:

$$r = 1 - (1 + g)w - (2 - aC)AC \quad (12)$$

The return to capital is reduced when either the wage or the level of government employment increases. The value of r also declines as the number of criminals increases $\partial r / \partial C = -2A(1 - aC) < 0$. The relationship between r and C is affected not only by stealing in itself but also by the increased guarding as a result of the increased stealing. The labor market regimes determine the wage level and the level of crime in equilibrium. By combining (12) with Table 1 the return to capital in equilibrium is given in Table 2.

Table 2: The return to capital

Regime	r
1: Subsistence	$r_1 = 1 - (1 + g)q$
2: Low income	$r_2 = 1 - (1 + g)q - A/a + (q + m)^2 / (aAK^2)$
3: Medium income	$r_3 = 1 - 2A + aA + (1 + g)(m + (1 - a)AK)$
4: High income	$r_4 = r^*$

The regimes are illustrated by the bold curve in Figure 3. In the first regime the return to capital is constant as workers are recruited from the subsistence sector at fixed wage. In the second regime crime pays and increased production in one firm will increase the number of criminals and imply a negative externality for all firms. Thus the return to capital declines in the aggregate capital stock. In the third regime the subsistence sector is no longer employing workers and therefore increased production reduces the number of criminals. This effect represents a positive externality for the other firms and the return to capital will increase in the aggregate capital stock. In the fourth regime the wage is bid up until the return on capital reaches r^* , as no more workers are available.

Note that the reason for the increasing marginal return in the third regime is different from other recent theories. In growth theory, economic geography, and the “Big push” literature increasing returns play an important role.³ In these theories positive externalities at the micro level produce an aggregate production function with increasing returns to scale. In our model, unlike these theories, we have an aggregate production function with constant returns to scale. The return to capital increases with the aggregate capital stock purely as a result of the endogenously modelled criminal behavior. With crime taken into account, increased labor demand generates a positive externality. Increased formal employment reduces the number of criminals, but each firm is too small to take this into account. It is the mechanism following from this positive externality, as the capital stock grows, that makes the marginal return to capital an increasing function of the aggregate capital stock. Thus, socioeconomic interactions rather than properties of

the aggregate production function generates the result.

We are now ready to characterize the long run equilibria in the model. There are three equilibria: A, B, and K^* . A and B are stable equilibria while K^* is unstable. If the economy starts out with a level of capital below K^* it will end up at the low income equilibrium B. If it starts out above K^* it will end up at the high income equilibrium A. Hence, K^* is the threshold level of capital that determines whether the economy ends up in the poverty trap B or enters into a growth process ending up with high income and no crime in A.

2.4 Policies

Changes in the level of moral costs, m , and the subsistence wage, q , affect the return to capital and the possibility of a poverty trap. Let us first consider an increase in m , which may not only capture the case of an improved morale among potential criminals. A higher level of m may also capture the case of more efficient law enforcement and harsher punishment. A positive shift in m is illustrated by the dashed curve in Figure 3, where the shifts follows from Table 2. Increasing m has no effect in regimes one and four, as no one choose to be criminals in these regimes anyway. But a higher m pushes the low level equilibrium to the right as a higher level of capital and production is required before people turn into criminal activity, extending regime one to the right in the figure. At all levels of the capital stock there are fewer criminals when m is higher, the curve for the marginal return to capital therefore shifts up in regimes two and three, shifting the bottom of the U up. For a sufficiently high moral cost the poverty trap disappears. When the value of m goes to infinity, no one will chose to become a criminal under any circumstance. In that case only regimes one and four are relevant and we are back to the simplest possible version of a neoclassical growth model: The wage will be determined by the subsistence sector and the marginal return to capital will be constant until all workers are employed in the formal sector. At that point the wage will be bid up to equalize the domestic and world market return on capital.

Generally, the moral cost m will not be equal across individuals. Some individuals are less restrained towards crime than others and will have a lower m . Those with the lowest m will be the first to enter into crime and m will increase with the number of criminals, $\partial m / \partial C > 0$. Taking account of this heterogeneity effect will reduce the steepness of the r -curve in regimes two and three, lifting the bottom of the U, but not altering the qualitative features. Another possible endogenization of m follows by incorporating mechanisms of social interaction as discussed for example in Glaeser et al. (1996 p.508). “When one agent’s decision to become a criminal positively affects his neighbors decision[...]” then m will be a decreasing function of C . This interaction effect will work in the opposite direction of the heterogeneity effect and will lower the bottom of the U. Finally, there may be hysteresis effects whereby the moral cost is an decreasing function of the historic crime levels. In that case the r -curve will shift down given a history of high crime. In the following we will stick to the assumption about a stable r -curve.

A rise in the subsistence wage, q , improves the outside option for the labor, increasing w in regime one and two. In regimes three and four, however, a rise in q has no effect as employment in the subsistence sector is not a relevant option. The shifts following from an increase in q is illustrated by the dotted curve in Figure 3. In regime one the effect of the increased wage is a reduction in the return to capital, hence the downward shift. In regime two increasing q not only increase the wage for the formal workers but

also improves the alternative wage for the criminals, reducing crime and increasing the return to capital. The simultaneous increase in wage and capital return is possible due to the reduction both in guarding and stealing. Algebraically the effect is easily seen by differentiating r_2 in Table 2 and combining with the regime two labor market condition from Table 1.

$$\frac{\partial r_2}{\partial g} = \frac{(1-g)aK + 2(1+aF-a)}{Ka} > 0$$

It follows that increasing the subsistence wage will lift the bottom of the U and possibly remove the poverty trap. This illustrates an important feature of the model, namely that the lack of attractive and legal opportunities for the workers may generate a serious cost for the firms. Better opportunities for the poor can be beneficial for private business even though it also represents an increased wage bill. This is the main issue of the next section where the government sectors role as an employer of last resort is studied in the context of transition.

3 Economic reform and transition

As seen from the return to capital function, the consequences of policy changes (changes in g) are different in the various regimes. The dashed curve r' in Figure 4 illustrates a shift in the return to capital as a result of setting public employment to zero ($g = 0$). In the two first regimes a reduction in public employment gives an equal increase in the number of subsistence workers. Taxes are reduced, crime is constant, and hence the return to capital will increase. In the third regime, however, lowering public employment will have a double effect. On the one hand the reduced tax contributes to increased return to capital. On the other hand the number of criminals will increase, increasing the costs associated with crime. It must be the case that this latter effect dominates, giving reduced return to capital. Hence, the derivative of r with respect to g is positive

$$\frac{\partial r_3}{\partial g} = m + (1-a)AK > 0$$

The intuition is as follows: For any given level of the capital stock in regime three, the sum of criminals and public employees is constant (equal to $1 - K$). The capital owners “pay” the public employees in the form of taxes and “pay” the criminals through the costs of stealing. A criminal earns at least the same income as a public employee. In addition stealing represents extra costs through guarding. Hence, for any level of the capital stock, the more criminals and the less public employees, the lower is the return to capital. Decreased public employment therefore, in regime three, shifts the marginal return to capital down. The return to capital in the fourth regime is by definition equal to r^* and is therefore not affected by changes in public employment. But note that the maximum production moves to the right as g is lowered.

Assume now that we start out in the no crime steady state with $g > 0$, A. Here, there is no crime and thus no costs of crime. But the economy is inefficient, with a large public sector producing nothing. The no crime equilibrium given $g = 0$, A' (where $X = L = K = 1$), is efficient and superior to A. On the basis of this, a reform that moves the economy from A to A' would make everyone better off. However, with endogenous crime the transition to the efficient steady state is not straight forward and may derail. The success of the reform will depend on how it is implemented.

First, consider a big bang reform where public employment is set equal to zero over night. As seen, this will shift the return to capital down as depicted by the curve r' in Figure 4. This may or may not bring r below the critical level r^* . In the present example the downward shift in the marginal return to capital is sufficient to bring r below r^* at the level of the given capital stock, A . The cost of crime has thus increased to an extent that brings the economy on to a negative growth path increasing the number of criminals. Instead of ending up in A' the economy will end up in the poverty trap equilibrium.

Assume now that the reform program is carried out more gradually, say in two stages from r via r'' to r' . The first stage is illustrated by the dotted curve in Figure 4 (where we have only drawn the curve in regimes three and four). In this case the downward shift in the return to capital curve is sufficiently small, and r will be above r^* in this first stage of reform. The capital stock therefore increases over time, until an intermediate steady state equilibrium is reached. At this point the second and final stage can be implemented, shifting the return to capital from r'' to r' . Capital will again start to grow. This growth process will take the economy to A' . In this way a reform program consisting of several stages will guarantee a favorable outcome while a big bang reform will throw the economy into a crime induced poverty trap.

A large unproductive public sector in the first place is the cause of a low capital stock, and is the rationale for policy reform. In standard models downsizing an inefficient public sector will push the rate of return up, giving the necessary price signal to reach the efficient steady state. In the present model the low capital stock in itself represents a problem for the transition process. Too many laid off workers coupled with a too low labor demand can throw people into social disruptive activities that eventually lock the economy into a poverty trap.

4 Conclusion

A dynamic macroeconomic model has been used to analyze the interaction between economic growth, labor demand and crime. Apart from endogenously modelled criminal behavior the model is the simplest possible version of a conventional neoclassical growth model. But the inclusion of a social mechanism alters the standard model properties dramatically.

The derived relationship between crime and economic development is not monotonic, but takes an inverted U-shape. Increasing returns to the aggregate capital stock results from endogenous criminal behavior. Increasing returns can generate accelerating growth. If the initial condition is characterized by high poverty and low formal labor demand, however, prolonged stagnation may be the result. This possibility of divergent development paths have implications for economic policies and the design of reform programs. On the one hand, policies that improve law enforcement and raise the expected costs of being criminal, not only reduce crime rates but may also trigger a sustainable economic take off. Transfers to the worst off group may have similar growth inducing effects. On the other hand, policies, like a big bang restructuring of the public sector, may create conditions for higher crime levels. In general, a falling labor demand, that otherwise would have been temporary, may kick off social reactions that block the return to full formal sector employment. The interplay between a rising crime rate and declining capital stock may lock the economy into a poverty trap. Hence, a “big bang” reform intended to improve on the efficiency of the good equilibrium may actually end up as a reverse “big push” from the good equilibrium and into a poverty trap.

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Notes

¹The 39 countries selected are all the countries that had sufficient information of the crime development over the specified time span.

²Note that in a model with multiple equilibria, as the present one, the reduced form investment function above may be in conflict with rational expectations. It might not be rational to invest even when the marginal return to capital exceeds the required return if the economy ends up in an equilibrium where r falls short of r^* . As will be seen, this problem does not arise in the present model since the economy will never end up in an equilibrium where the marginal return to capital is first above and then below r^* , or the opposite (given the usual assumption that private agents can not predict the extent and timing of eventual future policy reforms).

³See the special issue of the Journal of Development Economics (Bardhan ed. 1996), for many contributions.

Figure 1: Crime growth versus economic growth

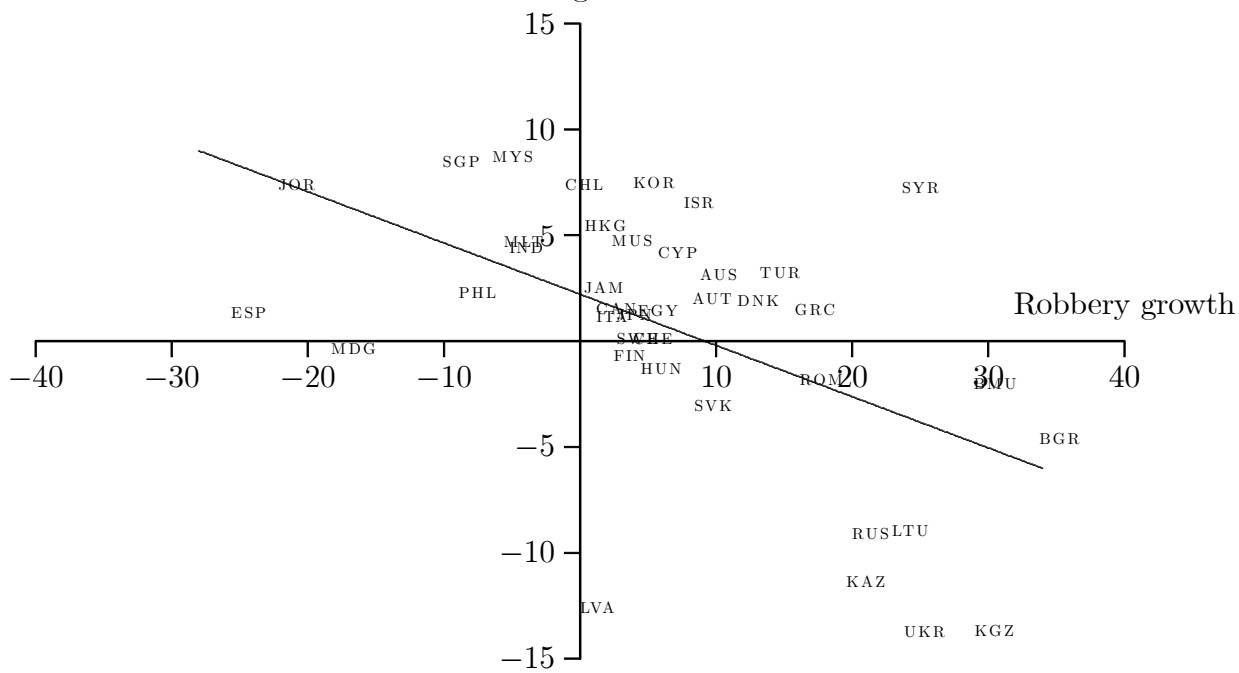


Figure 2: Labor market regimes

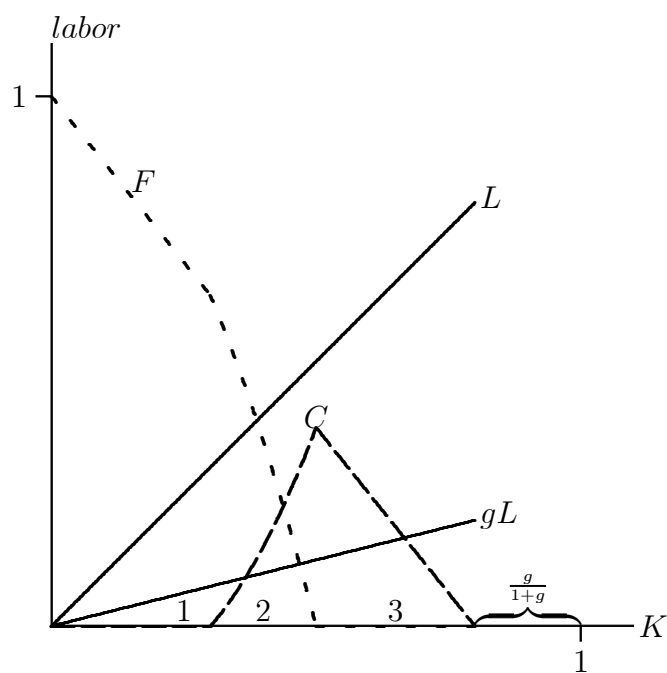


Figure 3: The marginal return to capital as a function of the aggregate capital stock

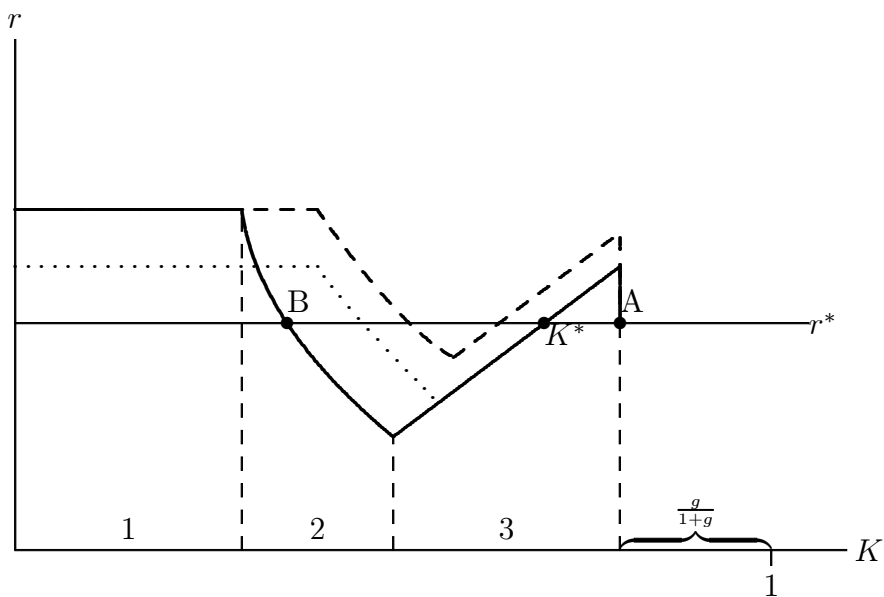


Figure 4: The marginal return to capital as a function of the aggregate capital stock

