Chapter 6

Institutions and capital accumulation

6.1 Institutions and private ordering

WHY would people accept bad institutions despite the wealth of theoretical and empirical evidence that good institutions are necessary for economic development? This chapter proposes an answer to this question by creating a model which relates the quality of institutions to the effort devoted to it. Very much like the Romer-model in section (3.3), which relates growth in technology to investments in research. A similar feedback loop also seems plausible for institutions: On one hand, production thrives on the quality of institutions; on the other hand, institutions themselves are the result of resources devoted to their creation and maintenance.[1] There may be situations where it does not pay for individuals to demand good institutions. It is especially difficult for people to put their money where there mouth is when they are too poor to begin with. Hence, institutions remain bad and output low; and poor countries will fail to accumulate enough resources to improve institutions. Such a situation can be characterised as a poverty or development trap.

The expensive part of institutions is their enforcement. The process of

[1] There is an important difference between institutions and technology with regard to the distribution of efforts. New ideas, the source of technological progress, are expensive to create but rather cheap to maintain because it sometimes suffices to write them down in a book. Institutions are easy to create but need a lot of effort to be put into practice—ie, maintenance and enforcement are more expensive.

designing of good rules is probably cheaper and may be copied from existing blueprints.[2] Enforcing these rules, though, requires the deployment of significant resources in order to monitor transactions, punish perpetrators, and pay civil servants sufficient wages to make them less susceptible to corruption, et cetera.

If enforcement is identified as one of the keys to good institutions, then it is important to know why and when economic agents comply with rules, and why and when they do not. To keep things simple, one may distinguish two basic forces, which contribute to the enforcement of rules:[3]

- An exogenous force which may be traced back to cultural roots; shared values, norms, and beliefs; or traditions. It is expressed by the first layer in table (4.1). This exogenous force is here termed 'social capital', which does not in any way imply its constancy.

- An endogenous force which is the effort people put into the enforcement of rules. It depends on the resources available, the "productivity" of resources devoted to enforcement, and the alternatives available to economic agents. This endogenous force is termed here 'private ordering'.

The term social capital is used here in a narrow sense. It is a parameter that allows two otherwise identical societies spending exactly the same amount on private ordering (the endogenous force) to experience a different quality of institutions because of differences in the social capital endowment. This is not to say that social capital is constant over time, but only that the determinants of change are not explicitly taken into account in this model. The reason for this approach is, that these determinants are often unrelated to economic considerations. Max Weber (1920) famously emphasised the importance of protestant ethics with the glory of hard work, thrift and honesty as an explanation of economic success. However, it seems hard to imagine any catholic changing his or her beliefs for the sake of higher incomes.

[2]Turkey, for instance, adopted the Swiss Civil Code in 1926.

[3]Gérard Roland suggests a distinction between fast-moving and slow-moving institutions, where the former refers to short-term legal changes and the latter addresses social norms and culture. Institutional change is seen in the interaction between slow-moving and fast-moving institutions. Different cultural paths may require different fast-moving institutions, hence, "best practices" and institutional transplantation may deliver disappointing results if the stock of slow-moving institutions is ignored (Roland, 2004, pp 16-23).

To avoid confusion it should be noted that the term 'social capital' is defined in various ways in the literature (see Durlauf and Fafchamps, 2004, for a survey). Moreover, it is related to various other concepts, such as *goodwill* in management and business literature, and *credibility* with regard to monetary policy making in particular (Paldam and Svendsen, 2000, p 343). Some define social capital as the density of trust within a group, which determines how easily people work together. It can relate to production as a production factor, similar to physical and human capital, or as a transaction costs factor (Paldam and Svendsen, 2000, p 342-347). Robert Putnam (1993) suggests that the density of voluntary organisations in a society could be used as a proxy for social capital because people who meet and interact, for instance in sporting clubs, build social relations and trust which may be transferred to business transactions as well.[4] However, he observes a process of social capital building which lasts centuries, and which is only vaguely related to economic considerations. In this sense, it may be justified to regard social capital as an exogenous variable—as it is in this model. It may change, and it may (and is expected to) differ from country to country, but the roots of changes are exogenous to this model.

However, social capital as an exogenous force is only one layer in the quality of institutions matrix. From a practical point of view, it would be more interesting to see which activities deliberately improve institutions and which may be targeted with policy instruments. These activities are captured by private ordering, the endogenous force of rules enforcement.

It seems reasonable to relate the degree of rule enforcement to some extent to the effort devoted to it; just as the rate of new ideas is related to efforts to R&D. Institutions are often regarded as a public good because in an ideal world the rules apply to every member of society. In fact, rules only make sense if a critical mass of people comply. In this sense, institutions are not only non-rival, but have a network effect: like a fax-machine or email, they become more valuable when more people use them.[5]

[4]The obvious downside of this proxy is that it ignores the negative effect clubs may have on corruption and insider trading. If deals are struck during golf rather than in the form of a regular tender, private relations may trump economic efficiency. However, the empirical importance of this caveat may be small given that most people who join voluntary organisations are not even in the position to authorize substantial deals.

[5]There may be congestion effects at some point—spam emails, for instance, spoil the fun of electronic messages. A too rigid and relentless enforcement of rules may prove counterproductive because rules are usually less complex than the social reality they are supposed to structure. There may be unforseen circumstances where certain rules are misleading, and where people may achieve superior results if they have the flexibility and

Private ordering is assumed to thrive on the resources devoted to it. However, if good institutions were a pure public good then the usual free-rider problem would apply, because few people would spend on something they could enjoy for free, when it is provided by the spending of others. The provision of private ordering will be below its optimal level, probably zero. In such a case, people would delegate the task of rule enforcement and the collection of necessary resources to an agent (such as the state) who could organise collective action, although the usual caveats of agency costs and consistency of preference aggregation would apply.

Regarding institutions as a pure public good does not seems entirely convincing because many rule enforcement related activities are located with the individual. People lock their doors to protect their property at home; they hire expensive lawyers to increase their chances of winning a legal dispute; they pay for extensive financial research to pick successful investment opportunities, et cetera. These private actions have a positive impact on the institutional quality. If some people improve their home security, the average chances of a successful burglary are reduced for all houses in the community.[6] This adds to the deterrence of would-be burglars and contributes to the protection of property rights in the community. By the same token, spending for a qualified lawyer should ideally increase the accuracy of the verdict. This improves the settling of future disputes, since legal decisions are an important signal, in particular to those not taken to court. Consider the following example. Many banks in Germany have unlawfully charged fees for withdrawals by private customers. Suing a bank as a small private customer is costly and risky, which deterred most in the first place. Nevertheless, some tried—with the backing of an association for consumer protection—and received a favourable verdict. Since then, all banks did away with the fees, because the decision serves as a precedent. Hence individual actions of private ordering did have a positive externality on enforcement, because the actual behaviour of important actors was realigned with the rule of law.

Individuals are not passive with regard to the quality of institutions. On the contrary, they may compensate a lack of institutional quality by stepping up private ordering; or they may reduce private ordering once institutions are very good. For instance, there is no need to lock doors, if would-be

leeway to interpret rules differently. However, such congestion or over-enforcement effects are neglected here.

[6] At least as long as would-be thieves are unable to distinguish between the better and worse protected homes. As it is easy to fake protection at low costs (think of a phoney alarm), this should not be very restrictive.

burglars are deterred anyway. However, the relation between institutional quality and individual private ordering is not necessarily unidirectional: Bad institutions might also discourage individuals from spending anything substantial on private ordering. Think of a community where burglaries are so frequent and respect for private property is so low that even a better door or new alarm would not make much of a difference. The individuals might rather join in to the shady behaviour of the community or, if possible, leave it.

Definition 2. *Private ordering: Private ordering includes all active efforts by capital-owners to enforce the rules of the game without resorting to illegal means. Individuals may delegate these efforts to agents, such as an investment fund or a government, to coordinate collective action. Private ordering does also include efforts to change rules where appropriate, but it does not include passive adjustments, such as reallocations of resources as reaction to bad institutions.*

Private ordering includes all activities by individuals to secure their transactions and to protect their property. In a broad sense, it also includes efforts to scrutinize the government, and, if it proves to be corrupt or incompetent, efforts to replace it. Private ordering may be delegated to an agent, such as an investment fund which manages part of an individual's wealth. Then the fund is obliged with tasks of selecting profitable assets, monitoring the assets already in the portfolio, and taking measures to improve their performance. Institutional investors are often among the most active shareholders and exert substantial pressure on managers to perform well. Of course, investment funds want to be compensated for these efforts, for instance in the form of fees which they charge from customers. The usual agency problem applies.

In this sense, the state may also be regarded as an agent to which rule enforcement, and other activities which shape institutional quality, are delegated. An investment fund charges an administration fee for its services, while the state levies taxes to finance its activities. In a competitive environment, the market will sort out those funds which charge excessive fees, while the electorate votes on the desired tax rate, and thus, the corresponding level of institutional quality. Besides social capital, institutional quality depends on the amount of private ordering, either through agents (state, investment fund, etc) or through individual activities (locking the door, et cetera).

6.2 Baseline model

This section develops a baseline model which illustrates the interaction between institutional quality and capital accumulation. The benchmark is a Cobb-Douglas production function à la

$$Y = K^{\alpha}(AL)^{1-\alpha}, \tag{6.1}$$

where output, Y, is produced by combining inputs capital, K, and labour, L, at a constant level of technology, A, which for simplicity, is assumed to be equal across countries ($A = 1$).[7] Moreover, in line with standard assumptions, the elasticity of capital inputs, α, is restricted to values between zero and one. The benchmark (6.1) only applies with perfect institutions and zero transaction costs, which is a common simplification in neoclassical economics. This assumption will be dropped in the following because the impact of institutions on output is of particular interest. Therefore, this section includes a variable Q which represents the quality of institutions.

Definition 3. *Q: The variable Q is defined as the quality of rules and the degree of enforcement within a society—ie, the quality of institutions. It indicates the fraction of potential output, as given by the benchmark function (6.1), which is actually and orderly produced in the economy. The fraction* $1 - Q$ *is lost because of misallocations as a result of less than perfect institutions. Q is defined to depend on social capital, used here as an exogenous variable, as well as on the resources devoted to the design and enforcement of rules in relation to market size.*

Definition (3) implies that Q is limited to values between zero and one, where $Q = 1$ would indicate perfect institutions. Production thrives on strong institutions because property is respected and transactions are cheaper. Less than perfect institutions ($Q < 1$), thus, reduce output below its potential. A company, for instance, may suffer from bad institutions because the bureaucracy behaves erratically, claims are unenforceable, and workers keep stealing from the factory. Knowing this, many firms will be reluctant to produce in a position where they may fall prey to such activities, and rather will operate in a way (if at all) which reduces the exposure to bad institutions. For instance, they could reduce the specificity of production for that would allow more flexibility and hence reduce the threat of

[7] On page 168, the appendix includes a list of variables and parameters used in this chapter.

expropriation by business partners (the holdup-problem) or the government. The downside of this approach is that a less specific production may be less efficient, thus, with the same amount of input factors less output would be generated. This loss of output is captured by a lower Q, too.

Bad institutions, however, may also be exploited, because they allow firms to evade taxes, reduce work security, or disregard environmental standards. Although, these activities appear less than salubrious, they seem to be a fact of the business world where institutions are poor in quality. It is unlikely that an economy might actually produce more than its potential by using these shady or illicit activities, but a fraction, θ, of what is lost through less than perfect institutions relative to the benchmark should be recuperated by shady activities.[8]

Definition 4. *θ: The parameter θ is defined as the fraction of output loss which is recuperated by shady activities. This parameter is exogenously given, and expresses country-specific features which determine the extend to which shady activities are profitable.*[9]

Actual output thus depends on institutional quality which determines the extent to which potential output may be translated into actual production, plus the fraction θ of output loss which is generated by shady activities.[10]

[8] Besides theoretical plausibility, it is attractive to include a parameter like θ because it ensures that production does not drop to zero once institutions become very bad. As detailed later on, there may be a low-income steady-state where capital endowment per worker is very low but not zero. This does not only fit with empirical observations, but also delivers unique policy options.

[9] The parameter θ could for instance depend on the production structure or resource endowment in an economy. Some production may be more apt at exploiting bad institutions than other, and thus recuperates a higher fraction of the output loss. Consider for example the case of financial institutions in offshore locations such as the Cayman Islands and elsewhere. Apparently, they are quite effective in turning the disadvantage of weak institutions into an advantage. In this sense, θ should not be seen as a constant because the production structure should respond to these incentives and evolve in a way that increases θ. However, this endogenous adjustment of θ is not considered in this model.

[10] A similar production function is considered by Jones (2002, p 147),

$$Y = IK^{\alpha}(hL)^{1-\alpha},$$

where I stands for social infrastructure, and h denotes human capital, which determines the speed of technology diffusion. Since social infrastructure and quality of institutions are highly overlapping concepts, I could be replaced by Q without dramatic changes in meaning. With h normalised to unity this production function equals the first "production" term of equation (6.2).

$$Y = \underbrace{Q\ K^{\alpha}L^{1-\alpha}}_{\text{orderly production}} + \underbrace{\theta(1-Q)\ K^{\alpha}L^{1-\alpha}}_{\text{shady activities}} \tag{6.2}$$

$$Y = (\theta + Q - \theta\ Q)K^{\alpha}L^{1-\alpha} \tag{6.3}$$

In per worker terms:

$$y = (\theta + Q - \theta\ Q)k^{\alpha} \tag{6.4}$$

The output of shady activities is calculated by multiplying the difference between orderly production and potential output with parameter θ ($0 \leq \theta \leq 1$). It thus indicates the destructiveness of bad institutions in terms of economic output.

Proposition 1. *The benchmark case (6.1) applies whenever institutions are perfect, $Q = 1$, or bad institutions are not destructive, $\theta = 1$.*

Proposition (1) can be easily shown with equation (6.3): the term $\theta + Q - \theta\ Q$ equals one if either Q or θ becomes one. In such a case, equation (6.3) equals the benchmark (6.1). Both cases, though, seem somewhat extreme and implausible. In most countries, institutions are less than perfect, and the destructive consequences are easily observed. A value for θ substantially below one seems more realistic.

The economy shall be populated by n capital-owners, where n is a high number. For simplicity, assume that capital-owners share identical characteristics, in particular, that each is endowed with an equal amount of capital. Moreover, each capital endowment should be small, so that each capital-owner would be too feeble to affect the domestic rate of return with their investment decisions. Later sections will introduce heterogenous capital-owners.

Individual capital-owners are assumed to spend a fraction of their capital in order to protect their property and enforce transactions. This amount represents the resources devoted towards private ordering. For instance, if individual i, $i \in \{1, ..., n\}$, owns capital worth \$100 (relative to labour supply) and with a rate of private ordering of 5 percent then they would spend \$5 for private ordering. Such an expense becomes obvious if it is paid in form of a tax or as an administration fee to an investment fund. But they also include the \$-equivalent of other actions, such as working through the pages of the *Wall Street Journal*. The more people spend on private ordering, the better institutions will be.

For simplicity, assume that individuals in a society agree collectively on a rate of private ordering, which is binding for all. Such a collective action could be organised by the government: Individuals vote for the desired rate of private ordering, and the state collects these amounts through taxes (a similar approach is found in Gradstein, 2004). In this case, the quality of institutions is equal to all individuals in the economy, since they devote the same amount of resources and share otherwise identical characteristics. These assumptions will be relaxed in later sections.

Following definition (3), Q depends on the level of social capital (indicated by parameter Ω), and on the amount of private ordering relative to market size. Labour supply is a widely applied proxy for market size, therefore private ordering may be calculated as the product of capital endowment per worker, k, and the rate of private ordering, po. Q is a function of Ω and $po \cdot k$:

$$Q = Q(\Omega, \underbrace{po \cdot k}_{\text{private ordering}}) \tag{6.5}$$

In the baseline model, individuals agree collectively on a joint rate of private ordering, po. Adjusting po is one way to change the quality of institutions. Changes in the capital endowment per worker are a second way to affect the provision of private ordering because they determine the resources available (relative to labour supply) for private ordering. If new investments boost k and if po is kept constant, then private ordering, $po \cdot k$, increases, and so does the quality of institutions. To put it another way, a rich country with a high capital endowment per worker could achieve a similar institutional quality with a much lower rate of private ordering than a poor country with a low k: Individuals may spend the same amount of private ordering in absolute terms, but since they are richer, it will be a lower fraction of their capital endowment. Hence, individuals may affect the quality of institutions by changing the rate of private ordering as well as by investment decisions, which have the potential to change the capital endowment per worker in the economy. Changes in social capital, Ω, would also affect institutions, but this parameter is taken as exogenously given for the time being.

Any explicit functional form of Q should satisfy a number of conditions. First, as implied by definition (3), it should give values for Q between zero and one:

$$\lim_{po\ k\to\infty} Q = 1$$

$$\lim_{po\ k\to 0} Q = 0$$

Second, standard Inanda-conditions should apply, in the form of $\frac{\partial Q}{\partial po} > 0$, $\frac{\partial Q}{\partial k} > 0$, $\frac{\partial^2 Q}{\partial po^2} < 0$, and $\frac{\partial^2 Q}{\partial k^2} < 0$, because it seems plausible that efforts to improve the design and enforcement of rules have a positive but diminishing effect on the quality of institutions. Some basic and cheaply enforced rules may boost institutions initially, but driving institutions to perfection (or close to) may require enormous amounts of private ordering. Hence, diminishing returns.

Third, private ordering and social capital should be imperfect substitutes. Q should be zero if one of them would be zero, and it should be possible to partly compensate a lack of social capital with private ordering, and vice versa.

Equation (6.6) proposes a possible explicit form of Q. Figure (6.1) illustrates how (6.6) increases in po and k and converges to 1.

$$Q = 1 - \frac{1}{\Omega\ po\ k + 1} \tag{6.6}$$

Equation (6.6) satisfies the three conditions (see appendix for proof). However, it should be noted that (6.6) is only one among many possible functional forms that does so. The appendix introduces a different functional form and shows that the qualitative results are not sensitive to a different specification of Q. (6.6) is chosen for computational ease.

The capital density has a twofold effect on marginal returns to capital. On one hand, marginal returns decrease in k because of the usual property of diminishing returns to capital in a Cobb-Douglas production function. On the other hand, the quality of institutions ceteris paribus increases in k because a higher k raises the provision of private ordering. The net effect depends on the level of k as well as on the values of parameters. It is quite possible that marginal returns take a convex-concave form in relation to k—ie, that there may be diminishing and increasing returns to capital depending on the level of k.

Domestic returns, r, are defined as the marginal return to capital minus the rate of private ordering. It is important to deduct this rate from

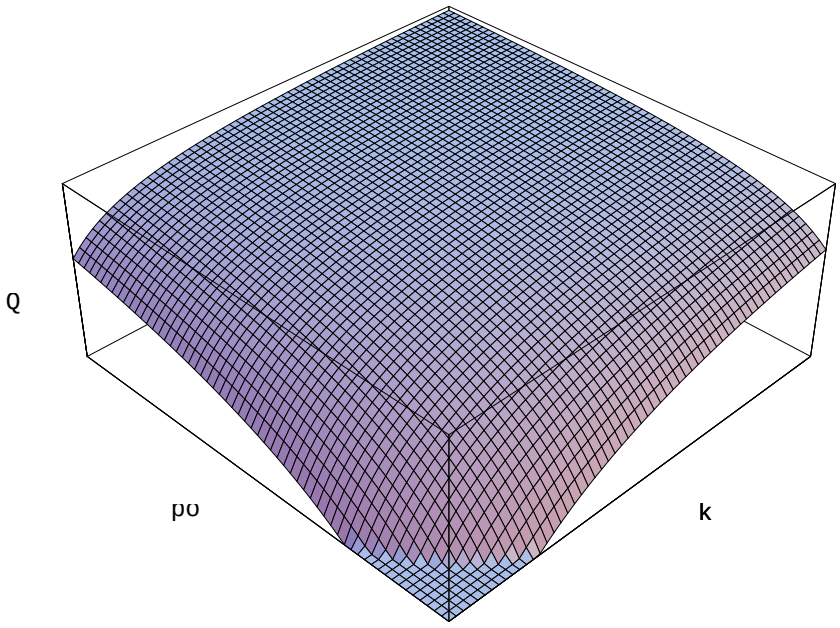

Figure 6.1: Q

marginal returns because all individuals have to pay this fraction po to private ordering for each unit of capital they have invested in the economy—ie, the stock of capital investments. Moreover, this amount has to be paid each period; think of a tax levied to finance law enforcement. Therefore, individuals have to balance the benefits and costs when choosing the desired rate of private ordering. To simplify the calculation of the marginal return to capital, $\frac{\partial y}{\partial k}$, it is assumed that $\frac{\partial Q}{\partial k} = 0$. As a consequence, individuals only considers the impact of their decisions on the level of the quality of institution but ignore the feedback that comes from a marginal adjustment of the capital endowment. This does not change the qualitative results—as is exemplified in the appendix—but makes the derivations substantially easier (also shown in the appendix). The marginal return to capital are thus,

$$\frac{\partial y}{\partial k} = \alpha k^{\alpha-1}(\theta + Q - \theta\ Q). \tag{6.7}$$

Domestic returns are marginal returns to capital minus the rate of private ordering:

$$r = \frac{\partial y}{\partial k} - po \tag{6.8}$$

$$= \underbrace{Q\alpha k^{\alpha-1}}_{\text{orderly returns}} + \underbrace{\theta(1-Q)\alpha k^{\alpha-1}}_{\text{shady returns}} \underbrace{-po}_{\text{costs of private ordering}} \tag{6.9}$$

$$r = \alpha k^{\alpha-1}(\theta + Q - \theta\ Q) - po \tag{6.10}$$

Figure (6.2) illustrates the development of r with respect to po and k.[11] It shows the complexity in the interaction of these variables. It shows in particular, that domestic returns may be small at very low capital densities, contrary to the predictions of the classical Cobb-Douglas function. Poor countries with little capital in place, may nevertheless offer low returns and probably few incentives for further capital accumulation.

Why does r follow such a roller-coaster? There are multiple mechanism at play. For any given capital density, there is an optimum rate of private ordering where marginal benefits, in the form of improved institutions, equal costs. Any po above or below this optimum results in a lower r, which explains the hump-shape with regard to po. The capital density affects returns by basically two factors. First, diminishing returns to capital lead to lower returns for higher capital endowments. Second, the capital density influences the quality of institutions, which ceteris paribus improves with a

[11] Figure (6.2) is plotted with $\Omega = 1$, $\alpha = 0.6$, and $\theta = 0.1$.

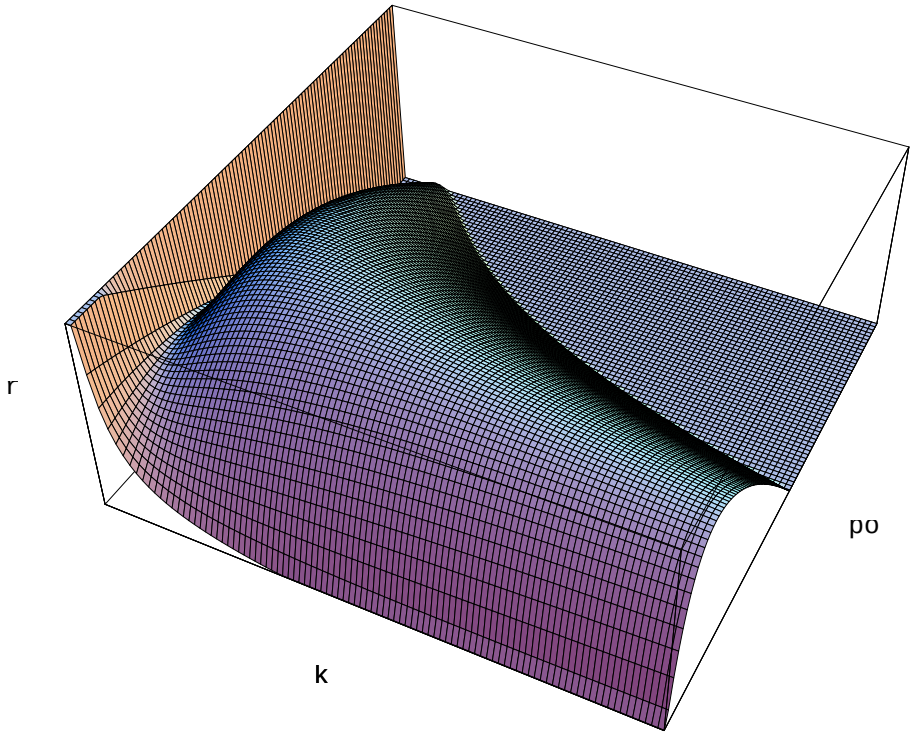

Figure 6.2: A 3D picture of domestic returns

higher density, and hence tend to push up returns. Moreover, with a very low capital density, institutions are most likely bad, and profits are made mostly with shady and illegitimate activities. Hence, these competing forces create the roller-coaster for k. Together, the variables po and k create the pattern illustrated by figure (6.2).

The optimum rate of private ordering, po^*, is defined as the rate which delivers the highest domestic returns for a given capital density. The first order condition is straightforward:

$$\frac{\partial r}{\partial po} = -1 - \frac{k^{\alpha}\,\alpha\,(-1+\theta)\,\Omega}{(1+k\,po\,\Omega)^2} \stackrel{!}{=} 0 \tag{6.11}$$

$$po^* = \frac{-(k\,\Omega) + \sqrt{-(k^{2+\alpha}\,\alpha\,(-1+\theta)\,\Omega^3)}}{k^2\,\Omega^2} \tag{6.12}$$

The government (as an agent of capital-owners) is assumed to set the

rate of private ordering equal to this optimum rate because it ensures the most favourable investment conditions.[12] Substituting (6.12) and (6.6) into (6.10) gives the value of domestic returns under the condition that investors always choose the optimum rate of private ordering.

$$r = \frac{k\,\Omega + k^{1+\alpha}\,\alpha\,\Omega^2 - 2\,\sqrt{-\left(k^{2+\alpha}\,\alpha\,\left(-1+\theta\right)\,\Omega^3\right)}}{k^2\,\Omega^2} \lessgtr r^* \tag{6.13}$$

The model assumes an open economy and perfect capital mobility—ie, individual investors can decide whether to invest their capital endowment domestically or abroad. The world-interest rate, r^*, is taken as exogenously given and constant. Hence, capital-owners will compare domestic returns, r, with the world-interest rate, r^*, and—assuming greed and rationality—invest their marginal unit of capital where the return is higher. The same holds symmetrically for foreign capital-owners, who may enter the domestic market freely if they consider it profitable. However, it is important to keep in mind that each individual capital-owner (domestic or foreign) disposes of a small capital endowment only. Small means that individual investment decisions have only a negligible effect on domestic returns. Hence, whenever $r > r^*$ new capital-owners will appear and invest in the economy. If $r < r^*$, capital-owners already in the economy will cut their investments and go abroad (financially and/or physically). Aggregated investment decisions over many capital-owners will then adjust the capital endowment per worker in the economy until a steady-state, $r = r^*$, is reached.

Figure (6.3) illustrates the development of r and po^* with rising k. As in this illustration, the curve of domestic returns may intersect with the world-interest rate more than once, and thus create multiple (three) equilibria at k_A, k_B, and k_C. The equilibria at k_A and k_C are stable because the economy tends to move towards either of them—as indicated by the arrows. The equilibrium at k_B is unstable, since any minor shock would trigger an adjustment to either k_A or k_C.

6.3 Steady states

The term steady state is borrowed from growth theory and is defined here as a point where intrinsic adjustments in the economy have come to an end—ie,

[12] This optimum rate maximises marginal returns to capital less private ordering; it does not necessarily maximise total output less private ordering ($y - p\,k$). However, since marginal conditions are more important for investment decisions, this approach appears more appropriate. Qualitative results are unaffected by this choice.

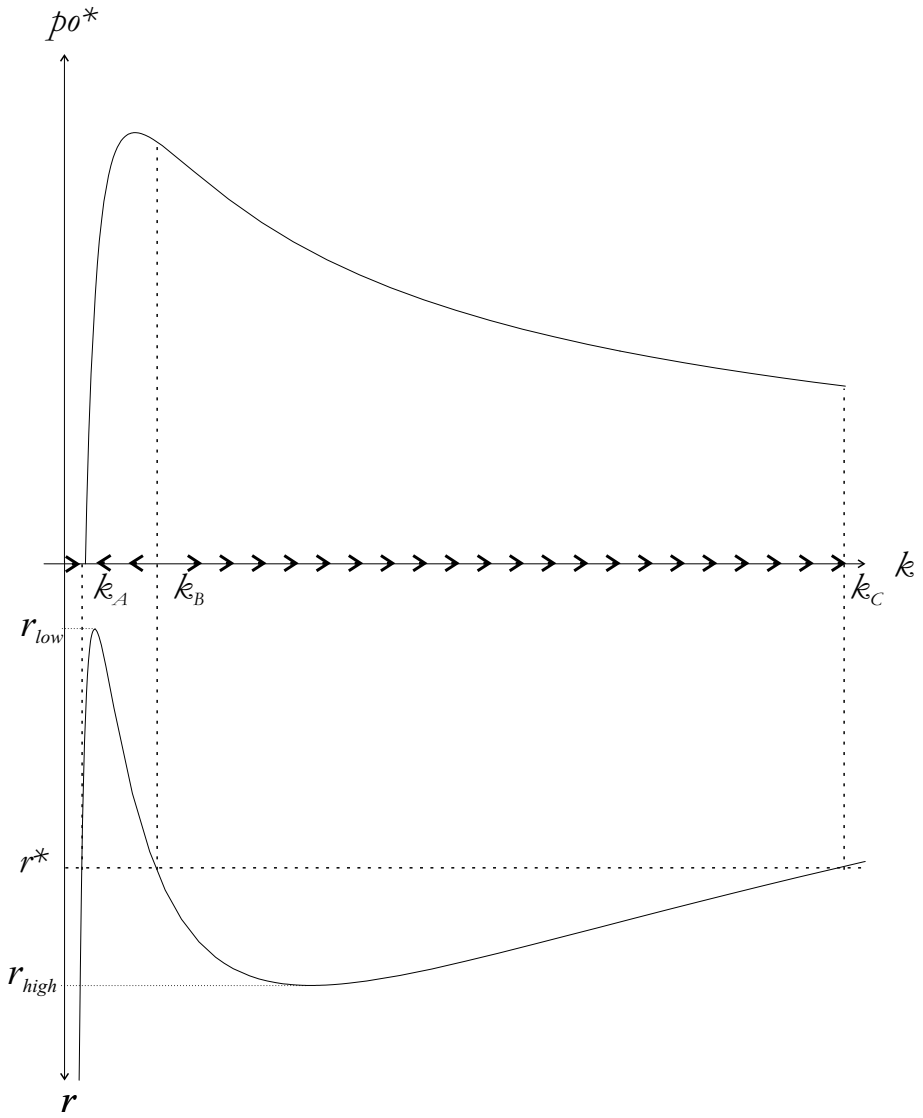

Figure 6.3: Development of r and po^*

where no capital-owner has an incentive to reconsider his investment decision or to change the rate of private ordering. Therefore, a steady state requires that $r = r^*$ and $po = po^*$. Under the conditions laid out in proposition (2), multiple steady states appear at different levels of institutional quality and incomes.

Proposition 2. *Domestic returns, r, equal the world-interest rate, r^*, multiple (three) times, if*

1. *the world-interest rate is between r_{low} and r_{high},*
2. *bad institutions are sufficiently destructive $\left(\theta < \frac{\alpha^2}{(\alpha-2)^2}\right)$, and*
3. *social capital is sufficiently scarce.*

Condition (1) is immediately obvious from figure (6.3): any world-interest above r_{high} or below r_{low} would intersect the r-curve only once, either at a very high or very low capital density.[13]

If θ would be higher than the critical value indicated in condition (2), then the r-curve would exhibit a monotonous form without local maximum or minimum. Bad institutions would not be destructive enough to reduce r sufficiently at low capital densities. This effect would be dominated by the higher marginal product at low k, and the receipts of shady activities. Please refer to the appendix for technical details.

Social capital has a similar effect. If Ω would be very high, even a tiny amount of private ordering would deliver good institutions—ie, the economy would enjoy good institutions without bearing the costs in the form of a high po. In fact, the r-curve would still evolve in a roller-coaster, but k_A and k_B would converge to zero. However, in most cases it seems plausible to assume that social capital does not suffice to uphold the quality of institutions with very little private ordering.

If the conditions of proposition (2) are fulfilled, multiple equilibria emerge. If an economy is stuck at k_A, an unfortunate position with low incomes and bad institutions, there is no endogenous adjustment mechanism which would transport it to the more affluent points k_B and eventually k_C. The reason behind this failure is that individual investors are too small to "tunnel" from

[13] Condition (2) is necessary for that the r-curve evolves in the form of a roller-coaster. For high values of θ the r-curve converges towards the benchmark, which is monotonically falling, and hence, may exhibit no multiple equilibria at a constant world-interest rate. In such a case r_{low} and r_{high} would coincide, and hence, r could not possibly fall in between them. Strictly speaking, condition (1) includes conditions (2), and it is only for clarity that they are listed separately.

k_A to k_B. Any investor who would increase its domestic assets beyond k_A, would suffer losses because the returns would be lower than what could be earned on the world capital market. The equilibrium at k_A may be regarded as a development or poverty trap.

The optimum rate of private ordering runs akin to figure (4.1)—hardly surprising, since the authors are the same. And the explanation is similar, too. For low values of k even a high rate of private ordering would result in a somewhat small amount of private ordering, and would have only limited effect on institutions and domestic returns. Given the costs of *po*, individuals prefer a low rate. With increasing k, however, the punch of *po*—ie, the effect on institutions—becomes stronger. In other words, expenses for *po* get more rewarding and people opt for a higher rate. At some point, the balance tips again, and with higher k the costs of *po* do not justify the current level; people decide to lower the rate. Please note that institutions improve, whenever individuals opt for po^* and k rises. Even if the rate of private ordering is reduced, this is more than offset by a higher k. On balance, Q rises. The mechanics are detailed in the appendix.

Please note that the development trap does not exist because people spend too little for private ordering. On the contrary, a profit-maximising strategy would include a hike in *po*, as indicated by the rise in po^* in figure (6.3). Nevertheless, the amount of private ordering does not suffice to uphold domestic returns, which drop below the world-interest rate, and thus constitute the development trap. If only the economy could "tunnel" from k_A to k_B, it would pick up momentum on its own and progress to k_C through further capital accumulation.

As indicated in figure (6.3), the economy converges towards either k_A or k_C, depending on starting conditions, in particular the initial level of k. Once the economy has reached either, there no further endogenous adjustment and the economy has come to a steady state.

6.4 Policy options

Any economy with a capital density below k_B will eventually return to the development trap at k_A, where production is low and institutions are bad. A situation rightly characterised as development trap. The economy could produce potentially much more (ie, k_C), but individual capital-owners have no interest in investing since they would suffer losses temporarily. Such a situation seems a fair description of some of the world's poorest coun-

tries which live in misery despite their potential. Moreover, since the small amount of capital in place returns mainly illegitimate profits, this can explain why poor countries are plagued additionally by corrupt governments and marauding crooks.

Without an external push, the economy will have no endogenous momentum to escape this trap. This is unsatisfactory in particular because there is no fundamental flaw that prevents the economy from producing more, barring perhaps an insufficient social capital endowment. It is not that technology is too backward, or that education is lacking, or any other element of typical growth regressions is missing. These factors are still important for determining the high-income steady-state, but they are not responsible for the development trap. At the same level of technology the economy could potentially produce much more, if only it could "tunnel" from k_A to k_B.[14]

This section aims to present and discuss a number of policy options designed to provide that push. However, it should be no surprise that there is no silver bullet; no easy way out of the development trap. Otherwise, it would not qualify as a trap in the first place. Each policy option that could potentially lift the economy out of the development trap brings a number of other problems. Some of them appear in the model, while it seems common sense to add others.

6.4.1 Variations in exogenous parameters θ and Ω.

Proposition (2) implies that there would be no development trap if Ω or θ exceed certain thresholds—ie, if either social capital is abundant or bad institutions are not very destructive. Although, Ω and θ are defined as exogenous parameters whose variations are not explicitly modelled, this subsection speculates on what would happen if they were to change. The central point is how private capital-owners react to changes in these parameters, in particular, whether they adjust their expenses to private ordering, and if they change their investment decisions.

It is easy to see that domestic returns, as given by equation (6.10), are strictly increasing in Ω and θ:

[14] It seems reasonable to assume that similar feedback loops, such as the one created here with regard to institutions, may also exist for other variables, for instance health, education, or technology. Azariadis (2001) provides an overview on the theory of poverty traps and the various variables they may be attributed to. Here, however, only institutions create this type of feedback loop with a potential for a development trap, while other variables, such as technology, are held constant or evolve in line with wealth.

$$\frac{\partial r}{\partial \Omega} = \frac{k^{-1+\alpha}\,\alpha}{1 + k\,po\,\Omega} > 0 \tag{6.14}$$

$$\frac{\partial r}{\partial \theta} = -\frac{k^{\alpha}\,po\,\alpha\,(-1+\theta)}{(1 + k\,po\,\Omega)^2} > 0 \tag{6.15}$$

Increases in Ω and θ, thus, appear like windfall profits to capital-owners. If the economy is at the low-income steady-state k_A initially, then an increase in either parameter will shift domestic returns above the world interest rate and will trigger new investments until both are again equalised. Although, this is a welcome boost to per-capita incomes—because the capital endowment will be higher and institutions better—the economy may still persist at the low-income steady-state, only that k_A and incomes per capita are now higher. At the same time k_C would be higher, too, while k_B would sink. Increases in either Ω and θ therefore increase the high-income steady-state and reduce the gap between k_A and k_B, and thus make it easier to escape the development trap. If the resulting hike in domestic returns equals at least $r^* - r_{low}$ then the low-income steady-state would be eliminated and the economy would proceed to the high-income steady-state. It is only in this case that increases in the parameters Ω and θ would trigger self-sustained capital accumulation and institution building which went beyond the direct effects delivered in the first place.

Moreover, private-capital owners may match increases in Ω and θ by reducing their own (relative) efforts for private ordering. The optimum rate of private ordering is strictly decreasing in θ, and possibly decreases in Ω, therefore the net effect on domestic returns may be smaller:

$$\frac{\partial po^*}{\partial \Omega} = \frac{k^{1+\alpha}\,\alpha\,(-1+\theta)\,\Omega^2 + 2\sqrt{-\left(k^{2+\alpha}\,\alpha\,(-1+\theta)\,\Omega^3\right)}}{2\,k\,\Omega^2\sqrt{-\left(k^{2+\alpha}\,\alpha\,(-1+\theta)\,\Omega^3\right)}} \gtreqless 0 \tag{6.16}$$

$$\frac{\partial po^*}{\partial \theta} = \frac{-\left(k^{\alpha}\,\alpha\,\Omega\right)}{2\sqrt{-\left(k^{2+\alpha}\,\alpha\,(-1+\theta)\,\Omega^3\right)}} < 0 \tag{6.17}$$

The result in (6.17) is hardly surprising, given that θ is defined as the fraction of output loss that is generated by shady and illegitimate activities, such as corruption, fraud, savings on work conditions, or violation of environmental standards. These shady activities thrive on bad institutions, and when they become more rewarding because θ rises, the incentive to improve institutions via private ordering is reduced. Although the reduction in po^*

crowds out some of the potential increases in domestic returns, the net effect on r remains strictly positive.[15]

The effect of θ on institutions is somewhat paradoxical. Increasing the profits of shady business ($\theta \uparrow$) contributes to the extermination of shady business because the economy grows and institutions improve inevitably due to rising contributions to private ordering. In a sense, shady business crowds itself out.[16]

The caveat in this argument is that once shady business were very profitable, vested interests might oppose further development which threatens to erode these profits. Consider the following example. Botswana is one of the most successful countries in Africa, partly due to its generous endowment with diamonds, which account for half of the treasury's revenue. But diamonds and other resources can be a mixed blessing. However, compared with Sierra Leone and Angola, diamonds in Botswana are deep underground, so exploitation is expensive and incurs high and specific sunk costs (see The Economist, 2004a, p 52). Asset specificity increases the sensitivity to institutional quality and production suffers more from bad institutions as compared to a situation where diamonds were found in shallow soil. This can be captured by a lower value of the parameter θ: Where diamonds are easy to reach, as in Sierra Leone and Angola, bad institutions depress output, as well, but they may also open ways to recuperate part of that loss by illegal exploitation, hence θ might be larger. This would lower the destructiveness of bad institutions. It would also enrich criminals and could trigger armed conflict. It appears that Botswana did much better than either Sierra Leone or Angola. Hence, the theoretical appeal of a higher θ should be seen in perspective, and the problems it may cause—not explicitly described in the model—should not be underestimated.[17]

[15] Under the condition that $po = po^*$:

$$\frac{\partial r}{\partial \theta} = \frac{k^{\alpha}\,\alpha\,\Omega}{\sqrt{-\left(k^{2+\alpha}\,\alpha\,(-1+\theta)\,\Omega^{3}\right)}} > 0 \tag{6.18}$$

[16] This is perhaps the story of Russia: In the first phase of transition, the allocation of assets into private hands was considered as most important, irrespectively if these belonged to crooks or not. The result was the rise of Russian oligarchs and a persistently bad business climate (Black, Kraakman, and Tarassova, 2000). Unlike most Eastern European countries, Russia was exporting capital at magnitudes which are often described as capital flight. Eventually, Russia mastered its—still fragile—turnaround, pushed in particular by rising oil revenues. The new government under Vladimir Putin seems prepared to take on powerful oligarchs and to restore law and order, perhaps at the costs of personal freedom, as some say.

[17] Another important element could be that diamonds were found in Botswana only after

Things are more complicated with regard to social capital, Ω. As indicated by equation (6.16), the reaction of capital-owners to variations in Ω is less clear-cut. But again, this should not be too surprising, since the optimum rate of private ordering po^* is itself evolving non-linearly with respect to, for instance, capital endowment (see figures 6.2 and 6.3).

Improvements in social capital and reductions in the destructiveness of bad institutions deliver windfall profits to the economy because domestic returns increase. If this increase suffices to shift r_{low} above the world-interest rate, r^*, then it would eliminate the development trap and the economy would proceed to the high-income steady-state at k_C. Unfortunately, Ω and θ have been defined as exogenous parameters which are probably immune to deliberate policy intervention, at least in the short run. However, this does not imply that variations or shocks in these parameter may not occur. But change may be slow, hard to influence, and hard to predict. Moreover, differences in Ω and θ across countries may be used to explain why some countries have never been in a development trap.

6.4.2 A public investment programme, $k \uparrow$

The lack of private investment is at the heart of the development trap. Since domestic returns are below the world-interest rate, and individual investments are too small to bridge the gap between k_A and k_B, there are no incentives for further private capital formation, and hence, the capital density persists at the current low level. This seems to create a good argument for a public investment programme, which could push the capital density beyond k_B, disregarding temporary losses. This argument is related to some aspects of high development theory as laid out in section (3.1): single modern firms are reluctant to settle in poor countries for a lack of customers. Only when a broad industrial basis is created, by industrial programming for instance, sufficient demand may be generated to make the country attractive to individual (modern) investors. The reason is that modern firms are assumed to need a certain output level in order to produce more efficiently than traditional firms. And the modern sector will become profitable only when this output can be sold in the market. The caveats of sections (2.4.1) and (2.4.2) apply.

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independence, which may have reduced the urge to install extractive institutions during colonial times.

This idea has some appeal, in particular to policy-makers who find it a nice argument to justify economic intervention. Since the economy gains momentum on its own, once it passes the threshold of k_B, future tax revenues may compensate the transitory minus. Such arguments are frequent with increasing returns. For instance proponents of the infant-industry argument claim protection for certain industries to allow them to gain size and experience for that production cost drop to or below the world level, and the industries become competitive. This assumes that returns increase with size and experience, at least during a certain period, and that the capital market is unable or unwilling to provide the intermediate financing. These approaches have been widely popular with policymakers because they justify market-intervention with economic rationale (Krugman and Obstfeld, 2003, pp 120-150 & 256-257).

The devil is in the details. What may work with a particular industry, is less likely to work for the economy as a whole. A first caveat could be that public investments simply crowd out private, and have no net effect on capital density. Moreover, public investment programmes often suffer from a lack of economic accountability, in the sense that they usually do not have to fear bankruptcy if things turn sour. This distorts investment decisions towards white elephants. There is, nevertheless, a case for public investments in infrastructure, education, science, and other public goods. However, it seems more likely that these evolve gradually in line with economic development.

A second caveat may be noted with regard to financing. This model assumes perfect capital mobility, but it also assumes small investors, who only borrow small amounts on the international capital market. A state who wants to push the capital density from k_A to k_B would certainly be a big investor, and might experience difficulties in finding sufficient financing, either at home or abroad.

A final problem may surface with regard to institutions. Major public spending is often associated with corruption and fraud, which may have adverse effects on social capital. If that were the case, then the push in k would have to be even greater to compensate a possible reduction in Ω. Moreover, it is questionable whether the relation between capital accumulation and private ordering would work the same way if capital is formed through public investment. It seems more likely that the state (or any other behemoth investor) would spend a lower rate of private ordering. Possible reasons are economies of scale in the enforcement of transactions and claims (see section, 6.5.3), or the concomitant corruption and fraud, which may have a deteriorating effect on *po*. Moreover, typical investments into public

goods simply need fewer private ordering, because they are often used without charge anyway.

In a nutshell: it may be tempting to push an economy from k_A to k_B with a deliberate investment programme, but a number of caveats turn this into a delicate endeavour. Without sufficient private-sector involvement, it will be difficult to jump-start a self-sustaining growth up to the high-income steady-state.

6.4.3 Capital controls

A glance at figure (6.3) shows that a development trap exists, because individuals will reduce their capital holdings for any k between k_A and k_B. Since higher returns are to be made abroad, people cut investments at home and invest in foreign markets. A straightforward policy option could be to impose controls on capital outflows, and thus, to hinder the exodus of capital in the first place.[18]

The damage would accrue to capital-owners, who would earn less, but this might be considered acceptable because returns would catch-up once k_B is passed. However, capital controls are unlikely to solve the problem.

First, if investors want to export their money, capital controls may be a nuisance, but they will not stop them. Capital controls are often found to be ineffective and to breed corruption (Edwards, 1999). People are inventive at finding ways around outflow restrictions if the incentive is strong enough. That said, the difference between r and r^* is the potential gain, and if this difference is higher than the costs of circumventing capital controls, then they will be circumvented. If anything, outflow restrictions may hinder a stampede to k_A if a minor shock hits the economy at k_B.

Second, a contracting capital density does not necessarily reflect capital outflows. Population growth and depreciations continuously put a strain on k, and need to be matched by sufficient gross investments for a positive net effect. Low gross investments are thus enough to reduce k.

Third, capital controls may limit the outflow of financial resources but they are unable to stop the flow of a country's most precious asset: human capital. It is usually the best educated, trained, and motivated people who

[18]This argument reverses the conventional wisdom after the Asian crisis which prefers controls on capital inflows rather than outflows in order to prevent the build-up of a currency or maturity mismatch (Eichengreen, 1999). These recommendations, however, are expressed towards advanced emerging markets in order to prevent financial distress, and do not address options to escape a development trap.

turn their back if wages are low and economic prospects dim. In a development trap wages are low because the average worker is endowed with little capital, and will therefore have only small productivity. Moreover, the little capital in place is spent inefficiently because institutions are bad, and people will probably spend more time cheating than on productive activities.

The importance of human capital to economic growth is well recognised, not least since the contributions by Robert Lucas (1988, 1990). Health and education, in particular, are found to have a positive and robust relation to growth. So if capital is regarded in a broad sense, including physical as well as human capital, an increase in the endowment per worker in physical capital might be offset by a reduction in human capital, because the smart and motivated people leave the country. Capital controls will not stop them. Some countries resorted to draconian measures to prevent the outflow of workers, most prominently the wall which separated Germany. But eventually even this wall proved unsustainable against the will of the population. Finally, even if a brain drain could be prevented, human capital might not be too useful if high-end jobs are missing. Well educated workers without the right jobs will look for other occupations, and may use their talent for more shady activities (Easterly, 1999).[19]

A development trap persists because any increase in k smaller than $k_B - k_A$ will automatically lead to a subsequent reduction back to k_A. Capital controls, or even more draconian measures to prevent the exodus of educated and motivated people, seem an unlikely instrument to stop this.

6.4.4 Technological progress, $A \uparrow$

And then there is technological progress. Though a constant level of technology across countries was assumed to begin with, this is much less defendable across time. Poor countries are perhaps an unlikely source of path-breaking inventions, but they may take existing ones and adapt them to their needs, which is difficult enough.[20]

Technological advance is usually embodied in the form of labour-increasing progress, in that it enables the production of more output the same way as if more labour were employed (*Harrod-neutrality*).[21] An increase in A, thus,

[19] Please refer to section (2.3) for a more detailed discussion.

[20] This is not to underestimate the importance and impact of contributions by individuals from poor countries, but the bulk of technological progress still stems from rich countries either through deliberate investments in R&D or as a byproduct of other economic activity.

[21] See Barro and Sala-i-Martin (1995, pp 38-40) for a presentation of different con-

means that the marginal product to capital is higher at a given capital density. Graphically speaking, the r-curve in figure (6.3) will shift downwards, hence, k_A and k_C increase, while k_B decreases (remember that the figure is upside-down). The economy will enjoy higher incomes and better institutions if technology improves.

It is easy to see that r_{low} actually increases in A—ie, for a sufficiently high level of technology, r_{low} will surpass the world-interest rate, r^*, and the development trap ceases to exist. Very advanced technology is able to compensate for bad institutions, in the sense, that it increases profitability and thus induces capital accumulation even in otherwise dire situations. The caveat, however, is that poor countries may also be unlikely candidates for technological progress. Even if high-tech is available, its application in poor countries might be stalled until other complementary requirements are in place, such as an educated workforce, et cetera. Since these requirements may need a certain threshold of economic wealth in the first place, for instance to pay for schooling and health care, a vicious circle may emerge again.

If it is true that most technological advances come from rich, industrialised countries, the effort to adapt them to the needs and constraints of poor countries will increase in as much as their developments take diverging paths, because the design of innovations will increasingly be targeted towards producers and consumers who have little in common with those in a country in a development trap. Hence, technological progress may eventually pull a country out of a development trap, but don't hold your breath.

6.4.5 What might actually work: disintegration

The previous sections discuss various policy options of how to evade or exit a development trap. Unsurprisingly, no silver bullet appeared, because each potential instrument came with a list of problems of its own. Were a silver bullet to exist, development traps would not be traps in the first place. However, the outlook may not be all bleak.

If it is impossible to accumulate sufficient capital to pass the threshold at k_B in the economy as a whole, it might be possible in smaller, regionally or functionally limited entities. If a problem is too big to solve it in one piece, divide and conquer.

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cepts of technological progress, including capital-saving and labour-saving progress; as well as, *Hicks-neutral*, *Harrod-neutral*, and *Solow-neutral* variants of unbiased technological progress. The application of *Harrod-neutrality* has been dominant in the literature because it facilitates the creation of models with a long-term equilibrium.

Usually, the level of capital employed is not equal across a country, but concentrated in various centres of economic activity, such as the capital town, important harbours, or other industrial or commercial clusters. The reasons for such clusters may be standard agglomeration advantages, such as technological spillovers, a pooled labour market, or specialised suppliers. Moreover, geography and infrastructure do play their part.

Any such centre on its own might boast a capital density higher than k_B, while remote and rural areas might score even lower so that the average remains around k_A. The rules of the game, the institutions, are by and large the same within a country. The higher amount of private ordering generated in economic centres is diluted by lower amounts elsewhere. Separating centre from periphery could serve as a strategy to create growth poles within an economy because private ordering would then remain concentrated.

The basic appeal of disintegration is that it triggers growth in the economic centres as well as in the remote regions. If the economic centre alone passes the threshold at k_B, it will move on to k_C, while the remote regions, whose capital density alone is below k_A will bounce back to k_A. Hence, growth in both parts of the economy, although stronger growth might be expected in the centres, if only because usually $k_C - k_B > k_B - k_A$.

The trick is to separate in a way which prevents the spillover of private ordering from the economic centres into the rest—ie, to concentrate the efforts in the centres and thereby to improve institutions. This is not as implausible as it might sound. The Chinese special economic zones (SEZ) might be an example. These were designed to experiment with market forces in an otherwise planned economy, and turned out to be a success. Apparently, the set of rules which makes up a market economy was superior in promoting wealth. However, these rules were limited to the boundaries of the SEZ: transactions which are possible there might be impossible elsewhere or at least prohibitively expensive.

At the end of the 1970s, China introduced special economic zones as a laboratory to experiment with market-economy, while at the same time retaining political control.

> "SEZs are geographically or functionally limited parts of an economy in which rules and other institutions concerning the production and the distribution of goods and services differ from those in the rest of the economy." (Ahrens and Meyer-Baudeck, 1995, p 88)

Institutions did not evolve overnight, because it was not clear from the

outset that newly enacted laws were properly interpreted and enforced. Ethnic Chinese from abroad were the strongest investors in the beginning, because they had an apparent comparative advantages over other foreigners in securing their property rights (Knoth, 2000, p 225). Only when the SEZs were perceived as sufficiently established, did other investors line-up, as well. The success, however, was breathtaking. Shenzhen, China's most prominent SEZ, experienced at times growth rates of 30-40 percent (Knoth, 2000, p 10). The story of Shenzhen illustrates the interaction between business activity and institutions: both reinforce each other, and both require a certain threshold of the other to be effective.[22]

But wouldn't a successful economic centre attract an inflow of workers which increases labour supply and dilutes the capital density? Perhaps, if the workforce grows faster than capital and outpaces the formation of good institutions. The slums around poor countries' towns are a vivid warning. But migration may also be necessary for success, because it helps to keep wages low, and encourages investments. Moreover, the influx of workers may also be an influx of human capital for it is the healthier and better educated people who tend to migrate. Shenzhen grew from a small fishing town to a modern, urban centre of economic activity with 4-6m inhabitants according to some estimates (Knoth, 2000, p 97). Highly-skilled labour was a substantial part of this migration, not least because the new businesses demanded more sophisticated workers (Knoth, 2000, p 224).

A strategy of disintegration must not necessarily lead to special economic zones or other forms of regionally separated entities. The concentration of private ordering can also be achieved with regard to certain transactions or businesses: the way diamonds are traded in Antwerp is different from the way a morning coffee is ordered in the streets of Amsterdam. Business associations or guilds may create and enforce rules for its members which are different from the rest of the economy.

[22]It should be noted that China apparently did not intended to deliberately escape a development trap, but rather used the SEZs to experiment with market-economy; probably in an attempt of finding a way to reconcile the benefits of markets with a socialist political order. If China would have opened the whole economy at once (a shock therapy), unleashed market forces might have led to wealth reductions, because economy and institutions were not yet ripe for it (eg, a too low capital density). Even more threatening to the establishment might have been the prospect that unleashed market forces would bring about growth and prosperity, and that a growing middle-class would demand political rights.

If disintegration is a success, the centre moves to k_C, while the periphery moves to k_A. In that case, it may be time to integrate again. Let me denote the periphery with superscript p and the centre with superscript c; variables without superscript represent aggregates for the whole economy. If

$$\frac{k_A^p \; L^p + k_C^c \; L^c}{L} > k_B, \tag{6.19}$$

then integrating centre with periphery will lead to an aggregated capital density which suffices to exit the development trap and allows to move towards k_C, the affluent steady state with high incomes and good institutions. Condition (6.19) illustrates another potential advantage of migration from the periphery to the centre, because it increases L^c and lowers L^p. This means that the centre does not only become richer, but also bigger (in terms of labour supply) which in turns makes it more likely that its success will suffice to lift the whole economy out of the development trap.

It should be noted, however, that disintegration is no panacea. Business associations and guilds may create better institutions for their members, but they may also pursue closed shop policies or other activities which are harmful to economic efficiency. Regional disintegration has distributional consequences because the periphery no longer receives the spillovers of private ordering from the centre, and institutions deteriorate at the periphery. This actually increases domestic returns there and attracts new investments, but it also shifts business towards more shady activities which may not be welcomed by residents. Disintegration may thus meet opposition from the periphery. The centre benefits from better institutions, but this also means that business moves away from shady activities. Again, this may trigger opposition. By the same token, re-integration might also arouse hostility because of the change in the supply of private ordering. Although, domestic returns increase with every step in the centre as well as in the periphery, this might not suffice to ensure approval because of the concomitant distributional effects.

6.5 Extensions

This section relaxes a number of assumptions which were used to introduce the baseline model. It discusses how qualitative results are sensitive to alternative designs, including the effect on policy options.

6.5.1 Failure of collective action

The baseline model assumes that individuals in a society always set the optimum rate of private ordering, which maximises domestic returns at a given capital density. Institutions, however, are often regarded as a public good, whose benefits extend even to those who do not contribute. In such a case, individuals have an incentive to downplay their true willingness to pay and free-ride on the expenses of others.

Society can coerce a certain amount of private ordering in that it levies taxes on individuals and spends the receipts on good institutions. But it can only do so much. Poor countries are often characterised by a rotten bureaucracy and abundant tax evasion. Moreover, unless good institutions are in place, the ruling elites might imagine better ways of spending tax revenues than promoting institutions. If in place, institutions such as checks and balances on executive behaviour would limit the ability to steal from the country, which may not sound too promising for the executive in the first place.

Moreover, it is impossible to publicly supply everything that makes up good institutions. Consider the case of home security. Good laws punishing burglary and an effective policing to enforce them are important rules that serve to protect homes. However, despite these rules, most people prefer to do something themselves, such as locking the door, installing an alarm, hiring a neighbourhood watch; et cetera. The quality of institutions, in terms of their enforcement, depends as much on private action as on the publicly provided framework. Obviously, since two people might not spend the same amount, the quality of institutions might not be the same for both. It thus makes sense to analyse the quality of institutions as experienced by individual i, which depends on what they themselves spend, and on what society provides. Let me use subscript i to indicate those variables at the level of the individual, while variables without subscript represent aggregated values. Q_i is the quality of institutions as experienced by i, and po_i is the rate of private ordering of i—ie, the fraction of i's capital endowment (relative to labour supply) they expend to protect their claims:

$$Q_i = Q_i(po, po_i, k, \Omega) \tag{6.20}$$

Equation (6.20) expresses this argument: the quality of institutions for i is a function of the individual rate of private ordering, po_i, and the aggregated rate, po, as well as the variable k and parameter Ω as in (6.6).

$$po = \frac{\sum po_i}{n} \tag{6.21}$$

The profitability of individual private ordering given a certain aggregated level already present determines the optimum individual rate of private ordering, po_i^*.

$$r_i = \alpha k^{\alpha-1}(\theta + Q_i - \theta\ Q_i) - po_i \tag{6.22}$$

$$\frac{\partial r_i}{\partial po_i^*} = 0 \tag{6.23}$$

Individual returns are denoted by r_i. Equation (6.23) marks an important step from collective action to failure of collective action. Individuals in the baseline model were able to set the rate of private ordering collectively, and thus, could maximise domestic returns at any given capital density. Without collective action, individuals will only contribute as much to private ordering as is necessary to maximise individual returns and disregard any positive externality. The likely result will be under-investment in private ordering and worse institutions.

The aggregated rate of private ordering represents the quality of institutions provided by society, while the individual rate describes i's own efforts. The interaction between the aggregated and the individual rate determine the effectiveness of individual investments to private ordering.

Society's rules and private enforcement are imperfect substitutes. The example of home security may illustrate the argument again: if laws against burglary are badly enforced, for instance because the police is ineffective, homeowners may react by stepping up security themselves, in the form of tougher locks, et cetera. But the effectiveness of these measures will decrease. If your neighbourhood is plagued by marauding gangs, it may take quite an effort to keep your home safe. A lack of institutional quality may be substituted by individual investments, but at a price: increases in the individual rate of private ordering will have diminishing impacts on the quality of institutions (figure 6.4).

$$Q_i = Q_i(po^{1-\lambda}\ po_i^{\lambda}, k, \Omega) = 1 - \frac{1}{1 + k\, po_i^{\lambda}\, po^{1-\lambda}\, \Omega} \tag{6.24}$$

Equation (6.24) translates the idea into an explicit form of Q_i. The individual rate of private ordering, po_i, and the aggregated rate, po, are imperfect substitutes, because they are raised to the power λ and $1-\lambda$ respectively.

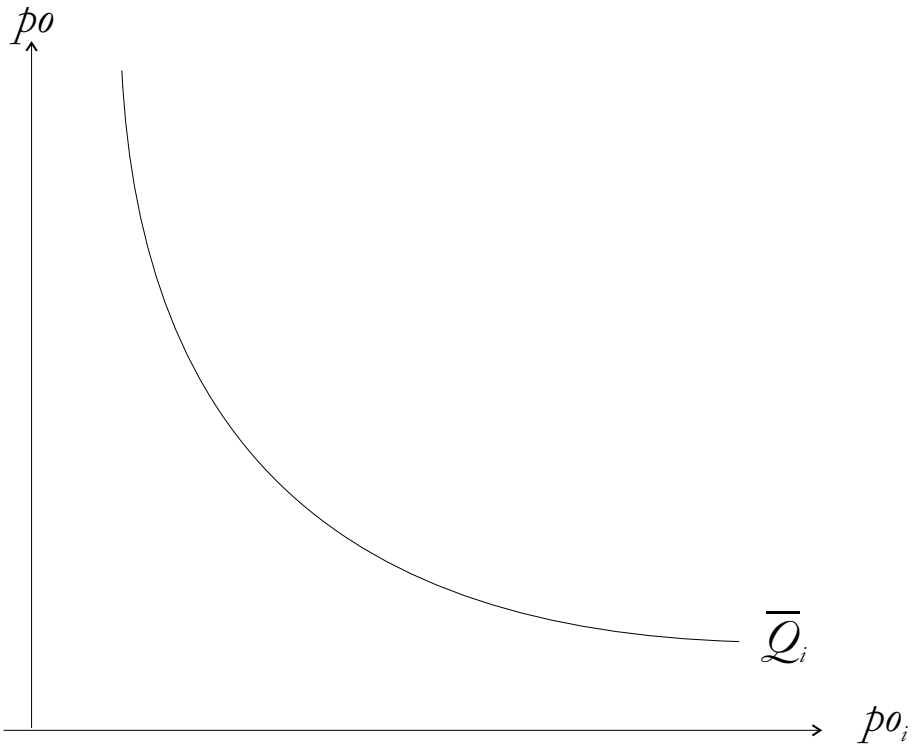

Figure 6.4: Aggregated and individual private ordering are imperfect substitutes.

Were collective action to appear, then $po_i = po$ and $po^{1-\lambda}\ po_i^{\lambda} = po$—ie, equation (6.24) would equal (6.6) of the baseline model.

The parameter λ ($0 \leq \lambda \leq 1$) is the elasticity with which the individual rate of private ordering pushes the quality of institutions for i. In other words, λ indicates the effectiveness of individual contributions to private ordering. If λ were one, institutions were a pure private good, and everybody would set $po_i^* = po^*$; for $\lambda = 0$, institutions were a pure public good and the usual free-rider problem would apply, $po_i^* = 0$. However, as long as one regards individual and aggregated private ordering as imperfect substitutes, an intermediate value for λ is more reasonable—ie, people spend a little on institutions and free-ride a little.

And there is another twist. Because of the assumption that individual capital owners are identical, the optimisation of individual i in setting po_i^* is also the optimisation of all other individuals in the society. Eventually, everybody will have the same rate of private ordering: $po_i^* = po$ for $i \in \{1, .., n\}$.

Figure (6.5) illustrates the adjustment. It pictures the relation of domestic returns and the rate of private ordering at a given capital density. The thick line indicates the aggregate case, while the thin lines are individual calculations. The parameter λ has an intermediate value, say $\lambda = 0.6$. Let us assume that the aggregated rate of private ordering is in optimum to begin with—ie, $po = po^*$. Any capital owner has an incentive to reduce their individual rate of private ordering, because the savings outweigh the loss in institutional quality. The po_i^1-line plots individual returns, r_i, as function of po_i, given that the aggregate rate is still at po^*. Evidently, individual i can increase returns by reducing the rate of private ordering, until $\frac{\partial r_i}{\partial po_i} = 0$. Unfortunately, i's überprofits are rather short-lived, because all other capital owners in the economy have the same idea and reduce their rates of private ordering as well. This means, that the aggregated rate of private ordering plummets, and thus reducing individual returns. With lower po, individual returns drop from the po_i^1-curve to the po_i^2-curve. At that time, i may reconsider the rate of private ordering and choose to increase or reduce it, depending on what would improve returns. The process comes to an end, when a value po^{**} is reached with

$$po^{**} = \frac{\sum po_i^{**}}{n} \quad \text{and} \tag{6.25}$$

$$\frac{\partial r_i}{\partial po_i^{**}} = 0 \quad \text{for all } i = 1...n, \text{ therefore} \tag{6.26}$$

$$po_i^{**} = po^{**} \quad \text{with identical capital-owners.} \tag{6.27}$$

The rate of private ordering po^{**} which satisfies (6.26) as well as (6.27) is stable because neither the aggregated rate of private ordering changes, nor do individual capital-owners have an incentive changing their rate.

The economy will always end up at po^{**} irrespective of its starting position. If po were zero in the beginning then i would have an incentive to increase po_i according to the po_i^3-curve. Other capital owners would follow suit, thus $po \uparrow$. Then its i's turn again, and so forth. The adjustments end when $po_i^* = po_i^{**} = po^{**}$.

The result is obvious and hardly surprising. The rate of private ordering without collective action is lower than with collective action: $po^{**} < po^*$, where po^* is given by equation (6.12). As a consequence, returns are lower—ie, the economy is poorer and has worse institutions. The failure of collective action leads directly to a type of prisoner's dilemma: everybody would be better off if po were increased. However, nobody has an incentive to increase the individual rate unless everybody else joins in. Hence, the economy persists at po^{**}.

The difference between po^* and po^{**} depends on the parameter λ: the higher λ the smaller the difference. The more institutions are like a private good the less harm causes the failure of collective action. Assume for simplicity that

$$po^{**} = \xi po^* \quad \text{with} \tag{6.28}$$

$$\xi = \xi(\lambda) \quad \text{and} \tag{6.29}$$

$$\frac{\partial \xi}{\partial \lambda} > 0, \quad \text{with } 0 \leq \xi \leq 1. \tag{6.30}$$

The parameter ξ captures the aforementioned argument. The higher ξ the smaller the difference between po^* and po^{**}. Plugging equation (6.28) into (6.10) and (6.12) yields:

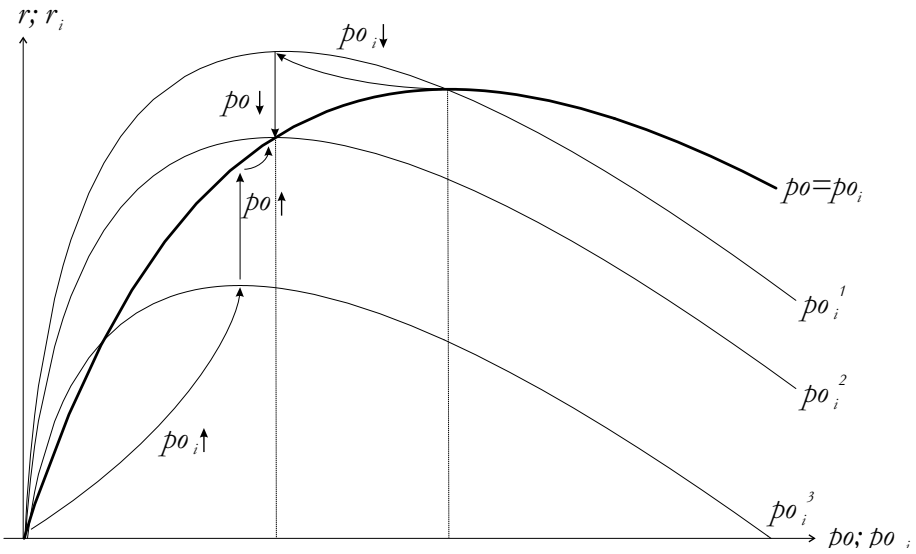

Figure 6.5: Adjustment towards po^{**}

$$r = -\frac{k^{\alpha}\,\alpha\,\theta}{k\,(-1+\xi)-\sqrt{-(k^{2+\alpha}\,\alpha\,(-1+\theta))\,\xi}} + \frac{-k+\sqrt{-(k^{2+\alpha}\,\alpha\,(-1+\theta))}\;\;\xi\;\;-1+\frac{k^{1+\alpha}\,\alpha}{k-k\,\xi+\sqrt{-(k^{2+\alpha}\,\alpha\,(-1+\theta))\,\xi}}\Big)}{k^2} \tag{6.31}$$

Figure (6.6) shows the consequences of a lack of collective action with regard to the development trap and the economy's long-term prospects. The black curves represent the baseline model, while red curves illustrate what happens if collective action fails, and $\xi = 0.5$. Unsurprisingly, there are some dire consequences. First, it becomes harder to overcome a development trap, because the threshold capital density gets larger: $k_B^{coll} < k_B^{nocoll}$ (superscripts indicate whether or not collective action applies). The reverse is true with regard to the high-income steady-state: $k_C^{coll} > k_C^{nocoll}$—ie, an economy becomes richer and better governed with collective action. Another worrying feature is that a low value of ξ also depresses r_{high}^{nocoll}. If r_{high}^{nocoll} drops below the world-interest rate, r^*, the economy will always persist at the low-income steady-state at k_A^{nocoll}.

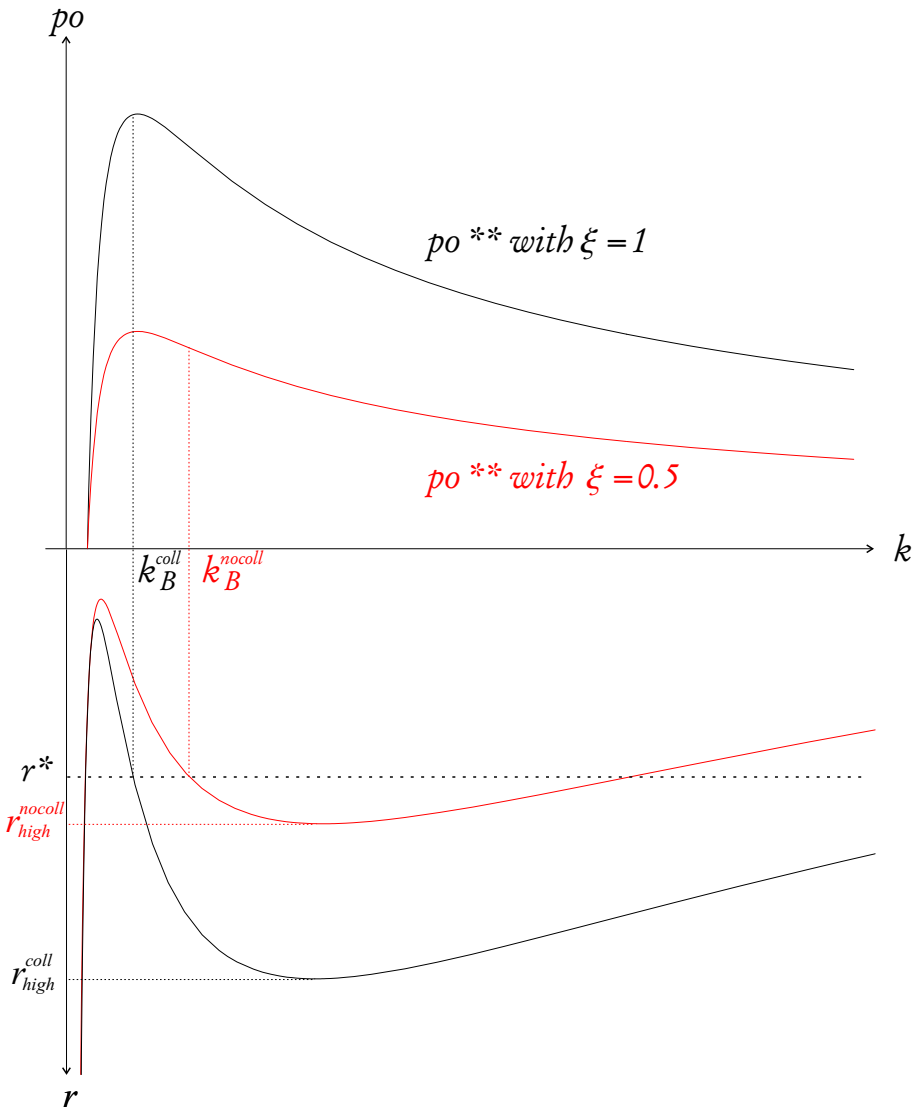

Figure 6.6: Development of r and po^{**} with and without collective action

Consequences

Failure of collective action is the rule rather than the exception. Private ordering is not a well defined activity, or an expenditure which could easily be scrutinised. On the contrary, individuals have leverage to overstate their true level of private ordering because of the difficulties to observe and verify actual efforts. This in turn damages the credibility of any commitment in the first place, and coordinating a joint movement in private ordering gets virtually impossible.

The baseline model and other examples in the literature (for instance Gradstein, 2004) circumvent this problem by arguing that private ordering may be passed to the state which could then levy taxes in order to finance the expenditures. There is a reason why "private ordering" means private and not public ordering: public ordering (or the aggregated level of private ordering) and private ordering are more reasonably regarded as imperfect substitutes. A lot of activities, such as locking the door, are much more efficiently done privately than collectively. If institutions are to be improved, it is necessary to encourage actions at the level of the individual, too.

Without collective action, private ordering is reduced to a level which optimises individual returns without considering social returns. The price individuals have to pay for their strategy is that they receive less than in the baseline case because everybody suffers from under-investments in private ordering. Domestic returns plummet and the development trap worsens. The economy has to accomplish a greater leap forward, because the gap between k_A and k_B widens. Moreover, if ξ drops below a critical value, there will be no high- or middle-income steady-state, because the r-curve never intersects the r^*-curve, except for the low-income steady-state at k_A.

However, it is important to note that the failure of collective action does not eliminate all private ordering because good institutions usually include characteristics of a private good, as well. In as much as individuals have an incentive to single-handedly engage in private ordering they create positive spillovers and contribute to the aggregated quality of institutions.

What are the consequences for policy option? Failure of collective action strengthens the case for institutional disintegration (see pages 137-140). The reason is that coordination costs increase with size and heterogeneity of the group of people. Consequently, if disintegration leads to a smaller and more homogenous group, coordination becomes easier and a higher degree of collective action may be achieved.

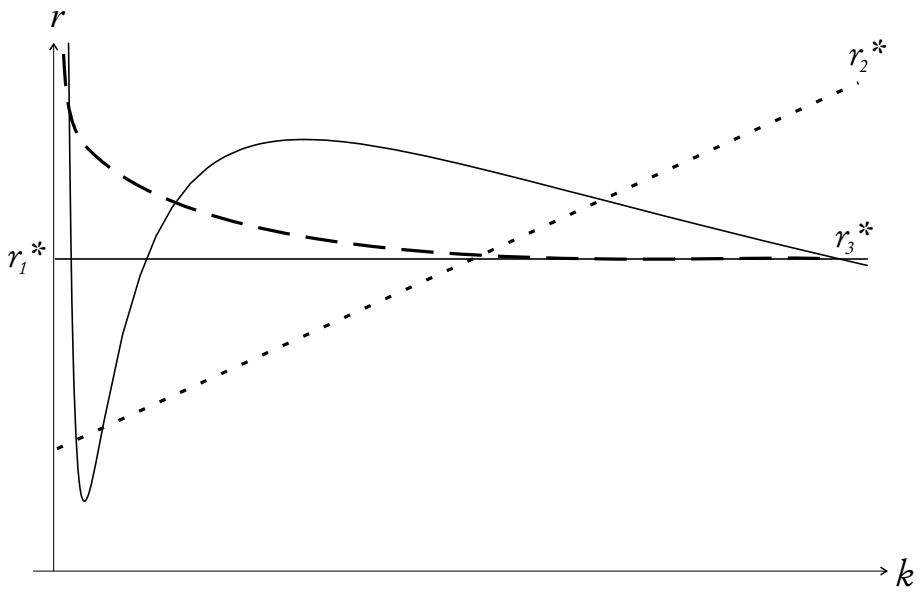

Figure 6.7: Various capital-supply curves meet demand

6.5.2 Imperfect capital mobility

The baseline model's assumption that capital supply and demand are unlimited at a given interest rate is strong. This sections aims to show that although this assumption is strong it is not crucial for the results of the model.

Figure (6.7) shows three different curves of capital supply, r_1^*, r_2^*, and r_3^*, and the already familiar capital-demand curve from figure (6.3). Please note that the r-curve in (6.3) has been upside down in order to match the po^*-curve. This is not the case in (6.7). Although the developments of the three capital-supply curves are fundamentally different, the general pattern of the model, the development trap, persists. As long as proposition (2) holds, supply and demand intersect three times irrespective of the detailed development of capital supply.

Different capital-supply curves can be motivated by *stock* and *flow* aspects. The stock of capital per worker determines ceteris paribus the quality of institutions and output in the economy. The international capital market usually charges higher interest rates for poor countries with bad institutions because they are often characterised by higher economic volatility and more risk. Therefore, the world-interest rate may decrease in the capital endowment per worker as reflected by the negative slope of the r_3^*-curve. Moreover,

it seems likely that the world-interest rate converges to some world-interest rate for risk-free assets given by the scarcity of capital, for instance r_1^*. As drawn in figure (6.7), the gap between k_A and k_B widens compared to the r_1^*-curve because the world-interest rate is higher and financing from abroad less attractive.[23]

The r_2^*-curve may reflect flow considerations in the short-run. For a given capital endowment and domestic savings, additional capital formation requires foreign capital inflows and current account deficits. The more capital is accumulated in a given period of time, the higher the capital inflows and the higher the current account deficit will be. The markets may charge a risk premium which depends on the current account deficit because a high current account deficit may be regarded as adding to economic fragility, for instance because the probability of a currency or financial crisis rises (Lipschitz, Lane, and Mourmouras, 2004, p 10). Hence, the positive slope of the r_2^*-curve.

There are good reasons—not least technical elegance and simplicity—to work with perfect capital mobility in models such as this. The qualitative results are unchanged if different capital-supply curves are used.

6.5.3 Heterogeneous capital-owners

How boring life would be if everybody would be the same! Fortunately, it is highly unrealistic to assume identical capital-owners. Diversity is much more likely and exciting. Heterogeneity may express itself in many ways. However, this sections looks at two distinct features: (i) the size of individual capital holdings, and (ii) the "institutions-intensity" of the individual business. In all other respects capital-owners are assumed to be identical.

The desired rate of private ordering of identical capital-owners is given by equations (6.12) and (6.28)—the former with collective action, the latter without. Different capital-owners will prefer different rates of private ordering, and this may translate into a different aggregate rate. Taking (6.28) as benchmark, assume that the desired rate of private ordering of individual i is given by

[23] It seems worth noting that the model has been deterministic so far. There was no risk, and no need to compensate for taking risk. It is only here that potential investors assume, perhaps reasonably, that low incomes and bad institutions go with an increase in the riskiness of investments.

$$po_i^{***} = z_i \, \xi \, po^*, \tag{6.32}$$

where z_i is a function which captures individual characteristics of i: the lower z_i, the lower will be the desired rate of private ordering by i. Applying the two dimensions of heterogeneity, z_i is expected to be lower for (i) big capital-owners because of economies of scale in the production of private ordering, and (ii) for those businesses which are less institutions-intensive.

Economies of scale

It seems reasonable to assume economies of scale in the provision of private ordering: somebody who owns assets worth $2,000 might use more resources to protect his property as if he owned only $1,000, but probably not twice as much. Equation (6.33) proposes a simple functional form for z_i which illustrates the impact of economies of scale on the effectiveness of individual private ordering.

$$z_i = \eta \, k_i + x \quad \text{, with } z_i > 0, \ \eta \leq 0 \tag{6.33}$$

$$z_i = \eta \, \bar{k} + x \stackrel{!}{=} 1 \tag{6.34}$$

$$\text{therefore} \quad x = 1 - \eta \, \bar{k} \tag{6.35}$$

$$z_i = \eta \, (k_i - \bar{k}) + 1 \tag{6.36}$$

$$po_i^{***} = \big(\eta \, (k_i - \bar{k}) + 1\big) \, \xi \, po^* \tag{6.37}$$

The parameter η represents economies of scale: the lower η the stronger z_i decreases in k_i, hence, the more important will be economies of scale for the provision of private ordering.[24] Moreover, equation (6.34) says that z_i shall be such that a capital owner of average size—ie, with a capital endowment $\bar{k} = \sum k_i / n$—would choose the same rate as before.[25]

How will be the effect on the aggregated rate of private ordering? This depends on the distribution of capital in the economy, and whether or not collective action will determine a binding rate for all capital-owners. A standard assumption would be a positively skewed distribution of capital—ie, a distribution where there are many individuals with a low capital endowment,

[24] From (6.33) and (6.34) follows that η will be restricted to values which satisfy $k_i - \bar{k} > \frac{1}{\eta}$ for $i = 1...n$. The suggested functional form might not be appropriate if the variance in the distribution of capital is very large because then the restriction in η would be very tight.

[25] This specification is chosen for simplicity.

and few with a high capital endowment. The median capital-owner holds assets below average. If the collectively chosen rate will be determined by a public vote, then the median capital-owner will prevail and the aggregated rate of private ordering will be higher than in the benchmark. But this scenario appears unlikely because private ordering is hard to coordinate.

Following section (6.5.1), failure of collective action leads to a reduction in the aggregated rate of private ordering because individual capital-owners will choose a rate so as to maximise individual returns but ignore possible externalities. They will adjust their rate of private ordering until $\frac{\partial r_i}{\partial po_i^{***}} = 0$ for all $i = 1...n$, but due to the heterogenous distribution of capital this rate will not be equal across all individuals. According to (6.28) and (6.37), the aggregated rate of private ordering without collective action will be:

$$po^{***} = \frac{\xi\, po^*}{k} \sum k_i(\eta\,(k_i - \bar{k}) + 1) \tag{6.38}$$

It is easy to see that if capital is unevenly distributed, there will be a lower aggregated rate of private ordering, po^{***}, compared to a uniform distribution. The reason is that better endowed people opt for a lower rate of private ordering (economies of scale) which is not balanced by the higher rate desired by those with a below average capital endowment because the rates of private ordering are multiplied with the respective capital endowments. The rich, therefore have more weight than the poor.

Consider the following example. Let there be two individuals in the economy with $k_1 = 10$ and $k_2 = 50$—ie, a quite uneven distributed capital endowment. The parameter η shall be given at $\eta = -0.04$, and $\xi = 1$. In this case the aggregate rate of private ordering, po^{***} would be around 47 percent of the rate that would be chosen when the same amount of capital would have been uniformly distributed: $po^{***} \approx 0.47\, po^{**}$.

An unequal distribution of capital together with failure of collective action in the provision of private ordering has two consequences. On one hand, there is an obvious advantage because the economy needs to spend less for private ordering at any given capital endowment. This drives up domestic returns and potentially encourages further capital accumulation. On the other hand, less private ordering means that institutions are worse, if compared to an economy with uniform capital distribution and the same level of capital endowment. It is the big capital-owners which are able to thrive in such an economy because they are able to exploit economies of scale in private ordering, while small capital-owners are at a disadvantage. This creates

a new threshold because a certain size is necessary to operate profitably.[26]

At this point, it is important not to confuse large firms with large capital-owners. The existence of huge corporations itself may be compatible with an equal distribution of capital as long as ownership of the corporation is dispersed. The economies of scale enjoyed by big firms will be balanced by management-shareholder conflicts within firms. The total amount of private ordering might thus be unaffected. Individual capital-owners are presumed to look for the most efficient way to place their private ordering, including delegation to agents—the state, investment funds, public companies, et cetera.

This approach helps explaining why some countries, such as a stereotypical 'banana republic', may have poor institutions despite a high level of capital endowment per capita. Big capital-owners operate profitably while smaller entrepreneurs face a hard time. Although aggregate production may be higher, the unequal distribution of capital may be undesirable for normative or political economy reasons. Again the cliché of a banana republic is illuminating: The concentration of wealth may convey political power and influence, which could be used against potential competitors, for instance by denying foreign firms access to the market.

Institutions-intensive business

A second possibility why z_i should vary across capital-owners is because they may be engaged in different types of businesses. Simple production with spot transactions, a low degree of specificity, easy to observe assets, et cetera is less institutions-intensive then, say, a complex production with long-term contracts and commitments, as well as highly specific assets. Most primary production and resource extraction as well as simple services (craftsmen) may qualify as less institutions-intensive, while many modern production facilities, a car plant or a financial intermediary for instance, may be more sensitive to the quality of institutions.

The benchmark case (6.12) shall apply in case of a uniform distribution of z_i. Moreover, capital-owners are now assumed to have identical capital

[26]Economies of scale in private ordering create an incentive to concentrate all capital within a single individual. This can hardly be observed, and it would violate the assumption of small capital-owners. Therefore a counter-veiling effect, such as agency-costs which increase with the size of assets, would have to be included in order to determine an optimal size which is less than the total economy. However, this would go beyond the scope of this section, which takes the distribution of capital as given.

holdings, $k_i = k/n$; therefore: $\sum z_i = 1$.

If the rate of private ordering is collectively set by a public vote, then again the median capital-owner will be decisive. If the median capital-owner has a z_i below average—ie, he or she is engaged in a less institutions-intensive business—then the aggregated rate of private ordering will be below the benchmark as given by (6.12).

Poor countries with bad institutions provide incentives to businesses that are less sensitive to the quality of institutions. Therefore, the median capital-owner is more likely to have a z_i below average, and private ordering will therefore be lower. In course of development and with improving institutions, the focus should shift towards more institutions-intensive production and the median capital-owner of a richer country has possibly a z_i above average. Hence, institutions would be better than in the benchmark case.

There are however some countries which become richer without substantial changes in the production structure. Countries that live on resource extraction (which is presumed to be less institutions-intensive) are sometimes sluggish to switch to modern production. They have less incentive to improve institutions. Saudi Arabia, a major oil producing and exporting country, has a GDP per capita of \$7,562 which is much higher than the \$4,746 of the average upper middle income economy. However, the quality of institutions—as measured by the ICRG composite indicator—is slightly below the average country (73 v 74).[27]

Without collective action, the benchmark case of (6.28) would apply because differences in z_i would average out. The result differs from the case with economies of scale because here the different z_i-values receive the same weight.

$$po^{***} = \frac{\sum \xi\, po^{*}\, z_i\, k_i}{k} \tag{6.39}$$

With $k_i = k/n$ and $\sum z_i = 1$:

$$po^{***} = \xi\, po^{*} \tag{6.40}$$

Policy options

From a policy point of view, it might be attractive to deliberately increase the inequality of the distribution of capital in an economy which is stuck in a development trap. More concentrated ownership would deliver economies

[27] Figures are for 2002 from the World Development Indicators Database, 2004.

of scale in private ordering, domestic returns would increase, and new investments would be attracted. In fact, if the distribution of capital were used as a policy instrument, it might be applied to increase inequality and lift the economy out of the development trap and to reduce inequality once a level of capital endowment has been reached which allows a self-sustained growth towards the high-income steady-state. A more equal distribution would then improve institutions because the provision of private ordering would rise. This appears like a policy-induced Kuznet-curve. The problem is that it seems unlikely that the distribution of capital can be used as policy instrument. Increasing the variance in the distribution may be possible, but it may prove very hard to reverse this trend against the interest of the established wealthy firms and individuals. A development strategy based on the distribution of capital may therefore be a delicate business.

6.6 Summary

Good institutions—including an effective bureaucracy, protection of property, low corruption, et cetera—are closely related to economic development because they facilitate transactions, encourage investments, and reduce allocative distortions. Institutions allow the degree of specialisation and division of labour which generates most of the prosperity in today's rich economies. If this relation is robust, there should be stunning demand for good institutions. However, as shown by the existence of poverty and development traps in the empirical literature,[28] some countries apparently fail to exploit this relation and remain in a situation with low incomes and bad institutions.

Bad or predatory governments are an important reason why some countries show little progress in institutional quality. They may prefer a situation which allows them to steal from the country rather than to bring prosperity to the masses. However, this raises the question why people would accept this instead of demanding change. This demand could appear in public votes or, if formal representation is missing, it could be taken to the streets. An oppressive regime might silence such demand but this could infuriate new protests, and eventually only a very rigid and closed regime might get away with it.

However, there are costs associated with such activities. Individuals who take to the streets have to devote effort (time and resources) and take

[28] See for instance Azariadis (2001); Bloom, Canning, and Sevilla (2003); Graham and Temple (2001); Jones (2002); Quah (1996); Semmler and Ofori (2003).

personal risks. Such activities are worthwhile only if the expected benefits surpass these costs. In other words, there may be situations where individuals content themselves with low incomes and bad institutions because the costs of change—at least at the individual level—are prohibitively high. These costs have been called *private ordering*, and they comprise activities to enforce but also to change the rules of the game.

This chapter introduces a mechanism which explains a possible interaction between good institutions and wealth. Good institutions require resources to be put into practice, and it is much easier for a rich country to have good institutions than for a poor country. Moreover, good institutions increase wealth, because they allow a more efficient production. Voilà, a feedback loop. Wealth promotes institutions and good institutions promote wealth. Such a feedback loop may turn into a virtuous or vicious circle, and lead the economy to a high or low-income steady-state. Which cycle applies depends on some exogenous parameters, such as the amount of social capital, as well as starting conditions with regard to the endowment with physical and human capital. Domestic returns (=marginal returns to capital minus the rate of private ordering) evolve as a roller-coaster with respect to capital density, exposing up to three equilibria where domestic returns equal the world-interest rate. Each equilibrium creates a steady-state.

The low-income steady-state is a development or poverty trap because individual capital-owners, domestic or foreign, have no incentive to invest further in the economy and capital accumulation and institutional development are stalled. However, there is not necessarily a fundamental flaw which prevents a high-income steady-state: The economy could potentially produce much more if only it were able to overcome this development trap.

Section (6.4) discusses a number of policy options and the consequences of variations in the exogenous parameters. The development trap disappears for parameter values above certain thresholds, however since these are exogenously given, there is probably little political leverage. Other policy options are conceivable: an economy that were flooded with capital, ignoring temporary losses, could be pushed from the low-income to the medium-income steady-state and then step on a path of self-sustained growth. The downside is a tendency of investments which lack economic accountability and hard budget constraints towards white elephants and less private ordering. The practical quality of industrial programming in order to escape a development trap may thus be limited. A more promising strategy seems to disintegrate the economy into regionally and/or functionally separated centres and periphery. This would allow the concentration of capital and private ordering

in some areas which may then pass the medium steady-state and proceed to the high-income steady-state on their own, while the rest of the country bounces back to at least the low-income steady-state. Gradually enlarging the centres could then move the whole economy past the medium steady-state.

During section (6.5) a number of assumptions of the baseline model are relaxed. The most important changes are failure of collective action and heterogenous capital-owners. Failure of collective action reduces the rate of private ordering desired by individual capital-owners because they ignore positive externalities. Taking on a corrupt government is much harder alone than in a grand coalition. However, the desired rate must not necessarily drop to zero, since there is a private element in the provision of private ordering. Hence, individuals have an incentive to expend resources to private ordering even if others do not join in. This incentive is stronger the more private ordering has characteristics of a private good, and lower if it resembles more a public good.

Heterogeneity among capital-owners may compound the problem because those with huge capital-holdings may enjoy economies of scale in the provision of private ordering, and expend a lower fraction. This depresses private ordering in the economy and leads to worse institutions. Countries with a highly unequal distribution of capital may thus boast a high capital density and bad institutions at the same time. Such may be the case in a stereotypical banana republic.

A similar result may emerge when production is concentrated in industries that are less institutions-intensive, such as resource extraction. Countries which are well endowed with natural resources may feel less pressure to acquire the necessary institutions for a production structure with high specialisation and division of labour. In other words, countries with a low share of institutions-intensive business in output should be expected, ceteris paribus, to have worse institutions.

Figure (6.3) illustrates the roller-coaster evolution of domestic returns with respect to the capital endowment per worker. The three equilibria where domestic return equal the world-interest rate establish the steady states, though the medium-income steady-state is unstable. The economy converges to either the low-income or high-income steady-state, depending on starting conditions and parameters. The model, however, does not say how fast this convergence will take place, nor if it will be fuelled by domestic or foreign

investment decisions. In a deterministic setting with perfect capital mobility an immediate convergence would follow, but this is not supported by empirical observations. Even if domestic returns exceed the world-interest rate, capital formation might be restricted because an economy may only absorb so much capital at a time. Potential investors might charge a risk premium which is increasing in the investment rate, and therefore slows convergence. Moreover, it should be noted that the steady states are not necessarily situations of zero growth. Technological progress, for instance, would increase domestic returns and encourage new investments increasing capital-endowment in the low- and high-income steady-states. For simplicity, this chapter has taken technology as a constant (except section 6.4.4), but if this assumption is relaxed, even countries in a low-income steady-state may have positive growth rates.

6.7 Appendix

Equation 6.7 is calculated using the simplification $\frac{\partial Q}{\partial k} = 0$. Comparison of figures 6.8 and 6.9 (both using the same set of parameters as in figure 6.2) shows that this simplification has no qualitative impact on the results. The accurate expressions for the optimum rate of private ordering and the corresponding domestic returns are given on the next two pages, however.

$$
\begin{aligned}
&po^* = \\
&-\frac{1}{k} + \Big(\big(1 + I\sqrt{3}\big)\big(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\big)\Big) \Big/ \Big(3\,2^{2/3}k^3\,\Big(-54k^6 + 27k^6(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta) - 27k^6(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta) + \\
&\quad 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta}\Big)\,\hat{}\,(1/3)\Big) - \\
&\frac{1}{6\,2^{1/3}k^3}\Big(\big(1 - I\sqrt{3}\big)\Big(-54k^6 + 27k^6(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta) - \\
&\quad 27k^6(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta) + 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta}\Big)\,\hat{}\, \\
&\quad (1/3)\Big)
\end{aligned}
$$

$$
\begin{aligned}
r = {} & \frac{1}{k} - \left(\left(1 + I\sqrt{3}\right)\left(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\right)\right) \Big/ \left(3\,2^{2/3}k^3\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) + \\
& \frac{1}{6\,2^{1/3}k^3}\left(\left(1 - I\sqrt{3}\right)\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) + \\
& \left(k^{-1+\alpha}\right. \\
& \quad \left(\theta\left(\alpha + k(-1+\alpha)\left(-\frac{1}{k} + \left(\left(1 + I\sqrt{3}\right)\left(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\right)\right) \Big/ \left(3\,2^{2/3}k^3\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - \right.\right.\right.\right.\right. \\
& \left.\left.\left.\left.\left. k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) - \right. \\
& \quad \left.\frac{1}{6\,2^{1/3}k^3}\left(\left(1 - I\sqrt{3}\right)\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\right.\right.\right.\right. \\
& \quad \left.\left.\left.\left.\theta\right) + 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right)\right)\right) + \\
& \quad k\left(-\frac{1}{k} + \left(\left(1 + I\sqrt{3}\right)\left(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\right)\right) \Big/ \right. \\
& \quad \left(3\,2^{2/3}k^3\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \quad \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) - \\
& \quad \frac{1}{6\,2^{1/3}k^3}\left(\left(1 - I\sqrt{3}\right)\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \quad \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right)\Big) \\
& \quad \left(1 + \alpha + k\alpha\left(-\frac{1}{k} + \left(\left(1 + I\sqrt{3}\right)\left(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\right)\right) \Big/ \left(3\,2^{2/3}k^3\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\right.\right.\right.\right. \\
& \quad \left.\left.\left.\left.\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) - \right. \\
& \quad \left.\frac{1}{6\,2^{1/3}k^3}\left(\left(1 - I\sqrt{3}\right)\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\right.\right.\right.\right. \\
& \quad \left.\left.\left.\left.\theta\right) + 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right)\right)\right)\Big) \Big/ \\
& \left(1 + k\left(-\frac{1}{k} + \right.\right. \\
& \quad \left(\left(1 + I\sqrt{3}\right)\left(3k^{4+\alpha} - 3k^{4+\alpha}\alpha - 3k^{4+\alpha}\theta + 3k^{4+\alpha}\alpha\theta\right)\right) \Big/ \left(3\,2^{2/3}k^3\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \quad \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right) - \\
& \quad \frac{1}{6\,2^{1/3}k^3}\left(\left(1 - I\sqrt{3}\right)\left(-54k^6 + 27k^6\left(3 + k^\alpha - k^\alpha\alpha - k^\alpha\theta + k^\alpha\alpha\theta\right) - 27k^6\left(1 - k^\alpha - k^\alpha\alpha + k^\alpha\theta + k^\alpha\alpha\theta\right) + \right.\right. \\
& \quad \left.\left. 6\sqrt{3}\,k^{\frac{1}{2}(12+2\alpha)}(-1+\theta)\sqrt{\left(27 + k^\alpha - 3k^\alpha\alpha + 3k^\alpha\alpha^2 - k^\alpha\alpha^3 - k^\alpha\theta + 3k^\alpha\alpha\theta - 3k^\alpha\alpha^2\theta + k^\alpha\alpha^3\theta\right)}\right)^{\wedge}(1/3)\right)\Big)\Big)^{\wedge} \\
& 2
\end{aligned}
$$

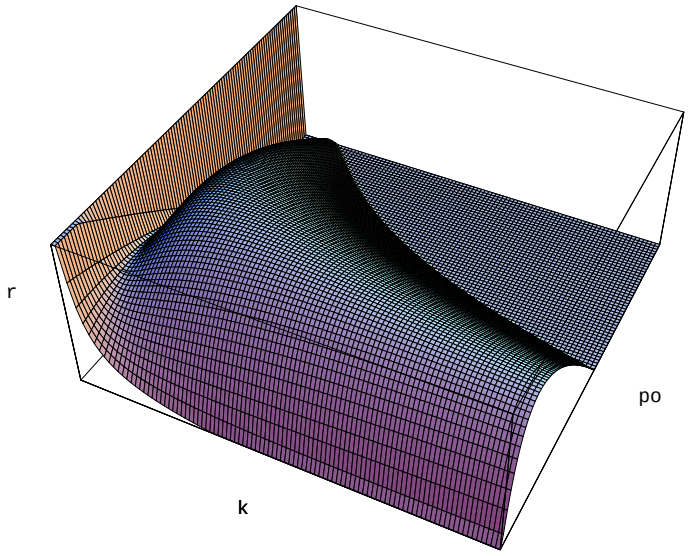

Figure 6.8: Evolution of domestic returns with $\frac{\partial Q}{\partial k} = 0$

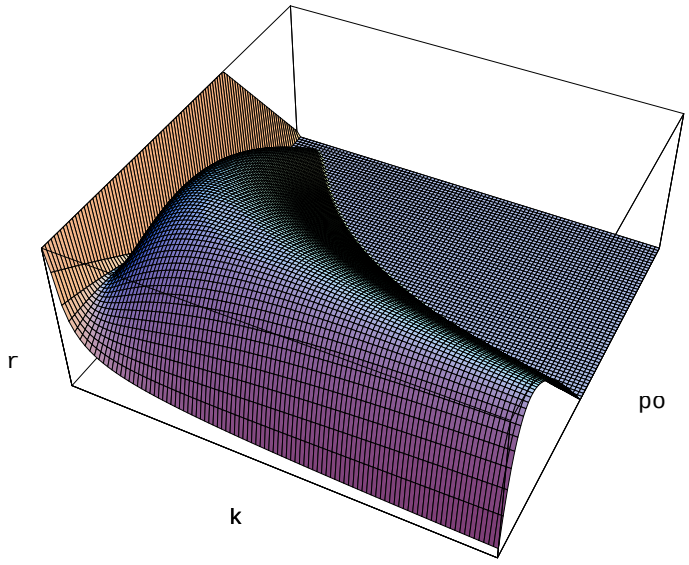

Figure 6.9: Evolution of domestic returns with feedback from $\frac{\partial Q}{\partial k}$.

Proposition 3. *The functional form* $Q = 1 - \frac{1}{\Omega\ po\ k+1}$ *satisfies the conditions laid out in section (6.2)—ie,* $\lim_{po\ k\to\infty} Q = 1$, $\lim_{po\ k\to 0} Q = 0$, $\frac{\partial Q}{\partial po} > 0$, $\frac{\partial Q}{\partial k} > 0$, $\frac{\partial^2 Q}{\partial po^2} < 0$, *and* $\frac{\partial^2 Q}{\partial k^2} < 0$*:*

Because of symmetry in the argument of the denominator, it suffices to show that the conditions hold with regard to one of the variables *po*, *k*, or the parameter Ω. Note, that *po*, *k*, and Ω are restricted to nonnegative values.

$$\begin{aligned}
\lim_{k\to\infty} 1 - \frac{1}{\Omega\ po\ k+1} &\to 1 \\
\lim_{k\to 0} 1 - \frac{1}{\Omega\ po\ k+1} &\to 0 \\
\frac{\partial Q}{\partial k} = \frac{po\,\Omega}{(1+k\,po\,\Omega)^2} &> 0 \\
\frac{\partial^2 Q}{\partial k^2} = \frac{-2\,p^2\,\Omega^2}{(1+k\,p\,\Omega)^3} &< 0
\end{aligned}$$

The basic qualities and features of the model are illustrated by figure (6.2) which shows the characteristic "roller-coaster" pattern of domestic returns. The qualities of this pattern are not sensitive to the actual functional form of *Q*.

A functional form such as $Q = e^{-\frac{1}{\Omega\ po\ k}}$ would satisfy the conditions as well:

$$\begin{aligned}
\lim_{k\to\infty} e^{-\frac{1}{\Omega\ po\ k}} &\to 1 \\
\lim_{k\to 0} e^{-\frac{1}{\Omega\ po\ k}} &\to 0 \\
\frac{\partial Q}{\partial k} = \frac{1}{e^{\frac{1}{k\,po\,\Omega}}\,k^2\,po\,\Omega} &> 0 \\
\frac{\partial^2 Q}{\partial k^2} = -\frac{-1+2\,k\,po\,\Omega}{e^{\frac{1}{k\,po\,\Omega}}\,k^4\,po^2\,\Omega^2} &< 0 \\
(\text{for } k > \tfrac{1}{2po\ \Omega}) &
\end{aligned}$$

Comparison of of figures (6.10) and (6.11) shows that the qualitative properties of the model are the same. Both show the typical evolution of domestic returns which is responsible for the possible emergence of multiple steady-states. Of course, the figures are not identical; instead the two

functional form for Q deliver quantitatively different results which show up as slight variances of the underlying, joint pattern. This is to illustrate that the model does not react qualitatively sensitive to changes in the functional form for Q as long as the aforementioned conditions are met.

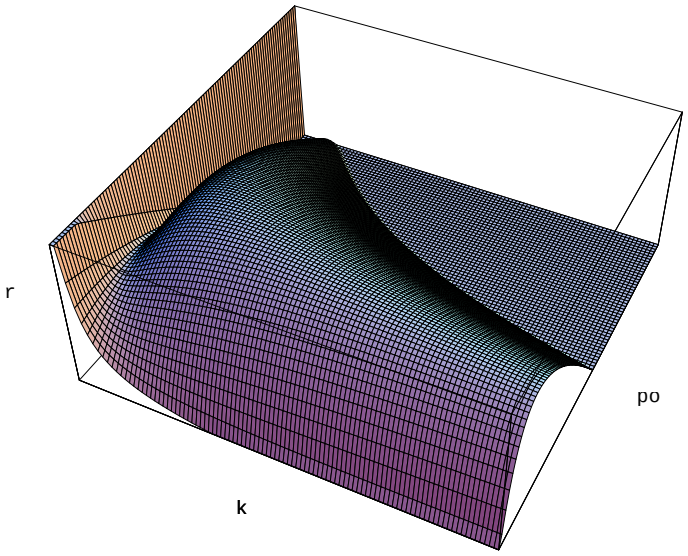

Figure 6.10: Evolution of domestic returns with $Q = 1 - \frac{1}{\Omega\ po\ k+1}$

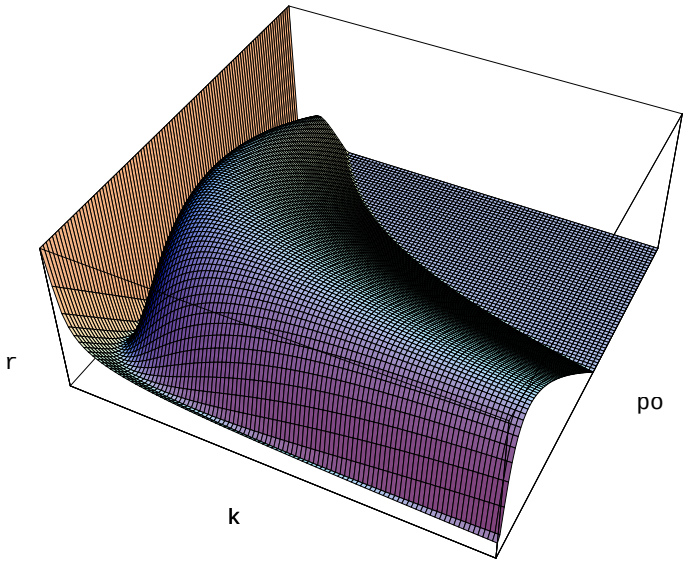

Figure 6.11: Evolution of domestic returns with $Q = e^{-\frac{1}{\Omega\ po\ k}}$

Proposition 4. *If $\theta > \frac{\alpha^2}{(\alpha-2)^2}$, then domestic returns, r, would be monotonically falling in the capital endowment per worker,k. The typical "roller-coaster" pattern would not emerge.*

Domestic returns are given by equation (6.10):

$$r = \alpha k^{\alpha-1}(\theta + Q - \theta\ Q) - po$$

Its first derivative with regard to k is:

$$\frac{\partial r}{\partial k} = \frac{k^{\alpha-2}\alpha(\theta(\alpha - 1 - 2k\ po\ \Omega + k\ po\ \alpha\ \Omega) + k\ po\ \Omega(\alpha - k\ po\ \Omega + k\ po\ \alpha\ \Omega))}{(1 + k\ po\ \Omega)^2} \tag{6.41}$$

Setting (6.41) equal to zero and solving for k gives two functions, which provide values of k where $\frac{\partial r}{\partial k} = 0$. At k_1 marginal returns become (locally) maximal, $r = r_{high}$, and at k_2 they are (locally) minimal $r = r_{low}$ for any given value of po.

$$k_1 = \frac{-po(\alpha - 2\theta + \alpha\ \theta)\Omega - po\ \Omega\sqrt{\theta - 1}\sqrt{-\alpha^2 + 4\theta - 4\alpha\ \theta + \alpha^2\theta}}{2po^2(\alpha - 1)\Omega^2} \tag{6.42}$$

$$k_2 = \frac{-po(\alpha - 2\theta + \alpha\ \theta)\Omega + po\ \Omega\sqrt{\theta - 1}\sqrt{-\alpha^2 + 4\theta - 4\alpha\ \theta + \alpha^2\theta}}{2po^2(\alpha - 1)\Omega^2} \tag{6.43}$$

Solving equation (6.43) for θ returns:

$$\theta = -\frac{k_2\ po\ \Omega(\alpha - k_2\ po\ \Omega + k_2\ po\ \alpha\ \Omega)}{\alpha - 1 - 2k_2\ po\ \Omega + k_2\ po\ \alpha\ \Omega} \tag{6.44}$$

Now, setting $\frac{\partial\theta}{\partial k_2} = 0$, and solving for the critical values k_k and θ_k respectively (subscripts denote critical values) delivers the maximum value for θ.

$$\frac{\partial\theta}{\partial k_2} = -\frac{po(\alpha - 1)\Omega\ (1 + k\ po\ \Omega)(\alpha - 2k\ \Omega\ po + k\ po\ \alpha\ \Omega)}{(\alpha - 1 - 2k\ po\ \Omega + k\ po\ \alpha\ \Omega)^2} \tag{6.45}$$

$$k_k = -\frac{\alpha}{po(\alpha - 2)\Omega} \tag{6.46}$$

Plugging (6.46) into (6.44) delivers:

$$\theta_k = \frac{\alpha^2}{(\alpha - 2)^2} \tag{6.47}$$

If θ were above its critical values, θ_k, neither k_1 nor k_2 would be solvable because there were no local maximum and minimum. Instead, the r-curve would evolve monotonically.

Moreover, plugging (6.42) and (6.43) in equation (6.10) yields the values for domestic returns at the local minimum and local maximum:

$$r_{high} = -po + \frac{\alpha \quad \alpha - \alpha\,\theta + \sqrt{-1+\theta}\,\sqrt{\alpha^2\,(-1+\theta)+4\,\theta-4\,\alpha\,\theta} \quad \frac{\alpha-2\,\theta+\alpha\,\theta+\sqrt{-1+\theta}\,\sqrt{-\alpha^2+4\,\theta-4\,\alpha\,\theta+\alpha^2\,\theta}}{2\,po\,\Omega-2\,po\,\alpha\,\Omega}^{-1+\alpha}}{2+\alpha\,(-1+\theta)-2\,\theta+\sqrt{-1+\theta}\,\sqrt{\alpha^2\,(-1+\theta)+4\,\theta-4\,\alpha\,\theta}} \tag{6.48}$$

$$r_{low} = -po + \frac{\alpha \quad \alpha\,(-1+\theta)+\sqrt{-1+\theta}\,\sqrt{\alpha^2\,(-1+\theta)+4\,\theta-4\,\alpha\,\theta} \quad \frac{\alpha-2\,\theta+\alpha\,\theta-\sqrt{-1+\theta}\,\sqrt{-\alpha^2+4\,\theta-4\,\alpha\,\theta+\alpha^2\,\theta}}{2\,po\,\Omega-2\,po\,\alpha\,\Omega}^{-1+\alpha}}{-2+\alpha+2\,\theta-\alpha\,\theta+\sqrt{-1+\theta}\,\sqrt{\alpha^2\,(-1+\theta)+4\,\theta-4\,\alpha\,\theta}} \tag{6.49}$$

Proposition 5. *If the optimum rate of private ordering, po^*, as given by equation (6.12) prevails then the quality of institutions strictly increases in k, even if po^* sinks.*

Equation (6.1) and (6.12) state that

$$Q = 1 - \frac{1}{\Omega\ po\ k + 1}$$
$$po^* = \frac{-\left(k\,\Omega\right) + \sqrt{-\left(k^{2+\alpha}\,\alpha\ (-1+\theta)\ \Omega^3\right)}}{k^2\,\Omega^2}.$$

Plugging (6.12) into (6.1) is the quality of institution under the condition that $po = po^*$; taking the first derivative with respect to k yields:

$$Q = 1 - \frac{k\,\Omega}{\sqrt{-\left(k^{2+\alpha}\,\alpha\ (-1+\theta)\ \Omega^3\right)}} \tag{6.50}$$

$$\frac{\partial Q}{\partial k} = \frac{\alpha\,\Omega}{2\,\sqrt{-\left(k^{2+\alpha}\,\alpha\ (-1+\theta)\ \Omega^3\right)}} > 0 \tag{6.51}$$

It is easy to see that (6.51) is positive, therefore Q increases in k under the condition that the optimum rate of private ordering, po^*, prevails.

Table 6.1: **List of variables and parameters in chapter 6**

A	Level of technology
α	Factor-input elasticity of capital and share of profits in the Cobb-Douglas production function, $0 \leq \alpha \leq 1$
η	Economies of scale in the provision of private ordering, $k_i - \bar{k} > \frac{1}{\eta}$, $\eta < 0$
K	Capital endowment
k	Capital endowment per worker; capital density
k_i	Capital endowment per worker of capital-owner i
L	Labour supply
λ	Parameter which indicates the effectiveness of private provision of private ordering vis-à-vis public provision, $0 \leq \lambda \leq 1$
n	Number of capital-owners in the economy
Ω	Social capital, $\Omega > 0$
po	Aggregated rate of private ordering, $po \geq 0$
po_i	Rate of private ordering of capital-owner i, $po_i \geq 0$
po^*	Optimum rate of private ordering with collective action and homogenous capital-owners
po^{**}	Optimum rate of private ordering without collective action
po^{***}	Aggregated rate of private ordering with heterogenous capital-owners
Q	Quality of institutions, $0 < Q < 1$
Q_i	Quality of institutions for capital-owner i, $0 < Q_i < 1$
r	Domestic returns
r_i	Domestic returns to capital-owner i
r^*	World-interest rate
θ	Fraction of output loss that is recuperated by shady activities, $0 \leq \theta \leq 1$
ξ	Parameter which captures the reduction in po^* because of failure of collective action, $0 \leq \xi \leq 1$
Y	Output
y	Output per worker
z_i	Characteristics of individual i