Notes on Restructuring and R-D Space

Econ 497

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1. Restructuring and R-D Space

Survival orientation is the key motivation. Why? Enterprise directors can appropriate resource flows if the enterprise stays open. It is a function of soft-budget constraints surviving in implicit form.

1.0.1. Market Distance

Reform via the budget constraint is premised on the assumption that the only dimension for survival is profits. If enterprises cannot earn profits, they cannot survive. Hence, tightening the budget constraint would force enterprises to increase efficiency. Of course, this weakens all enterprises on impact. But such a policy is also intended to have a *differential* effect on enterprises based on their relative efficiency. The key idea is that the weakest enterprises will be the most severely impacted by the policy, while the stronger enterprises will survive and, presumably, get stronger.[1]

The underlying notion here is *monotonicity* of reform. Reform is monotonic if its impact on an enterprise is related to its degree of inefficiency. A profits tax is likely to be monotonic, if profits are monotonically related to efficiency. A random monitoring of enterprises will not be a monotonic policy, however. Policies that are monotonic may be preferable, because their impact is directly related to a characteristic of the enterprise that we are interested in. But we need an index of efficiency with which to characterize the enterprise. A useful measure is the distance an enterprise must traverse to produce a marketable product.[2] Let $d_i \in (0, D)$ be the distance of enterprise i. An enterprise that produces a product it can sell in world markets has $d_i = 0$, while a completely inefficient enterprise has $d_i = D$. Transition starts with some initial distribution of enterprise distance.[3] The greater is d the less viable the enterprise. Suppose

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[1] The image suggested is that of a vaccine, which introduces minute amounts of a virus in order to trigger the immune system to produce antibodies. The rationale for hardening budget constraints represents an attempt to stress the organism to induce it to restructure its behavior to increase long-run viability.

[2] The notion of market distance is discussed at length in 2.

[3] Let μ_i be i's share of GDP (or employment), then $\Omega = \int_i (d_i \mu_i) di$ is a measure of the average distance of

that $\underline{d}$ is the cutoff point for viability: that is, all enterprises with $d_i > \underline{d}$ are not financially viable.

Notice that d_i is a state variable that describes the conditions of the enterprise. At the start of transition it is inherited. During transition, however, it is an endogenous variable. If an enterprise restructures it can reduce its d_i.[4]

Now consider the effect, for example, of an increase in tax collection. This tightens the budget constraint for all enterprises, essentially increasing d_i for all i. Those enterprises that were closest to the break-even point, $\underline{d}$, are pushed beyond it. The pressure to restructure is greatest for enterprises closest to this point, but all feel the pressure. The more inefficient, the greater the shock. The most inefficient may be wiped out by the shock, but healthier enterprises will grow stronger as a result of the intervention.

This unidimensional view of restructuring – reform means reducing d_i – lies at the heart of much reform advice.

1.0.2. Relational Capital

Now suppose that the organism has another survival mechanism. Enterprises also differ in their inherited stock of relational capital. Some enterprises (directors) have better relations with local and/or federal officials than others. Relations with other enterprises (directors) will also vary. The stock of these relationships determines the types of transactions that can be supported (barter versus cash, pre-payment, etc.). Relational capital is goodwill that can be translated into informal economic activity.[5]

Let r_i be the stock of relational capital of enterprise i. The actions that an enterprise takes can affect its stock of r. Just as investment augments the physical capital stock, enterprises can

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the economy. It thus represents the initial level of the gap that must be overcome in transition. An important point about Russian initial conditions is that Ω was larger than in other transition economies.

[4]But distance depends not only on the decisions within the enterprise but also on what is happening in world markets.

[5]It is important to note that relations aid in production. Hence, investing in relations is *not* the same activity as rent-seeking. The extent to which relational capital has positive or negative impacts on the economy depends on the environment. In a transparent market economy, r may reduce transaction costs – acting like trust. In an opaque environment, such as Russia's Virtual Economy, however, r may be used to circumvent fiduciary responsibilities.

invest in relational capital as well.[6] An enterprise can, for example, perform services for the

local government. This action may enhance the enterprise's relationships with local officials,

and thus increase its capacity to conduct informal activities in the future. It is important to

recognize that augmenting relational capital is costly.

The key point is that relational capital can aid enterprise survival. Enterprises that have

high d may survive by exploiting relational capital, r_i. Thus if we let ρ_{t+1} be the probability

that an enterprise in operation at time t will survive to time $t + 1$, we can now write $\rho_{t+1} = \rho(d_{it}, r_{it})$. The unidimensional view of restructuring ignores the effect of r on this probability.

We can also consider that the enterprise chooses to invest in reducing d and in increasing r in

order to increase this probability.
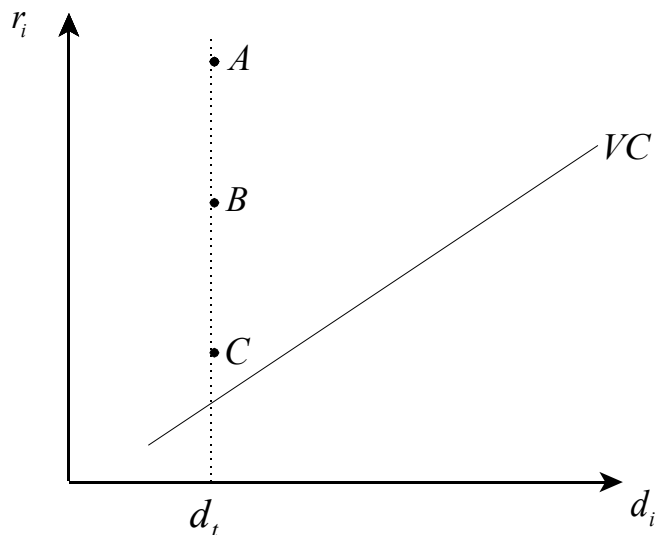
This yields the $r - d$ space diagram:

Figure 1: Enterprises in R-D Space

The VC line in figure 1.1. gives the minimum combinations that keep an enterprise viable.

Enterprises below that locus asset strip and go out of business. Enterprises above the locus

can choose to restructure, invest in relations, or do both.

The three points in figure 1.1. represent enterprises with the same level of d but different

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[6] "Organizations will also encourage the society to invest in the kinds of skills and knowledge that indirectly contribute to their profitability. Such investment will shape the long-run growth of skills and knowledge, which are the underlying determinants of economic growth" 5, 79.

levels of relational capital. How will their investment decisions differ? Increasing returns to relational capital is important to the answer.

1.1. R-D Space

Once we take into consideration the importance of relational capital it is evident that the initial conditions that characterize enterprises in transition are two-dimensional. We can illustrate this with figure 1.1. (taken from 2) which we refer to as the R-D space diagram.

Although relations can allow an enterprise to compensate for large distance, some enterprises have such poor initial combinations of r and d that they are not viable. Not only are these enterprises situated far from the market, but the quality of their relations with officials and other enterprises is so poor that they cannot be relied on for survival. Clearly, the minimum level of relations needed to survive is increasing with distance. So we can imagine a boundary (VC in figure 1.1.) that separates the region of viable enterprises from those that are not viable.[7] It is clear that the larger the distance to the market, the greater is the minimum level of relations necessary to survival. This implies the positive slope of the VC line. How steep VC will be depends on the institutional setting.[8] In a fully transparent economy relations may compensate very little for large distance. If officials are more corrupt, then relations may be much more important.

In this two-dimensional environment, the effects of market-type reforms need not be monotonic. That is, tightening of the budget constraint does not necessarily put the most pressure on those enterprises that are most inefficient (have the highest d). Those that inherited and/or invested in r are relatively better off. If investment resources are limited then the relevant issue for an enterprise is the relative return to investing in distance reduction and relational capital.[9] What is critical for our analysis is that these relative returns will depend on the nature of reforms and on the choices of enterprises.

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[7]Notice that the position of the VC line will depend on how open is the economy. Enterprises that would be unviable (for given d) in an open economy may be viable if the economy is autarkic.

[8]As d increases, we may further suppose that the minimum r necessary to survival increases at an increasing rate.

[9]The analysis of enterprise decisions to reduce distance and invest in relations is analyzed in 2.
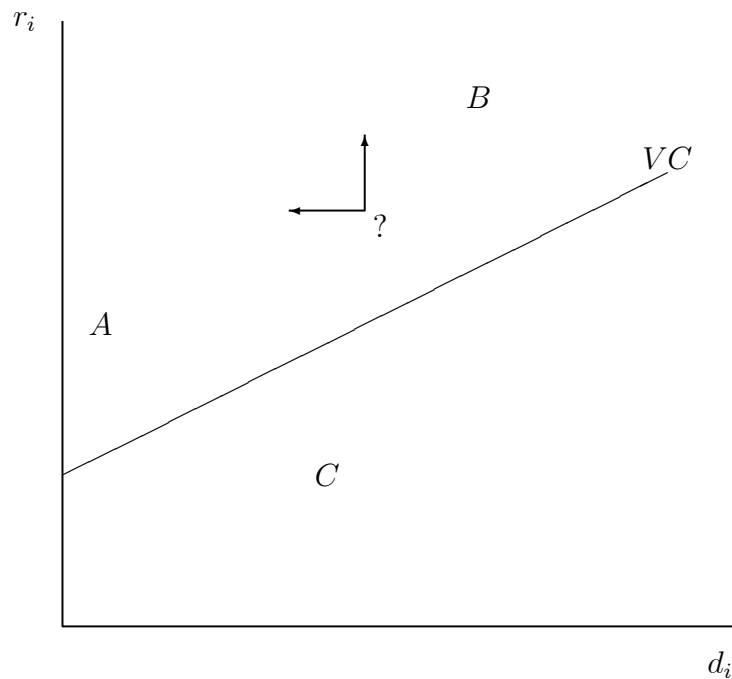
Figure 2: R-D Space

1.2. Privatization of Relational Capital

One of the most important, but rarely emphasized, results of economic reform in Russia was the privatization of relational capital.[10] In Soviet times, personal relations, connections, and influence (*blat*),[11] had important value to the functioning of the system. The primary benefit to the director lay in increased ability to fulfill the plan. In the highly distorted regime of central planning supply failures were a constant feature of economic life. Relations with local party officials and with other enterprise directors were often crucial to obtaining

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[10] Although this process was not his concern, North noted that property rights will not develop in a socially efficient manner if transaction costs are high: "If political transaction costs are low and the political actors have accurate models to guide them, then efficient property rights will result. But the high transaction costs of political markets and subjective perceptions of the actors more often have resulted in property rights that do not induce economic growth, and the consequent organizations may have no incentive to create more productive rules" 5, 52.

[11] See **?**.

scarce inputs. In late *perestroika* and even more during economic reform the autonomy of the director increased as the force of the plan weakened. One consequence of this was that directors obtained the capability to appropriate the returns to the relationships they had developed.

In order for directors to appropriate these returns, the enterprises had to continue to operate. Much of the relational capital was enterprise specific. The primary form of these connections is in relationships with directors of other enterprises, often in related lines of activity. The director cannot cash this out. Instead, to appropriate these rents it is crucial to keep the enterprise operating.

To appropriate these rents the director utilizes relationships to obtain inputs and find customers. If the enterprise produced marketable products these relationships would be of less importance. Hence, workers would be less content to see a portion of the income of the enterprise diverted by directors. But for an nonviable enterprise the alternative to director appropriation is enterprise closure. Faced with this trade-off, workers are more willing to accept the personal enrichment of a director who is also able to obtain resources necessary to keep the operation going.

The privatization of relational capital is thus an important part of the explanation of why directors fight to keep open enterprises that have few prospects in the market economy. Notice the symbiotic relationship between the workers and directors. Workers need the director to keep the nonviable enterprise afloat. Directors need the enterprise in order to exploit their relational capital.

1.3.   Relational Capital and Reform

In the Soviet system as it actually operated informal relations were central. A key role was played by officials – primarily *obkom* and *raikom* officials – who mediated this process. Informal relations increased flexibility in the Soviet system, but some system of mediation was needed to impose some notion of social efficiency in a system where prices could not provide that information. Officials played that role. Relational capital in the Soviet system

involved relationships with *Gossnab*, *obkom* officials, and enterprise directors. In transition, the privatization of relational capital means, essentially, that *Gossnab* and the *obkom* officials are out. But the enterprise relations remain. Thus reform removed the formal rules of the old system (which had already eroded under Gorbachev), but left much of the informal system intact, but without the mediating aspects.

The paradox then, is that under the Soviet system Communist party officials had mediated and limited the use of relational capital. In transition the role of relational capital was enhanced by the formal changes in the system.

The elimination of mediation made it easier (more economical) to invest in relational capital. The director has more power than before. There are now less people to please. Returns to investment in relational capital are now all appropriated by the director. To some extent it could be argued that the tax service still takes it, but liberalization makes it easier for director to evade the state. Hence, the director has more incentive to invest in r.

Had the relational capital not previously existed privatization-"Russian style" would have had different effects. The initial conditions facing enterprises would have been such that the only survival strategy would have been to invest in reducing d. Privatization of relational capital altered the outcome.

1.3.1.   Relational Capital and Increasing Returns

The ability of an enterprise to use relational capital to circumvent the strictures of the budget constraint will depend on the strategies employed by other enterprises. If all other enterprises eschew relational capital the ability of an enterprise to exploit it may be attenuated. This may seem paradoxical: if enterprise i is the only one to possess relational capital surely its return ought to be higher as it is more scarce. This seems plausible, but it ignores the means by which relational capital is utilized.

The more enterprises eschew relational capital the more transparent is economic activity. This makes it more difficult to use the strategies that enterprises utilize – such as barter and tax offsets – to circumvent the budget constraint. When all other enterprises act like firms

in a market economy the one that tries to exploit relational capital stands out. This raises the cost of getting officials to help; especially as they must also use non-transparent means to provide resources. In using informal activities to survive there is strength in numbers. This may lead to economies of scale in using relational capital.

Consider, for example, the use of barter. If most enterprises do not use non-monetary transactions then it will be hard for an enterprise to employ barter. The costs of finding a partner to transact with will be harder. When barter is widespread, on the other hand, it is easier to find such partners. Barter thus is an example of a thick-market externality. The fact that others use barter increases the return to me from using it.[12]

Increasing use of relational capital results in reduced transparency. This lowers the cost of using relational capital. It may thus enhance the net return to investing in relational capital, even if it means that more agents are seeking resources. When transactions are transparent it is difficult to transfer value via a non-monetary exchange. The reason is that stakeholders can readily see the subsidy element contained in the transaction. This vitiates the point of the transaction. To engage in such a transfer in a transparent economy would then require more resources to buy off those now privy to the real deal. When the economy is opaque, on the other hand, the value transfer is hidden from view. This may mean that more resources are available to be redistributed.[13] Hence, the cost of implementation is lower. Consequently, the return to using relational capital must increase with the number of enterprises employing such strategies.

It is useful to consider the analogy to rent seeking. The greater the number engaged in a contest over rents the smaller is the expected return. But this is because the size of the rent is fixed, so that a greater number of contestants means a lower probability of achieving the given prize (or a smaller share). With relational capital this may no longer be the case. When the economy is transparent government resources must be used for their official uses. Government officials may find it very difficult to divert tax revenues to enterprises. In an

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[12]See 3 for empirical evidence of economies of scale in the use of barter in Russia.

[13]This may offset the effect of more contestants for the pie. The pie may increase with greater non-transparency.
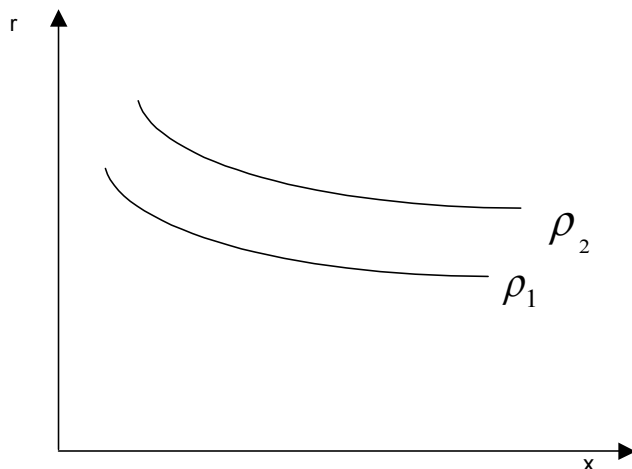
Figure 3: Relational-capital intensive enterprise

opaque economy, on the other hand, the cost of diverting resources decreases, as it is harder to follow the transactions. In a transparent economy a tax offset is a clear subsidy to an enterprise, and an official will have to answer for his action in allowing it. In an economy where these are widespread, however, granting an offset no longer appears out of the ordinary.

This increasing returns phenomena turns out to plan an important part in the following analysis.

Let us define $x_i = \frac{1}{d_i}$ as enterprise *competitiveness*. We can consider combinations of r_{it} and x_{it} that yield a constant probability of survival – *iso-survival* curves. Then consider figure 3 which gives the *iso-survival* curves for a typical "rust-bucket" enterprise. Greater r and/or greater x increases the probability of survival, $\rho_2 > \rho_1$, but at the margin the return to investing in relational capital is much greater. This can be contrasted with a "restructuring-intensive enterprise" i.e., one with low d, as in figure 4. The latter can be thought of as one that exports a "hard good," though it could also reflect an enterprise with very poor inherited relations; hence, its only option is to invest in restructuring.[14]

Now the actual decisions of the enterprise will depend on relative prices. If we ignore the future then this fully determines the enterprise's decisions. We can consider that the enterprise

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[14]That is, two enterprises may have iso-survival curves that have the same shape, but the survival probability may be very different given identical values for r and x.
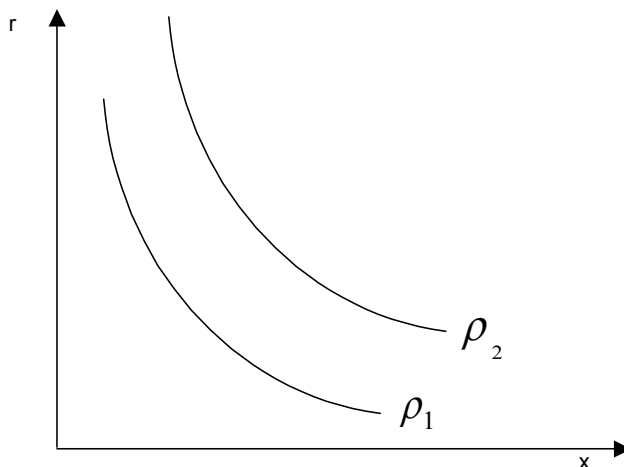
Figure 4: Restructuring-intensive enterprise

has a fixed amount to invest in relations and restructuring in any period, I. Then we can draw *iso-cost* lines, given by

$$r = -\frac{P_x}{P_r}x + \frac{I}{P_r} = -px + \frac{I}{P_r} \tag{1}$$

The relative price of restructuring, p, then determines how much restructuring will take place, along with the funds available, I.[15] Of course, it is critical to explain the determinants of the relative price. The key policy problem of transition can thus be thought of as lowering p.

In figure 5 the relative price of restructuring falls, solely through a change in P_x. In this case the amount of restructuring increases, as does r, because of the income effect. Notice that a policy that eliminated non-transparency, and thus made $P_r \rightarrow \infty$, would result in vertical *iso-cost* lines, and the only means of increasing ρ would be through restructuring – the conventional view.

One shock that lowers p is devaluation. This increases the competitiveness of most enterprises. Hence, it lowers the cost of trying to survive by making the product more marketable. One must be careful, however, because devaluation also increases tax revenues and so enables governments to offer more resources – subsidies – for any given level of relations. In a similar

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[15]Note that investing in restructuring requires funds, while investing in relations can use non-cash goods. This means that if I is measured in monetary units, then the price of relational capital is discounted relative to restructuring for this reason before we consider any others.
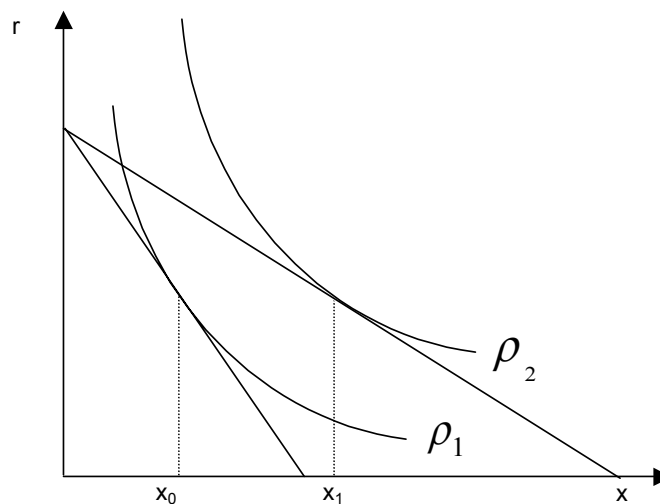
Figure 5: Fall in the relative price of restructuring

manner we can consider how real appreciation – due for example to Dutch Disease type effects for Russia – leads to less restructuring.

We can think of the enterprise as choosing x, r to maximize the probability of survival. This gives a desired level of distance, x^*, that the enterprise would prefer to attain given the current relative price ratio, p. We can think of the current rate of restructuring as a function of the difference between the current distance and the desired distance:

$$i_d = \gamma(d_{it}^* - d_{it}) \tag{2}$$

where $\gamma < 1$ is the adjustment parameter. Note that in the theory of investment we typically assume costly adjustment of the capital stock. It seems natural to think that this will be important in transition as well.

But enterprises can also invest in relational capital, i_r. Are these substitutes or complements?

- they are complements in the sense that better relations makes it easier for the enterprise to take risks and make deal with bad contract enforcement, especially in transition conditions

- but they are substitutes in the sense that becoming more transparent makes it harder to engage in some informal arrangements.

- And, in any case the enterprise faces a budget constraint: $i_d + i_r \leq \pi$ (if there is no borrowing).

These considerations imply that enterprise A in figure 1.1. will be more likely to invest in relations than enterprise C. Hence, we obtain the restructuring boundary as in figure 6:
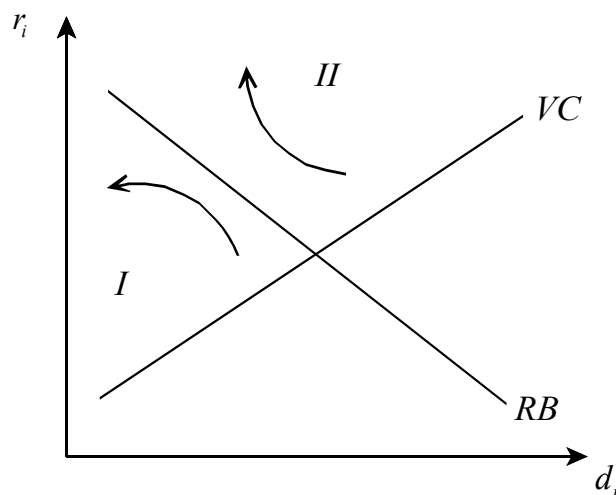

Figure 6: The Restructuring Boundary

2.   Insights from Institutional Analysis

It is increasingly popular to attribute the failure of shock therapy in Russia to the lack of attention paid to institutions. The argument is that reformers paid too much attention to macroeconomic policy and changes in property rights and not enough attention to the creation of the foundations of a market economy. While superficially appealing, this characterization misses much of the point. The real issue is not the importance of market-based institutions, but rather how they are created. Reformers hoped that if the macroeconomic setting was correct market-based institutions would develop from below. The critics argue that failure to create such institutions created a vacuum in which reforms were hijacked. Common to both

arguments, however, is the notion that post-Soviet transition takes place in an institutional vacuum. In this section we present an alternative formulation.

The demise of the planning system constituted a dramatic change in the formal structure of the economic system. The primary means of economic coordination and formal authority were replaced by the market mechanism. It is a mistake, however, to focus exclusively on formal mechanisms. As North has argued, in revolutionary circumstances,

> the formal rules change, but the informal constraints do not. In consequence, there develops an ongoing tension between informal constraints and the new formal rules. An immediate tendency... is to have new formal rules supplant the persisting informal constraints. Such change is sometimes possible, in particular in a partial equilibrium context, but it ignores the deep-seated cultural inheritance that underlies many informal constraints. Although a wholesale change in the formal rules may take place, at the same time there will be many informal constraints that have great survival tenacity because they still resolve basic exchange problems among the participants, be they social, political, or economic. The result over time tends to be a restructuring of the overall constraints – in both directions – to produce a new equilibrium that is far less revolutionary [5, 91]."

The importance of informal constraints is critical to understanding developments in Russia. The importance of informal mechanisms in the Soviet system was the key idea in Grossman's model of the command economy.[16] These informal mechanisms developed because the formal planning system alone could not cope with the economic problems of a complex economy. Because a consistent feasible central plan was impossible to produce, decisionmakers, especially enterprise directors, had to choose *which* elements of the plan they would have to violate so that other elements could be fulfilled. Hence, an enterprise director had to resort to informal means in order to survive.[17]

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[16] Hewett 4, chapter 4 pays special attention to the analysis of informal mechanisms in the Soviet economy.

[17] As Hewett noted, "[t]he successful 'entrepreneur' in this system is not a person who develops new products and new technologies, but one who successfully develops a workable relationship with the government and party authorities supervising his enterprises." 4, 199

In the late Soviet period the importance of informal mechanisms intensified as *perestroika*-era reforms further weakened the effectiveness of the formal system. Enterprises, and especially their directors, developed relationships to insure supplies of inputs and to protect against interference. These relationships not only survived the end of the Soviet era, but their value was enhanced by the elimination of many formal mechanisms that they competed with.[18] Thus enterprise directors were highly skilled at adapting to survive in an environment where adherence to the rules of the game were not a feasible survival strategy.

There is a general point here: organizations develop to meet the problems created by the institutional framework. Thus, North notes that in an unproductive institutional framework, "The organizations that develop in this framework will become more efficient – but more efficient at making the society even more unproductive and the basic institutional structure even less conducive to productive activity. Such a path can persist because the transaction costs of the political and economic markets of those economies together with the subjective models of the actors do not lead them to move incrementally toward efficient outcomes" 5, 9.

The important lesson from this discussion is that institutions develop in accord with problems faced by agents in the economy. In the Russian case these are dominated by the structural problems that are the legacy of the Soviet period. These institutions were robust to the formal changes in the environment brought on by the reform process. But this also means that an alternative approach to transition that was more gradual would still have to cope with the structural problems that the informal mechanisms are solving. Slowing reform down so that institutions could catch up neglects the fact that there was no institutional vacuum, and that behavior was adaptive.

3.   Relational Capital and Insurance

It is useful to think of this insurance in historical perspective. In Soviet times the viability of an enterprise director was contingent upon meeting a production quota established by central planners. With high probability, failure to meet the quota (fulfill the plan) exposed the

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[18]Especially party and state organs, at lower levels, such as the *obkoms* and *raikoms*.

director to risk of penalties. One of the chief sources of uncertainty for directors was possible shortages of supplies of inputs. To protect themselves against supply failures, directors established and maintained good relations with other directors, industrial ministry functionaries, and Communist Party officials at various levels. Relations with Party and ministry officials were important because such individuals could influence the central allocation of inputs. Good relations with other enterprise directors were a way to ensure supplies of inputs "horizontally" (outside the hierarchical allocation system).

Although enterprises varied in productivity, virtually everyone felt the need for the insurance. Success in meeting the quota one period did not put the enterprise in a better position to meet the quota in the next period, owing to the so-called ratchet effect of Soviet planning: that is, an enterprise that overfulfilled the plan target in one period could expect to have its target raised for the next period. The effect was to equalize the likelihood of plan fulfillment (or failure) for all enterprises. This equalization, or leveling, implied that the likelihood of missing plan targets was similar for high and low productivity enterprises. Thus the demand for insurance against failure was near-universal.

Today's scheme of investing in relational capital as insurance is the continuation of the Soviet system, but with some critical changes. Privatization means that the directors of enterprises have access to the income streams generated by the company's business. Those streams, however, are threatened by the new discipline of the market, under which lossmaking enterprises risk bankruptcy. A key goal of the director, therefore, is to continue production regardless of profitability. For many enterprises the risk to be insured against is, as before, a shortage of inputs. Only now that risk arises not because of failures of central planning but because the enterprise lacks the means to pay for the inputs in the market. Relationships with other enterprise directors and government officials — in many cases the very same individuals as in the Soviet system — are a way to ensure needed supplies.

At the same time, the move to the market has had a differential impact on low and high productivity enterprises. While the low productivity enterprises still need insurance, now because of the likelihood that they will be unable to cover costs, for the high-productivity

enterprise, the need for such insurance seems no longer necessary. Hence, such enterprises would prefer to opt out of the insurance scheme that they participated in — building relations with officials — in Soviet times.

The problem for officials is that if high-productivity enterprises opt out of insurance, only lossmaking enterprises remain in the insurance pool. Such adverse selection makes insurance impossible. Without the participation of value producers the scheme will not work. Hence, officials need to continue the participation of high-productivity enterprises. This means retaining viability risk for such enterprises. As these enterprises are profitable, this can be accomplished through introduction of expropriation risk.

4.   Mutation and Resistance: An Evolutionary Analysis

An enterprise that exploits its relational capital to circumvent the budget constraint can be thought of as a mutation. This follows because the enterprise is utilizing strategies that were previously not available. For example, the enterprise has adopted strategies – barter, tax offsets – that were not available to market-like firms.[19] This view of enterprise behavior fundamentally contradicts that of reformers who designed the Russian privatization. They viewed Soviet-type enterprises as potential "market-like" enterprises encumbered by political controls. The notion was that without government control, and with hard budget constraints, enterprises in Russia would behave like "normal" enterprises.[20] That is, once political controls were lifted they would maximize shareholder value like any firm in the west.

This conventional view ignores the fact that due to the mutation of the enterprise it has survival strategies unavailable to the "normal" enterprise.[21] The enterprise in the virtual economy can produce goods that can be used for barter or for tax offsets but that cannot be sold on the market. It can also procure inputs at a lower cost because it exploits relations to

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[19] It is inappropriate, but probably inevitable, that these should be termed *virtual* strategies.

[20] This was articulated clearly by some key architects of Russian privatization. For example: "In our view, controlling managers is not nearly as important as controlling politicians, since managers' interests are generally much closer to economic efficiency than those of the politicians" **?**, 65.

[21] A "normal" enterprise can increase its profits by increasing revenue or reducing costs. It does not have alternative means for survival. Of course, this "normal" enterprise is an ideal type. Firms in market economies may also engage in bribes and rent-seeking.

allow it to pay in non-monetary means. The cost of employing these extra strategies is a lack of transparency which necessarily ensues. This may make it impossible to attract external funds for restructuring.[22] Hence, the enterprise that uses these strategies finds it prohibitive to reduce distance, while the market-oriented enterprise cannot engage in virtual survival strategies.[23]

Shock therapy produced a sudden change in the environment facing enterprises.[24] Formal subsidization from the state budget was eliminated, and enterprises were supposed to cover their own costs.[25] In the absence of mutation, the enterprises that were inefficient – had high d – would be less fit. The importance of mutation is that the effects of the environment shift were *not* monotonic. High d enterprises may have have higher survival probabilities if they had invested sufficiently in relations. Enterprises that chose transparency would be at a competitive disadvantage to those that invested in, or had initially high, relational capital. Shock therapy is supposed to impact on enterprises via the effect on the budget constraint. Hence, those enterprises that had invested in alternative means of survival would be less effected by the shock. These enterprises are "effectively" immune from the therapy, even if the therapy was designed precisely to attack them.

Notice that the proportion of enterprises that follow these "virtual" strategies is not limited by the frequency of mutation. Enterprises can *imitate* behavior that they observe to be successful. If some enterprises in the virtual economy are able to survive without undertaking costly restructuring, then other enterprises may choose to follow this behavior.[26] Hence, once virtual strategies appear to be working the system may rapidly tip.[27]

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[22]The non-transparent enterprise has financial records that are difficult to assess, hence outside investors are reluctant to invest.

[23]In practice the boundary is rarely so sharp. See 2 for a discussion of *Igor's* rules for successful enterprise management in Russia.

[24]Or, a change in the formal rules of the system in the terminology of institutional analysis.

[25]In practice, this took several steps which we ignore for simplicity.

[26]This points to a generic problem in transition, pooling. For example, once enterprises that lack liquidity are able to barter other enterprises will pretend they are illiquid to share in the benefits of barter. This pooling makes it difficult to target policies that ameliorate the conditions of enterprises and households that suffer in the transition. The ability to engage in such pooling is clearly dependent on the initial distribution of agents in distress.

[27]In section 4.2. we provide an example of an evolutionary game where such tipping can occur. Starting from an economy populated only by Soviet enterprises, the evolution to the market can detour to the virtual

This is not necessarily an argument that reforms were ill-conceived,[28] though excessive focus on the budget constraint may suggest that it was. It also refers to *implementation.* Reforms that would have shut down lossmaking enterprises were shunned because the consequences of these reforms were deemed intolerable.[29] Clearly, effective hardening of budget constraints was an implicit assumption necessary to the therapy of tight money and liberalization. The fact that hard-budget constraints were avoided through investment in relational capital means that reforms were not fully implemented.

4.1. Incomplete Therapy

Incomplete shock therapy failed to wipe out loss-making enterprises. A new mutant strain emerged with the survival strategies available in the virtual economy. This made it harder for new enterprises to compete. The greater the number of mutant enterprises that exploit these virtual strategies the greater the relative disadvantage for market-type enterprises, because mutant enterprises operate under different rules.

The process we are examining bears a relationship to the problem of multi-drug resistant (MDR) tuberculosis (TB). MDR strains of TB are never found in the wild. Rather, they are the product of human intervention. Genetic resistance to particular anti-TB drugs occurs naturally, but this is diluted by the overwhelming prevalence of drug-susceptible organisms. In the natural environment there is no evolutionary advantage to genetic resistance to antimicrobials which are introduced by man. The presence of antimicrobials provides the selective pressure for resistant organisms to become predominant. Human intervention that introduces antimicrobials creates the selective pressure in favor of MDR. The primary mechanism by which this happens is an *incomplete* regimen of treatment (or poor adherence to a proper regimen). The incomplete regimen wipes out the drug-susceptible organisms, leaving the field for the drug-resistant varieties.

The analogy with enterprise behavior is straightforward. In a competitive environment

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economy if enough Soviet-type enterprises survive.

[28] That argument has been made quite often, recently, most notably in **?**.

[29] This argument is developed further in **?** using the concept of "impermissibility."

there is no selective advantage to investing in relational capital. Reducing market distance is the key to viability. Incomplete therapy in Russia, however, did not create such an environment. Relational capital continued to result in a positive payoff in terms of enterprise fitness and survival. For enterprises that possessed sufficient relational capital, the opportunity to survive via virtual strategies became a viable option. Hence, the greatest burden of shock therapy was felt by enterprises that did not have, or chose not to invest in, relational capital. Incomplete therapy imposed a *relative* burden on enterprises that chose to act in a "normal" manner. Hence, incompleteness provided selective pressure that favors the mutant enterprise. This is similar to the outcome for a TB patient who does not take the full complement of anti-TB drugs, or who fails to follow a multi-drug regimen.[30]

4.2. A Simple Evolutionary Model

One way to see the effects of incomplete shock therapy is to analyze the evolutionary process of enterprise behavior. Suppose that enterprises can choose to behave as market-like (M), Soviet (S), or virtual (V).[31] The relative payoff for each of these strategies will depend on the conditions of that particular enterprise and on the choices of other enterprises. The former we have already characterized in terms of d_i and r_i. Presumably the greater is the market distance for a given enterprise the lower the payoff to choosing the M strategy. Similarly, the payoff to choosing V would be less if an enterprise had a low level of r. But relative payoffs will also depend on how other enterprises behave, and that is our focus in this section.

Why would the payoff to a strategy depend on the choices of other enterprises? Consider, for example, barter. The cost to a given enterprise of eschewing cash will depend on the difficulty of finding other partners willing to use non-monetary exchange.[32] This suggests that there is a thick-market externality in choosing the V strategy. It may be that the

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[30]In fighting TB it is crucial to follow a multi-drug regimen, because the virus mutates sufficiently so that a unitary drug regimen is ineffective. See, for example,

[31]This is a poor use of terminology. The virtual economy refers to an economic system, not a particular type of enterprise. The virtual economy contains both inefficient manufacturing companies and *Gazprom*. But it is simpler to refer to enterprises that use barter and offsets as virtual enterprises, as a second-best type of shorthand.

[32]For some empirical evidence on the presence of economies of scale in using barter in Russia, see 3

market system is more efficient if all enterprises are market-like enterprises; indeed, this is the assumption we make in this section. But that is not the critical question for transition. Rather, we want to know if there is a path from the command system to the market economy. It may be that the market is more efficient if all enterprises are market-like. Nonetheless, it may be impossible for the market system to invade and overtake an economy that is populated primarily by Soviet-type enterprises.

A crucial question for transition is whether the market system can be approached gradually. A simple way to study this question is to see how the choices of strategies evolves based on the populations of the three types of enterprises. We study this question in the form of a simple model with three strategies: Soviet (S), Market (M), and Virtual (V). The payoff that an enterprise receives depends on the strategies that other enterprises are playing. Let $\pi(i,j)$ be the payoff to an enterprise choosing strategy i when all other enterprises choose strategy j $(i,j = S, M, V)$. We assume that the payoff to being a market enterprise is greatest when other enterprises choose the market strategy, and it is lowest when all other enterprises follow the Soviet strategy.[33] Hence the payoff to the market strategy is:

$$\pi(M, M) > \pi(M, V) > \pi(M, S)$$

and similarly for the virtual and Soviet strategies:

$$\pi(V, V) > \pi(V, S) > \pi(V, M)$$
$$\pi(S, S) > \pi(S, V) > \pi(S, M)$$

Notice also that the market economy is assumed to be socially efficient and an economy fully populated by Soviet-type enterprises is least efficient. Thus, $\pi(M, M) > \pi(V, V) > \pi(S, S)$. It is important to recognize, however, that these payoffs refer to outcomes in the transition

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[33]This is somewhat counter to the analysis of partial reform, ala Murphy-Shleifer-Vishny. In their analysis, market-like invaders can prosper in an environment of state-owned enterprises by purchasing inputs from state-owned enterprises at below market prices. The case is not directly related, however, because there is no discussion of how the surplus (bribes) is distributed, so we cannot really discuss relative fitness.

environment. This means that when all enterprises choose the soviet strategy they are playing in an environment without Soviet institutions. It is an economy where all enterprises play Soviet-type strategies (play by formal and informal Soviet rules), but where Soviet institutions such as *Gosplan* no longer exist

An illustrative payoff matrix that shares these assumed payoffs is given by:

$$
\begin{array}{cccc}
 & \text{Market} & \text{Soviet} & \text{Virtual} \\
\text{Market} & 5 & 0 & 3 \\
\text{Soviet} & 0 & 3 & 1 \\
\text{Virtual} & 2 & 3 & 4
\end{array}
\tag{3}
$$

where the numbers are payoffs to a row strategy against a population of column strategies. Hence, $\pi(M, M) = 5$, $\pi(M, S) = 0$, $\pi(M, V) = 3$, etc. Notice that the payoff matrix given above has the following features:

- The Soviet enterprise is (weakly) dominated by the Virtual enterprise: that is, the Virtual enterprise always does as well as the Soviet enterprise and sometimes better.

- Against a population of Soviet enterprises the Virtual enterprise does as well as the Soviet enterprise.

Most of the payoffs in 3 are straightforward. The fact that $\pi(M, V) < \pi(V, V)$ is worth comment. A market enterprise that operates in an economy with many virtual enterprises is under threat precisely because of the fiscal pressure from the government. With many virtual enterprises, enterprises that operate in the monetary economy are prey to the tax authorities. The relative situation of a market-like firm is decreasing in the number of virtual enterprises because the latter are able to barter and use tax offsets to reduce the real value of liabilities. One might also question the assumption that $\pi(M, V) > \pi(M, S)$. If the economy is dominated by Soviet enterprises the market enterprise would find it very difficult to procure inputs – much harder than with virtual enterprises. This is the logic behind the assumption. One may argue, however, that in the virtual economy the market-type enterprise will, again,
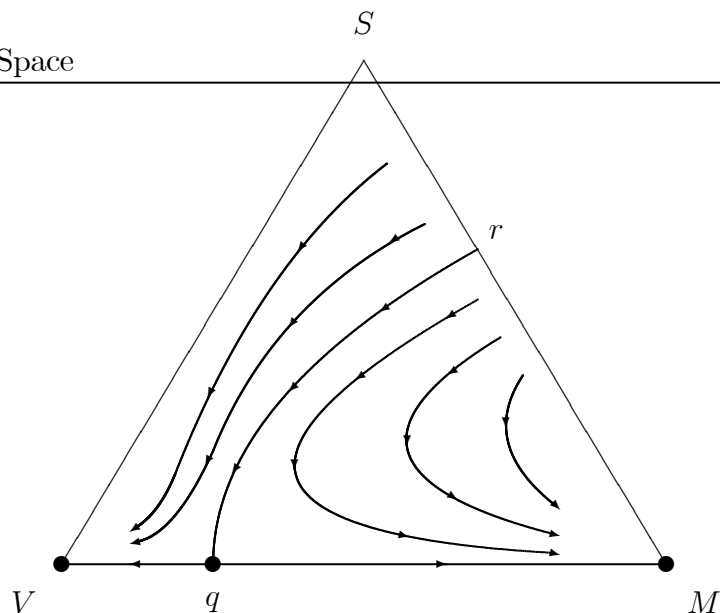
Figure 7: Some Evolutionary Dynamics

be the prey of the tax authorities. This may suggest that it is plausible to also investigate the implications of assuming that $\pi(M, V) < \pi(M, S)$.[34]

There are three pure strategy equilibria in this game. One consists of all Market enterprises; this is the most efficient. A second equilibrium consists of all Virtual enterprises. The last one consists of all Soviet enterprises but this is, of course, weakly dominated. In addition, there is also a mixed strategy equilibrium q with $\frac{1}{4}$ Market enterprises, no Soviet enterprises and $\frac{3}{4}$ Virtual enterprises.

Notice that if there were no Soviet-type enterprises we would not expect to see any virtual enterprises. The reason is that the "all market" equilibrium dominates the "all virtual" equilibrium. By assumption we have chosen the all-market equilibrium to be most efficient, and in an environment where the only two types of enterprises are M and V the system will

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[34]Notice that we can do this without altering the pure-strategy equilibria. For example, we can use the alternative payoff matrix

	Market	Soviet	Virtual
Market	5	2	0
Soviet	0	3	1
Virtual	2	3	4

We have investigated the evolutionary dyanamics with this payoff matrix using replicator dynamics, as in the example studied in the text. The qualitative behavior remains similar – there are still two basins of attraction – but the likelihood of getting stuck in the virtual economy is smaller than with the original payoff matrix, in the sense that we need a larger initial mutation of virtual enterprises, $p_V(0)$, and the critical value to reach the market economy is lower.

end up in the "all market" equilibrium. But when Soviet-type enterprises exist it is possible that the economy will end up in the "all virtual" equilibrium. The presence of Soviet-type enterprises affects where we end up, even though this strategy is dominated by the others.

To see this we assume that the population of each type of enterprise depends on its relative performance compared with the other types. Thus, let $p_i(t)$ be the proportion of enterprises that choose type $i = S, M$ or V at time t. We can formulate the change in the population by:

$$\dot{p}_i = p_i \left[e_i A p - p^T A p) \right] \tag{4}$$

where p is the vector of population shares (p_M, p_S, p_V), A is the 3×3 matrix of payoffs from (3), and e_i is the vector of payoffs for an enterprise choosing strategy i (i.e., $e_S = (5, 0, 3)$). The term in the brackets is the difference between the payoff from a particular strategy and the average for all enterprises given the current population shares. Thus the growth in the population of any type of enterprise depends on its *relative* performance compared to the average of all enterprises. For initial populations of the three types of enterprises we can see how strategies evolve. In particular, we can study how the basins of attraction are altered by the initial population shares.[35]

The results can be understood with the aid of figure 5.1. Suppose initially that all enterprises are Soviet-type. We are at the top of the simplex. Now assume that in period 0 a shock occurs that converts some proportion of these enterprises to market strategies. Further suppose that there is a mutation that creates a virtual enterprise. We can let the initial population of these enterprises be arbitrarily small (i.e., $p_V(0) = .001$). The resulting dynamics depend on how large is this shock. The critical value is $p_S(0) = r_S = .625$.[36] If the shock does not bring the share of enterprises choosing the Soviet strategy below this critical value, the dynamics take the economy to the "all virtual" equilibrium. When the shock is greater than this, however, the economy successfully transits to the market. The critical boundary is labelled in Figure 5.1 as the curve qr.

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[35] The dynamics specified in (4) is known as the "replicator dynamics" in evolutioary game theory. See, for instance, Weibull (1995) for a further discussion and interpretation.

[36] Of course the specific shares are dependent on the chosen payoffs in the matrix A.

Another way to think about these dynamics is to consider the basins of attraction. There are two basins of attraction. One is the market economy. The other is the virtual economy. The choices of enterprises eventually take us to one of these basins. In our example, the basins of attraction are given by the regions Vq and Mq along the base of the simplex. As is apparent from figure 5.1 the basin of attraction of the market economy is larger than that of the virtual economy. It is interesting, however, to ask what would happen if there was a constraint that the proportion of Soviet enterprises could not shrink to zero. That is, suppose that a political constraint requires the continued presence of state-owned enterprises. In a sense this was precisely the case early in transition, primarily with respect to defense enterprises. The effect of such a constraint is to increase the relative size of the virtual economy's basin of attraction. To see this, notice that such a constraint implies that the economy no longer ends up at the base of the simplex – where the share of Soviet enterprises is zero – but at some higher level. Essentially, the base of the simplex shifts up, with the boundary qr unchanged. Given the slope of qr it is apparent that the probability that a virtual mutation will take us to the virtual basin of attraction increases.

The market economy is evolutionarily stable. The system is immune to *small* mutations. The virtual economy is also evolutionary stable. The problem is large mutations. When there are both Soviet and Market enterprises the system is vulnerable to the virtual virus.

A key assumption is that when most enterprises are M then being a market enterprise dominates being a virtual one. But when there are a sufficient mass of non-market enterprises it pays to be virtual. The reason is that when most enterprises are operating with tax offsets and barter it is very costly to restrict to cash.

Remark 1 *Note that this is related to the rotation of the RB curve in R-D space. The* RB *curve separates the regions where enterprises choose to invest in relations from that where enterprises choose to reduce distance. If the boundary rotates counter-clockwise this increases the domain of attraction of the basin in the Northeast. The key to push market reform is to rotate it clockwise.*

Because the virtual economy is a basin of attraction, it may be stable to small perturbations. Thus reforms that might seem effective on market thinking may backfire. For example, tightening the cash constraint. See **?**.

4.3.   Behavioral Adaptation

In the biological world evolution relies solely on relative fitness. In social evolution, however, adaptation can occur not just through replication but through adaptation.[37] Enterprise directors can observe the success of other enterprises and adapt their behavior. This could lead to more rapid adjustment to the virtual equilibrium.

In the previous example it was assumed that enterprises were equally likely to interact with any type of enterprise. Payoffs were determined solely on the basis of population frequencies for the economy as a whole. This seems to be the logical assumption because the nature of the payoffs depends on the mixture of enterprises in the economy, not on particular interactions.

One could argue, however, that enterprises may be more likely to interact with like-minded enterprises. This could lead to further bifurcation. If agents tend to interact with like-minded agents, this may reinforce behavior.[38] Recall that the payoff to being a virtual enterprise increases is higher when interacting with other virtual enterprises. This suggests that the virtual trap could be strengthened by the presence of non-random interactions.

Evolution can also occur via cultural transmission. Most models in evolutionary game theory assume that agents interact randomly with other agents. But in structured environments, agents interact more often with agents that are similar to them. This can speed the adoption of certain equilibria. This is certainly relevant for transition economies, because enterprises in the production sector tend to interact with the same enterprises that they dealt with under central planning. The increased interaction with such a structured group can lead to a more rapid adjustment to the new equilibrium.

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[37] This has been studied in different contexts by **?** and **?**.

[38] For example, **?** has shown that if agents interact in sufficiently small, close-knit groups, then the expected waiting time until the evolutionary process comes close to its asymptotic distribution is bounded independently of the number of agents or of the initial state.

4.4. Policy Ineffectiveness

Notice that all of the shocks that have occurred since the start of transition have had greater relative impact on marketized enterprises. Attempts to increase the intensity of reform have all focused on hardening the budget constraint without any actions to reduce the payoff to investments in relations. Such policy measures illustrate the principle that in the virtual economy populated by mutant enterprises, conventional policy prescriptions will not work as expected. Here we consider two examples.

4.4.1. Transparency

The first illustrative example of a policy that has unintended consequences is increasing enterprise *transparency.* An essential element of market reform is that enterprises make their financial activities more transparent. The implicit bargain of market reform was that greater transparency would be rewarded by greater access to credit. Financial markets require transparency, as does foreign investment. Of course, transparency also makes problems more apparent. But if the only way to obtain external financing is to take the plunge to greater transparency, then enterprises will choose this costly option.

The problem with choosing transparency is two-fold. First, it precludes the use of strategies that rely on relational capital. Second, transparency is essentially irreversible. If there were no r then those enterprises with greater d would be disadvantaged. The move to greater transparency would have the greatest benefits for enterprises that are closest to the market. Hence, the fitness of the most efficient enterprises would be enhanced relative to lossmaking enterprises. The problem is that when relational capital is an available survival strategy those enterprises that chose transparency may be relatively *disadvantaged.*

Why are market-like firms relatively disadvantaged when r is an available survival strategy. The enterprise that eschews relations and tries to become more efficient will face more favorable market conditions if less efficient enterprises must meet budget constraints. When these enterprises exploit relations, however, then they can continue to produce even though they do not cover costs. The more transparent enterprises have undertaken costly restructuring but

the payoff has been reduced by the continued operation of the less efficient.

This argument has important implications for discussions of the role of corporate governance. It has become almost commonplace to point out that inadequate corporate governance is a severe problem in Russia, one that inhibits investment, especially foreign investment.[39] The conventional view is that weak corporate governance is a key barrier to external finance for Russian enterprises. This is an important argument, but it is critical to keep in mind that the opposite is also true: the low probability of attracting external finance inhibits the development of good corporate governance. There are two parts to this. First, enterprises that have very high d see very little return to improving corporate governance. Even with very transparent relations they are unlikely to attract external financing, because the expected return is so low. Second, enterprises that may have higher expected returns face the twin problems of high interest rates and increased tax incidence. The fiscal problems of the Russian government prior to August 1998 increased the cost of external finance to enterprises through crowding out.[40] This automatically reduces the expected return to choosing transparency. In addition to this, an enterprise that chooses to reduce d faces increased relative tax incidence from entering the monetized part of the economy. This also reduces expected return. Hence, enterprises led by directors that fully understand the connection between good corporate governance and external finance may *choose* not to implement the former because the benefits are not sufficient.

The relative disadvantage faced by enterprises that chose transparency is the product of extremely high costs of external finance. Ignoring problems of corporate governance – these should be less severe in transparent enterprises – the fiscal policy of the Russian government has crowded out much investment. Transparent enterprises have not received the intended benefit, but they have paid the cost in terms of foreclosing the use of relational strategies. Those enterprises that chose transparency are now more vulnerable than before.

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[39] See, for example, **?**, 176-181 for a discussion of the problems of corporate governance on the prospects of attracting investment. This issue has recently been taken up by Stiglitz **?**.

[40] After the crisis and default raising external finance may be even more difficult. Certainly, foreign investment is more difficult to attract. Interest rates remain high, and domestic financial institutions engage in very little lending to the commercial sector of the economy.

This effect is especially true when there is a tax crackdown. High tax rates that result from fiscal weakness and campaigns to increase tax collections mean that pressure falls greatest on those enterprises whose books are most transparent.

4.4.2. Tight money

A second example of a policy that is rendered ineffective by the virtual economy is that of tight money. An essential element of shock therapy is a policy of tight money to stabilize the price level. Indeed, most critics of so-called shock therapy have pointed to tight monetary policies as one of the prime causes of the output fall.[41] Certainly, tight money is an essential element of the tightening of budget constraints. If credit is lax there is less pressure on enterprises to restructure.

Tighter credit is a perfect example of a policy that is supposed to hurt all enterprises and is supposed to have the greatest impact on the least efficient. The latter are most likely to suffer cash flow problems, and hence most likely to be pressured by an inability to borrow.[42] The policy of tight money is premised on the assumption that survival is uni-dimensional. If survival via investment in relational capital is feasible, then this assumption is not appropriate. Enterprises that invest in relational capital may insulate themselves against credit shocks. Tight money then has greater relative impact on those enterprises that invested in reducing distance. The "fitness" of the latter enterprises is reduced relatively by the tight money policy. This induces imitation, and virtual behavior spreads.

Enterprises in Russia were able to use relational capital to insulate them from the stringencies of the budget constraint. The ability to pay for inputs and to pay taxes in kind, rather than in cash, provides them with an advantage compared to those that must use cash. Barter typically costs the paying enterprise less than an equivalent *nominal* amount of cash. Else, the enterprise would sell the output for money and pay with it.[43] Hence, once barter became

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[41] Which does not mean that this argument is correct.

[42] This is not necessarily the case. It is possible that more efficient enterprises have borrowed to finance restructuring so that they are burdened by a shortage of credit. But less efficient enterprises may have to borrow for working capital.

[43] This is not quite correct. There are other costs of using cash. It may attract criminal groups if it is

more common even enterprises that could afford to pay with money chose to use barter.

We can put this in the context of our evolutionary analysis. The transition process was perturbed by the tightening of credit during 1995 and the ruble corridor. This induced a mutation in enterprise behavior. In particular, monetary tightening induced the use of barter. Lack of liquidity may have induced enterprises to engage in non-monetary behavior. Once this mutation occurred, the stability of virtual behavior implies that barter would persist even if the initial conditions that shocked the system are no longer present.

This account fits with some recent empirical work that studies barter. It has been argued by 1, for example, that barter became widespread in Russia in response to the monetary tightening of 1994-1995. Yet, as demonstrated in 3, barter does not seem to be related to the financial position of the enterprise. The latter study also shows that there is a lock-in effect of barter: once enterprises use barter it is cheaper to continue. We return to this below 4.4.2..

The key point is that the importance of relational capital and of networks of relationships among enterprises preceded the imposition of tight money. Hence, when tight money was imposed, resort to virtual strategies caused the policy to be ineffective. Tight money penalized the wrong enterprises. It reinforced barter – a phenomenon that clearly preceded the tightening of credit – and provided a relative advantage to those whose relations were sufficient to support barter. This leaves the interesting counterfactual: if tight money would have been imposed earlier – *before the mutation* – would it have been more effective because virtual behavior was not consolidated yet?

5.   Explaining Subpar Performance

Suppose that you see a team of very high-priced players performing very badly. According to the NYT:

> Steinbrenner growled that he was "bitterly disappointed" by the Yankees' "lack of
> performance." He said it was "unbelievable to me that the highest-paid team in

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know that the enterprise possesses cash. There may also be tax advantages of using barter. In addition, an enterprise that signals that it has cash may find it harder to delay wage payments to workers. For further discussion, see 2.

baseball," with a payroll of nearly $200 million, would be in such a "deep funk"

through two weeks of the season...He ranted that "they have the talent to win and

they are not winning," but that he expected Joe Torre (now in his 10th season as

the manager), the coaches and the players to "turn this around."

The point is that the inputs are high quality, so lack of performance must be associated

with poor coaching or players not working hard.

This is what we do in economics all the time. We separate performance into inputs,

outputs, and efficiency, which is measured as a residual. Thus,

$$Y_t = A_t F(K_t, L_t) \tag{5}$$

Then we can obtain the rate of productivity growth (or the level of output) as a residual from

measured outputs. E.g.,

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \left(F_K \frac{K}{Y} \right) \frac{\dot{K}}{K} + \left(F_L \frac{L}{Y} \right) \frac{\dot{L}}{L}$$

or

$$\frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - \left[\left(F_K \frac{K}{Y} \right) \frac{\dot{K}}{K} + \left(F_L \frac{L}{Y} \right) \frac{\dot{L}}{L} \right] \tag{6}$$

Now suppose that we observe very low TFP growth. It is natural to assume that this is due to

poor incentives and inefficiency. The big gain will come from improvements in TFP growth,

not in accumulating inputs.

To a large extent, people have thought about transition in this way. Focus on privatization

and other economic reforms. But this assumes that the inputs are being used *appropriately*.[44]

But just because Kevin Brown is paid $15 million does not mean he is worth $15 million.

The problem here is that that capital inputs are valued in a way that may seriously distort

interpretation.

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[44]It is important to be careful here. I want to say efficiently, but that could be interpreted as relating to A.
What I am referring to is more akin to using the ingredients correctly to cook a meal.

- Notice that Kevin Brown not playing up to $15 million could be offset by some low-price player playing out of his mind. Random errors we don't really worry about. It is systematic errors that are the problem.

The standard in national income accounting is to include as investment the cost of adjusting to climate and distance. Thus, extra insulation required for a heating plant in Novosibirsk is counted as extra capital. It is important to note that the impact of cold may in fact overstate investment in Russia. In calculating investment, the PWT explicitly excludes an adjustment for the extra cost of investing in cold climates.[45] A power plant built in Siberia requires extra heating and insulation compared with Mexico. That greater cost is included, however, as output, so it shows up as greater investment. If one were to account for this adjustment investment would be relatively even more expensive in Russia, especially as this applies most to structures and we have seen that the composition of Russian investment is skewed in that direction.

The τ effect. Capital is handicapped by location and other distortions – due to misallocation.[46] Suppose that we can index by τ the ratio of the true capital stock to the measured capital stock. The actual return to capital is measured capital net of the handicap. So if the production function is of the customary Cobb-Douglas form, we should write:

$$Y_i = A_i(\tau K)_i^{\alpha} L_i^{1-\alpha} \tag{7}$$

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[45] Kravis, Heston and Summers explicitly discuss this question and explain why they cannot correct for it: "Suppose that in a cold climate a stream power plant had to be built with insulating walls around its boiler room and switchhouse, whereas in a warm climate both can be exposed to the weather. Assuming that all other characteristics are identical, should the inputs and costs required for closed construction in the cold climate be regarded simply as added costs, or as more output?

One line of reasoning in response to such questions is to regard the future flow of services that each capital good would produce in each country as the basis for evaluating the relative amounts of investment. This implies that an international comparison should be made of the present value of the increases in output — ultimately in the form of consumption goods — that new capital goods would contribute in each economy. In the real world, no dated list is available of consumer goods that will eventually flow from new investment, but only the value of investment an the prices of the capital goods themselves in each country's own currency. Furthermore, knotty problems would arise in isolating the differences in future flow that could be attributed to the input of capital from the differences attributable to other elements, such as other factor inputs and environment. Therefore, it is too difficult to implement the future-flow-of-services approach **?**, 29."

[46] One way to think of this is that in each period more capital depreciates than would otherwise be the case. Hence, a greater portion of gross investment is really replacement, though this extra replacement is compensating not for wear and tear or even economic obsolescence, but rather to allow capital to function as it would in a normal environment.

Ignoring this effect the marginal product of capital is $\alpha A_i K_i^{\alpha-1} L_i^{1-\alpha}$. But this is in fact smaller than the actual return to capital if $\tau < 1$. This means that the impact of investment on Russian growth is overstated if τ is ignored. Alternatively, the difference in income levels – as in development accounting – overstates the impact of differences in A, as it understates differences in functioning capital stocks across countries. This diverts attention from problems with factor accumulation towards efficiency.[47]

- implication for thinking about FDI. Conventional wisdom is that barriers, restrictions and taxes on investment are the chief culprit preventing capital flows to developing economies. So if these restrictions are removed FDI will flow. But if $\tau < 1$ rates of return may be insufficient to attract investment even if "the chief culprit" is eliminated.

All countries (except Singapore where $\tau = 1$) have a $\tau < 1$. This is Gordon's point about US versus Europe. This is because we should measure output by welfare criteria, not just by goods itself.

But the handicap can be decomposed into a self-imposed part and a fixed effect. The latter is due to irreducible features of the environment optimally adpated to. The former refers to the extra costs imposed due to misallocation.

The Kravis-Heston-Summers approach is to consider $\tau < 1$ as present but measurement error. Their implicit assumption is that differences in τ across countries are not systematic. If one were to take their discussion seriously, one would realize that some countries, notably Russia, would have systematic errors.

6.   Machinery and Equipment

DeLong Summers. Romer type idea. Critical for transition due to skills.

they argue that you should exclude transportation equipment, and this is especially important due to size. In Russia lots of transportation should really count like insulation in

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[47]Caselli notes, "the consensus view in development accounting is that Efficiency plays a very large role. A sentence commonly used to summarize the existing literature sounds something like "differences in efficiency account for at least 50% of differences in per capita income. (p. 2)"

Siberia.

7.   Is Investment a Problem in Russia

How important a problem is the investment rate in Russia? The Soviet period demonstrated that very high investment rates were consistent with stagnant, and even decreasing growth rates. Hence, many observers focus on organizational improvements and other elements of economic reform as crucial, de-emphasizing the role of investment. The implicit assumption is that inherited inefficiency takes the form of production well within efficiency frontiers, and that privatization and other reforms can lead to rapid improvements in productivity growth.

McKinsey view – Palmeda and Lewis

While organizational improvements are clearly important, this view ignores, however, the legacy of the capital stock inherited from the Soviet period. Installed capital is highly inefficient and may not be competitive even with frontier management. This is partly the result of investment decisions made with energy and other inputs that were priced too low, and without regard to the costs of the cold and location.

Moreover, the enterprises that produce inefficient producer goods present a continued handicap for the growth process, as outlined below.

7.1.   New versus Installed Capital

Especially in transition, it is crucial to distinguish the returns from installed and new capital. Installed capital is critical because inherited capital stocks from the Soviet period are so inefficient. Returns to new investment are high.

- Q-models and the energy crisis

- the returns to labor in transition economies

The problem is how to encourage new investment. This is difficult due to the need of relational capital.

8.   Is Investment High in Russia?

It is clear that investment is crucial for Russian economic performance. How high is Russian investment? We begin by looking at this in the standard way – that is the ratio of investment to GDP measured at domestic prices. Then we examine how the picture looks at international prices.

8.1.   Traditional Comparisons

The "traditional" investment rate in Russia is not that high by international standards, especially adjusting for the level of GDP, etc. In table 1 investment rates for a sample of transition economies indicates that while investment in Russia is about the FSU average, it is below levels in the more successful EU Accession countries.

Table 1: Investment Rates in Transition Economies

Averages of observations from 1995-2000, from World Bank (2002).

Investment/GDP Ratio %

EU Accession

Bulgaria	14.6
Czech Republic	31.4
Estonia	27.5
Hungary	27.9
Latvia	23.5
Lithuania	23.9
Poland	24.2
Romania	20.9
Slovakia	33.2
Slovenia	25.5

Ex Soviet Union

Armenia	19.0
Azerbaijan	30.2
Belarus	24.7
Georgia	13.5
Kazakhstan	16.3
Kyrgyzia	19.1
Russia	**20.1**
Tajikistan	20.8
Ukraine	21.3
Uzbekistan	20.8

In figure 8 we note that the investment rate of Russia is below that of Japan, China, Korea, and the Czech Republic. Notice that the takeoff in Korean growth occurs when the investment rate rises above 25%, and that the miracle periods occur when the investment rate
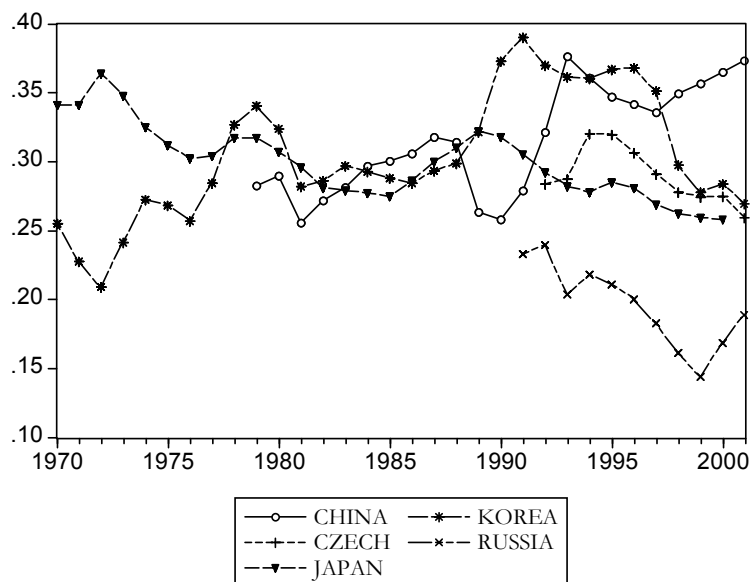
Figure 8: Gross Capital Formation for Selected Economies, Domestic Prices

is even higher. Russian investment declined from the beginning of transition until 1999. Since then it has recovered – this is the sharp recovery in investment, and the rapid growth year to year that is talked about quite often. Nonetheless it is apparent that this is still significantly lower than other comparable economies.

The fact that investment rates in Russia are lower now than in the early 1990's (let alone the Soviet period) may be less important if there has been a significant increase in the efficiency of investment. After all, one goal of economic reform has been to improve the nature of the investment process. Whether efficiency has actually risen is an important question that we discuss below. It is important to note, however, that the investment rate is also low compared not only with fast growing economies but in comparison to slower growing ones too – Czech Republic, Japan in the 1990's.

If no oil this investment rate would lead to slow growth

8.2. PPP Comparisons

In the previous section we analyzed Russian investment rates measured at domestic prices. Development economists have increasingly turned their focus, however, to measuring investment at world prices.[48] This is because in many developing economies investment is the focus of many policy distortions. The relative price of investment when measured at international prices is higher in poor countries than in rich countries. This means that when we measure investment rates at international prices richer countries tend to invest a higher share of GDP than poor countries.[49] In this section, we examine the relative price of investment in transition economies.
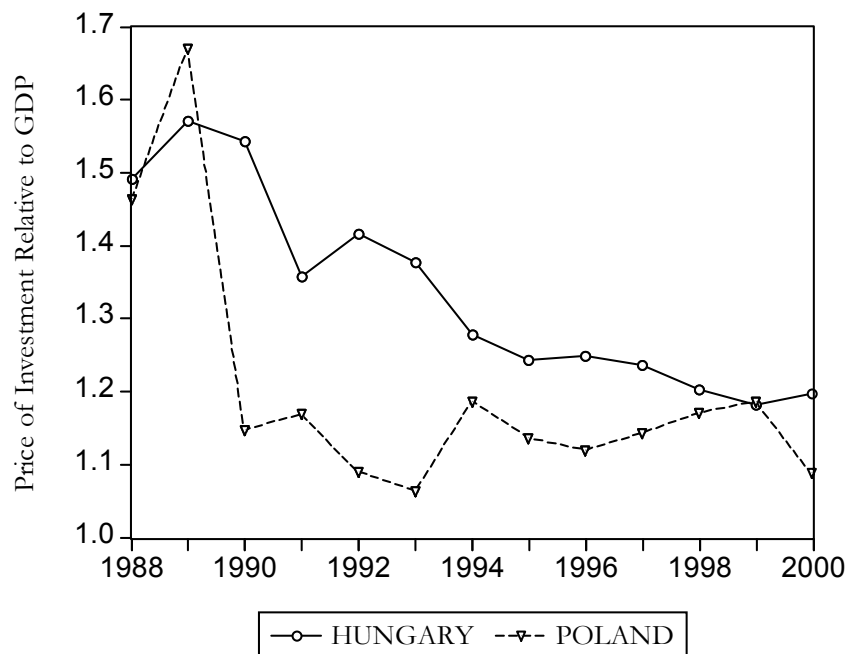

Figure 9: The Relative Price of Investment in Hungary and Poland: The Impact of Liberalization

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[48]De Long and Summers 6, 396 stress the distinction "between investment effort – share of national product saved, plus capital inflows – and investment – buildings constructed and machines put into productive use. Many of the policies that have been followed in the post-WWII period, especially in the developing world, seem designed to maximize 'investment effort,' while ensuring that each unit of 'investment effort' translates into as little actual investment as possible." Like so many other aspect of economic policy, what was merely a disease in developing countries was a pathology in the socialist world.

[49]This was first noted by 14, 339.

For transition economies there is an extra complication. Under the Soviet system the relative price of investment was low due to planners' preferences. Consumption was a residual priority. Ericson stuff. Hence, liberalization of prices causes a shock to the relative price of investment, pushing it up initially. For example, in figure 9 the relative price of investment in Hungary and Poland show exactly this decline. In Poland the decrease in the relative price of investment was more immediate – a reflection of the quicker pace of price liberalization in general. In both cases, however, the relative price of investment is significantly lower in the second half of the 1990's than in the first half. Hence, transition led to an effectively lower relative price of investment in Hungary and Poland.

In Russia price liberalization also led to a decrease in the relative price of investment. Subsequently, however, the relative price of investment has been increasing, significantly. Indeed, the distortion in relative prices (which could be measured as the difference from unity) has more than doubled during transition. A similar tale can be told for Ukraine.

Measured at international prices the relative price of investment is high in transition economies in general, and in Russia in particular (see figure 10). Notice that the dispersion in relative prices has increased over the period, the coefficient of variation increasing
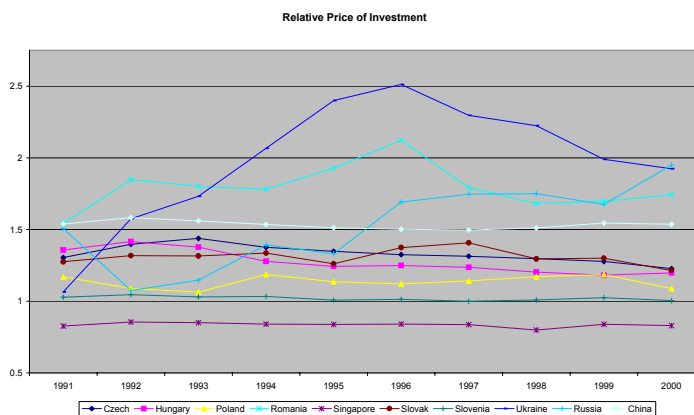

Figure 10: The Relative Price of Investment in Transition Economies

from .188 in 1991 to .304 in 2000.[50] This is somewhat surprising. One might expect that market reforms would cause the relative price of investment to converge. At least this would

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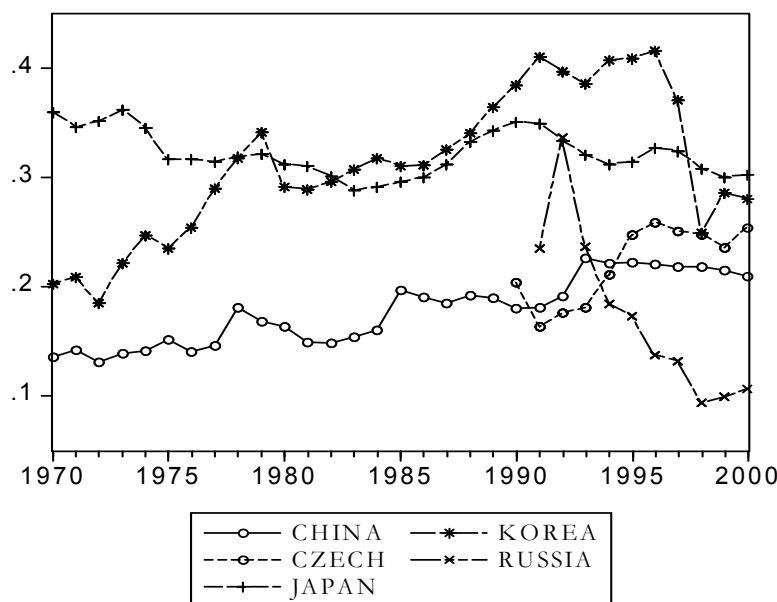[50]Notice that much of this divergence is caused by Russia and Ukraine.

Figure 11: Gross Capital Formation at International Prices

be so if all differences in relative prices were due to planning distortions. These are important, but they are not the only ones. For example, governments may engage in policies that distort prices. That seems to be what is taking place in Russia and Ukraine in figure 10.

Compare the same countries as in figure 8 above:

Given the high relative price of investment in Russia (and Ukraine) it is not surprising that investment rates are lower when measured at international prices (figure 12). The adjustment is quite dramatic for Russia. Recall from table 1 that Russia invested, on average, about 20% of GDP at domestic prices. At international prices, however, the investment rate falls below 10% after 1998. Adjustment for international prices reduces investment rates for all of the economies displayed in figure 12, but the adjustment is highest for Russia and Ukraine. Moreover, the gap increased during the second half of the 1990's.

The impact of a high relative price of investment on growth is straightforward. It means that for any level of savings, the addition to the capital stock is lower. Hence, when we compare the relative price of investment to growth performance it is not surprising that we find a strong negative relationship for transition economies, as in figure 13. Notice that Russia
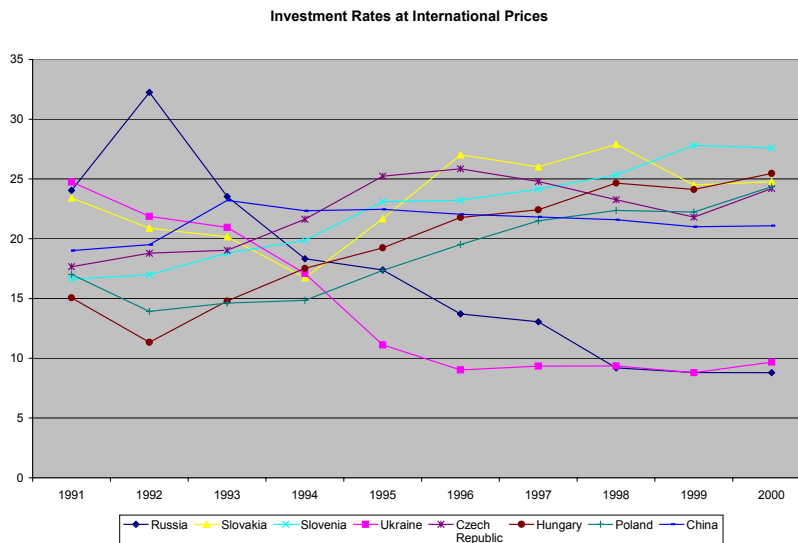
Figure 12: Investment Rates at International Prices

is a bit of an outlier because of its energy abundance. It is less reliant, in a period of high and rising oil prices, on investment. The negative impact of the relative price of investment is quite apparent.

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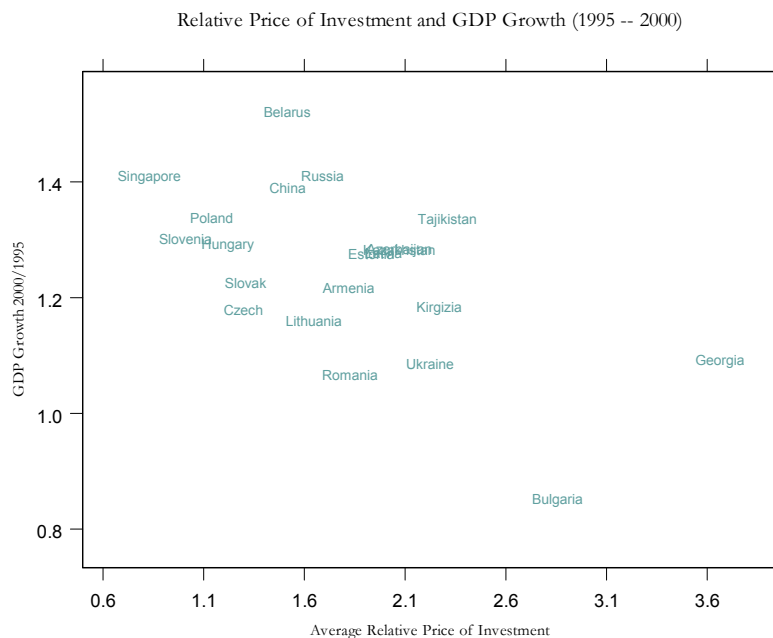Relative Price of Investment and GDP Growth (1995 -- 2000)

Figure 13: Relative Price of Investment and GDP Growth

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