Beyond Rosenstein-Rodan:

The Modern Theory of Coordination Problems in Development

Karla Hoff

Abstract. The theme of this article is the importance – and the many causes – of coordination problems in development. Rosenstein-Rodan pointed out that spillovers may cause the return to an activity to increase with the number of others who undertake the same or complementary activities. If such spillovers are strong enough, multiple equilibrium outcomes may exist, some of which are better for every person than the alternatives, but with no tendency for market forces to lead from the worse to the better state of affairs. This article shows how modern economic theory broadened our view of the sources of spillovers that could lead to underdevelopment as an equilibrium. It argues for an “ecological” perspective on development, where the influences from others in one’s environment are a critical determinant of outcomes, and many interaction effects are not mediated by markets. This perspective provides the basis for the distinction between “deep” interventions, which change underlying forces, and “shallow” interventions, which do not and may actually make things worse.

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Class I-C. Identical Actors and Continuous Actions
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Paul Rosenstein-Rodan (1943) famously argued that at an early stage of development, the investments of industrializing firms in one sector may increase the profitability of other sectors throughout the economy. Simultaneous industrialization of many sectors of the economy could be profitable for them all, even though no sector would be profitable industrializing alone. As a result, an underdevelopment equilibrium was possible. Even the market mechanism need not succeed in coordinating the activities needed to ensure development.

In modern terms, there could be a coordination failure, where individuals' failure to coordinate complementary changes in their actions leads to a state of affairs that is worse for everyone than some alternative state of affairs that is also an equilibrium. The obstacle to achieving the better state of affairs is not a matter of technological opportunities (or even knowledge of those opportunities), nor resources or preferences, but only of coordination.

In the 1950s, the possibility of “underdevelopment equilibria” and “vicious circles of poverty” was elaborated on by many others [including Nurkse 1953, Leibenstein 1957, Myrdal 1957, and Hirschman 1958]. But individuals are rarely convinced by those who do not address their concerns. Without a well-developed theory of the sources of spillover effects (externalities), the idea of an underdevelopment equilibrium had little influence on neoclassical economists of that period. They continued to use their models to argue that the market mechanism could coordinate the changes needed for development (Krugman, 1992, 1995, and the comment by Stiglitz, 1992).
 Advances in the last three decades in the modeling of externalities, technological progress, and scale economies have made it possible to provide formal models to capture Rosenstein-Rodan’s insights. At the same time, information economics showed that neoclassical theory was based on a special case—perfect, costless information\footnote{In this article, the term *neoclassical theory* is used as a short-hand for models that postulate maximizing behavior plus interactions through a complete set of perfectly competitive markets. This narrow definition is for convenience only. There is no consensus on the scope of this term, which is sometimes (as in Laffont 1989, p. 6) used broadly to include any “systematic exploration of the implication of rational behavior in economics.” In that broad sense, all the models discussed in this article, except for one evolutionary model, are examples of neoclassical theory.} – and its results on efficiency broke down as soon as one departed in almost any respect from that assumption. Before these theoretical developments, most economists thought that the implication of externalities was that the economy would be slightly distorted. But we now understand that the interaction of the slightly distorted behaviors of different agents may produce very large distortions.

Although it formalizes Rosenstein-Rodan’s basic insight, modern work on coordination problems is very far from his original story in several respects.

- **Remedies through international trade.** Rosenstein-Rodan [1943] was particularly concerned with demand effects associated with increasing returns industries. In some cases, once an economy is opened to international trade, this argument loses its force, as Tinbergen (1967) pointed out early on.

- **Channels of spillovers.** Whereas Rosenstein-Rodan focused primarily on demand effects, modern theory has identified many other channels of

\[\text{Example of a mathematical formula here}\]
spillovers that can lead to coordination failures: spillovers in the technology of the individual agent, spillovers mediated by social and political interactions, informational externalities, and spillovers when agents come together through a search process.\(^2\) The result can be coordination problems with respect to a wide range of behaviors that matter for development. This article considers examples regarding R&D, entrepreneurship, contract enforcement, corruption, innovation and training, protection of endangered species, and the demand for the rule of law.

- **Role of government.** Rosenstein-Rodan argued that there could be coordination "from above" where government planned the process of industrialization. In contrast, most recent scholars recognize that there is no such thing as coordination “from above" because government is itself part of the endogenous set of institutions to be explained (see, e.g., Dixit 1996 and Basu 1997, 2000). Moreover, even in democracies, governments fail, just as markets do.\(^3\) But a positive development that has emerged in recent years, as I discuss below, is to try more limited interventions to harness the spillovers

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\(^2\) A further channel of spillovers, which is outside the scope of this article, arises where one person’s preferences depend on another person’s preferences, as in role model effects. These effects, too, can give rise to coordination failures: The value placed on conformity can lead each individual to choose a particular action because others do, and yet another group with identical microeconomic characteristics can exhibit, due to intra-group interactions, different behaviors that make all individuals strictly better off. Durlauf (1999, pp. 164-65) illustrates this idea formally.

\(^3\) Besley and Coate (1998, pp. 151-152) provide a definition of political failure that is parallel to that of market failure. One begins in each case by defining the set of technologically feasible utility allocations. For the case of political failure, this reflects the available policy instruments, e.g. taxes, transfers, and investments. Political institutions are then modeled. By analogy with market failures, a political failure arises when equilibrium policy choices result in an outcome
among agents, and to try to design sequences of policy reforms that will make it more likely for “good” equilibria to emerge.

The goal of this article is to show how developments in economic theory in the last 30 years have broadened our understanding of the channels of spillovers, and made possible a new understanding – which I call the "ecological perspective" – of pitfalls and opportunities in the development process.

The remainder of this article is organized as follows. The first section focuses on the place of coordination failures in modern economic theory. The second section shows that many aspects of underdevelopment can be interpreted as coordination failures. The third section presents an econometric test of poverty traps and coordination problems in rural China. The last section presents perspectives on policy.

**The Place of Coordination Failures in Modern Economic Theory**

*Neoclassical theory and the Coase theorem*

Neoclassical theory—as I use the term here – was the central economic paradigm until the mid-1970s. It studies price-mediated allocations in a setting of "complete markets." There is a market for all commodities that are, or could be, produced. The “virtual” prices ensure that every set of actions whose social benefits exceed their opportunity costs is undertaken.

where it is technologically feasible (given available tax and transfer instruments, information, etc.) to implement a Pareto-improving policy, but that policy will not be an equilibrium choice.
We were always told that such models served only as a benchmark. Neoclassical economists recognized that their models did not take account of direct interdependencies among individuals that were not mediated through markets (e.g., Pigou's polluting factories). But by and large, they believed that these were relatively unimportant and that interdependencies that were mediated through markets (pecuniary externalities) did not have efficiency effects (for example, Mishan 1971, Cheung 1973).4

In an extension of neoclassical economics, Coase [1960] argued that when an economy departed from the complete markets assumption of neoclassical theory, private agents would negotiate to efficient outcomes.5 In that tradition, North and Thomas (1973) in their economic history of the West (The Rise of the Western World), argued that the institutional changes in the West, 900-1700, were driven by changes in relative scarcity

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4 It is true that in an economy with a complete set of markets, pecuniary externalities correspond only to a movement from one Pareto efficient outcome to another. Such externalities give rise to changes in distribution that “net out”: gains by agents whose prices increase are precisely offset by losses to agents who must pay higher prices. There are no efficiency consequences from the allocation effects of price changes because equilibrium prices always are equated to marginal costs and benefits. However, in economies with incomplete markets, pecuniary externalities generally do not net out. A general framework is Greenwald and Stiglitz (1986). One application of that idea (Hoff 1998) shows that in an economy where lenders cannot distinguish borrowers who differ in their probability of default, pecuniary externalities from an improvement in technology can dissipate some, all, or more than all of the gains from the technological change. This occurs if the marginal borrower produces negative expected value (getting an implicit subsidy from the lower risk, higher quality borrowers). As the technological change induces new entry of marginal borrowers, the interest rate rises to reflect the lower average borrower quality, which hurts all borrowers and leaves banks, as before, just breaking even.

5 To be sure, Coase himself recognized that his theorem would not hold in the presence of transaction costs (McCloskey 1998). Transaction costs are important, particularly in the process of economic development.
values of products and factors; as with competition among firms in neoclassical economics, superior institutions ultimately eliminated inferior institutions.

**Institutional economics outside of the “straitjacket” of neoclassical economics**

Another strand of the literature, however, recognized that markets were inherently limited by problems of information and enforcement. There could never be the complete set of markets in goods, risks, and futures on which the efficiency results of neoclassical theory rest. Non-market institutions arise in response to limits on markets, but there need be no forces that ensure efficiency.

This can be put another way. Individual actions that are privately rational when the individual takes his environment more or less as given, need not be socially rational. There might be another set of individual actions that would create a different environment, within which a different set of actions would be an equilibrium, and that environment might be a better state of affairs. There could be multiple equilibria in institutions, with no tendency for market forces to select the one that was best.

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6 Whereas most authors are associated with one strand or the other, it is striking that North's work helped to advance both. North's early work, which one might call "North I", was in the Coasean tradition and pioneered its application to economic history. North's later work, which one might call North II, disparages the prospects for understanding economic history as a more or less inevitable movement towards more efficient institutions: “Throughout most of history, the experience of the agents and the ideologies of the actors do not combine to lead to efficient outcomes” (North 1990, p. 96; see also North 1994). I owe to North (from his comments at a conference in May 1999) the metaphor of the straitjacket.
This can be illustrated in a simple way, following de Meza and Gould 1992. Suppose that property rights are well-defined but that those individuals who own forested land must incur a fixed cost (e.g., to build a fence or hire a patrol) to enforce their property rights over the forest. Without this private expenditure, workers will be free to use the private forests and extract income from them. The benefit to an owner from enforcing his property right is that he can hire workers to exploit his forest and collect the resource rents. Thus, in deciding whether to enforce his property rights, an owner compares his potential rents to the enforcement cost. These rents will be larger, the lower the reservation wage of workers. The reservation wage of workers, in turn, depends on how many other owners are enforcing their property rights. As the fraction of property owners who enforce their rights increases, the outside opportunities of workers fall and, thus, so does the reservation wage. With lower wages, potential resource rents rise. Two stable equilibria may therefore exist, indicated in bold in Figure 1. In the first, all owners enforce their property rights, wages are low, and rents are high. In the second, no one enforces, wages are high and potential rents low, so that it does not pay any owner to enforce his property rights.  

As Coase [1937] emphasized, when the enforcement of property rights is costly, a market may or may not be the best allocation system. But as those working in the Coase

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7 Formally, suppose each resource owner who enforces his property rights hires L workers, and the value of their output is F(L). His rents are thus F(L) – w(x)L, where w is the wage function. Wages decrease with the fraction x of resource owners who enforce their property rights, which means that rents increase with x. Let the enforcement cost be C. There are two equilibria if F(L) – w(1)L > C > F(L) – w(0).
tradition did not, in general, recognize, whatever the best allocation system is, a
decentralized economy may not reach it.

A very general insight of recent theoretical work is that while institutions may
have, as their intention, the improvement in economic outcomes, there is no assurance
that that will be the case. Institutions may be part of an equilibrium, and yet be
dysfunctional. For example, Arnott and Stiglitz [1991] consider the consequences of the
social institutions that arise as a result of the incomplete insurance provided by markets
because of moral hazard problems. They show that informal social insurance may crowd
out market insurance and lower welfare. Developing countries may be caught in a
vicious circle in which low levels of market development result in high levels of
information imperfections, and these information imperfections themselves give rise to
institutions—for example, informal, personalized networks of exchange relationships
(Kranton, 1996)—that impede the development of markets. Banerjee and Newman 1997
show that an inefficient dualistic economic structure, where market forces govern
economic exchange in one sector but not in another, can be explained as the consequence
of a self-sustaining network. Dualism may be one equilibrium among several.

A further implication of the modern theory of coordination failures is that
improvements in any existing set of institutions—“good mutations”—may not survive
on their own if they require accompanying changes in other social institutions (Greif
1997). "If the institutional matrix rewards piracy, then [only] piratical organizations will
come into existence..." (North, 1994, p. 361).
History Dependence and Poverty Traps

Recent historical accounts go beyond the observation that there are multiple equilibria and show that economic outcomes exhibit history dependence. By history (or path) dependence is meant not just the obvious fact that past events may circumscribe current choices, but that they determine and predict the decisions at all crossroads since some initial starting point. For example, after a war-time disruption of trade, an economy may undergo a structural change, develop a new system, and never return to the original one.

The distribution of wealth in the past is one of the most important channels through which history can have potentially large, permanent effects. Here I summarize a few central ideas from this rapidly growing literature. One line of thought emphasizes political influences. Engerman and Sokoloff (1997) and Sokoloff and Engerman (2000), for example, find that the historically highly unequal distribution of wealth in the colonies of the Americas that practiced plantation agriculture had longlasting effects through the legal, educational, and political institutions that were adopted. Another line of thought, summarized in Hoff (1994, 1996) and Bardhan et al. (2000), emphasizes that with imperfect capital markets, the poor may be unable to enter into labor and land rental contracts that provide strong incentives for effort (for example, they may be sharecroppers instead of renters, and entrepreneurial activities may be foreclosed). Hence, high inequality can lock poor households into economic stagnation. Some initial
distributions of wealth are associated with subsequent growth whereas for other initial wealth distributions, growth paths do not exist.\(^8\)

History also affects outcomes by affecting beliefs. An obvious case is one where expectations are (at least partly) adaptive: individuals expect people to behave in the future as they have in the past. But even with fully rational expectations, history can cast a long shadow. For example, an outbreak of corruption, or the revelation that some firms in an industry passed off shoddy goods as high-quality goods, can tarnish the reputation of the whole industry and reduce the incentive of every member of the group to behave honestly in the future. Tirole (1996) explores this idea formally in a setting where the reputation of a member of the group (e.g. an employee in an organization or a firm in an industry) depends on his own past behavior and also, because his track record is observed with noise, on the group’s past behavior. The revelation that any member of the group was dishonest in the past will increase the time it takes for any given agent to establish a reputation for honesty. This will lower his incentives to be honest, and may create a vicious circle of corruption: “the new members of an organization may suffer from the from the original sin of their elders long after the latter are gone.” (p. 1).

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A radically broadened view of externalities and public goods

Coasians have generally argued that real-world externalities were hard to find. In the 1970s, the iconic example of externalities was still Meade's apple farmer and beekeeper (who each provide "unpaid factors" to the other); Cheung (1973) showed that contracts internalized these externalities. The iconic example of public goods were lighthouses; Coase (1974) argued that throughout much of British history, private arrangements addressed that problem, too. 9

Modern theory, in contrast, suggests that those working in the Coase tradition were looking for inefficiencies in the wrong place. The iconic examples of technological externalities—the pastoral examples and the lighthouse, as well as many other examples described in Chandler's history of American business—are ones where the "unappropriated benefits" may be internalized through private arrangements. Such private arrangements include mergers, which change the boundary between what is transacted in the market and what is transacted within the firm. But there are many other externalities not amenable to easy solution. They include information externalities, group reputation effects, agglomeration effects, and knowledge spillovers. They also include pecuniary externalities (Newbery and Stiglitz 1982, Greenwald and Stiglitz 1985). Pecuniary externalities often look analytically like externalities of the familiar technological sort. Recall the example above on property rights, where as a larger number of people fenced

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9 In a revision of Coase’s interpretation, Van Zandt (1993) notes that even the early lighthouses in Britain did not operate in the “pristine ‘private’ world,” but relied on governmental intervention in fixing rates, granting monopolies, and collecting user levies—services well beyond the standard government services of property protection and contract enforcement. (p. 56)
in their forests, the return to fencing went up. In that example, the spillover effects were transmitted *only* through the change in the wage rate.

Modern theory radically broadens our notion of spillover effects. It shows that there are many cases where even the set of equilibrium prices can be viewed as a kind of public good. In such cases, the price vector is not a deterministic outcome that one mechanically derives from supply and demand functions. Multiple equilibrium sets of prices exist. Each individual's choices in a society may contribute to an outcome that leads to an equilibrium set of prices that does a better or worse job in achieving the desirable coordination among complementary activities. In one equilibrium, the price system points the way to an efficient outcome, which may be better for everyone than the alternative equilibrium outcomes; but there are other equilibrium prices that do not.

"Ecological Economics"

Whereas neoclassical economics emphasizes the forces pulling toward equilibrium—and with similar forces working in all economies, all should be pulled toward the same equilibrium, modern development economics focuses more on evolutionary processes, complex systems, and chance events that may cause systems to diverge. Thus, it tends to be influenced more by biological than physical models. Near the end of *The Origin of Species*, Darwin (1859) wrote, in thinking about the Galapagos Islands:

> [The plants and animals of the Galapagos differ radically among islands that have] the same geological nature, the same height, climate, etc…. This long appeared to me a great difficulty, but it arises in chief part from the deeply seated error of considering the physical conditions of a country as the most important for its inhabitants; whereas it cannot, I think, be disputed that the nature of the other inhabitants, with which each has to compete, is at least as important, and generally a far more important element of success (p. 540).10

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10Darwin (1859) devotes two chapters to this idea (chs. XII and XIII).
The economy is like an ecosystem, and Darwin was implicitly recognizing that ecosystems have multiple equilibria. Far more important in determining the evolution of the system than the fundamentals (the weather and geography) are the endogenous variables, the ecological environment. Luck—accidents of history—may play a role in determining that and, thus, in the selection of the equilibrium.

The table summarizes the main story of the change between the old and new views of spillover effects. From a number of these spillover effects, it is easy to formulate models with underdevelopment equilibria, as I show in the next two sections.

**Old and Modern Views of Externalities and Public Goods**

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<th>Old view: Iconic examples</th>
<th>&quot;Ecological&quot; view</th>
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<td><strong>Externalities</strong></td>
<td>Beekeepers and apple farmers</td>
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<td>Social and political interactions</td>
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<td><strong>Public goods</strong></td>
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<td>The equilibrium set of prices</td>
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<td>Group reputation</td>
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<td>Knowledge (e.g., that a certain technological result is feasible)</td>
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Some examples of coordination problems in development

Among the many models of underdevelopment equilibria in modern theory, three major channels of spillover effects stand out—externalities present in the technology of the individual agent, expectations interactions, and externalities relating to the thickness or size of the market. I show below how these spillover effects can give rise to coordination failures in R&D, the “culture” of innovation, the structure of property rights, and industrialization. The Appendix presents a mathematical treatment of coordination problems.

R&D Spillovers

One way to conceptualize the kind of R&D that producers undertake is that it transforms a set of known facts and accepted principles into a potentially profitable new application. In this view, the expected return to an investment in R&D rises as the stock of ideas that are in the public domain increases. If part of the outcome of private research seeps into the “local public pool,” then the more research that is conducted, the larger the pool of ideas upon which each producer in the community draws. (There is persuasive evidence that knowledge spillovers are strongest over short distances; see Jaffe et al. 1993.) Thus, one possible impact of expanded R&D is a greater incentive to invest in R&D (Romer 1986)

To analyze this situation, consider a simple model where there are a large number of identical producers. The profit (utility) of any producer depends on prices, his own
level of R&D (his action \(a^i\), which can be any value between say, 0 and 1) and the level of R&D of all others (their action \(a\)). Since I will be concerned here only with the set of symmetric equilibria, I consider the case where all other producers choose the same action. Thus, the profit function can be written as \(U^i(a^i; a, p(a))\), where \(p\) is the price vector (which itself depends on the vector of actions of the agents). Assume for each agent decreasing marginal returns to an increase in the level of his action. Each agent chooses its action to maximize its utility, given the actions of others. (Each agent is small enough that there are no strategic interactions, and it ignores its effect on \(p\).) The 

reaction function

\[
\frac{d}{da^i} U^i(a^i; a, p(a)) = 0
\]

characterizes the action that the representative agent \(i\) will take for all possible values of \(a\) selected by the remaining actors. Let \(u^i_1\) represent the partial derivative of \(u^i\) with respect to the first argument \(a^i\). The reaction function states that, given \(a\), the agent cannot obtain a higher payoff by a marginal change in the level of his action. Figure 2 depicts the case where a higher action \(a\) by all other agents will lead the remaining agent \(i\) to follow suit. A higher action by other agents increases the marginal return to higher action by each. The actions of different agents are complements.

The interior, symmetric equilibria are values of \(a^*\) that solve the equation:

\[
\frac{d}{da^i} U^i(a^*; a^*, p(a^*)) = 0
\]
Figure 2 illustrates a stable low-level equilibrium at $a^*$ and a stable high-level equilibrium at $a^{*''}$.

Equilibrium prices, in and of themselves, do not provide the incentive needed to implement the efficient equilibrium ($a^{*''}$).

**Spillovers from Bureaucrats, Predators, and Collectivist Enforcers**

The literature on coordination problems is concerned not only with the level of activities (e.g., more or less R&D or investment) but also the kinds of behaviors that individuals adopt. Do individuals seek out innovations or behave bureaucratically? Do they become producers or predators? Do they pursue individualist or collectivist strategies to enforce contracts? Do they enter into contracts that provide high-powered incentives for effort? In each of these cases, an individual's relative gain from whatever choice he makes (as compared to the alternative) may depend on the fraction of the population that makes the same choice, as I show in four examples. These examples, like the preceding one, emphasize what I have called the ecological perspective. An individual’s behavior depends on the environment; among the most important elements of the environment are the behaviors of the other individuals; and feedback effects create the possibility that in equilibrium, the environment is one that discourages high productivity.

*Example 1. Bureaucrats and innovators.* Sah and Stiglitz [1989] formulate a model of societal equilibrium in which individuals can choose to behave “bureaucratically” or “innovatively.” Bureaucrats make life for innovators more difficult, and conversely. Let

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11 An unstable equilibrium is one where the reaction curve is steeper than the 45 degree line.
x be the fraction of the population that chooses to be innovative. Let $U(I; x, p)$ be the utility associated with the innovative strategy, and let $U(B; x, p)$ be the utility associated with the bureaucratic strategy. Each individual chooses the activity that yields him the greater utility, taking $x$ and $p$ as given, where $p$ is a function of $x$: $p = p(x)$. Then it is easy to see that there may be multiple equilibria. If most people choose to behave bureaucratically, it may pay only a few people to behave innovatively, and conversely.

An interior equilibrium (where $x$ is between 0 and 1) is a fraction $x^*$ that solves the equation

$$U(I; x^*, p(x^*)) = U(B; x^*, p(x^*))$$

Equilibria also may exist where all agents make the same choice, one entailing bureaucratic behavior if

$$U(I; 0, p(0)) < U(B; 0, p(0)).$$

and another entailing innovative behavior if

$$U(I; 1, p(1)) > U(B; 1, p(1)).$$

A slight variant of this model can be used to explore evolutionary dynamics. Assume that rather than the individual’s choosing to be either innovative or bureaucratic, each individual has a certain fixed type (innovative or bureaucratic), which may reflect his
upbringing, and agents live just one period. Differential reproductive rates are a function of utility levels so that

$$\frac{d \ln x}{dt} = k \left[ U(I; x, p) - U(B; x, p) \right]$$

for some positive constant k and time variable t. Then the set of equilibria will be the same as before, and the equilibrium upon which the economy converges will depend on its history. Historical events—e.g. the opening of a country to international competition that differentially hurts “bureaucratic” firms—may move the economy from one equilibrium to the other, thereby affecting the long-run rate of technological progress.\(^\text{12}\)

**Example 2. Predators, cash crop producers, and subsistence producers.** A variant of the preceding model, in Murphy, Shleifer, and Vishny [1993] and Acemoglu [1995], focuses on rent-seeking. By predation is meant any activity that is not productive but extracts incomes from others through, e.g., bribe-taking, lobbying for preferences, and outright theft. The model sheds light on why some countries fail to develop at all when rent-seeking makes property rights insecure. Consider a farm economy in which each individual chooses to engage in one of three activities. He can produce a cash crop for the market, but the output from the activity is vulnerable to rent-seeking. Or he can produce a subsistence crop, in which case his output is not vulnerable to rent-seeking. Or he can be a predator and expropriate part of the output of the cash crop producers. An equilibrium is an allocation of the population among the three activities. Suppose that,

\(^{12}\) For recent examples of evolutionary approaches to characteristics, see Fershtman and Weiss 1998, Roland and Verdier 1999, and Francois and Zabojnik 2000.
over some range, as more resources move into predation, returns to cash crop production fall faster than returns to predation. As a consequence, the returns to predation relative to production for the market increase. This can give rise to multiple equilibria. An economy can be trapped in an equilibrium where the fraction of cash crop producers is low and returns to such production are low because the fraction of predators is high. But there is another equilibrium where the reverse is true.

Example 3. Individualistic versus collectivist enforcement. Most development economists are by now agreed that among the most important set of institutions in an economy are those that provide for the enforcement of contracts. Greif [1994] examines the cultural factors that might explain why two pre-modern societies—the Magribi in North Africa and the Genoese—evolved along different trajectories of societal organization. To illustrate the main ideas, he presents a model in which there are two kinds of actors: merchants and agents. Agents carry out overseas trade on behalf of the merchants and choose between two strategies: to be honest or to cheat the merchant. A merchant also chooses between two strategies: to rely on collectivist or individualist means to punish cheaters. Under collectivist enforcement, a merchant refuses to hire an agent who is known to have cheated any merchant in the collective group. Under individualist enforcement, a merchant punishes only agents who have cheated him. Greif shows that if a merchant believes that collectivist enforcement is likely to occur, then it may not be in his interest to hire an agent who is known to have cheated other merchants. That makes such expectations self-fulfilling.
The intuition for this result is straightforward: an agent who already has damaged his reputation has little to lose by cheating again, and so he will be more easily tempted to cheat his current employer than would an agent with an unblemished reputation. That makes the agent who has already damaged his reputation by cheating an undesirable prospect to hire. On the other hand, if the merchant believes that individualist enforcement will occur, then the motive for collectivist enforcement is absent. Thus, two equilibria, one entailing collectivist enforcement and the other individualist enforcement, may exist. The equilibrium that is “selected” will depend on beliefs (culture).

In the short run, reliance on individualist enforcement will be more costly since it forgoes the stronger, group-level punishment mechanism. But in the long run, individualist enforcement will strengthen the forces contributing to the emergence of state-level mechanisms to enforce contracts and adjudicate conflicts. By facilitating the widening of markets and anonymous trades, such institutions, in turn, tend to promote long-run growth. Greif [1994] interprets the history of the West in just such terms.

*Spillovers and inequality: A parable of capitalism*

The recent revival of the theory of income distribution has focused attention on the idea that, when capital markets are imperfect, the poor will tend to underinvest. For example, their firms will be undercapitalized, or they will have to become wage-earners when a better use of their talents is as entrepreneurs who invest in their own projects, or they will underinvest in education (e.g., Banerjee and Newman 1993, Galor and Zeira 1993, Hoff and Lyon 1995, Aghion and Bolton 1996, and Mookherjee 1998). The standard
treatment of this problem assumes no direct spillovers across agents. But the evidence suggests many settings in which direct spillovers are important. As discussed above, ideas spill over across firms in a Silicon Valley. Similarly, a break-through into an export market by one entrepreneur increases opportunities to export by others in the economy. One impact of a larger number of entrepreneurs (rather than salaried managers) who have high-powered incentives for effort is that the return to effort by all entrepreneurs may increase. As a result, there may be multiple equilibria in the structure of ownership of enterprises, with some better for everyone than alternative equilibrium outcomes (Hoff and Sen 2000).

To be more specific, consider an environment where each firm is managed by either a salaried wage earner or an individual with a substantial equity stake in the firm (an “entrepreneur”). The capital market is imperfect—the interest rate for individual borrowers is higher than that for lenders. This means that a low-wealth individual will choose to become an entrepreneur only if his expected return to effort is high enough to offset the transaction costs of borrowing. Each individual chooses the contract (equity ownership or a wage contract) that yields him the greater utility, taking as given the fraction $x$ of firms in the economy managed by entrepreneurs. Let $V(e, x, W)$ be the utility associated with entrepreneurship, an initial wealth level $W$, and a fraction $x$ of firms managed by entrepreneurs; and let $V(n, x, W)$ be the utility associated with the same parameters and a non-entrepreneurial contract. Then there is a critical level of endowment wealth, $W^*$, at which an individual is just indifferent between entrepreneurship and the alternative of working as a salaried manager: i.e.,
\[ V[e,x,W^*] = V[n,x,W^*] \]

An increase in \( x \) raises the left-hand side more than the right-hand side if there are complementarities among entrepreneurial efforts. A fall in wealth lowers the left-hand side more than the right-hand side, since in addition to the loss of consumption there is an increase in the transaction costs of borrowing. Complementarities among entrepreneurial efforts imply that associated with a higher \( x \) is a lower \( W^* \). The threshold wealth level above which an individual becomes an entrepreneur, and below which he becomes a salaried manager, is

\[ W^* = W^*(x) \quad \text{with} \quad W^* \prime < 0. \]

Given the distribution of wealth in the economy, say \( F(.) \), associated with any value of wealth \( W \) is a proportion of the population, \( x^* \), whose income exceeds \( W \):

\[ x^* = 1 - F(W). \]

The simultaneous solution of the two preceding equations defines the equilibrium proportion of the population that are entrepreneurs, and the associated threshold income level, \( W^* \). Both curves are downwardly sloping, as illustrated in Figure 3, and so obviously they can have multiple crossings. There may exist a low-level equilibrium, in which a minority fraction \( x^* \) of individuals buy enough equity to become entrepreneurs (who put in high effort), the resulting positive externalities are low, and this outcome supports the majority decision to stay with a wage contract and produce low output. Only
individuals with wealth at or above the critical level \( W^* \) become entrepreneurs. By contrast, when a majority fraction \( (x^{*''}) \) of individuals become entrepreneurs by buying equity in the firms they manage, they generate the higher level of spillovers that makes that better state of affairs an equilibrium. The critical wealth level falls to \( W^{*'''} \).

Many of the spillovers in learning and innovation that seem important for growth are local spillovers. Hoff and Sen (2000) show that when there are strong local complementarities among the efforts of individuals in an industrial belt or neighborhood, rich and poor individuals will stratify by “contract type” and income—the rich in areas with a high level of entrepreneurs and of positive externalities, and the poor in areas with low levels of both. In this way one can explain pockets of underdevelopment within a developed country, without assuming any innate differences in abilities or preferences among agents within the economy.\(^{13}\)

“\textit{Big Push}” theories of industrialization

Return now to the central concern of Rosenstein-Rodan, which was that an economy with all the pre-conditions for industrialization would fail to industrialize because of a failure to coordinate complementary investments. The relevance of models of coordination failures rests on diffuse externalities. For if externalities were not diffuse, negotiation among the affected parties—or mergers among firms--should internalize them. Rosenstein-Rodan was particularly concerned with diffuse externalities through demand

\(^{13}\) Durlauf (1999) surveys recent work on group effects with endogenous stratification.
effects associated with increasing returns industries. But if all goods are tradable, then this argument loses its force.

The modern theory of underdevelopment equilibria based on demand effects therefore focuses on nontradable inputs into production. Complicated technologies often require a variety of local inputs and producer services. Increasing returns in their production can generate external economies at the level of final (tradable) goods. An expansion of industry in an economy increases the demand for these nontradable inputs, which lowers their average costs and increases the available variety. With greater variety of intermediate inputs, production of final goods may be more efficient (e.g., computer technicians who specialize in particular programs can troubleshoot problems faster than generalists). It can thus be the case that when all other sectors industrialize, it pays the remaining sector to do so, but when all other sectors use a traditional technology that does not require intermediate inputs, it pays the remaining sectors to do so, too. An underdevelopment equilibrium can thus be sustained even when the economy is fully open to international trade [Helpman and Krugman 1985, ch. 11; Rodríguez-Clare 1996; Rodrik 1996].

There are a variety of ways one can think of the nontradable inputs. One way is that they represent different categories of specialized skilled labor, e.g. computer technicians and software designers. As Rodrik [1996: 2] argues, “A worker’s decision to invest in a specialized skill depends both on the demand for the particular skill and the existence of complementary skills in the economy.” But why can’t a single firm train the labor force
it needs and thereby internalize the externalities among the decisions of employees and between their decisions and those of the firm? Acemoglu (1997) suggests one reason. He shows that even perfect contracting within a firm and perfect capital market may fail to internalize the social consequences of the decisions made by workers and firms. His explanation relies on *search costs*.

Following Acemoglu, suppose that there are two kinds of actors: firms that choose whether or not to adopt new technology, and workers who choose whether or not to become trained to use the new technology. A worker’s investment in training pays off only if he is employed by a firm that has innovated; and a firm’s investment in innovation pays off only if it employs a worker that is trained. There are a large and equal number of firms and workers. Each firm employs just one worker. There are two time periods. In the first period, a firm is matched with one worker, they jointly make decisions over training and innovation, and there is complete contracting between them, i.e., no information problems or transactions costs. At the end of the first period, there is some risk of separation. If separation occurs, a firm has to find a new worker, and a worker has to find a new firm. In the second period, output is produced.

If there were no search costs in the labor market, separation between a firm and employee would not create a loss. If separation occurred, the worker would simply move on to another firm that had adopted the new technology, and all the surplus from training and investment would be captured by the firms and workers who made the investments. But suppose that search is costly. With costly search, matching will be imperfect. There
is no guarantee that the firm with the investment in the new technology will be matched with the worker who has the training.

Multiple equilibria can occur because a firm's likelihood of finding the right worker depends on the thickness of the market (the number of trained workers). And the worker's likelihood of finding the right employer also depends on the thickness of the market provided by firms who have adopted the new technology. Of course, without a risk of separation, there would be no inefficiencies since there would be no interactions with future employees or employers. The inefficiency arises because of an externality between the worker and his future employer, and between the firm and its future employee, which cannot be internalized because the identity of the actor with whom one may be matched is unknown.

In contrast, Rosenstein-Rodan identified the obstacles to training only with incomplete contracting between a given firm and his employee: "There are no mortgages on workers--an entrepreneur who invests in training workers may lose capital if these workers contract with another firm" (1943, p. 205). What Acemoglu’s model shows is that this imperfection is not necessary to generate inefficiency. Search cost create the possibility of multiple equilibria.
An Econometric Test of Spillovers and Local Poverty Traps in Rural China

Formalizing the idea of coordination problems and underdevelopment traps has led to testing. It is beyond the scope of this paper to review that literature.14 Moreover, the empirical testing of coordination problems is still at an early stage. The literature does not directly test for specific channels of coordination failures such as those modeled in the previous section (Manski 2000). The purpose of this section is to present one promising line of investigation, based on work using Chinese census data by Jalan and Ravallion (1998) and Ravallion and Jalan (1996, 1999).

China provides a good place to examine the theory for several reasons. Because the state severely limits geographic mobility in China, and there is also limited mobility of capital, factors move little in response to differences in opportunities across regions. It may thus not depart too far from reality to treat the assignment of households to particular counties as random (not the result of self-selection), and to view each household’s investment opportunities as a function of its own local opportunities. Further, there are remarkable geographic differences in levels of living and in growth rates within China. For example, one finds a rural poverty rate in the inland mountainous province of Guizhou in 1990 that is 7-10 times higher (depending on the poverty line) than in the neighboring coastal province of Guangdong, only a few hundred kilometers away.

14See the survey on coordination problems in Cooper and John (1999). Examples from the empirical literature on poverty traps Azariadis and Drazen 1990 and Easterly and Levine 2000, who provide evidence of traps based on cross-country growth patterns.
The data are from a six-year panel of 5,600 farm households in southern China over 1985-90. Jalan and Ravallion estimate two models, which are derived from optimizing behavior.\textsuperscript{15} The first is a simple expository model where the only two explanatory variables (apart from household time-varying fixed effects) for the consumption growth rate of a household are the initial household wealth per capita (HW) and the mean wealth per capita in the county of residence (CW). The estimated equation for the growth rate, g, is (t-ratios in parentheses):

\[ g = -0.143 - 0.0166 \ln HW + 0.0378 \ln CW \]

\[ (5.61) \quad (5.91) \quad (8.13) \]

The results indicate that in counties where average wealth is higher, average growth of household consumption is higher. Thus, there is divergence over the 6-year period of the survey. Jalan and Ravallion interpret this result to mean that an increase in the average wealth of the county increases the marginal return to own household wealth. This is due entirely to geographic externalities, rather than increasing returns to own wealth at the farm-household level, since the negative coefficient on initial household wealth (HW) implies that there are decreasing returns to capital within households.

\textsuperscript{15} The key equilibrium condition equates the intertemporal marginal rate of substitution with the marginal product of 'own capital', which is a function of the initial endowment of own capital and the stock of capital in the county. The econometric analysis then tests the hypothesis that this function is decreasing in own capital and increasing in county capital.
I illustrate these results in Figure 4. Let $K$ denote the household’s capital stock, and $\bar{K}$ denote the average household capital stock in the county. The econometric results suggest that marginal productivity function is downward sloping with respect to own capital, and shifts up with an increase in the average level of capital in the county. (Ignore points 1 and 2 in the figure for now.)

Figure 5 depicts the equation $g = 0$; that is,

$$g = -0.143 - 0.0166 \ln \text{HW} + 0.0378 \ln \text{CW} = 0$$

and also plots the actual values of household wealth and county wealth from the survey. Notice that every household is near the critical line. (The reader may check his understanding of the graph by noting that a typical household whose per capita wealth is $\ln 6$ yuan will enjoy rising or falling consumption over time, respectively, as the household lives in a county with per capita wealth lower or greater than $\ln 6.5$ yuan.) It is clear from the plot that there is a large subset of the data for which county wealth is too low, given household wealth, to permit rising consumption. Spillover effects appear to be large enough to generate poverty traps.

Looking back at Figure 4 makes it clear why a household in a poor county might have a lower incentive to accumulate capital than a household in a richer county. Suppose for simplicity that households in a county are identical, so $K = \bar{K}$. Then point 1 can be interpreted as an underdevelopment equilibrium where household capital is low.
and the returns to new investment are low because others’ capital is low. But there is another equilibrium at point 2 where the reverse is true.

The richer model that Jalan and Ravallion estimate does not use county wealth but instead the detailed county-level variables listed in the table. The table shows their main results (dummies for county, period, mountains/plains, coastal/inland, etc. are deleted; all regressions are run with household time-varying fixed effects).

<table>
<thead>
<tr>
<th>Geographic variables</th>
<th>Coefficient estimate</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm machinery usage per capita (x100)</td>
<td>0.0420*</td>
<td>3.4328</td>
</tr>
<tr>
<td>Cultivated area per 10,000 persons</td>
<td>0.0013</td>
<td>1.5013</td>
</tr>
<tr>
<td>Fertilizer used per cultivated area</td>
<td>0.0023*</td>
<td>4.5678</td>
</tr>
<tr>
<td>Population density (log)</td>
<td>0.0160</td>
<td>1.6949</td>
</tr>
<tr>
<td>Proportion of illiterates in 15(^{+}) population (x100)</td>
<td>0.0159</td>
<td>0.9000</td>
</tr>
<tr>
<td>Infant mortality rate (x100)</td>
<td>-0.0313*</td>
<td>-2.5295</td>
</tr>
<tr>
<td>Medical personnel per capita</td>
<td>0.0011*</td>
<td>3.6882</td>
</tr>
<tr>
<td>Proportion of pop. Emil. nonfarm commerce (x100)</td>
<td>0.0067*</td>
<td>2.1156</td>
</tr>
<tr>
<td>Kilometers of roads per capita (x100)</td>
<td>0.0741*</td>
<td>4.3033</td>
</tr>
<tr>
<td>Proportion of population living in the urban areas</td>
<td>-0.0228</td>
<td>-1.0254</td>
</tr>
</tbody>
</table>

Source: Jalan and Ravallion, 1998, Table 2.

The results indicate that the county-level variables that relate to the extent of modernization in agriculture (farm machinery usage per capita and fertilizer usage per acre), and also the proportion of the population employed in non-farm commerce, have highly significant positive impacts on individual consumption growth rates. A one standard deviation increase in farm machinery usage in an area adds 0.6 percentage
points to the annual consumption growth rate holding all else constant; a one standard deviation increase in fertilizer usage adds 1.5 points. By comparison, a one standard deviation increase in rural road density adds 0.7 points to annual consumption growth. Following the same basic procedure as above (setting $g = 0$ and evaluating all but one of the variables at its mean value), Jalan and Ravallion show that the magnitude of these spillovers is large enough to generate underdevelopment traps, consistent with the implication of their simple, expository model.

**Perspectives on Policy**

The literature on coordination problems and poverty traps suggests that development may be both easier and harder than was previously thought. While under the older theory, “all” one had to do to ensure development was transfer enough capital and remove government-imposed distortions, under the new theories, “all” one has to do is to induce a movement out of the old equilibrium, sufficiently far, and in the right direction, that the economy will be “attracted” to a “good” equilibrium. While this may require fewer resources, it may require more skill. Some policies could lead the economy to an even worse equilibrium. That is, even after the policies were removed, their ill effects would persist. And just as the equilibrium set of behaviors in a decentralized economy may not be Pareto efficient, one cannot jump to the conclusion that Pareto improvements are likely to emerge from the political process (as I discuss further below).

One response to the modern literature on coordination problems has been to emphasize the limitations in our knowledge of the combination of activities that should
be coordinated and, hence, the dangers of a using the power of the state to establish a particular coordination mechanism (Matsuyama 1998). The problem of highly centralized coordination of activities by government, as occurred in the centrally planned economies, is not so much that they never experienced rapid growth, but rather that they suffered from a lack of inventiveness and “became prematurely grey” (attributed to Jeffrey Sachs by Matsuyama, 1998). For Matsuyama, the problem of coordination is like "the problem of hundreds of people, scattered in a dense, foggy forest, trying to locate one another..." (p. 134). Neither governments alone, nor markets alone, can solve it. Early writers who correctly pointed out the sources of coordination failures drew the wrong policy lessons when they interpreted coordination failures as a call for a “big push” industrialization centrally controlled by the state.

Another strand of the literature emphasizes the incompleteness of models of coordination failures. The selection of the equilibrium is determined outside the model, by initial conditions. To make the analysis of intervention precise requires a dynamic framework. Only in a dynamic framework can one ask whether an initial coordination failure will in fact transmit itself over time. Why wouldn’t forward-looking agents, with sufficiently low discount rates, adopt a path (that might include the option of changing their behavior several times) that would permit as an equilibrium a self-fulfilling move away from a bad equilibrium to a good one? Is there really any scope for policy? Adsera and Ray (1998) address these questions in a setting where each agent makes a discrete choice between two activities (which could be interpreted as entry into a high-technology sector that offers a high return in the long run if it obtains a critical mass, versus a low-
tech sector). They obtain a striking result: *If* the positive externalities from moving to the more favorable set of activities appear with a time lag (that can be made arbitrarily short), *then the final outcome depends entirely on initial conditions unless there is some gain to being the first to switch.* To put it another way, without some gain to being among the first to switch, each individual will rationally wait for others to switch first, and so no one will switch at all! Initial conditions will thus determine the entire equilibrium outcome.

*Interventions to Solve a Coordination Problem*

Adsera and Ray show that there is a *potential* role for policy to enable an economy to break free of history. A temporary intervention can “force” an equilibrium, and yet, once the equilibrium is attained, the intervention is no longer necessary to support it. (This has the advantage that by the time agents have learned how to corrupt the rule-administering process, the rule may no longer be needed.) I consider several such interventions below.

*The coordinating role of anti-corruption programs*

Tirole’s (1996) model of group reputation, discussed above, demonstrates the role that an anticorruption program of sufficient duration and severity can play in switching an economy from an equilibrium with high corruption—sustained by expectations of high corruption, to one with low corruption—sustained by expectations of low corruption. A historical case is Korea in 1961. President Park inherited from Syngman Rhee a corrupt bureaucracy that chose policies on the grounds of self-enrichment. Within a month of seizing office, he dismissed the top 10% of bureaucrats, jailed owners of conglomerates
for corruption, and sent the rest of the bureaucracy to two-week training courses in
management, efficiency, and public spiritedness. He then personally monitored the
performance of the “economic bureaucrats” and shifted them from one bureau to another
quickly, so that they could not develop corruption networks. The result was a total
transformation of the functioning of the government and its interaction mode with the
chaebols, from a soft state to a hard one. Park then proceeded to design the subsequent

The coordinating role of affirmative action programs

A change in a legal statute may also be able to “force” an equilibrium, if the path to
the new equilibrium entails a revision of beliefs and the revised beliefs sustain the new
equilibrium. Stiglitz (1974) shows that affirmative action programs can eliminate
equilibria in which productivity is unequal between groups (e.g., races or ethnic groups)
whose innate abilities are identical, but whose histories are different. Productivity
between groups may be unequal if, for example, individuals’ preferences for education
depend on their parents’ education and if the resulting differences in education lead to
differential expectations by employers regarding the payoffs to training workers.
Decisions by employers may then lock different groups into different positions in the
income distribution. An affirmative action program changes the behavior of employers,
the new behavior creates a new “history” and reveals information about the
discriminated-against group, and the revised information can lead to an equilibrium in
which prospective employers no longer want to discriminate.
The coordinating role of law based on social norms

Another way that law can serve as a coordination device is by changing the extent to which individuals impose social sanctions on violators of a norm. Following Cooter (2000), suppose that a person who punishes someone for violating a social norm risks confrontation or revenge, but that this risk falls as the proportion of people willing to punish increases. Suppose also that enactment into statutory law of the social norm (e.g., to use generally accepted accounting standards) lowers the individual’s private cost of enforcement because it leads him to believe that other individuals will be more likely to impose social sanctions on those who violate the norm. That expectation can be self-fulfilling. There can be multiple equilibrium levels of private enforcement of social norms. Enactment of the social norm into law can “pull in” private activity rather than “crowding it out” (as occurs in traditional analysis of government provision of public goods), and thus shift an equilibrium from one with little private enforcement of the norm to one with a high level of private enforcement.

By extension, Cooter (1997) argues that a state governed by laws that mirror social norms (a rule of law state) tends to be one which is hard to corrupt, whereas a state where law is imposed and enforced from above (the rule of state law), tends to be costly, ineffective and easily corrupted. A related view of statutory law is Basu (2000), who argues that the only way government-enacted law can influence an economy is to switch it from one equilibrium to another: if an outcome is not a candidate equilibrium absent the law, it is still not an equilibrium under any conceivable legal regime. Below I present
an example, in the context of the transition process of Eastern Europe from plan to market, where there may be multiple equilibrium legal regimes.

*The coordinating role of stockpiling resources*

It is sometimes suggested that in order to for the state to resolve a coordination problem, it needs to change a broad array of policies at the same time. But this need not be true. I illustrate this with a striking example, due to Kremer and Morcom (2000), of a policy that can resolve a coordination problem in the exploitation of an open access resource used for storable goods.

More intensive harvesting of an open access resource (such as elephants, pandas, tigers, and otters) leads to anticipated future scarcity of such resources, which leads to higher current prices, and therefore to more intensive current exploitation. In particular, elephant poaching can lead to expected future shortages of ivory and thus raise future ivory prices. Since ivory is a storable good, current ivory prices rise with future prices, and this increases incentives for poaching today. Thus “poaching creates its own incentives” (p. 213). There may be multiple rational expectations paths of ivory prices and the elephant population. The paths along which extinction occurs make every individual worse off (not to mention the elephants). Government can eliminate the extinction equilibria by accumulating a sufficient stock of ivory—culled from sick elephants, for example—and threatening to sell it should the population of elephants fall below a threshold. Flooding the market would drive down the price for elephant ivory and discourage poaching. The stockpiling policy changes the anticipated price path of
ivory, which coordinates the behaviors of a vast number of potential poachers and eliminates the extinction equilibria.

**Deep versus Shallow Interventions**

Public choice theory has provided considerable insights into the nature of political processes, including the problems associated with the formation of interest groups (Olson 1965, Becker 1983). For instance, free-rider problems play an important role in determining which interest groups form, just as they play an important role in the provision of public goods more generally. Public actions affect the costs and benefits associated with interest-group formation. Since the costs of interest-group formation are, to some extent at least, fixed costs, interventions that affect the dynamics of the political process—thereby affecting subsequent outcomes—can be thought of as *deep* interventions. They entail irreversibilities.

An example of the dynamics of the political process may help illustrate what I have in mind. Assume that the government is contemplating privatizing a monopoly. There are several potential buyers. Each has an interest in ensuring that the regulations that prevail after privatization allow him to continue to enjoy the monopoly profits and perhaps even leverage the monopoly power further. But each, thinking that he has a small probability of winning, is unwilling to spend much to ensure this “collective” good (or bad, depending on one’s perspective). Moreover, each may face large costs of identifying who the other potential buyers are. Even if a potential buyer succeeds in identifying the others, if they are numerous there would still be a free-rider problem, each claiming publicly that
he himself will obtain high profits through increased efficiency rather than by exploiting monopoly power.\textsuperscript{16} But once the privatization has occurred, there is a single party who is the “winner.” There no longer is a collective-action problem, and the winner has the incentive and resources to fight legislation imposing regulation or competition. Thus, before the privatization, it may be possible to pass rules to promote competition (since there is no organized resistance in the private sector) and there may be, admittedly weak, public interest groups pushing for it.\textsuperscript{17} The sequencing of reforms—that is, whether regulatory policies precede or follow privatization—matters. In one sequence, the result may be a competitive or regulated industry, where the benefits of privatization in terms of lower consumer prices are realized. In the latter case, one may end up with an unregulated monopoly, which, to be sure, may be more efficient than it was as a public sector producer but that may be more efficient not only in producing goods but also in exploiting consumers.

It is precisely because history matters that interventions can be effective in the long run. A perturbation to the system at one date can have permanent effects. By contrast, in neoclassical and related theories, it is fundamentals—including those associated with the political process—that determine long-run outcomes.

*Deep* interventions need to be distinguished from the *shallow* interventions that do not entail irreversibilities. For example, a deep reform is one that effectively ties the

\textsuperscript{16} Palfrey and Rosenthal (1984) present a model in which the larger the number of potential beneficiaries of a discrete public good, the less likely the public good is to be supplied.

\textsuperscript{17} In the next section, I discuss the case, which is especially relevant in transition economies, in which there is organized resistance *within the government* to privatization.
hand of all parties by imposing a high fixed cost of undoing the reform. A shallow reform does not fundamentally change the forces that support the equilibrium one is trying to change, and can make matters worse. Consider the unsuccessful agricultural privatization in Russia in 1991-1999, based on Amelina (2000). In 1991, Russia legalized individual farming and dismantled the federal subsidies for cooperative farms. Under the law, every farmer had the right to become a private producer (and many expected that they would exit the inefficient collectivist system in droves and produce for themselves). Yet six years later, the share of agricultural land used by cooperatives had fallen little: from 91% in 1991 to 80% in 1997. At that point, market institutions for providing inputs to the farmers for storage, processing, transport, and insurance were still not in place (and because of the fixed costs of setting up those services, they could only succeed if the number of private farmers was sufficiently high). When the Soviet system collapsed and cooperatives were left without federal support, district-level politicians to varying degrees had the incentive and the political power to take up the task of ensuring the supply of inputs and subsidies to the cooperatives, just as the Soviet center had once done.18 This largely removed the potential demand for new market institutions and for suppliers capable of servicing the needs of small producers. Amelina interviewed households to learn their reasons for remaining within the cooperative system. Among the top two reasons (out of a choice set of 10) in both districts she studied was that

"There is no other place to work."

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18 Amelina’s comparison of two districts finds that this was more true in the district in which agriculture bulked larger in the local economy. In that district, most politicians had risen through the ranks of the cooperative system. They had highly developed valuable “human capital” in transferring funds to and from the cooperatives and had a large political stake in meeting cooperatives' needs.
The Transition Process as a Coordination Problem

Massive societal change itself creates a huge coordination problem. Consider again the issue of privatization, but now consider the political aspects of the transformation of a society from one without a rule of law to one with the legal institutions to maintain a successful market economy. One aspect is coordination in law enforcement (Roland and Verdier 1999). Another aspect is coordination in the size of the official sector, where firms pay taxes and benefit from publicly provided goods, versus the unofficial sector, where firms pay mafias for private protection (Johnson, Kaufmann, and Shleifer 1998). Here I will emphasize a third, perhaps more fundamental aspect of the coordination problem — the multiplicity of equilibria related to the demand for reforms that would lead to the rule of law.

The view that transferring state property to private agents automatically creates support for the rule of law, put forward by many economists, neglects an alternative activity, namely, stripping assets and tunneling value out of the enterprise. Consider two contrasting images of the behavior of private agents after privatization:

“Privatization offers an enormous political benefit for the creation of institutions supporting private property because it creates the very private owners who then begin lobbying the government...for institutions that support property rights.” (Shleifer and Vishny 1998, p. 10)

“[The owner typically] doesn’t pay wages to the employees, doesn’t pay taxes, is not interested in the enterprise’s development, establishes subsidiaries in order to ‘pump out’ the assets while leaving only the legal shell of the company, etc.” (Radygin 1999)
Radygin goes on to conclude from his observations in Russia that the productive entrepreneur is a myth. Here I will sketch a model, based on Hoff (2000), that the productive entrepreneur is not a myth but rather a creature of his environment, and there exist a multiplicity of equilibrium environments, some of which are highly undesirable.

Suppose that agents have some talent and may also have some initial control rights over firms, which they can use in two ways:

1. productive activities (“entrepreneurship”),
2. activities that entail stripping assets and tunneling value out of the firm (“tunneling”).

For simplicity, I treat these two activities as mutually exclusive.19 The essential assumption is that entrepreneurs seek reforms that lead to the rule of law, whereas tunnelers do not.20 The probability $\pi$ that the rule of law is enacted depends on the size of the coalition of productive entrepreneurs. Let $x$ denote the fraction of agents who are tunnelers. The power of the political coalition that seeks the rule of law is $1-x$, and thus $\pi = \pi(x)$, with $\pi' < 0$.

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19 In practice, a productive entrepreneur controller can always find some ways of self-dealing; even in developed economies, there are well-known opportunities for tunneling (Johnson, La Porta, Lopez-de-Silanes, and Shleifer 2000). But there are trade-offs between the two strategies; suppliers, minority shareholders, and employees will ultimately refuse to do business with a firm who defrauds them. Black et al. 1999 provide many examples of these trade-offs faced by privatized Russian firms.

20 Anecdotal evidence in Russia of the flagrant use of the political process to undermine the rule of law abounds. In October --, 1999, the New York Times (“Frustrated, Russian Securities Regulator Resigns”) reported that “Investors said that [the securities regulator] had tried to help establish the rule of law in a realm where powerful local business interest use friends in the government to solve their problems, and where courts are notoriously corrupt.”
Time is divided into two periods. Tunnelers receive a payoff $t$ in period 1, whereas the payoff to entrepreneurship comes only in period 2. In present value terms, that payoff is $V_L$ if the rule of law is in place, and $V_N < V_L$ if it is not, as illustrated in Figure 6. For simplicity, assume that $V_L$ and $V_N$ are the same for all agents, but that $t$ is distributed across agents according to $F(.)$. 21

Given $\pi$, the expected payoff to tunneling is $\pi V_L + [1-\pi] V_N$, and so there is a threshold value of control rights to tunneling, $t^*$, where

$$t^* = \pi(x)V_L + [1-\pi(x)] V_N.$$  

Agents for whom $t > t^*$ tunnel, while agents for whom $t < t^*$ are entrepreneurs.

Given $\pi$, there is a unique threshold level $t^*$, defined above. Associated with any threshold is a fraction of agents, denoted $x^*$, for which $t > t^*$, and who thus choose to tunnel:

$$x^* = 1 - F(t^*)$$

Formally, the model has elements of the models of entrepreneurship discussed above, but now the spillovers are mediated through the political process. Since both equations above

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21 There are many possible reasons for differences in $t$ across agents who do not differ with respect to $V_L$ and $V_N$. Tunneling possibilities are greater in sectors that are extractive rather than manufacturing. Among extractive industries, they are greater in firms in which capital investments needed for extraction are already in place. They are also greater where agents have the ability to collude with bureaucrats or to loot state banks, where the firms whose assets the agents control are highly leveraged, and where there is a ready market for the assets of the firm. So agents for whom the rewards are the same if the agent allocates his talent and control rights to entrepreneurship, may differ with respect to the rewards they obtain from tunneling.
are downward sloping in the space \((x,t)\), there can be multiple equilibria. The intuition is straightforward. An increase in the fraction of individuals who behave as productive entrepreneurs will increase the size of the coalition \((1-x)\) that favors the rule of law, which raises the expected return to productive activity and thus increases the coalition in favor of reforms that would lead to the rule of law. But if most individuals tunnel, the size of the coalition in favor of the rule of law is weak, the legal regime needed for a market is viewed as unstable or unlikely to emerge, which raises the expected return to tunneling, and so this also may be an equilibrium.

Figure 7 depicts the case where every individual would be better off as an entrepreneur under the rule of law, rather than as a tunneler enjoying a one period gain \(t\) for sure. There are two stable equilibria. At \(x = 0\), the coalition in favor of the rule of law includes all agents, and no agent wishes to tunnel, which makes \(x = 0\) an equilibrium. As some commentators have noted, “Why steal Gazprom, if you can make billions from it?” At \(x = 1\), there is no coalition in favor of the rule of law, and therefore no individual has an incentive to maximize the long-run value of the firm in which he has control rights. Tunneling creates its own incentives. The equilibrium at \(x = 0\) is a worse state of affairs for every agent. Following Hellman (1998), this equilibrium may be interpreted as a “partial reform trap,” because the rule of law that is necessary to achieve a market economy, which was a central purpose of the reform, is unlikely to emerge in this environment.

Conclusion
Developments in economics over the past 30 years have validated Rosenstein-Rodan's basic intuition. A critical determinant of actions is one’s environment, including the behavior of other agents in that environment. Whereas we used to believe that the implication of externalities was that the economy would be slightly distorted, we now understand that the interaction of these slight distortions may produce very large distortions. An economy may in equilibrium in an environment with poor incentives for productivity, even though there exists a better state of affairs for all individuals that would also be an equilibrium.

Modern theory has extended Rosenstein-Rodan's insight very far. We now see that some of the basic distinctions developed in standard theory do not hold. There is no simple technology-based distinction between activities that produce externalities and those that do not, or between activities with public good properties and those with private good properties. The externalities that matter for welfare are not just direct interdependencies (Meade's beekeeper and apple farmer). We now recognize many classes of systematic externalities, of which an important example are those that arise in purely price-mediated interactions. Given history, beliefs, and chance, certain behaviors are rewarded, others are not. Rewarded behaviors will tend to increase relative to others, and that may further increase the rewards to those behaviors. Initial differences in circumstances or beliefs may not only persist, but be magnified over time.

Development policy in this view is both easier and harder than it was before. It is easier because, in general, there is slack. The lack of resources need not be the
fundamental constraint on development. A temporary policy intervention, or a seemingly minor shock, may produce discontinuous change. But policy is harder because there is no single easily identifiable source of failure that is waiting to be resolved.\[^{22}\] Neither the transfer of capital, nor free markets and international trade, nor the emergence of an entrepreneurial class ensures development. In some environments, the entrepreneurial class become entrepreneurs in predation! In the view outlined here, development requires a set of complementary changes in the behavior of agents, which not even the market mechanism can coordinate. This article discussed certain policies – policies that change beliefs, reforms in law, and the sequencing of policies – that may contribute to coordinated changes to shift an economy to a better equilibrium.

This article emphasized, finally, the distinction between shallow interventions -- which do not change the incentives of the key players and thus may fail to improve matters -- and deep interventions. The way in which a set of reforms is sequenced may make the difference between a deep intervention and a shallow one, and I offered examples with respect to corruption and privatization.

I hope I have conveyed the intellectual excitement generated by the idea that multiple equilibria, some with higher incomes for all individuals, can occur due to the collective interdependence in decision-making. Consider the simple adage, “If a man can … make a better mousetrap than his neighbor, though he builds his house in the woods, the world

\[^{22}\] Despite a long history in development economics of arguing that there was such a factor. See Adelman, forthcoming.
will make a beaten path to his door.\textsuperscript{23} From the perspective of the literature on coordination failures, the outcome predicted by the adage might still require that individuals expect that there will be enough users to make services in mousetrap repair affordable, that search costs for those services not be prohibitive, that there be confidence that improved mousetraps would not be stolen, that barriers sufficiently restrict the free movement of mice so that one mousetrap can make a difference in one's environment, and that there be a means for the disposal of dead mice!

The basic lesson to draw from this literature is that coordination failures abound and are important. Neither the market alone nor government alone can solve them. There are in many cases misguided incentives in the private sector. There are a different set of misguided incentives in the public sector. But it need not be the case that the misguided government cannot correct the misguided private sector. There may be a social equilibrium in which the forces are balanced in a way that is Pareto-improving relative to a situation in which the government's hands are completely tied, and certainly better than one in which the private sector's hands are completely tied.

\textsuperscript{23} Attributed to Ralph Waldo Emerson by Bartlett 1980. I consider the favorable case where people know about the invention.
References


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Figure 1: Multiple equilibria (with corner solutions) in the level of enforcement

Open access equilibrium

Rent, $F(L) - w(x)L$

Private property equilibrium

Cost of enforcement

$x$, fraction of resource owners who enforce their property rights
Figure 2: Multiple equilibria in a model with symmetric agents
Figure 3: Multiple Equilibria in the Fraction of entrepreneurs

\[ W^* = W^*(x) \]
\[ x^* = 1 - F(W) \]

Low-entrepreneurship equilibrium

High-entrepreneurship equilibrium

\( x, \text{ fraction of entrepreneurs} \)
Figure 4. The marginal productivity of household capital as a decreasing function of own capital, $K$, and an increasing function of average county capital, $\bar{K}$.
Figure 5: Minimum levels of county wealth to assure rising household consumption given household wealth

Note: Wealth is measured in yuan per capita at 1985 prices.

Source: Jalan and Ravallion, 1998, figure 1.
Figure 6: Decision tree of agent in a context of initially ill-defined property rights
Figure 7. Multiple equilibria in the fraction of tunnelers

\[ x^* = 1 - F(t^*) \]

\[ t^* = t^*(x) \]

*Rule of law*

*Partial reform trap*

*Decreasing security of property rights*
# A taxonomy of models of coordination problems

## Actors

<table>
<thead>
<tr>
<th>C. Continuous choice variable</th>
<th>I. Actors are identical</th>
<th>II. Actors differ in their payoff functions</th>
<th>III. Actors differ in their strategy sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D (Romer 1986)</td>
<td></td>
<td></td>
<td>Training and innovation (Acemoglu 1997)</td>
</tr>
</tbody>
</table>

## Actions

|----------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|