

Bear Traps: Can Russia Avoid the Pitfalls on the Road to Sustainable Economic Growth?¹

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Preface

The purpose of this report is to study the potential pitfalls Russia faces on the road to sustainable economic growth. The report was produced thanks to generous financial support from the Smith Richardson Foundation, and from the support of the Human Capital Foundation to CRIFES, the Center for Research on International Financial and Energy Security.

Chapter 1

Introduction

Russia seems on a perpetual search for the sources of sustainable growth of its economy. As so often in the past, discussions of “modernization,” “innovation,” and “diversification” are popular now in Russia. The chief sponsor today is President Medvedev, who says Russia’s resource-based economy is primitive and noncompetitive. Reactions to Medvedev’s modernization campaign vary. Some think this is a great hope to resume serious reform of the Russian economy and politics; others are cynical and are sure it will never happen. But virtually all agree that he’s correct in saying that if his modernization program were to be successful, it would be wonderful for Russia.

Our reaction is different. We think it most likely that under the specific Russian circumstances today, a modernization program would lead to negative results. This is because none of the modernization programs currently being discussed take into account the real causes of Russia’s backwardness. We argue that there are two main causes. The first is the inherited production structure – both the particular kinds of physical and human capital that were accumulated in the Soviet era and the manner in which they were allocated, including their spatial allocation. The second cause of backwardness is the condition we call rent addiction, which means that there is an imperative to distribute a large share of Russia’s oil and gas rents to the production enterprises that employ this inherited physical and human capital. Any “modernization” policy that fails to address the problem of addiction will simply distribute more rents to the addicts. Far from truly modernizing Russia, it will only reinforce the backwardness and inefficiency.

Herein lies the tragedy. Russia does need to move on a path towards sustainable growth. But unless the policies to achieve that goal are chosen

with full recognition of the real causes of stagnation and backwardness — rent addiction and the structural legacy it helps perpetuate — the policies will likely lead to even worse problems in the future. They appear to lead to the goal but in fact lead into traps. Our purpose in this work is to warn against such mistaken and misinformed policies by identifying and analyzing the specific conditions for Russia's backwardness. Because they are specifically Russian — rooted in Russia's geography, notably its vast size and resource abundance, and its history — we call them “Bear Traps.”

Russia is a resource dependent economy, and its addiction to resource rents is the most important feature of its political economy. We have dealt at length with this issue in our book (Gaddy and Ickes, forthcoming) and in a recent article (see Appendix to this report). Hence, for the purposes of this report we will take the problem of resource dependence and addiction as a given feature of the environment as we examine the Bear Traps that Russia faces. As we examine the consequences of Russia's inherited structure on its economic future we must not forget that it is the abundance of resource rents that makes it possible to preserve these distortions. And that it is the addictive nature of Russia's relationship with these rents that provides the mechanism for its preservation.

Typically the problems of the Russian economy manifest themselves in a distorted way, via mismeasurement. In Soviet times outside analysts examined data on the economy with great caution, owing to the hurdles presented by central planning. Although central planning is dead and Russia has a market economy now, the need for caution remains. There are two primary reasons for this. First, there are Russia's specific geographical peculiarities: space and cold.¹ Second, there are legacies from the Soviet period that continue to distort our picture. In the Soviet period it was the price system that led to a distorted prism, the "circus mirror effect," where distorted relative prices made loss-making manufacturing enterprises seem productive and made the resource sectors seem like modest contributors to prosperity. The Soviet price system is history, but the legacy of decisions made in the Soviet period continues to have effects. In particular, many of these legacies lead to an overvaluation of assets and consequently to an underestimation of the returns on those assets. This is not, primarily, a statistical issue; rather it is

¹Although Canada is similarly large and cold, unlike Russia, very little of its population lives and works in the very coldest parts of the country. The impact of size and cold are much less in Canada because it has adapted to its situation in a much more rational way.

a failure to take into account the legacy of misallocation and inherited structure. This leads both to overestimation of assets and failure to recognize that legacies are the real problem. This is the ultimate Bear Trap.

The key problem in Russia is the systematic misuse of assets. The returns to investments in physical and human capital are systematically below (or appear to be below) what they should be. That is, the *effective* input levels of capital and labor services are below the measured levels. This leads to a misdiagnosis of Russia's maladies. By overstating the input levels one concludes that the key Russian problems are efficiency, primarily organizational, and perhaps also corruption. We argue, on the contrary, that the input levels are systematically overstated. If we used the correct levels the picture would be different. We refer to this as the τ -factor. The idea is that if measured capital and labor services are L and K , respectively, the actual effective values are $\tau_L L$ and $\tau_K K$, where $\tau_L, \tau_K < 1$. Hence these are discount factors that ought to be applied to measure the actual factor services used in Russia. Our goal in this report is to explain the causes and magnitudes of these discount factors.

The first direction of our investigation will thus focus on physical assets, capital. In chapter 2 we investigate how capital is systematically over-valued in Russia. Investment represents the sacrifice of current consumption for future benefits, but as we will demonstrate Russia receives far less future benefit than its sacrifice implies. The primary reason for this is that conventional ways to account for capital accumulation do not take into account features of space and cold. In chapter 3, we then examine how the legacy of the location policies pursued in Soviet times produce this handicap. The analysis of chapters 2 and 3 present a dilemma, however. If cold and space are such handicaps to growth, why is they not removed by investment policies? That is, why doesn't a market economy undo the location decisions of the Soviet period, and cause the distribution of population to move towards the warmer parts of Russia? We try to answer this question in chapter 4 where we focus on the implications of federalism in Russia. Our analysis shows that federalism "Russia style" leads to an immobilization of factors. There is, in fact, a political imperative to "keep the lights on" — that is, to keep factories running and people in place to man them — in what ought to become the ghost regions of Russia. We then turn to an analysis of the other important factor for growth, human capital, in chapter 5. The problem of Russia's demography and its health crisis are well-known. The important question, however, is how important are these issues to Russia's economic

future. We argue in chapter 5 that the emphasis on these problems misses the key point. As with physical capital, human capital is mismeasured in Russia. There is a τ -factor regarding labor as well, and failure to recognize this can lead to another Bear Trap, another barrier to long-term Russian growth. The real goal of Russian policy should be to eliminate the impact of the τ -factor (to bring τ closer to unity).

Bear Traps thus arise because of the failure to recognize the implications of the τ -factor. It is important to emphasize that τ is not a measure of ignorance. It is the result of a systematic overvaluation of assets. The τ -factor is not unique to Russia. But owing to the peculiarities of Russia's climate, location, and history, its impact is greater there than in other countries. The risk of misdiagnosis of Russia's maladies is correspondingly greater. The misdiagnosis leads to faulty policies which invariably waste resources and in the worst case may even make the real problems worse. A prime example is the attention given to corruption as a main cause of Russia's inefficiency. Overvaluation of assets makes total factor productivity (TFP) in Russia appear very low. This is just a feature of arithmetic. But the interpretation of low TFP is that corruption and general inefficiency are the prime culprits. This is not to argue that corruption is not an important problem in Russia, but while the emphasis stays on corruption and general inefficiency the impact of the legacies is ignored. And this leads to Bear Traps.

Not all of the special factors associated with Russia's legacy are immutable. Much is self-induced. Physical geography cannot be changed, but economic geography can be. Where you choose to locate economic activity is endogenous. Calls for modernization and diversification ignore the benefits of Russia's geography and fail to recognize how the τ -factor is going to make diversification truly difficult. In our concluding section, we argue that Russia should take advantage of its resources (whose location is part of its physical geography) but minimize the negative effects of geography by moving non-resource industries into regions that are warmer and closer to markets.²

²Nothing illustrates the problem better than this story ("Vekselberg to Revive Soviet Oil Plant to Save Town") from Bloomberg, May 26, 21010. "Russian billionaire Viktor Vekselberg plans to renovate a moneylosing, Soviet-era synthetic oil plant as President Dmitry Medvedev demands the rich invest in towns left impoverished by dying industries." The largest oil producer in the world will make synthetic oil to save a dying one-plant town. According to a spokesman for Vekselberg: "While the Zavod Slantsy plant is the only hope for the town's economy, the potential for 'innovation and efficiency' sparked Vekselberg's

interest [Vekselberg] aims to upgrade the plant and produce synthetic fuel that can compete with petroleum...."

Chapter 2

Investment and Physical Capital

2.1 Introduction

Properly conceived, investment is the essence of the process of creating a market economy. Transition is typically thought of as re-writing the rules, and progress in transition is measured by what is still missing among the rules – and now institutions as well. But the big problem for Russia is not what is missing, but rather what is there – as a result of 70 years of misallocation. The real task of transition is to unmake and rebuild that old economy, i.e., investment. All else is prelude.

Analysis of investment decisions can be broken down into two components: the gap between the desired and actual capital stock, and the optimal path in closing this gap. Much of the analysis of investment in Russia implicitly focuses on the latter problem, given the emphasis on corporate governance and corruption as determinants. In the case of Russia, however, there are important misperceptions with regard to both the actual and desired capital stocks, and without understanding this a complete understanding of the problem of investment is unobtainable. In particular the actual capital stock in Russia is over-stated due to a failure to write down to market, and the desired capital stock is underestimated because of an unwillingness to recognize the distance to the market (the competitiveness of Russian capital). In this paper we examine the forces that lay behind these two tendencies.

The ironic situation of the Russian economy is that changing the rules,

and even the institutions, of the economy will not make many of these assets profitable to use in a market economy. Yet, as we will see agents still prefer to keep them in operation. This represents an important puzzle about the Russian economy that we address in this chapter. Moreover, it is the continued operation of many of these enterprises that makes the price of investment goods in Russia extraordinarily high when measured at international prices. This means that the increment to productive capacity that Russia gets for its investment effort is low compared with other comparable countries, including transition economies.¹

Why is the investment problem under-estimated? One reason is that the inherited capital stock from Soviet times was so large. Since the Soviets over-invested for 70 years, one might logically ask, how could underinvestment be the problem now? Under-investment could, in fact, be a healthy phenomenon. But this misses a fundamental point. The Soviet Union did not just over-invest; it mis-invested. It built and installed the wrong kinds of capital, and it located this capital in the wrong places. As a result, the actual and market value of the inherited capital stock is low. The depreciation of the capital stock caused by liberalization and the transition to the market economy is, in fact, disinvestment.² Hence, the market value of the capital stock at the start of transition was far below its notional value.

Yet when people speak of investment needs, they most often refer to what it would take to make existing physical configurations viable.³ This is not at all the correct way to view the issue, because it takes Soviet investment decisions as the correct base to build on. Yet it is a characteristic way of

¹The fact that investment rates measured at world prices is correlated with levels and growth rates of output across countries is a robust result in development economics ([8], [15]). The critical question is whether this is due to distortions that raise the prices of investment goods, or the relative efficiency of the production of consumption goods as in poorer countries. We argue below that in the case of Russia it is primarily problems on the investment side that dominate.

²What is the market value of the capital stock? It is that capital stock's contribution to the expected discounted value of future profits. The historical value of the capital stock, in contrast, is the sum of past investment, less depreciation. Given the regime change implied by transition, the probability that the market value would be within an order of magnitude of the historical value, let alone the same, must be very close to zero. Even in market economies the two quantities don't coincide, but on average they would be close. The problem in Russia is the systematic bias: that the market value is systematically lower than the historical value, and that the difference is at least an order of magnitude.

³That is, these analysts assume that the capital stock itself is fine but the problem is with institutions and organization.

viewing the problem, and we will focus on this.

2.2 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 no guarantee against stagnant, and even decreasing growth rates. This has led many observers to de-emphasize the role of investment rates, and to focus instead on organizational improvements and other elements of economic reform as crucial. The implicit assumption is that inherited inefficiency takes the form of production well within efficiency frontiers, and that privatization and other institutional reforms can lead to rapid improvements in productivity growth. A clear example of this view was offered by Palmeda and Lewis:⁴

There are no natural or economic obstacles to high economic growth in Russia, and the current situation need not be tolerated. Russia can rely on a skilled and inexpensive labor force, large and economically attractive energy reserves, and surprisingly, much spare capacity in potentially productive industrial assets. Explicit and targeted social policies combined with balanced and enforceable regulations (mostly at the sector level, involving taxes, energy, land and red tape) would remove the most important market distortions. The payoff would be strong economic growth in Russia (Palmeda and Lewis, 2001: 49).

While organizational improvements are clearly important, this view ignores the fact that the capital stock Russia inherited from the Soviet period – its installed capital – is highly inefficient and may not be competitive even with frontier management. This is partly the result of investment decisions 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.

⁴Although Palmeda and Lewis focus primarily on industry impediments due to lack of competition, rather than macro institutional issues such as corruption, lack of labor mobility, or corporate governance.

2.2.1 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 can be high, however, precisely because they can be appropriate to new economic circumstances.

The problem is how to encourage new investment that does not just replenish depreciated capital stuck in the wrong places. This is difficult due to the need of relational capital.

2.3 Growth Models and Russian Growth

Recent literature on the sources of economic growth underscores the importance of investment. In their benchmark study, Ross Levine and David Renelt (1992) concluded that despite the dozens of policy or institutional variables that have been hypothesized to account for growth, the only truly robust correlation they found was that between growth and investment share of GDP. Their work spurred a number of subsequent efforts to analyze the prospects for long-term growth, including in transition countries. Such analyses typically proceed from some form of the Levine-Renelt growth equation (see [11]):

$$\hat{y} = \alpha + \beta_1 y_0 + \beta_2 n + \beta_3 \text{sec} + \beta_4 i \quad (2.1)$$

where \hat{y} is the growth of per-capita GDP over some period, y_0 is initial per-capita GDP, n is population growth over the same period, sec is the secondary school enrollment rate (measured in the beginning period), and i is the investment share of GDP.⁵ This type of specification focuses on the role of catch-up in the growth process. Economies can expect rapid growth when there is a lot of catching up to do. The key policy variable, however, is the investment rate. Estimation of such equations for samples of transition economies shows that the role of investment is critical for growth projections (see, for example, [1]). This is especially true when one considers policy and institutional variables. Some fixed effect variables might affect growth but

⁵In almost all of the cross-country literature \hat{y} is measured at international prices while i is measured at domestic prices. See [11] for example. The literature does not seem to make notice of this. We discuss the implications of this below.

Russian cannot change its climate.⁶

Sutela, [18, 216-7], for example, explores the prospects for Russian economic growth under three different scenarios for investment: a basic scenario which employs the historical average investment rate of 21%, an optimistic scenario which uses 30%, and a pessimistic scenario which uses a rate of 15%. Using a model like (2.1) Sutela shows that the long-run growth rate more than doubles going from the pessimistic to the optimistic scenario.⁷ The forecasts for \hat{y} are given in table 2.1:

	Investment Rate	Per-Capita GDP Growth (\hat{y})
Pessimistic Scenario	15%	2.0%
Baseline	21%	3.0%
Optimistic	30%	4.7%

Table 2.1: Forecasts for GDP Growth Using the Levine-Renelt Equation

The critical lesson of these and similar exercises – based on the initial studies by Fischer and Sahay (2000) – is that investment is crucial for growth in transition economies. It then becomes important to ask whether Russia can produce the type of investment needed to meet Putin’s goals for growth.

This exercise is further pursued by Crafts and Kaiser (2002). Two important adjustments are made; first, they use additional explanatory variables such as the rule of law to tighten the forecasts. Second, they adjust the initial income variable to measure the gap from the frontier at the start of transition, not earlier.

These exercises are baselines for projections in transition economies. The key result of all these exercises, as the table shows, is that investment is the key variable for growth. A ten percent increase in the rate of investment leads to a 1.75% increase in the growth rate of GDP per-capita. Clearly,

⁶Though as we discuss in chapter 3 it could change the location of its industry and population.

⁷The forecasting model used by Sutela is the Levine-Renelt equation. In our notation it is:

$$\hat{y} = -0.83 - .35 * y_0 - .38 * n + 3.17 * sec + 17.5 * i$$

these results imply that meeting the Putinesque goals of doubling Russian GDP, will require a very high rate of investment.

2.4 How High Is Investment in Russia?

During the Soviet period investment rates were very high. The Soviet growth model was extensive, and investment rates exceeded 30% (See [8, 1786] for analysis). Much of this investment was wasted, however, due to the known inefficiencies of the Soviet model. Hence, when transition started there was need for investment to modernize the capital stock even as old capital had to be (or should have been) written off. To what extent did Russia invest in the post-Soviet era and how does this compare to other fast-growing economies.

We can summarize our findings in terms of three comparisons. First, the Russian investment rate is less than those observed in fast growing ("miracle" economies). Second, Russian investment is less than the levels observed in EU accession countries. Third, Russian investment levels are only in the middle of the pack of CIS countries.

2.4.1 Traditional Comparisons

Measured in the traditional manner — ratio of investment to GDP — Russia's investment rate is not that high by international standards. Figure 2.1 shows that the investment rate in Russia falls far below historical and current rates in Japan, China, South Korea, and the Czech Republic. Note that Korea's growth takeoff occurred when its investment rate rose above 25%, with so-called miracle periods occurring when the rate is even higher. Russia, in contrast, saw its investment rate drop to below 20% by the mid-1990s, down to under 15% in the post-crisis year of 1999.

In figure 2.1 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 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

	Investment/GDP Ratio %
EU Accession	
Slovakia	28.9
Czech Republic	29.1
Hungary	25.8
Estonia	30.2
Slovenia	25.5
Poland	21.4
Lithuania	22.0
Latvia	24.7
Romania	21.4
Bulgaria	18.2
Ex Soviet Union	
Azerbaijan	34.1
Belarus	25.4
Ukraine	21.5
Tajikistan	16.5
Uzbekistan	22.1
Russia	20.3
Kyrgyzia	17.7
Armenia	21.3
Kazakhstan	22.2
Georgia	25.2

Averages of observations from 1995-2005

Table 2.2: Investment Rates in Transition Economies

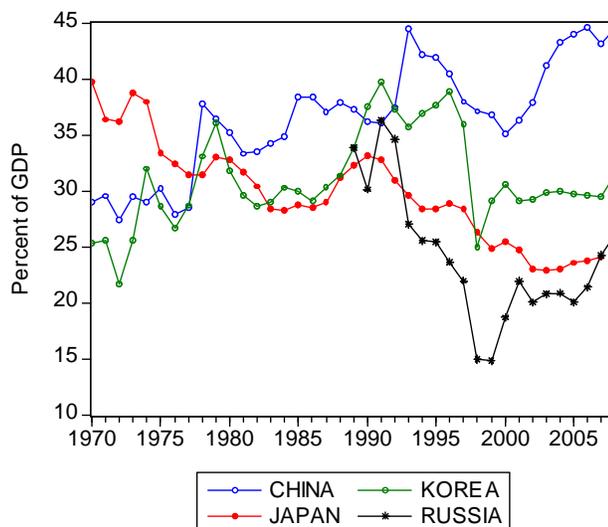


Figure 2.1: Gross Capital Formation for Selected Economies, Domestic Prices

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.

The obvious, but important, conclusion is that if Russia did not have oil this investment rate would lead to much slower growth. Russia's GDP level and its growth rate are enhanced by its resource abundance.

2.4.2 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 international prices. Using international prices allows one to measure the true value of the physical capital obtained as a result of the investment effort. If a country's relative price of investment is high this means that the country gets less increase in cap-

ital stock per unit of savings than in a country with a lower relative price.⁸ 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.⁹ This means that when we measure investment rates at international prices richer countries tend to invest a higher share of GDP than poor countries.¹⁰ In this section, we examine the relative price of investment in transition economies.

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. Hence, liberalization of prices causes a shock to the relative price of investment, pushing it up in the early stages of transition.¹¹ In the ensuing period, however, the relative price of investment declines. Figure 2.2 shows this decline in Hungary and Poland. 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 shock to 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.

⁸De Long and Summers [2, 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.

⁹In principle, the concept of high and low is relative to an international benchmark. In practice, the Penn World Tables uses the US as a benchmark. So if the relative price is greater than unity it means that the cost of increasing capital (in terms of foregone domestic consumption) is higher than in the US.

¹⁰This was first noted by [17, 339].

¹¹This has been intensively analyzed by Richard Ericson (1999). Essentially, costs of investment were shifted, under Soviet pricing rules, onto consumption. This was an implicit tax on consumption to finance investment. When price liberalization occurs, investment goods must cover their costs, so their relative price rises.

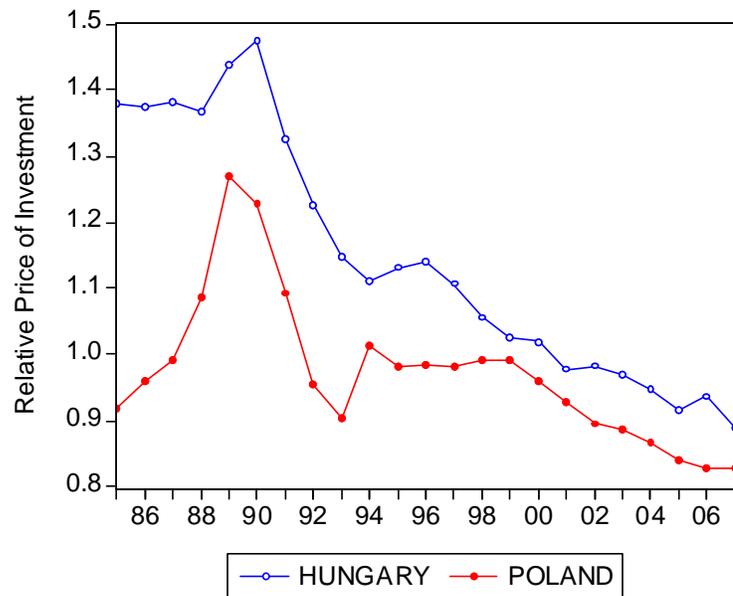


Figure 2.2: The Relative Price of Investment in Hungary and Poland: The Impact of Liberalization and Transition

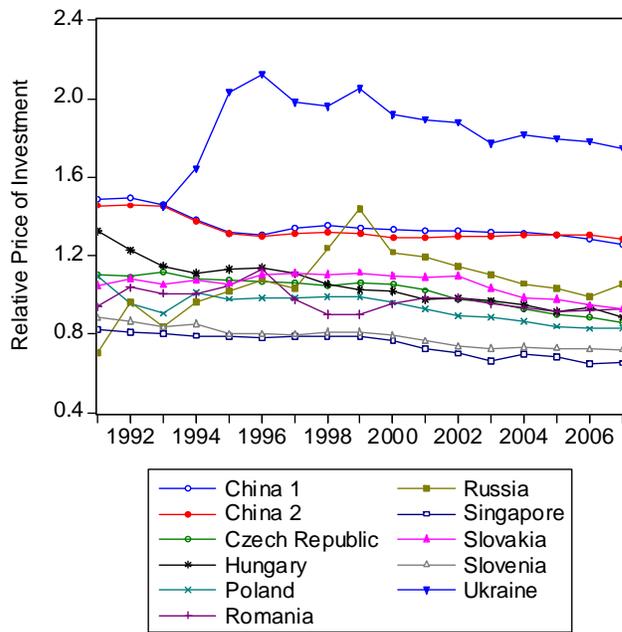


Figure 2.3: The Relative Price of Investment in Transition Economies

Measured at international prices the relative price of investment is high in transition economies in general, and in Russia in particular (see figure 2.3). Notice that the dispersion in relative prices has increased over the period, the coefficient of variation increasing from .188 in 1991 to .304 in 2000.¹² This is somewhat surprising. One might expect that market reforms would cause the relative price of investment to converge. At least this would 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 2.3.

Compare the same countries as in figure 2.4 above:

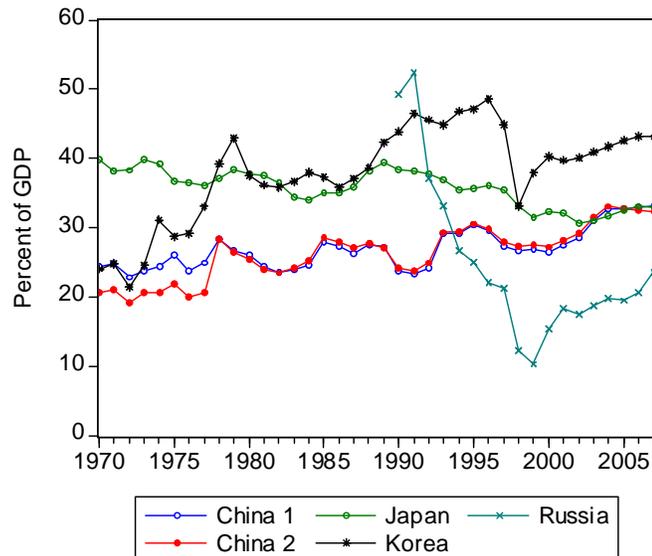


Figure 2.4: Gross Capital Formation at International Prices

Given the high relative price of investment in Russia (and Ukraine) it follows that investment rates are lower when measured at international prices (figure 2.5). 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

¹²Notice that much of this divergence is caused by Russia and Ukraine.

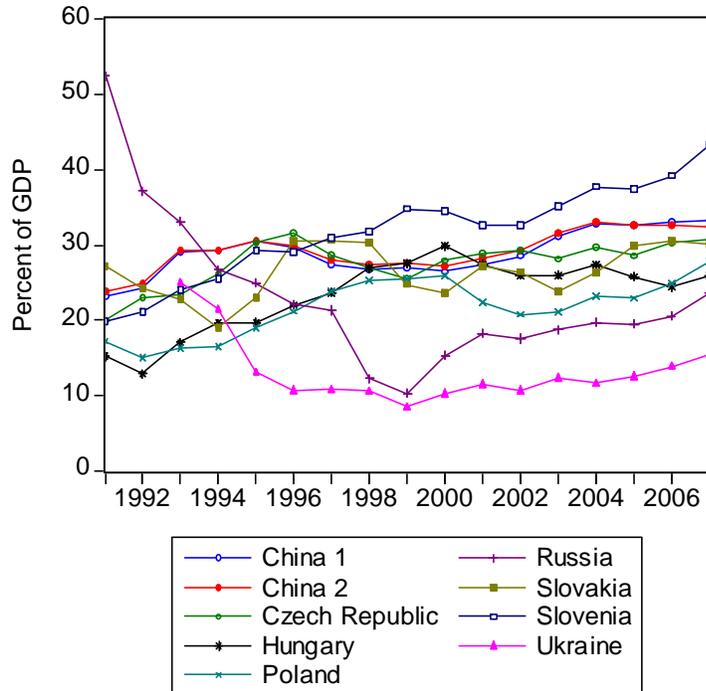


Figure 2.5: Investment Rates at International Prices

1998. Adjustment for international prices reduces investment rates for all of the economies displayed in figure 2.5, 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 2.6. Notice that Russia 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.

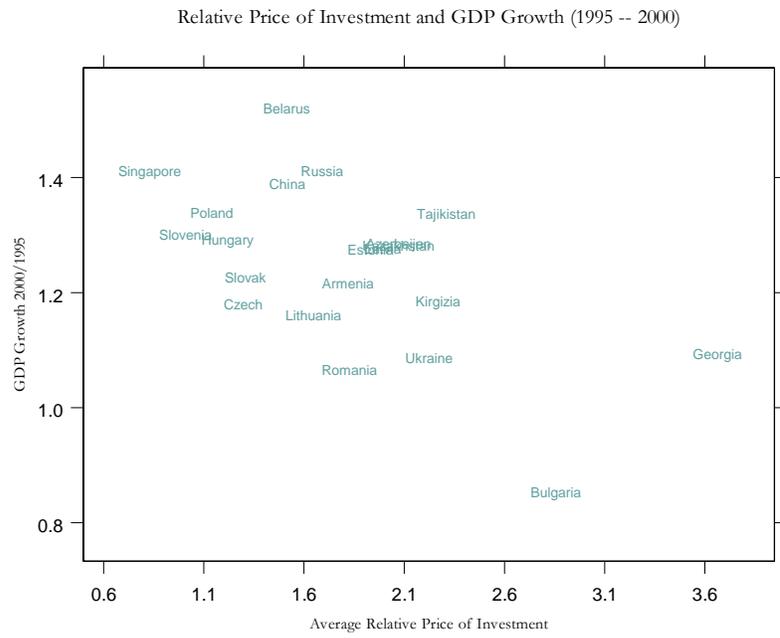


Figure 2.6: Relative Price of Investment and GDP Growth

2.4.3 Growth Equations Revisited

If measuring investment at international prices confers such a different picture it begs the question how are projections of growth affected? To answer this we return to the Levine-Renelt equations, but use investment at international prices. We estimate the equation using data from 1960-89 to maintain comparability with Levine-Renelt, though we can extend the data period (and do below). In figure 2.3 we present the Levine-Renelt equation and our alternative, the main difference being that we use investment shares at international prices. Our education variable is also different from Levine-Renelt. We use the share of the population aged 15 and over (as of 1960) that has *attained at least* the level of secondary school (BLSECA).¹³ The data is from Barro-Lee. We also include a squared-term for educational attainment to account for the non-linear impact of education levels on growth.¹⁴ From figure 2.3 it is evident that this term is negative and significant.

It should not be surprising that the two equations in figure 2.3 are so similar. The key difference, of course, is that the coefficient on investment is lower in our preferred alternative. By using the PPP measure of investment shares we are gauging the impact of actual investment, rather than investment effort as in the Levine-Renelt equation. This suggests that some of the

The good news is that Russia has oil so it does not need to invest 55% of GDP in order to grow at satisfactory rates. But this also points out how misguided is the idea that Russia should diversify out of oil. There are two reasons for this. First, and most obvious, oil is the primary generator of Russian growth. Second, the abundance of oil has raised the relative price of investment compared with countries without oil. The implications of this second point are critical. Because of Russia's high relative price of investment, diversification into manufacturing is likely to result in much less growth than would be the case in a less resource abundant economy.

¹³Recall Levine-Renelt use the level of secondary school enrollment. We use instead an attainment measure: the pct of the total population aged 15 and over that has attained some level of secondary education or higher. (In the Barro-Lee education data, appendix A2, it is the sum of "second level, total" and "post-secondary level, total.")

¹⁴The variable BLSECA is the share of the population aged 15 and over (as of 1960) that has attained at least the level of secondary school. The data is from Barro-Lee.

Variable	Levine-Renelt	Gaddy-Ickes
constant	-0.83 (0.97)	0.87 (1.20)
Y60	-0.35 (2.50)	-0.27 (3.85)
DPOP	-0.38 (1.73)	-0.41 (1.97)
SEC	3.17 (2.46)	
BLSECA		7.83 (2.65)
BLSECASQ		-8.05 (1.99)
Investment	17.5 (6.53)	12.52 (6.13)
R^2	.46	.48
n	101	91

t-statistics in parentheses, White corrected standard errors

Table 2.3: Growth Equations Compared

2.5 Why is the Relative Price of Investment so High in Russia?

This is really a manifestation of the Soviet inheritance in all its forms: a legacy of state-owned enterprises, location, and most importantly resource addiction.

One aspect of this is government ownership. Schmitz (2001) studies the impact of government production of investment goods in Egypt and Turkey. He shows that the impact on aggregate productivity of government production of investment can be quite large. Assuming that state-owned capital goods producers are 50% as productive as private-owned producers (the result based on case studies in these countries) he shows that aggregate productivity is only 64% of its potential level. Of course in the case of Russia all investment goods producers were 100% state owned prior to privatization, and little restructuring seems to have taken place in many of these enterprises (see, for example, [14]).

	Hungary	Poland	Russia	Singapore	USA	Czech Republic	Ukraine
Construction	1.24	1.23	1.86	1.68	1.15	1.17	2.28
Machinery and Equipment	2.06	1.94	2.74	0.65	0.95	2.52	5.33
Stocks	1.68	2.03	2.31	1.43	1.06	2.05	3.13
Capital Formation	1.55	1.54	2.12	0.89	1.05	1.72	2.95

Source: Penn World Tables and author calculations

Table 2.4: Investment Price Ratios by Type

A common cross-country observation is that the relative price of investment goods is higher in poorer countries. Hsieh and Klenow ([8]) show that this is because of higher relative productivity in consumer goods industries in poorer countries. This seems also to be the case in Russia, although, perhaps for different reasons. In the Soviet period consumer goods industries were low prestige and underinvested in. In the post-Soviet period they have received the overwhelming bulk of non-oil FDI. This presumably promotes

productivity growth in consumption goods industries. The relative low political weight of consumer goods industries probably also means that these sectors found it harder to resist entry.

In figure 2.4 we present calculations of the relative price of investment (specifically, the price of investment goods relative to consumption goods, $\frac{P_I}{P_C}$), for capital formation as a whole and by type of investment. The high relative price of investment for Russia stands out (2.12 compared to 1.05 in the US). Even in other transition countries, it is lower, aside from Ukraine. What is even more important, however, is the very high relative price for machinery and equipment. For as we discuss (in section 2.7) below, machinery and equipment are the most important component of capital formation for enhancing productivity growth.

The legacy of the Soviet period was low productivity assets. According to one estimate, these were 30% as productive as US assets in 1992 [14, 48]. Many dinosaur enterprises managed to survive the upheaval at the end of the Soviet period; they did not go extinct. The Soviet legacy in relation to capital was one of hypertrophied machine building and defense enterprises. There was a dual use imperative in the Soviet economy (Gaddy 1996) that lowered productivity.

These problems should become less important through the passage of time. As capital depreciates new enterprises built in the market economy should replace dinosaur enterprises. Russia's problem – its potential bear trap – is that rent addiction serves to sustain the dinosaurs.¹⁵

In a way Russia shares this problem with any country with a history of inward-oriented development. De Long and Summers [2, 399] point out that in

"India, like in Argentina, the savings is relatively high but equipment is expensive...India demonstrates not that boosting investment is unproductive, but that policies that boost saving while simultaneously raising the relative price of investment in equipment and structures are unproductive. We suspect that restrictions on imports of capital goods have ensured that the Indian government's attempts to support investment have had effects

¹⁵The transition to a market economy should have been a cataclysmic event for dinosaur enterprises, just as the K-T event at the end of the Cretaceous Period was fatal for the dinosaurs. Dinosaur enterprises, however, were able to survive by using their relational capital to obtain rents. See Ickes (2003).

not on quantities but on prices: India's policies have managed to enrich *industrialists* instead of encouraging *industry*."

But in Russia inward-oriented development was taken to an extreme not witnessed anywhere else. For the Russian case, the contrast is perhaps that attempts to support investment have insured the survival of dinosaurs at the expense of encouraging industry.¹⁶

2.6 Quantity of Capital

Even if the relative price of investment is correctly measured investment figures may still be inflated due to the standard, but peculiar, method of measuring investment. 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.¹⁷ A power plant

¹⁶Ironically, support for the dinosaurs often comes from the incomes of the oligarchs. One might be tempted to say that in this case rather than enriching them, such policies tax them. Of course, however, the oligarchs participate in these policies precisely because this allows them to indeed "enrich themselves" by exploiting the assets that they obtained. See [1].

¹⁷Kravis, 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 and 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 [10, 29]."

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.

2.6.1 The τ effect.

Capital can be handicapped by location. It may be in extremely remote locations, cold locations, mountainous regions, and so forth. One way to think of such "handicapped capital" – capital in abnormal environment – 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. Failure to account for this depreciation results in overmeasurement of the capital stock.

Suppose that we can index by τ the ratio of the true capital stock to the measured capital stock (τ is thus a mismeasurement index). Now consider the return to capital. 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:

$$Y_i = A_i(\tau K_i)^\alpha L_i^{1-\alpha} \quad (2.2)$$

Ignoring τ the marginal product of capital appears as $\alpha A_i K_i^{\alpha-1} L_i^{1-\alpha}$, but if $\tau < 1$ (if capital is overmeasured) the actual marginal product of capital is $\alpha A_i \tau K_i^{\alpha-1} L_i^{1-\alpha}$. With $\tau < 1$ it is obvious that

$$\alpha A_i K_i^{\alpha-1} L_i^{1-\alpha} < \alpha A_i \tau K_i^{\alpha-1} L_i^{1-\alpha}$$

In other words, the measured marginal product of capital is in fact smaller than the actual marginal product of capital. This means that the impact of investment is understated if measured capital is inflated. 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.¹⁸ Ignoring systematic mismeasurement can lead to lack of attention paid to differences in capital stocks.

All countries may have instances of inflated capital. Kravis-Heston-Summers recognize the problem:

"Suppose that in a cold climate a steam power plant had to be built with insulating walls around its boiler room and switch-house, 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?"

They are correct to argue that it should be added cost, but as a practical matter they ignore this, and opt to treat it as more output. They recognize that this means:

"The cost of a flat road of a given specification in one country was compared with the cost of a road of the same specification in another country, and likewise for a mountainous road. The effect, of course, was to treat the mountainous road as more output than a flat road; in a sense, an adverse environment in this instance required more production, just as low temperatures necessitated the provision of heat and warm clothing. Similarly, insulating walls for power plants in cold climates were regarded as part of output rather than mere addition to cost." (Kravis, et al., 1982: 28-9).

But for some countries – Russia, in particular, the problem may be systematic.

For Russia, in particular, problems of cold and size it is likely to have more of these handicaps. The impact is systematic, not random in the case of Russia. So ignoring $\tau < 1$ is likely to be much more problematic in the case of Russia than in almost any other country in the world.

¹⁸Caselli 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)"

This has important implications for thinking about Russia's relative inability to attract foreign direct investment (FDI). Conventional wisdom is that barriers, restrictions and taxes on investment are the chief culprit preventing capital flows to developing economies. So, the argument goes, if these restrictions are removed FDI will flow to Russia. But if $\tau < 1$ rates of return may be insufficient to attract investment even if "the chief culprit" is eliminated. Because if $\tau < 1$ is due to geographic burdens as in Russia, then removing the "chief culprits" will not solve the problem. Institutional reforms will not make Russia more compact or warmer.

All countries (except Singapore where $\tau = 1$ – the country is a city, after all) have a $\tau < 1$. But the handicaps that any country faces can be decomposed into a self-imposed part and a fixed effect. The latter is due to irreducible features of the environment optimally adapted 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. Hence, they can be ignored in comparative analysis. This may be true in general, but if one were to take their discussion seriously, one would realize that some countries, notably Russia, would have systematic errors.

2.7 Machinery and Equipment

DeLong and Summers (1993) argued that machinery and equipment is the most important component of capital accumulation in explaining productivity growth.¹⁹ The idea is that ideas may be embodied in capital goods, and it is machinery and equipment where this embodiment takes place. Employing modern machinery and equipment requires skills that are important for growth. Moreover, as it is equipment investment that is associated with growth, not structures, it is much more likely that the former causes the latter than an instance of reverse causation.²⁰ They were also able to show

¹⁹This idea is also consistent with the ideas of Paul Romer. And Mokyr has referred to technology embodied in machinery as the "lever of riches." (Mokyr 1990).

²⁰That is, if growth caused equipment investment then we would expect to see the same association with investment in structures. Higher growth would cause demand for both more machinery and more structures to house them. But given that the association is between equipment investment and growth it is much more likely that the former causes

that the effect applies to developing countries: it is not just a rich country effect.

The argument that machinery and equipment is the essential feature of capital accumulation is even more important when we think about Russia. Lots of capital accumulation in Russia goes towards coping with location and size; for example, transportation investment and insulation. Neither brings new ideas or increases total factor productivity. In Russia a large portion of transportation should really count like insulation in Siberia. Capital formation in Russia consists to a much greater extent than in the US, say, of construction as opposed to producer durables. Moreover, construction is the type of capital formation that lends itself most to corruption in all countries.²¹ Of course, corruption is high in all the post-Soviet countries.

Given that the relative price of machinery and equipment investment is high in Russia it is not surprising that the share of capital accumulation that takes this form is comparatively low (table 2.5). Whereas in the US about 50% of capital accumulation goes to machinery and equipment, in Russia it is less than a quarter.

2.8 Consequences of High Relative Price

The consequences of the high relative price of investment in Russia are several. First, it means that growth is lower than would be expected given Russia's savings rate. Russia obtains less return than would be expected from its sacrifice due to the "tax" it pays on investment. This effect is masked, to a large degree, by Russia's resource abundance which fuels growth independently.

Second, the high relative price of investment, and consequently the lower level of actual investment (as opposed to investment effort) means that the goal of diversifying the Russian economy out of oil and raw materials is more distant than thought.

the latter.

²¹One might argue that construction is such a high portion of Russian investment precisely because it is so susceptible to theft. Another important factor, however, is the impact of cold. Construction is more expensive in cold climates. See chapter 3.

	Share of Construction	Share of Producer Durables	Share of changes in stocks
Belarus	.82	.13	.60
Brazil	.69	.31	0
Czech Republic	.57	.36	.06
Germany	.54	.44	.03
Hungary	.53	.28	.19
Romania	.59	.34	.07
Russia	.62	.22	.15
Singapore	.25	.77	−.02
Slovakia	.66	.30	.03
Ukraine	.73	.20	.08
United States	.48	.50	.02

Source: Penn World Tables

Table 2.5: Components of Domestic Capital Formation

2.9 Conclusion

We used PPP investment rates to get the 55% estimate. But this is not the end of the story because the PPP measures still overvalue investment in Russia. This is because space and cold issues are not taken into account in Summers-Heston data – for fundamental reasons. Russia gets even less per unit of effort than other countries would. So the amount of sacrificed consumption Russia would require to grow at acceptable rates without oil is immense.

In the next chapter we examine aspects of location in detail. Now we briefly consider the implications of space and cold on the measure of investment in national accounting statistics.

We have quoted from Kravis et al (2002) to describe how investment is counted in national accounting statistics. There are two dimensions of this problem to consider. First, since Russia is colder on average, it spends more investment effort on insulation and other geographic hurdles than other countries. So comparatively its relative price of capital is even higher than measured. Second, Russia has located too much economic activity in places that have geographic handicaps, so this reinforces the problem. The first problem cannot be overcome – so mismeasurement relative to other countries is inevitable, the second could be addressed by overturning legacies of past location decisions. That is, if the second problem were addressed the consequences of the first problem would be less severe.

The analysis clearly implies that Russia gets credit for investment that shouldn't be counted. Statistically, it gets rewarded rather than penalized for bad location decisions. To achieve the same flow of capital services a plant in Novosibirsk requires more investment than one in Moscow. But this extra investment is compensation for cold and distance – it adds nothing to productivity. Hence, poor location decisions make Russia's capital stock look larger than it really is – it makes τ_K smaller. But productivity is still low.²²

Notice that this problem is not just about the initial investment decision. All further investment to maintain that location is similarly mis-measured. We can't adjust statistics for this, but this problem is likely to be very significant.

²²This is obviously a bigger problem for investment in the regions than for investment in Moscow. So it could explain why returns are lower in regions. Some of the extra return attributed to Moscow location could be due to access to authorities, but the τ -effect implies that this factor may be overstated.

We turn in the next chapter to the hurdles posed by location legacies.

2.9.1 There are two views about investment in Russia.

- The *conventional* view is that if the financial system is fixed and if corporate governance is straightened out that investment will flow to non-energy sectors of the economy. The idea is that the risk premium is too high right now to invest in non-energy sectors. With tax reform underway, and if new reforms are implemented investment will flow. The barrier to this investment currently are these institutional failures that reforms will fix.²³
- The *alternative* view is that investment in non-energy sectors is constrained by low potential. The problem is that the capital-labor bundles are too inefficient.²⁴ On this theory even if investment in energy is satiated it will not flow to these sectors. Here it is the internal aspects that are critical, not the external, institutional, aspects.

We suggested that agents tend to underestimate investment needs for three systematic reasons.²⁵ We explore them in turn.

Note that underestimating investment needs is precisely the result of the failure to write-down the capital stock to market valuations. So the operative question is why this write down does not occur in the Russian market economy?

²³Even those that recognize that much of the capital stock is junk assume that there is enough so that with proper institutions productivity increases would occur. What this view ignores is the write-off issue. Alternatively it assumes that because capital has no market value it can be freely disposed (in the economy-wide sense). This ignores the political struggle to give it value.

²⁴Location is an aspect of this as well.

²⁵Note this error occurs as well with natural resources – gold, diamonds, platinum, etc. Just because the resources are in the ground does not mean that their extraction has value once you incorporate the full costs of operating in these regions. All the arguments we make here with regard to capital apply equally to the resource sector, and the territories where they are located. Notice that these sites were often originally founded on the basis of prison labor – e.g., Norilsk – so the cost of production was clearly shifted on to others.

But there is one key difference. Technological advance (or using Canadian methods) can lower the cost of operating in cold regions, etc., so it may be profitable in the future (which is another reason for keeping it in the ground) whereas the dinosaur plant in Perm will never be profitable, and time will only cause d to increase.

Scrapping Problem

What are the policy implications of the two different views of investment? For the conventional view, the main implications are obvious: continue with institutional reforms (tax reforms, corporate governance reforms, financial market reforms, etc.) For the alternative view, the policy implications are more complex.²⁶

The real policy problem of the alternative view is what, if anything, can be done to change the true investment attractiveness of the non-energy sectors? Herein lie some dangers. The critical issue is to distinguish between investments to improve technical efficiency and those to improve allocative efficiency.²⁷

Put simply: Do you encourage investment to make economic activity in Novosibirsk more productive, or do you channel that investment into a Western oblast?

Consider the analogy of the investment dilemma of a business faced with a fundamental technological revolution in its industry. The business has invested heavily in the old technology over the years. Its activity is thoroughly dependent on that old technology. The company must choose between upgrading the old technology or scrapping the old technology entirely and fully re-equipping with the new.

The two technologies are incompatible. It is an “all-or-nothing” choice. Nothing of the existing capital stock can be re-employed. It also cannot be sold to help finance the new acquisition.

²⁶On the surface, it might seem that at a minimum, it is at least fine to continue with the same kind of institutional reforms as dictated by the conventional view. True, those institutional reforms might not solve the problem. But they can't hurt. But in fact, it's never enough to say that an action is worth taking simply because it has benefits. Policy-making is a costly endeavor. One must therefore always consider the alternatives. Prioritizing institutional reforms might divert scarce political as well as monetary resources away from more important and urgent tasks. In Russia, bureaucratic competence is a scarce resource.

A second reason why one should not automatically assume it's OK to push ahead blindly with “good” institutional reforms is that it might sustain false illusions about the outcome.

²⁷See Gaddy and Ickes (2002). Technical efficiency refers to obtaining more output from given inputs. Allocative efficiency is achieving optimal outcomes given available resources; it compares how resources are allocated across activities. They write: “Improvements in [technical] efficiency involve movements from inside the production frontier to the boundary of the frontier. However, the gain implied by this may not be sufficient to overcome the fact that the enterprise produces the wrong thing in the wrong place (p. 49, fn. 10).”

The first path—upgrading—is cheaper and produces results immediately. But it locks the company into a second-rate path. Now matter how much the old technology is upgraded, continuing to depend on it will ultimately doom the company to noncompetitiveness.

The second approach is very costly up-front. It requires shutting down operations for a period. New staffing will be required. A few employees can retrain. Most cannot.

Russia structurally (in types of industries and in location) is like a corporation that made the “wrong” technology choice long ago. Because of the poor governance of that corporation in the past, it ignored all the signals indicating that the choice was wrong. Rather, over time it concentrated even more on the wrong path.²⁸ In the market economy, when market value falls too far below the historical value you recognize the mistake, and disinvest – write down the investment - because you have no choice. But in the Soviet system this feedback was not there. There was no force correcting the mistakes.

The corporation ended up on the verge of collapse. So new management took over. The new managers correctly recognized that the current disastrous state of the corporation was fundamentally due to the management practices of the past. So they change the governance procedures. These new procedures will ensure that future business decisions are rational and will always be efficiency-enhancing.

The problem is that as they focus on a real problem—the old system of management and decision-making in the company—the new managers ignore the problem of the inherited antiquated technology. They fail to see that they will never be able to rehabilitate the company unless they can successfully rid the company of the single biggest mistake caused by the old management system: the commitment to the wrong technology.

And so, working hard to introduce correct new management practices, they work to “improve” the company’s inherited capital stock—the capital that is all based on the wrong technology. They do the “right” things in the “right” way . . . with the wrong capital. They are doomed to fail.

The question is why would a new owner be unwilling to write down the

²⁸This is also related to the willingness to write down debts. In Japan worthless debts remain on the books and the debt overhang prevents growth. In the US, after the S&L crisis, debts were written off. The lingering effects of the debt overhang were much smaller in the US.

So in market economies you recognize mistakes and try something else.

value of the assets and restructure? Why do they maintain the old technology? The key point is that transparently recognizing that the market value of the enterprise is much lower than what it is believed to be can be disadvantageous to the parties concerned. We develop this point in more detail in our Chapter 4 on the political economy of federalism. Before that, however, we examine the economics of location.

Bibliography

- [1] Crafts, Nicholas, and Kai Kaiser, "Long Term Growth Prospects in Transition Economies: A Reappraisal," LSE, September 2002.
- [2] De Long, J. Bradford, and Lawrence H. Summers, "How Strongly to Developing Economies Benefit from Equipment Investment?" *Journal of Monetary Economics*, 32, 3, December 1993: 395-416.
- [3] De Long, J. Bradford, and Lawrence H. Summers, "Equipment Investment and Economic Growth," *Quarterly Journal of Economics*, 106. 2. May 1991: 445-502.
- [4] Ericson, Richard, "The Structural Barrier to Transition Hidden in Input-Output Tables of Centrally Planned Economies," *Economic Systems*, V.23, #3, September 1999, pp. 199-224.
- [5] Fischer, Stanley, and Ratna Sahay, "The Transition After Ten Years," *IMF Working Paper*, WP/00/30, February 2000.
- [6] Gaddy, Clifford, *The Price of the Past*. Washington, Brookings Institution Press, 1996.
- [7] Gaddy, Clifford, and Barry W. Ickes, *Russia's Virtual Economy*. Washington, Brookings, 2002.
- [8] Hsieh, Chang-Tai, and Peter J. Klenow 2007. "Relative Prices and Relative Prosperity." *American Economic Review*, 97(3): 562-585.
- [9] Ickes, Barry W., "Evolution and Transition," in N. Campos and J. Fidrmuc, eds., *Political Economy of Transition and Development*, Boston, Kluwer, 2003.

- [10] Kravis, Irving B., Alan Heston, and Robert Summers. *World Product and Income. International Comparisons of Real Gross Product*. Johns Hopkins. 1982
- [11] Levine, Ross, and D Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions," *AER*, 82, 1992: 942-963.
- [12] Mokyr, Joel, *The Lever of Riches*, New York, Oxford University Press, 1990.
- [13] Ofer, Gur, "Soviet Economic Growth: 1928-1985," *Journal of Economic Literature*, Vol. 25, No. 4. (Dec., 1987), pp. 1767-1833.
- [14] Palmeda, Vincent, and Bill Lewis, "Unlocking Economic Growth in Russia" in *Russia's Economic Future: A Compendium of Papers*, Joint Economic Committee, US Congress, December 2001.
- [15] Restuccia, D. and C. Urrutia, "Relative Prices and Investment Rates," *Journal of Monetary Economics* 47, February 2001: 93-121
- [16] Schmitz, J., "Government Production of Investment Goods and Aggregate Labor Productivity," *Journal of Monetary Economics*, 47, February 2001, 163-187.
- [17] Summers, Robert and Alan Heston, "The Penn World Tables (Mark 5): An Expanded Set of International Comparisons, 1950-88," *Quarterly Journal of Economics*, 106, 2, May 1991: 327-368.
- [18] Sutela, Pekka, *The Russian Market Economy*, Helsinki, Kikumora, 2003.

Chapter 3

Economics of Location

3.1 Introduction

The biggest and deepest bear trap may be location. Russia is cold and big. It has a peculiar and unique economic geography that continues to define Russia and yet prevents it from building a competitive market economy and a normal democratic society. Today, despite the abolition of central planning, Russia still has a nonmarket and nondemocratic distribution of labor and capital across its territory. Too many people and factories still languish in places communist planners put them—not where market forces would have attracted them.

After the collapse of the command-administrative system of economic management in the early 1990s, free market forces in Russia began correcting the spatial misallocation that had occurred during the Soviet era. People migrated out of the coldest and most remote regions. That self-adjustment came to a halt in 1999. Now the trend has reversed. Plans for Siberian development and repopulation are back on the national agenda. For instance, in June 2006 Putin announced a new migration program designed to attract ethnic Russians from abroad to return to Russia in order to repopulate Siberia and the East.

Overall geographical mobility remains quite low in Russia, something that impedes reallocation of human capital. The total number of internal migrants in Russia — that is, people who changed their city or district [rayon] of residence during the year — fell from 3.3 million in 1992 to 1.7 million in 2009. Russia's internal migration rate is now only about 1.2 percent. The

comparable rates for the United States and Canada are over 5 percent. In an economy that needs much more dynamism, this trend towards less mobility is not good. Yet Russian leaders are trying to block the little mobility that there is as they argue against the depopulation of Siberia. Calls for policies to reverse population movements from Siberia is one of the most significant Bear Traps in Russia today.

3.2 Cost of Cold

Russia is cold. Our work on “Cost of the Cold” was an attempt to capture some of excess cost of faulty location decisions. The basic thesis is that much of the investment in human capital or physical capital will be wasted if you don’t make the proper locational match.

In the course of efforts to reform the Russian economy over the decade since the collapse of the USSR, the focus has naturally been on the future, not the past. One of the guiding assumptions has been that if the old system that produced the wrong results in the past is now changed, the proper new system will automatically produce the right results in the future. The future, then, will take care of the past. Unfortunately, creating a new Russian economy is not that simple. It is not enough merely to dismantle the old system and replace it with a new one. One must also rectify the consequences of operating under the old system for more than seven decades.

One specific aspect of this inherited economic geography is the development of Siberia. Nowhere was the freedom of the market more deliberately defied than in the Soviet efforts to conquer and industrialize Siberia’s vast territory. Beginning in the 1930s, slave labor built factories and cities and operated industries in some of the harshest and most forbidding places on the planet, places to which citizens would not freely have moved en masse on a permanent basis. In the 1960s and 1970s, leaders in Moscow decided to launch giant industrial projects in Siberia. Planners sought to create permanent pools of labor to exploit the region’s rich natural resources, to produce a more even spread of industry and population across the Russian Federation, and to conquer, tame, and settle Siberia’s vast and distant wilderness areas. This time, new workers were lured to Siberia with higher wages and other amenities—rather than coerced there and enslaved—at great (but hidden) cost to the state.

Thanks to the Soviet-era industrialization and mass settlement of Siberia,

Russia's population is now scattered across a vast land mass in cities and towns with few physical connections between them. Inadequate road, rail, air, and other communication links hobble efforts to promote interregional trade and to develop markets. One-third of the population has the added burden of living and working in particularly inhospitable climatic conditions. About one-tenth live and work in almost impossibly cold and large cities in Siberia. Given their locations, these cities (as they did in the Soviet period) depend heavily on central government subsidies for fuel and food; they also rely on preferential transportation tariffs. Costs of living are as much as four times as high as elsewhere in the Russian Federation, while costs of industrial production are sometimes higher still. The cities and their inhabitants are cut off from domestic and international markets. Russia is, as a result of its old centrally planned system, more burdened with problems and costs associated with its territorial size and the cold than any other large state or country in northern latitudes, like the United States, Canada, or the Scandinavian countries.

From the point of view of economic efficiency—that is, market economic efficiency—the dominant characteristic of the Soviet period was misallocation. The country's resources (including human resources) were misused. The Soviet system produced the wrong things. Its factories produced them in the wrong way. It educated its people with the wrong skills. But perhaps worst of all, communist planners put factories, machines, and people in the wrong places. For a country with so much territory, especially territory in remote and cold places, location matters a great deal. Not only did Russia suffer from the irrationality of central planning for more than seventy years, but Russia's vast territorial expanse offered latitude for that system to make mistakes on a huge and unprecedented scale. Had the Bolshevik Revolution taken place instead in a country as small and contained as, say, Japan, the damage could not have been as great. While central planning would still have distorted the economy, it would not, and could not, have distorted it as much in terms of locational decisions. In Russia, Siberia gave the Bolsheviks great room for error.

3.2.1 Size as Salvation and as Stumbling Block

In earlier epochs, Russia's size was seen as its most significant attribute. It was the source of wealth, power, and even invincibility. Russian historians claim that Russia's huge territory saved not just Russia itself, but all of

western civilization from devastation by serving as a buffer against Tatar-Mongol expansion. Even Pushkin wrote that “[Russia’s] vast plains absorbed the force of the Mongols and halted their advance at the very edge of Europe . . . [T]he emergent enlightenment was rescued by a ravaged and expiring Russia.”

Even today, after the collapse of the USSR, western observers remain in awe of Russia’s size and resources. They marvel at a country that sprawls across eleven time zones with a potential market of nearly 150 million consumers. They typically cite a long list of its natural resource holdings: 40 percent of world natural gas reserves, 25 percent of the world’s coal, diamonds, gold and nickel, 30 percent of its aluminum and timber, 6 percent of global oil, and so on, and so on.

But in today’s world size is less an asset than a liability. It is a disadvantage that has to be overcome. It is an obstacle to economic competitiveness and effective governance. Population centers are spread over vast distances. As distances between cities and towns increase, physical movement becomes more difficult. Direct transportation costs increase. Information flows, the establishment of trust among market actors, and the creation and functioning of shared institutions are all impaired. In short, “being big” is a serious impediment to economic development unless a country can reduce distance and increase connections between population centers and markets.

The primary issue is not just that of Russia’s physical expanse, but the location of people within that space and what they are close to or not close to (markets, communication routes, and so on). In Russia, it is costly to build and maintain the infrastructure to keep citizens in economic and political contact with one another and with the center in Moscow. But it is not only the vast physical space that is the problem. Russians have also located themselves poorly in “thermal” space. The uniquely cold location of many of Russia’s big cities adds further costs to Russia’s economic geography.

Coldest in the World

It is a commonplace that Russia occupies a cold territory. Not only does its uniquely large land mass lie in an extreme high-latitude (northern) position, but very little of that territory enjoys any moderating influence of temperate oceans in the east and west. By nearly any conventional measure of temperature, Russia claims the distinction of being the coldest country in the world. It has twice as much territory above the Arctic Circle as Canada, ten

times as much as Alaska, and fifteen times as much as Norway, Sweden, and Finland combined. Day after day, the coldest spot on the globe is usually somewhere in Russia. Not surprisingly, the lowest temperature ever recorded outside Antarctica was in Russia.¹

In more recent years, such glorification of the cold has been less in fashion. The imperative of competing in the world economy has focused attention on Russia's uniquely cold climate as a disadvantage.² For some, Russia's problem with the cold is God-given and it is eternal. What such an argument fails to recognize is that it does not matter how much of Russia's land mass lies in far-away, cold space. What counts is how much and what kind of economic activity is conducted in those regions. The central point is that population distribution, and hence a country's cold, is the result of human choices.

That Russia does pay some penalty, in human comfort and economic efficiency, for its cold climate seems clear. The question is, how great a penalty? Answering that question raises others. First, how extensive is the cold; how can a nation's cold be measured in an economically relevant way? Second, what economic cost does a country incur per unit of cold? Finally, how much of Russia's cold is "excess" cold? That is, how much is due to allocative mistakes of the past, and how much was the unavoidable

¹That temperature was recorded three times: in Verkhoyansk on February 5 and February 7, 1892, and in Oymyakon on February 6, 1933. Both locations are in the Republic of Sakha (Yakutiya).

²For some it has produced extreme pessimism, even fatalism, about Russia's prospects. The best known example is Andrey Parshev's book, *Why Russia Is Not America*. (Pochemu Rossiya ne Amerika: Kniga dlya tekhn, kto ostayetsya zdes' (Moscow: Krymskiy Most-9D, Forum, 2000).

Parshev argues that largely because of the cold climate and the costs it imposes on economic activity, Russia is fated to fail as a global competitor and thus should remain outside the world economic community. While Parshev is fundamentally correct in many of his assertions about the disadvantages of the cold, he goes badly astray in his analysis because he wrongly assumes that Russia's coldness is an immutable characteristic of the country and its location.

Parshev is also wrong because he ignores that even a cold climate can have a comparative advantage and can therefore benefit from trade with other countries. The tragic irony of Parshev's final recommendation is that if Russia were to follow his advice to withdraw from the world economy, it would be immeasurably worse off. However, this is not to say that Russia's comparative advantage lies in its current economic structure—a structure that includes location. The reason Russia is not competitive is precisely that its leaders insist on producing the same things in the same old locations instead of looking for true comparative advantage on a nationwide scale.

result of Russia’s geography? These questions have been tackled in a project called the “Cost of the Cold,” based at the Brookings Institution’s Center for Social and Economic Dynamics (CSED) and Pennsylvania State University Department of Economics. A summary of some of the findings so far follows.

3.2.2 Measuring Cold: TPC

Traditionally, studies of the effects of temperature on economic activity use territorial aggregations of climate variables—for instance, an “average national temperature” that is the mean of recorded temperatures spaced fairly evenly across the country. For economic studies, however, this is inadequate. What is important is the temperature of places where people actually live and work. If one uses territorial temperature aggregations, then the countries of northern Europe—Sweden, Norway, and Finland—appear to be cold. In fact, in these countries the population is concentrated along the coasts and in the south, where temperatures are not significantly different from the rest of Europe. The same is true for Canada, where most people live along the southern border.

To discuss the role of temperature across countries in an economically meaningful way we need to account for the fact that climate varies within a country and economic activity (population) is not uniformly distributed across territories. We utilize the concept of temperature per-capita (TPC) — a population-weighted *mean* temperature. We define TPC of country k as:

$$TPC_k = \sum_j n_j t_j \quad (3.1)$$

where n_j is the share of a country’s total population that resides in region j , and t_j is the average mean temperature in region j .³ We typically measure TPC for a given month – in most cases, January, since this is the coldest month – and we use oblasts for the region.⁴

³We could alternatively write the formula as

$$TPC_k = \frac{\sum_j p_j \tau_j}{P_k}$$

where p_j is the population of sub-region j and $P_k = \sum_j p_j$ is the total population of the country. Then $p_j \tau_j$ (a magnitude expressed in “person-degrees”) can be thought of as the “amount of cold” in sub-region j and is useful in thinking about the relative contributions of various sub-regions or cities to the entire country’s aggregate cold.

⁴Notice that calculating the TPC for Russia by using oblast data pushes down the

TPC allows comparison of the temperature of one country with that of another in an economically meaningful way. For instance, Canada’s territory lies in a northerly range that is similar to Russia’s. But Canada’s population distribution is very different, with a much larger proportion of the total population living in the southernmost part of the country. Is Russia then colder than Canada? By how much? For that matter, is Russia colder than other northern countries such as Sweden?

Another useful application of TPC is to track a single country’s temperature evolution over time. Measured by its TPC, a country can become warmer or colder not (only) because of global warming or cooling but because of population movement. If a country’s territory offers a range of temperature zones, its TPC could theoretically rise or fall if people moved to warmer or colder regions. It is thus meaningful to ask, for instance, whether Russia today is colder than it was in 1917.

Table 3.1 and figure 3.1 show how TPC data answer such questions. Around 1930, as Russia entered the period of central economic planning, it was already “economically colder” than not only the United States but also Sweden and Canada (table 1). It was more than a degree and a half degree colder than Canada and well over seven degrees colder than Sweden.

Country and Year	TPC ($^{\circ}C$)
USA 1930	1.1
Sweden 1930	-3.9
Canada 1931	-9.9
Russia 1926	-11.6

Table 3.1: TPC’s of the United States, Sweden, Canada, and Russia, around 1930

But what is particularly noteworthy is the contrast between Russia and

aggregation problem, but it does not eliminate it. Typically we have data for the largest city in an oblast. But this may not reflect the actual average temperature in the oblast. Ideally, we would calculate the TPC for an oblast in the same fashion, by using sub-regional data. TPC for Russia would then be a weighted average of TPC of the regions. Unfortunately, we do not have temperature data sufficiently disaggregated to make this feasible.

the other countries in the subsequent period. An illustrative example compares Russia with Canada, both cold climates, with dramatically different TPC dynamics. In figure 3.1 we see that Russia became colder during the

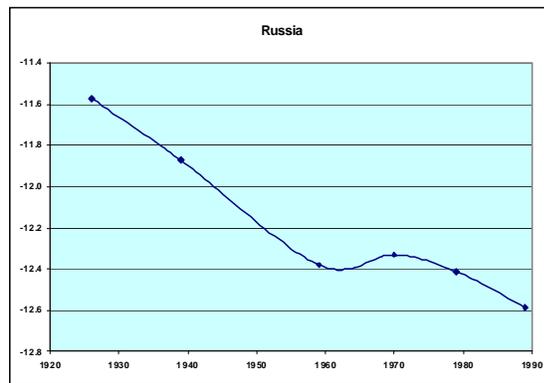


Figure 3.1: Russian TPC in the Twentieth Century

century, in start contrast with Canada as is evident in figure 3.2. Russia’s TPC declined steadily in the Soviet era, ending up a full degree colder by 1989, while Canada’s TPC rose by more than one degree in the same period. Canada’s TPC rose more than one degree centigrade during the twentieth century. This occurred primarily from population moving to the south. In Russia, thanks to Soviet policies that moved population to the extremely cold regions of the east, TPC fell more than one degree centigrade during the same period. In 1997 four of the top ten largest cities in Russia (each with population over one million) had average January temperatures of -14° C or below. In 1897, none of the ten largest cities had such low temperatures.

A further use of the TPC concept is to identify which specific regions of a country are most responsible for its overall temperature. By decomposing the aggregate index of coldness, we can find each location’s contribution to overall national or regional TPC. Associated with every region is a quantity of “person-degrees”—the product of its temperature and the number of people who live there. Hence, a very cold place inhabited by only a small number of people may be less important than a somewhat warmer (but still cold) location with a large number of people. Table 3.2 attempts to identify the “worst offenders” in the low Russian TPC. It is based solely on cities and

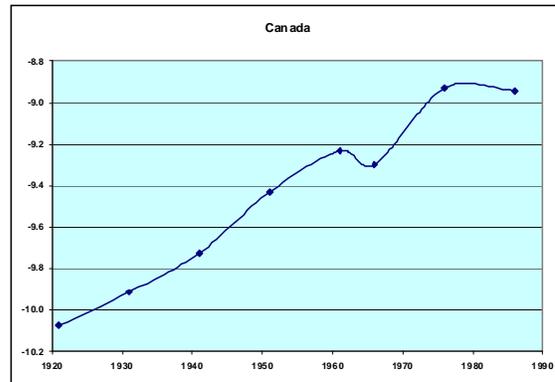


Figure 3.2: Canadian TPC in the Twentieth Century

asks the question, How much does each of these cities contribute to lowering Russia’s national TPC from a benchmark of $-10^{\circ}C$? The right-hand column in the table gives the answer. Specifically, we calculate the relative contribution of each city to the difference between Russia’s urban TPC (all cities with a population that exceeds 10,000) and the temperature of Moscow.

Clearly, no single city is the whole problem—even the biggest negative contributors, Novosibirsk and Omsk, together account for less than 10 percent of this reduction of TPC below $-10^{\circ} C$. However, as a group these cities are quite significant. To put their importance in perspective, note that there are a total of nearly 1,300 cities with populations of over 10,000 in Russia, home to almost 100 million people. What table 2 says is that of all these urban areas, the twenty listed account for over half of the drop in Russia’s urban TPC below -10° .

Also note the diversity of the list in both range of temperatures and range of populations. Since the product of temperature and population is the significant factor, the cities fall into three broad categories: (1) relatively small but extremely cold cities (Yakutsk, Ulan-Ude, Noril’sk, Chita); (2) very large, although not terribly cold—for Russia—cities (the Urals and Volga valley cities of Yekaterinburg, Chelyabinsk, Samara, Perm’), Ufa; and (3) cold and large cities (the two big “culprits,” Siberian capitals Novosibirsk and Omsk).

City	Location	Population (thousands)	January Temp °C	Percent of Cold
Novosibirsk	Siberia	1,399	-19	5.2
Omsk	Siberia	1,149	-19	4.3
Yekaterinburg	Urals	1,264	-16	3.2
Khabarovsk	Far East	607	-22	3.0
Irkutsk	Siberia	590	-21	2.7
Yakutsk	Far East	196	-43	2.7
Novokuznetsk	Siberia	799	-18	2.7
Ulan-Ude	Siberia	370	-27	2.6
Krasnoyarsk	Siberia	875	-17	2.5
Norilsk	Siberia	235	-35	2.4
Chelyabinsk	Urals	1,083	-15	2.3
Tomsk	Siberia	601	-19	2.3
Chita	Siberia	307	-27	2.2
Samara	Volga	1,275	-14	2.1
Perm	Urals	1,011	-15	2.1
Barnaul	Siberia	577	-18	1.9
Ufa	Volga	1,089	-14	1.8
Komsomolsk	Far East	293	-23.5	1.6
Kemerovo	Siberia	490	-18	1.6
Bratsk	Siberia	279	-23	1.5

Table 3.2: Leading Negative Contributors to Russian TPC

3.2.3 The Cost of the Cold

There are two categories of costs associated with the cold. The first are the direct costs. Cold reduces the work efficiency of both humans and machines, and it causes damage to buildings, equipment, infrastructure, agriculture, fishing, and to human beings (including deaths). The second type of costs are adaptation costs. These include expenditures of energy for heating, extra materials (and special materials) that are used in the construction of buildings and infrastructure—in general, all the money and effort that goes into protecting or at least buffering society from the cold.

To date, no one has conducted the kind of comprehensive research that could say what the total effects of cold are on any economy, much less for Russia specifically. But two strains of research offer partial answers. One is cold engineering, which looks primarily at direct costs. The other is the research on the effects of global climate change, which looks also at adaptation costs.

Cold Engineering Research

Cold regions engineering research has been used to study the effects of cold on specific activities, for instance, mineral extraction, construction, and military activity. These detailed, but narrow studies often place less emphasis on cost than on pure engineering requirements. Nevertheless, the research is valuable in presenting some of the negative productivity effects of cold temperature.

In a 1986 paper, Gunars Abele of the U.S. Army's Cold Regions Research and Engineering Laboratory synthesized data from various surveys from the construction industry and the military that indicate the effect of cold weather on the productivity of people and machines. Figure 3.3 shows the drop in efficiency for manual and equipment tasks involved in typical construction or repair work as the air temperature drops from below freezing to -30° or $-40^{\circ} C$. Below $-40^{\circ} C$ any manual work becomes nearly impossible, and even construction equipment is rarely used.

To express how the reduced efficiency translates into increased work effort (in terms of time) required to perform construction or repair work in cold weather, Abele introduced a “cold environment factor” (F). The baseline value ($F = 1$) represents the time needed to perform the task under ideal weather conditions (around $+10$ to $+15^{\circ} C$ for manual tasks and above $+5^{\circ} C$ for equipment tasks, with no wind or precipitation). The cold environment

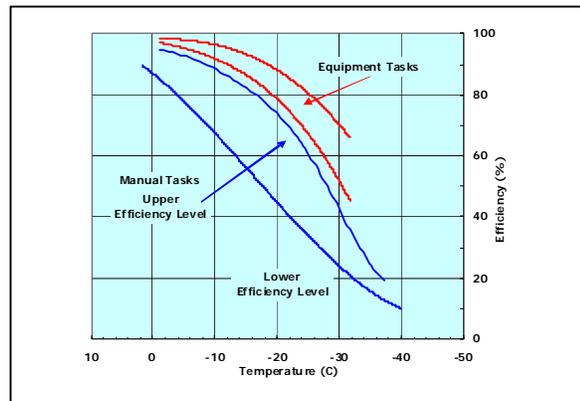


Figure 3.3: The Effect of Temperature on Manual and Equipment Tasks

factor rises as adverse weather affects work efficiency. Figure 3.5 6 shows the cold environment factors for manual (F_m) and equipment tasks (F_e). For instance, at -25°C , the standard time for each manual task would have to be multiplied by 1.6, and the time for each equipment task by about 1.3. At -30°C , these ratios rise to over 2.1 (manual) and 1.6 (equipment), and so on.

Figure 3.4 shows reduced efficiency due solely to temperature and disregards the effects of other climatic conditions such as wind and snow. Wind, in particular, is a serious complicating factor for manual tasks in cold weather. The severity of the wind-plus-cold effect, relative to the pure temperature effect, can be seen by noting that even at -15°C , a 20 miles per hour (32 kph) wind will produce a manual cold environment factor in excess of 4.0—in other words, quadrupling task performance times.

Finally, it is to be noted that in accounting for the adverse effects of cold on manual tasks, Abele looks exclusively at the physical limitations of cold. He expressly disregards any negative psychological or motivational effects of working in extreme cold.

What emerges from the cold regions engineering literature is a picture of an economic environment that is dangerous, costly, and unpredictable. Cold alters the properties of materials, leading to more accidents and breakdowns, and it reduces the ability of human beings to work efficiently and safely. Many precautions must be taken, or else serious damage to property and loss of life may result. Many of the studies raise the question of whether it is worth it at all to continue work in these regions, especially during winter months. But

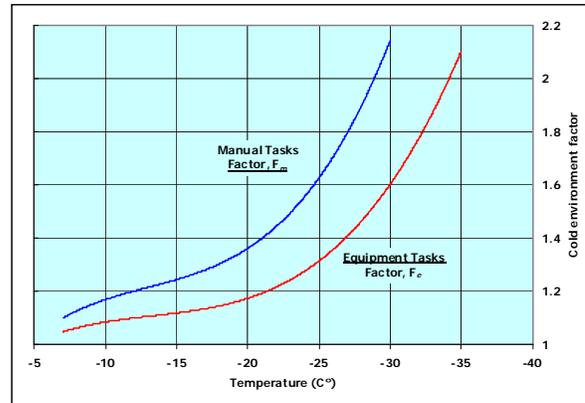


Figure 3.4: . Cold Environment Factors at Various Temperatures

even though the engineering literature provides a cautious can-do attitude to settling and living in cold regions, there is no systematic attempt to measure the costs associated with living and building in cold climates. To find such cost estimates, we must turn to recent studies spurred by concern over climate change.

Adaptation to Cold: The Case of Canada and the US

Reflecting a general concern over the consequences of global climate change, Canadian government agencies in the 1990s attempted to estimate the costs that Canadians incur in adapting to their climate. The problem, researchers found, was that although adaptation does occur, it is rarely accounted for and sometimes barely recognized as having taken place. As they wrote:

“Adaptation to present day climate is the result of a slow accumulation of policies and practices that protect people and property and allow economic and social activities to continue with a minimum of loss or disruption. Adaptation costs are thus ‘built-in’ to routine expenditures and budgets... “Because Canada is a modern industrialized country, it has sophisticated systems which enable Canadians to continue their activities in all but the most extreme weather conditions. Most Canadians take these systems for granted, and indeed believe that the Canadian climate does

not much affect them (aside from providing a perennial topic of conversation!). In fact, these systems are so taken for granted that their effectiveness and desirability are seldom evaluated.”

To begin to fill in the gaps, the researchers focused on the sectors of the economy most susceptible to climate effects: transportation, construction, agriculture, forestry, water supply and use, household expenditures, emergency planning, and weather forecasting. (They subsumed energy costs under the appropriate sectors.) Table 3.3 presents their cost estimates.

Sector	Cost of Climate Adaptation
	\$ millions per year
Transport	1,657.3
Construction	2,000.0
Agriculture	1,329.6
Forestry	402.6
Water	767.3
Household expenditure	5,296.4
Other	200.2
Total, all sectors	11,653.4

Note: Costs are in 1990 Canadian dollars. Canada's GDP in 1990 was approximately \$700 billion.

Table 3.3: What Canada Spends in a Year to Adapt to Its Cold

The total figure that the Canadian researchers arrived at is quite large, nearly \$12 billion (Canadian). This is about the size of the annual output of Canada's agricultural sector, and it is 1.7 percent of the country's gross domestic product (GDP). Nevertheless, they caution that it is likely a significant underestimate because they limited themselves to looking only at public expenditures at the national level. They note that “[a] more exhaustive survey would certainly yield a significantly higher adaptation cost estimate.”

But there is a more serious omission in the Canadian study, one that the authors themselves admit. Their study was only about adaptation costs

and did not attempt to estimate what we have referred to above as direct costs of cold. As high as the Canadian spending on climate adaptation is, it does not prevent all climate damage. Thus, a comprehensive account would need to include at least three main categories of such costs: (1) the impact on productive activities ranging from agriculture, forestry, and fishing, to manufacturing, and so on; (2) the impact on human health and mortality; and (3) the impact on human well-being and comfort apart from health—the so-called amenities effect.

Finally, another shortcoming of the Canadian studies is that even if additional cost categories were included, their approach leaves us short of the data needed to answer the question we posed earlier: What is the cost of cold per degree of TPC? That is, we have an (admittedly incomplete) estimate of the total amount of money spent by Canadians to cope with their cold climate. But how would these costs increase or decrease as TPC changed by one degree, plus or minus? Their data and findings do not allow us to proceed further in answering that question. Fortunately, a valuable effort that uses a per-degree-cost approach and which incorporates the missing categories of costs was made in an U.S. study conducted three decades ago, when most U.S. government and independent experts were concerned about, not global warming, but global cooling.

In the early 1970s the U.S. Department of Transportation sponsored a series of conferences to study the effects of climate change on the economy and on human well-being. This study, in which researchers were commissioned to study the effects of a cooling of 2° C, is the only one that explicitly looks at the costs of cold for the U.S. economy. In addition to the costs of damage to (reduced value of) the economy's production sectors such as agriculture, forestry, and marine resources and the extra costs of residential and industrial heating, specialists provided estimates of the costs to human health and comfort. The health costs included expenses for physicians' services, hospital visits, and drugs. Separately, they estimated the number of excess deaths that could be attributed to the cold. Finally, they looked at the cost to human beings of living and working in cold temperatures as expressed in differences in wages among urban areas in the U.S.⁵

⁵Robert Anderson, Jr. calculated the health costs of cooling: "The Health Costs of Changing Macro-Climates," in *Proceedings of the Third Conference on the Climatic Impact Assessment Program*, edited by Anthony Broderick and Thomas M. Hard. Conference Proceedings 1974, DOT-TSC-OST-74-15, 1974, pp. 582-92. Ralph D'Arge estimated other economic costs of cooling, including agriculture, forestry, and marine resources: "Economic

The DOT work was brought to the renewed attention of at least a small circle of readers by an iconoclastic study on the effects of global warming by economist Thomas Gale Moore in 1998.⁶ Table 3.4 summarizes the findings from the DOT study, supplemented by Moore's efforts to update some of the data. We have converted them into costs per one degree Celsius, in billions of 1990 dollars.

Activity	Cost per C°	
	billions of 1990 dollars	
Heating	4.9	
Health impacts	14.8	
Agriculture, forestry, fishing	14.4	
Wages	16.2	(10.3 – 34.4)
Human life	16.0	
Total	66.3	(60.4 – 84.5)
Cost as pct of GDP	1.14	(1.04 – 1.46)

Table 3.4: What Cold Costs the U.S. Economy Each Year

The total amount – roughly \$60 – 85 billion – can also be translated into a percentage of GDP in the United States.⁷ Thus, for the U.S. economy, the cost of a single “degree of cold” (the additional costs to the economy if national TPC were reduced by one degree) would be roughly 1.0–1.5 percent

Impact of Climate Change: Introduction and Overview,” in Conference Proceedings, pp. 564-74. The work on the value of climate amenities drew on the work of Irving Hoch: “Variations in the Quality of Urban Life Among Cities and Regions,” in *Public Economics and the Quality of Life*, edited by Lowdon Wingo and Alan Evans. Johns Hopkins Press, 1977.

⁶Moore himself did not use the DOT research to study the costs of the cold, but rather the benefits of warmer temperatures. See Thomas Gale Moore, *Climate of Fear. Why We Shouldn't Worry about Global Warming* (Cato Institute, 1998) and Thomas Gale Moore, “Health and Amenity Effects of Global Warming,” *Economic Inquiry*, vol. 36 (July 1998), 471-488.

⁷U.S. GDP in 1990 was about \$5,800 billion.

of GDP. This is a quite large cost, especially since it is incurred each year. For instance, an American economy that would normally expect to grow at an average of three percent per year over a 30-year period would sacrifice about 25-35 percent of that cumulative growth for a one-degree decline in TPC.

How Applicable to Russia?

These findings apply to the United States economy. Are they relevant for Russia? There are many problems involved in comparing anything to do with the U.S. and Russian economies, but we can mention two major issues of relevance here. The first is the relationship between the gross cost of the cold in the two economies and the efficiency of measures taken to adapt to the cold. The second issue is the very different range of temperatures at which the costs of the cold would have to be assessed in Russia and the United States.

With respect to the first: if one spends a dollar in the U.S. to adapt to the cold, what is the payoff, in terms of reduced damage or direct costs? What is the return to one dollar similarly invested in Russia? An area where this is particularly relevant is in assessing the health and mortality costs of the cold. Americans spend huge sums to protect their health and treat their illnesses of all kinds, including those possibly caused by the cold. Russians clearly do not spend as much, even as a share of their much lower national income. But that lower spending (and consequent lower level of health care) presumably leads to higher mortality rates. The U.S. is estimated to suffer 16,000 excess deaths per degree of cold. Pro-rated for population, that would imply about 9,000 annual excess Russian deaths per degree of cold. But do Russians die from cold at the same rates as Americans?

Then there is the issue of the economic value of each life lost. Cost-of-life calculations, though commonly used by economists, are controversial enough as it is. They are based on estimations of what an individual could have been expected to earn over the remainder of his or her working life. (Those lifetime earnings are taken as the value of a person's contribution to the economy.) This means that we would have to adjust for Russians' expected longevity as well as their specific earnings structure.

In sum, trying to adjust the U.S. findings on cost of the cold for Russian conditions may not be particularly productive. It would be wise to use the American results only as a very general indicator that cold in any

temperate or cold country undoubtedly has costs. But to determine precisely what those costs are, Russia would need to make special studies.

Another good reason to have specific research for Russia is the second reservation we made earlier about applying U.S. results to Russia, namely that the countries' temperature ranges differ so much. The U.S. estimates are for the cost of a degree of cold at the current U.S. TPC, which, of course, is considerably warmer than Russia's. The issue here is that the cold-cost function is clearly *nonlinear*. The magnitude of the effect will not be the same at -12° as $+3^{\circ}$ or $+4^{\circ}$. But how much different would it be? Cold engineering suggests that at least some of the costs associated with the cold are in fact bigger per degree at lower temperatures. for human and machine efficiency. It is clear, for example, from Figure 3.5 5 that a drop in temperature from -20° to -25° has a much greater effect on while a change in temperature from -5° to -10° has relatively little effect on human and machine efficiency than one from 0° to -5° . productivity, a drop from -25° to -30° is much more significant.

An even more serious consideration is what happens when the thermometer drops down below certain critical cold thresholds that trigger massive and disastrous materials failures. For most of the populated world, the extreme cold thresholds are, fortunately, not relevant. But Russia is different. And nowhere are these critical thresholds more of a daily reality for more people than in Siberia. It is not surprising that the most systematic study of the cold thresholds has been made by Russians, for the purpose of determining whether Siberian regions needed machines of special design or whether standard machines could somehow be modified through the addition of special parts made of cold-resistant steels. A compilation of the behavior of machines at various Siberian temperature levels gives a harrowing picture. See Table 3.5: What Table 3.5 shows is that there is a "seismic" component to very cold temperatures: extreme discrete events have the effect of an earthquake. This suggests that it is not just the mean temperature that is important; the variance also matters. To try and analyze this "extreme temperature" component of the overall temperature profile of a location, we created the notion of a "cold decile." This is the temperature that marks the coldest ten percent of all days in the period recorded. Our research suggests that in most of Russia the cold decile cutoff value is roughly 10 degrees lower than the mean. In other words, at any given mean January temperature it can be expected that ten percent of the time, the mean daily temperature will actu-

Temp C°	Effect on Standard Soviet Machinery
-6	Internal combustion engines require pre-start engine heaters
-10	Destruction of some standard metal dredge components
-15	High-carbon steels break; car batteries must be heated; first critical threshold for standard equipment
-20	Standard compressors with internal combustion engines cease to operate standard excavator hilt beams break; destruction of some tower crane components, dredging buckets, and bulldozer blades
-25 to -30	Unalloyed steels break; car-engine space, fuel and oil tanks must be insulated; frost-resistant rubber required; non-frost resistant belts and standard pneumatic hoses break; some cranes fail
-30	Minimum temperature for use of any standard equipment
-30 to -35	Trestle cranes fail; some tractor shoes break
-35 to -40	Tin-alloyed steel components (ballbearings, etc.) shatter; saw frames and circular saws stop work; all compressors stop work standard steels and structures rupture on mass scale

SOURCE: Adapted from Mote, p. 22. [In turn derived from Dogayev, pp. 29 - 31]

Table 3.5: Cold Thresholds in Siberia

ally be 10 degrees below the monthly mean.⁸ For instance, the city of Omsk in Siberia has a January mean of -19° C. But on average, for three days each January the million-plus residents of Omsk will see the thermometer drop below -29° C. And Omsk is only the beginning. It lies in the warmer part of the Siberian temperature range. The real cold comes farther east.

3.3 Cost of the Cold

An alternative way to measure the cost of the cold is to consider how Russia might have developed had Soviet location policies not moved so many people to such cold places. One could ask what Russia's TPC would be without such policies and then calculate the excess cost brought about by the distorted location policies. This is just the exercise pursued by Mikhailova (2004). Specifically, she conducts a counterfactual exercise, examining how Russia would have developed had location policies during the Soviet period resembled decisions made by Canadians.

The essence of Mikhailova's study is to use Canadian data to estimate a model that characterizes the dynamic links between, on one hand, spatial structure of the economy and, on the other hand, initial conditions and regional characteristics. With this estimated behavior model of the spatial dynamics in market economy in hand she then applies it to Russian initial

⁸On top of all the other issues that complicate the study of the effect of cold temperature, we have hitherto ignored one of the most basic: what is meant by the daily or monthly mean temperature? This is relevant for the present discussion of extreme events, since the mean daily temperature may still fail to reflect the fact that the daily low temperature may be significantly below the daily mean. In fact, most weather stations around the world, including those in Russia, report only the daily maximum and minimum temperature, and so what is labeled the daily mean is really only an approximate mean, namely the mid-point range of the maximum and minimum. Meteorologist John Griffiths noted that values labeled as mean temperatures have been calculated "in a bewildering variety of ways." He himself personally has unearthed over 100 different methods used to calculate the daily mean. John F. Griffiths, "Some Problems of Regionality in Applications of Climate Change," in *Proceedings of the Fourteenth International Congress of Biometeorology*, September 1-8, 1996, Ljubljana, Slovenia, pp. 384-390.

conditions and endowments.⁹

Mikhailova's results show that the post-Soviet allocation of population and industry in Russia is far different from that which would occur in the absence of Soviet location policy. It is colder and further to the east. Namely, the Eastern part of the country is noticeably overpopulated compared to the counterfactual market allocation, while the Western part experiences a relative population deficit. The excess population in Siberian and Far Eastern regions ranges from 9.6 to 17.6 million people according to various estimates.¹⁰ An illustrative comparison is given in figure 3.5 which compares the actual path of TPC in Russia with the forecast of her market model. The differences are significant. Without Soviet location policies TPC rises in Russia, as it did in Canada during the 20th century.

Mikhailova then proceeds to estimate the cost to the Russian economy of the excess population in cold climates. To calculate the cold-related cost of spatial inefficiency, she first investigates the relationship between temperature and various regional characteristics (energy consumption, health indicators, and productivity). She estimates the temperature elasticities of these characteristics and uses these estimates together with the measure of extra cold resulted from Soviet investment decisions — 1.5°C TPC difference — to calculate the cost in terms of present-day Russian GDP.

The costs Mikhailova finds are dramatic.

In the most modest of her estimates, this difference in TPC costs not less than 1% of GDP in extra energy costs, and 0.2% of GDP in lost productivity in construction sector alone annually. If all manufacturing industries had the same temperature elasticity of TFP as construction, loss of another 1.3% of GDP yearly could be attributed to cold. Additional 0.85% of aggregate mortality are also a direct consequence of Soviet spatial policy. These are

⁹The assumption behind her procedure is not that spatial structures of different market economies should be similar, but rather that the dynamic forces that impact on location should be similar. In other words, she does not just compare the existing spatial allocations in Russia and Canada, but instead looks at the changes in structure over time: initial conditions matter.

¹⁰Mikhailova tests for the effect of WW2 on location policy. "The impact of WWII, however drastic in the case of Russia, explains the eastwest misbalance only partly. Even according to the most liberal estimates, the excess population of Siberia and Far East remains at the level above 9.6 million after the war adjustment, and is statistically significant."

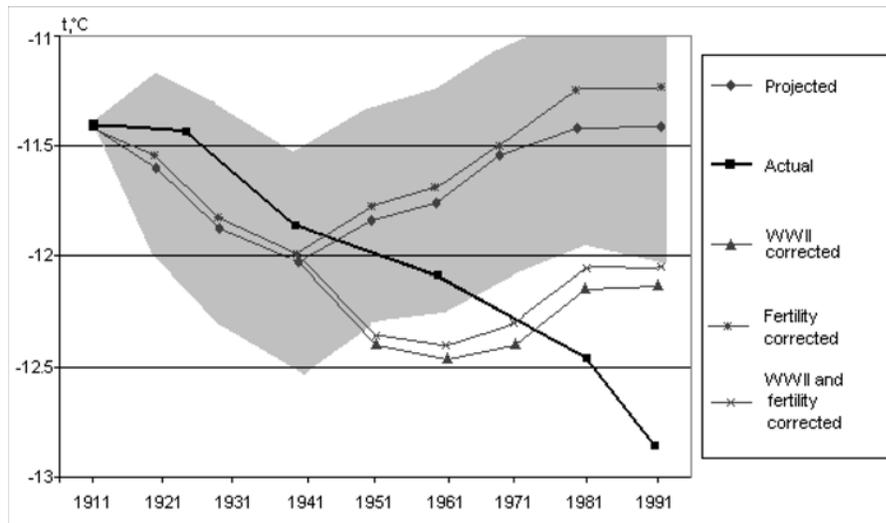


Figure 3.5: Mihailova's Projected and actual TPC dynamics in Russia

annual costs, but compounded over last 30 years of the Soviet era - a time when the spatial evolution of Russian economy took a sharpest detour from the optimal trajectory - lead to a GDP loss in excess of 35% (or 97% in worst case scenario). Every person in Russia gave up at least one fourth (or maybe a half) of his income for Siberian development!

These are dramatic costs, but it is important to note that Mikhailova only estimates a lower bound to these costs. Mikhailova was only able to estimate a portion of the costs. For example, she assumed that residential electricity consumption was independent of temperature, but it is almost certainly the case that in Russia electricity use rises as temperature falls.

3.3.1 Siberia and the GULAG

At the end of the tsarist period, the interior of Siberia was barely charted, let alone settled. The large-scale settlement and urbanization of Siberia were not possible under the tsars. The costs of peopling, exploiting, and maintaining such a vast, cold area were simply too onerous for their market-oriented economy. Only the Soviet Union—a totalitarian state with coercion at its

core, with its highly centralized control of production and redistribution of resources and with absolutely no sense of cost—could conquer Siberia.

Like the tsars, the Soviet state used Siberia both as resource frontier and as penal colony. But the Soviets developed the tsars' Siberian penal system to levels previously unimagined. Under Josef Stalin, the government launched the labor camp system in 1929 for the explicit purpose of colonizing and exploiting the natural resources of the nation's most remote regions. By 1934, half a million Soviet citizens—everyone who had received a prison sentence of three years or longer—were in the GULAG (an acronym based on the name of the department within the Soviet police ministry that ran the camp system). Stalin's great purges of the late 1930s brought the total camp population to more than two million.

The GULAG and its virtually inexhaustible pool of slave labor became fundamental tools in the industrialization of Siberia. GULAG inmates—some 18-20 million of them over the span of slightly more than two decades—facilitated the exploitation of timber and mineral resources in unpopulated remote areas. They also laid railroads, constructed roads and dams, dug canals, developed oil fields, and built factories and farms, all under monstrously inhuman conditions.

World War II gave further impetus to Siberian development when key factories were moved from European Russia eastward into the Ural Mountains and beyond to put them beyond the reach of invading German forces. Siberia received 322 of the relocated plants. Postwar economic development plans encompassing both these and yet-to-be-built industrial facilities demanded even more forced labor. Continuously, from mid-1949 until Stalin's death in 1953, the forced labor camps contained around 2.5 million inmates, half of whom had committed crimes no more serious than petty theft. During those peak years in the late 1940s and early 1950s, the GULAG accounted for an estimated 15–18 percent of all Russian industrial output and industrial employment.

The GULAG was largely dismantled after Stalin's death, but it had already laid the basis for what was to become a massive project of Siberian development under his successors. Many motives converged in the postwar development of Siberia. Communist economic planners sought to extract Siberia's oil, gas, diamonds, gold, and other rich mineral deposits to make the Soviet Union self-sufficient in strategic resources. Military planners, who already during the war had begun to reconceptualize western Siberia as a strategic redoubt—a defensible core deep in the interior—wanted to ensure

that the entire region be settled and secured. Soviet politicians tasked with engineering and mobilizing society in the 1960s-1980s stressed the ideology of “conquering new lands”—now to be interpreted as campaigns to overcome nature and the wilderness through industrialization—to increase the strength of the Soviet state.

Cities were an important feature of the plans for a Siberian industrial utopia. Cities were developed in Siberia in tandem with industries to provide a fixed reserve of labor for factories, mines, and oil and gas fields. In many respects, however, the cities were not really cities. Rather than being genuine social and economic entities, they were physical collection points, repositories, and supply centers—utilitarian in the extreme. They were built to suit the needs of industry and the state, rather than the needs of people. Indeed, primary responsibility for planning and constructing city infrastructure fell to the Soviet economic ministry in charge of the enterprise the city was designed to serve. Few responsibilities were assigned to the municipal governments.

Still the cities grew, in both number and size. By the 1970s the Soviet Union had urbanized its coldest regions to an extent far beyond that of any other country in the world. (See box 2.) At precisely the time when people in North America and western Europe were moving to warmer regions of their countries, the Soviets were moving in the opposite direction.

How cold are Russia’s cities? A comparison with Canada and the United States is instructive. A list of the 100 coldest Russian and North American cities with populations of over 100,000 would have 85 Russian, 10 Canadian, and 5 U.S. cities. The first Canadian city to appear on the list (Winnipeg) would be in 22nd place. The coldest U.S. city (Fargo, North Dakota), would rank 58th. Americans are accustomed to thinking of Alaska as the ultimate cold region. But Anchorage, Alaska, would not appear on a list of the coldest Russian and North American cities of over 100,000 until position number 135, outranked by no fewer than 112 Russian cities. The explanation for this result is not that Alaska isn’t cold. It is, It’s just that Americans don’t build large cities there. (In fact, Anchorage is the only city in Alaska with a population of over 100,000.) For really large cities, things are even worse. The United States has only one metro area over half a million (Minneapolis-St. Paul) that has a mean January temperature colder than -8° Celsius. Russia has 30 cities that big and that cold.

Boom... and Bust

In the 1970s and early 1980s, Siberia and the Russian Far East dominated Soviet regional development programs. Western Siberia, rich not only in oil but also in natural gas, was on its way to becoming the largest energy-producing region in the USSR, and grand long-term industrial projects were being planned for the whole of Siberia. Western analysts were astounded by the magnitude of the projects and by the scale of investment necessary to carry them out.

But the Soviet economic slowdown of the late 1970s would put an end to such ambitions. By the 1980s, the massive investments in Siberia and the Far East were offering extremely low returns. Many huge construction projects were left incomplete or postponed indefinitely. At first, the troubles were blamed on disproportional and incoherent planning, ineffective management, and poor coordination. But by the reformist era of the late 1980s under Mikhail Gorbachev, the problem was seen to be Siberia itself as well as the efforts to develop it. Criticism of the giant outlays in Siberia became commonplace. Regional analysts and planners in Siberia mounted a fierce rearguard action. They tried to justify continued high investment by pointing to the value of the commodities produced in Siberia on world markets and the state's dependence on Siberian natural resources and energy supplies. Still, by 1989, the industrialization of Siberia was beginning to seem a monumental mistake. The Siberian enterprise was, in any case, brought to a screeching halt by the collapse of the Soviet Union in 1991 and the beginning of Russia's macroeconomic reforms in the 1990s.

3.4 Conclusion

The costs to Russia of its location, and of its location policies – the immutable and the self-induced problems – are severe. They are a tax on Russian growth, and they are a potential Bear Trap if they are not understood correctly. It is tempting to think that given the industrial resources in many of the very cold cities Russia should invest its wealth to modernize these structures. With enough investment the cold can be adapted to. With sufficient investment you can make anything viable. As we noted in *Russia's Virtual Economy*:

"Of course, a sufficient infusion of outside resources can guarantee successful restructuring for any enterprise, because this makes it

possible to reconstruct the entire enterprise from scratch. Therefore, any meaningful notion of restructuring has to consider the opportunity cost of making a given enterprise viable [?, 7]."

But if one is to invest sufficient resources to rebuild an enterprise why would you do that in Perm rather than Rostov? Even with zero cost of capital you would not re-invest in Perm. You would build it in Rostov or some similarly warmer (for Russia) city. To rebuild in Perm you need directed capital subsidies. When Russia spends money to replace worn-out infrastructure in Siberian and Urals cities that are far colder than urban centers of that size anywhere else in the world, when it builds roads to connect cities whose very existence no market economy would have tolerated, when it channels investment into factories that were not located, equipped, and staffed with even the foggiest idea of a market in mind—when it makes these and hundreds and thousands of other similar investment decisions, it is not only wasting the very scarce resources it has available today. It is also dooming future generations to continue the waste.

Why does this location problem persist? The Soviet Union was dismantled in 1991, and a market economy has replaced central planning. Yet the legacy of the Soviet period in terms of location policy persists. To explain this, we must turn to political economy, especially the implications of federalism Russia style, which we do in the next chapter.

Bibliography

- [1] Gaddy, Clifford G., and Barry W. Ickes, *Russia's Virtual Economy*. Washington DC, Brookings Institution Press, 2002.
- [2] Mikhailova, Tatiana, *Essays on Russian Economic Geography: Measuring Spatial Inefficiency*. Unpublished Ph.D. Dissertation, The Pennsylvania State University, 2004.

Chapter 4

Market-Impeding Federalism

4.1 Introduction

"Muscovites should live well. Everyone else should think about Russia, so the Muscovites can live even better."¹

We have seen that Russia suffers greatly from the legacy of spatial misallocation: too many people, and too much capital, in the wrong places. This would not be so bad if internal labor migration was high. In fact, however, it has been and remains very low.² To understand why this legacy persists we turn our attention to the federal structure of Russia. Post-Soviet Russia imposed a formal federal structure on a spatial distribution of productive forces that was non-market. The federalism became market-impeding rather than, as had been intended, market-promoting. We refer to the peculiar Russian policy that emerges as "Lights On."

Our argument in this chapter is that the peculiar policy of "lights on" plays a central role in the conservation of the legacies from the Soviet period. It reduces mobility of both labor and capital. It is the result of the grafting of a federal system on a non-economic territorial divisions. Given its importance in the political economy of Russia it is worth developing the argument in full.

¹Reader comment by a resident of the Russian Far East in *Komsomol'skaya Pravda*, 29 May 2010.

²According to the most definitive study on migration in Russia, Andrienko and Guriev (2005), "Throughout more than a decade of economic transition, internal migration rates have been low, and there has been virtually no convergence across regions."

Some have argued that federalism may be advantageous for countries trying to reform. A federal structure offers several potential advantages. First, it allows for competition among jurisdictions with regard to policies. Second, a federal structure may serve as a check on central government interference. Some have argued that *market-preserving federalism* is a "governance solution of the state to credibly preserve market incentives [[13, 83]]." The example of China is often used to illustrate how market-preserving federalism works. In contrast, Russia, which is also a federal state, is often characterized as failing to implement market-preserving incentives. In this chapter we will show what can happen when federalism is implemented in an economy like Russia in which the initial allocation of resources across regions is non-economic. We will show that the conditions for federalism to work effectively may be absent in Russia.

Federalism is often considered to be a political structure that is conducive to market reform. We examine this argument. In particular, we focus on the consequences of a federal structure where the regional boundaries were created by administrative fiat, and where some regions may need to shrink if reforms are undertaken. We argue that observed industrial change will be slower than that predicted by a pure adjustment hypothesis because loser regions will want to subsidize high cost industry to prevent an outflow of capital and labor. Moreover, rich regions may also have an incentive to support such policies. In a social planner's solution to the adjustment problem for Russia, labor would move from the loser regions where TFP is low. Total income would be much higher if Moscow and similar regions were much bigger. But this lowers wage income in these regions. Hence, governors of rich regions may also want to restrict the movement of labor. Hence, they provide (support) the subsidies that the loser regions want to maintain their political authority.

4.1.1 Decentralization versus Federalism

Federalism is to be distinguished from decentralization. Governance of any territorially large country requires some decentralization. Nondemocratic societies typically use an administrative-hierarchical system of decentralization. Democracies, in contrast, rely on some notion of federalism — that is, a regional distribution of political power. Typically, the power distribution is related to the regions' economic importance as reflected in their population sizes.

Federalism, it is often argued, tends to enhance democratic efficiency. At least it may lead to more participation. But what about the relationship between federalism and economic efficiency? The answer depends on the nature of the economic problem. If the problem is central government interference in — or even predation of — the economy, then federalism can serve to protect the market. If, on the other hand, the problem is regional inequalities in economic performance, then federalism may be an obstacle.³ Finally, if predation by regional governments is the problem, then federalism is not the solution.

There is always a trade-off between the problems of central government predation and regional inequality, so the solution will depend on the relative importance of the two problems. Here it is important to distinguish cases depending on initial conditions. In a normal spatial allocation population adjusts so that marginal returns are equalized.⁴ Shocks alter conditions from that starting point. In Russia, on the other hand, the transition shock is imposed on an allocation that is very far from equilibrium.⁵ In Russia, market reform requires very large structural changes along regional lines. Yet, the pace of such change is very slow and is inversely related to the degree of disequilibrium [Ickes and Ofer, 2006]. This suggests that federalist institutions may be inhibiting change rather than promoting it.

The misallocation of industry across regions also implies that the marginal cost of taxation differs widely across regions. Allowing subnational units freedom to set tax rates is thus very inefficient. One could argue that Tiebout effects will solve this.⁶ But the size of the required population shifts may be

³In Gaddy Ickes 2002 Appendix F ("Regions in R-D space) we develop a model of governor decisionmaking and show how initial condition can lead to a bifurcation in regional outcomes.

⁴This was noticed long ago by Adam Smith: "The policy of Europe, by obstructing the free circulation of labour and stock both from employment to employment, and from place to place, occasions in some cases a very inconvenient inequality in the whole of the advantages and disadvantages of their different employments ([14, Book 1, chapter X, page 134]).

⁵For a regional analysis of structural change in Russia see [Ickes and Ofer, 2006].

⁶The Tiebout hypothesis predicts that given that individuals have differing personal valuations on public services and varying abilities to pay the attendant taxes, individuals will move from one local community to another until they find the one which maximizes their personal utility. The model states that through the choice process of individuals, jurisdictions and residents will determine an equilibrium provision of local public goods in accord with the tastes of residents, thereby sorting the population into optimum communities. The relevance to Russia, where internal migration is low and democratic institutions

very large. Else the level of public goods provision across regions will be too great for satisfying any democratic criteria.

Why not just re-draw the political boundaries? Keep federalism, but draw correct boundaries? This is an interesting possibility, but the problem is that without liberalization you don't know what the correct boundaries are. The virtual economy and pretense means that it is hard to uncover what these boundaries should be. Once transition is underway, on the other hand, vested interests make it very difficult to re-draw political boundaries.

Notice that with the very large differentials in marginal product across regions there are large incentives to move at the individual level. Given the wage differentials that exist in Russia today, everyone would want to move to Moscow. One might also expect that capital would flow to Moscow given that productivity is higher there and the infrastructure is better. But this is less likely to happen. The reason is that much of the capital in the regions is fictitious, maintained by the pretense of the virtual economy. Hence, diminishing returns will be reached much sooner in Moscow than would be the case if both capital and labor moved.

Contrary to what one might think, in Russia labor is less, not more mobile across regions than capital. Apparently, investment/disinvestment decisions produce more variation in the regional capital stock than interregional migration does for regional labor force. The regional labor supply is extremely stable, shockingly more so than regional capital.⁷ A cross-sectional series of regional capital stocks in 1994 and in 2000 display a correlation of 92.6%,⁸ while the series of regional labor forces are correlated at the 99.8% level.

But officials want to offset this. Not just via the use of *propiska*, but keeping enterprises open in home regions plays a big role.

relatively weak is not, perhaps, very strong.

⁷This is not to say that the labor mobility is non-existent in Russia. On the level of individual firms labor has been getting increasingly more mobile during the transition period. However, most of labor movement is intersectoral but not interregional. The level of labor migration across regions is still low.

⁸Note that capital stock is measured as the base (purchase) value of capital adjusted for depreciation at the official rate, and does not truly represent capital stock used for production. If a region is economically successful and the investment level is high, all new capital correctly shows up in data. If a region is in recession, capital is underutilized, and the measured capital stock is actually higher than the utilized capital stock. Probably, capital is even more mobile across regions than it appears to be.

4.2 Predation and Capture

Market-preserving federalism is seen as a mechanism for preventing predation. The idea is that decentralization of authority, by limiting the information available to central authorities enhances the credibility of commitments not to predate. By raising the cost of predation through limitations on information, federalist decentralization leads to improved market incentives.

The importance of restraining the predatory instincts of central governments is no doubt important. But it raises the question, why do some governments predate more than others? Why, for example, has the private sector developed more in China than Russia? Blanchard and Shleifer (2001) develop a simple model that is very useful for studying this problem. They put forward two hypotheses to explain the greater level of predation in Russia.

- Capture by older firms. Local governments work to generate transfers to older firms and to protect them from new competitors
- Competition for rents by local officials. unintended effect of administrative disorganization. Too many agencies trying to extract rents from new private firms

But why are these forces weaker in China? According to Blanchard and Shleifer there are two key explanations. First, they argue that initial rent holders were weaker in China than in Russia. This is partly due to the level of development in the two countries and the nature of economic structure. Second, the strength of the central government in China was stronger – no collapse of party. Blanchard and Shleifer focus on the consequences of the latter explanation.

We augment the analysis to consider the implications of inefficient federal boundaries. What happens if the political boundaries in a federal system are inappropriate economic units?

4.3 Blanchard-Shleifer Model

It is useful to set out the basic Blanchard-Shleifer model [B-S] in some detail as it will be the basic structure for what follows. There is a government that has two levels: central and local. Each *local* government has a simple choice:

- foster growth, by limiting transfers of resources to state and former state firms and allowing new private firms to enter and grow, or
- kill growth, by transferring resources to old firms and/or preventing new firms from being created.

Why would the government do the latter? Under the capture view it is straightforward. Under the competition for rent view the government might be simply unable to prevent bribes and corruption. Both have the same implication for growth.⁹

Let y be the additional output under growth, and normalize this so it also stands for the additional amount of revenue available to the central and local governments under growth. Let b be the private benefits to the local government of killing growth.¹⁰

Now turn to the *central* government. It is assumed to prefer growth. It has a carrot and a stick:

- *Revenue Sharing.* Central government can choose the extent of revenue sharing. Let a be the share of revenues from additional growth going to the local government.¹¹ If it chooses to foster growth it gets ay . Normalize so this is also how much it values growth. Note that it is *ex post* a that is crucial.
- *Political centralization.* This is the stick. Central government controls whether the local government can stay in power. Let p_x be the probability that the local government stays in power if it kills growth, and p_y is the probability it stays in power if it fosters growth. Let $p = \frac{p_y}{p_x}$. The value of p will clearly depend on how local officials are chosen. In China they can choose p freely. In Russia, there were elections for these positions for the first ten years of transition,¹² so p depends on how effective the central government is at affecting elections.

⁹In Appendix F of *Russia's Virtual Economy* we developed a model of governor decisionmaking and collusion with regional interests.

¹⁰Under the capture view this could be transfers back from existing firms – investing in relational capital. Under the rents interpretation it could be the cost to local officials of trying to stop bribe-taking.

¹¹In practice this could include tax sharing, tax assignments and transfers. The key point is that a represents what the region ends up with from increased growth, not how the sharing takes place.

¹²Putin eliminated direct elections for Governor and replaced this with appointments. But even Stalin could not prevent officials from being captured by local interests.

- In other words, p is an index that measures the central government's stick with regard to governors. The higher the value of p the greater the penalty for not engaging in pro-reform policies. Notice that the stick is limited in the sense that the governor can only lose his job.¹³
 - it would be nice if p were greater than one, but if the center has little control over outcomes, and if capture is important, then it may be less than one.
- *Uniformity.* Blanchard and Shleifer assume that regions do not differ. Hence, it makes sense to assume uniform values of a, p , and y .¹⁴

Under these assumptions the local government chooses growth if

$$p_y a y > p_x b$$

or

$$p a y > b. \tag{4.1}$$

Expression (4.1) says that the local government is more likely to choose growth the stronger the stick (high p), the larger the carrot (higher a), the larger the growth potential (y), and the smaller the benefits of not reforming – either capture or the lower are the costs of reducing rents (b).¹⁵

Proponents of the federalist position often focus on the fiscal problems of the center, which renegotiates its stake and cannot commit.¹⁶ They argue that market-preserving federalism provides better incentives and thus the differences in economic performance between China and Russia are explained by differences in a .

¹³This is thus a *Brezhnevite* system of incentives rather than *Stalinist* incentive system.

¹⁴This assumption is a result of their interest in comparing China versus Russia. This assumption, however, has implications that we discuss below.

¹⁵Notice that Blanchard and Shleifer do not subject b to any resource constraint, though obviously, there is a limit to how much looting there can be. We follow their interpretation in the subsequent analysis.

¹⁶What they ignore is an important structural difference. In China industry is not geographically specialized, in Russia it is. So for insurance reasons, alone, the optimal contract would have more fiscal federalism in Russia, hence lower a . For an empirical analysis of how fiscal transfers are related to structural differences in Russia, see [[11]]. Hence, below, our focus on differences across regions.

Blanchard and Shleifer argue that the empirical evidence suggests that a may be lower in Russia than China, but that this is not altogether clear. One complication is that there are actually three levels of subnational governments and most of the work looked at the bottom two.¹⁷ There certainly appears to be a high level of fiscal transfers. There are few taxpaying regions and many recipients of subsidies. In China, the evidence seems to indicate a value of a near to 0.8. Although this may suggest that there is more redistribution in China, Blanchard and Shleifer argue that differences in a are probably too small to explain the differences in performance.

Blanchard and Shleifer note that p also differs significantly between China and Russia. In China the Party still rules, so p is very high, could be enormous. In Russia governors are elected, and the center cannot always get their way. So p is much lower, perhaps less than unity.

This suggests that differences in p could offset large improvements in a in the case of Russia. With high enough p a high a may not even be necessary.

The model suggests that to the extent federalism has been important in promoting growth in China, such federalism relied crucially on the power of the Party. Greater democracy could mean much lower p . Then we would see how important are the differences in a .

The model also suggests that in Russia the primary problem may be political decentralization. Improvements in a may have little effect in this environment. In other words, the economic benefits of federalism depend on some degree of centralization.¹⁸

4.4 Loser Regions

The analysis in the B-S model is predicated on the idea that all regions could benefit from reform – the key problem is incentives. It is certainly true that market reforms would improve efficiency in any region, and certainly across regions. But it is not at all clear that reforms will necessarily lead to growth in all regions. Obviously if y is small (or even negative) – if there are poor

¹⁷For example, Zhuravskaya finds marginal a to be as low 0.1 between the bottom two layers of government [[15]].

¹⁸"As best we can tell, the economic benefits of decentralization obtained from federalism rely crucially on some form of political centralization. Without such centralization, the incentives to pursue regionalist policies are too high, and cannot be eliminated solely through clever economic and fiscal arrangements [[5, 178]]."

growth prospects – then it really doesn't matter much about carrots or sticks.

In the B-S model appropriate federalism always leads to pro-growth policies. If p is raised high enough it can always compensate for a low value of y . B-S improve on the previous literature by showing that variation in a is insufficient to insure that federalism will be growth inducing. But their analysis is based on the assumption that y is always positive; that is, there is always a pro-growth reform that results in higher income in the region.

It is important to notice that a is bounded from above by unity. The B-S model points out that there are thus limits to the carrots that the center can provide to governors. Indeed, that may be the central point. Moreover, even if $a \rightarrow 1$ the actual carrot is limited by the size of y . If y is low, carrots are limited.

Notice that p on the other hand can go to infinity. But this is still *Brezhnevite* incentives.¹⁹ The governor can always walk away – all he loses is his b .

What B-S do not consider, however, is what happens if $y < 0$.

Notice right away that if $y < 0$ then a policy of high a provides no carrot! Indeed, in the case of a loser region governors would prefer to have $a < 0$.²⁰ That is, they would want to be compensated for the loss – say, for example, in terms of tax revenue – incurred by adopting the pro-reform policies. Having a set of differentiated values of a is a move away from market federalism and towards discretion. To stay within the context of this literature we keep a

¹⁹As opposed to Stalinist incentives which involve the Gulag and worse.

²⁰What BS do not answer is why local governments are more likely to be anti-growth than the central government. They attempt to, arguing that larger units are less likely to be captured and that big oligarchs may be less anti-growth than local ones. But this is not all that satisfying.

A key reason why some regional officials are anti-growth is that they preside over loser regions. If they have a large share of dinosaurs, then policies that will be conducive to growth may also be conducive to growth *elsewhere*. The key point is that restructuring in Russia has a serious regional aspect to it, the governors realize this, and so they act accordingly. In this regard the comments of Viktor Tolokonkiy, Governor of Novosibirsk Oblast (August 2000) are instructive:

“Under conditions of total openness of the economy... , we here in Siberia should not expect any serious investment activity at all. Our costs of production are too high, residential housing and office manufacturing facilities are too expensive, and our transport costs and wages are higher than in southeastern Asia.”

fixed and then consider side payments that may be needed to get governors in loser regions to adopt reforms.

What does it mean for a pro-growth policy to induce $y < 0$? Consider a region whose location-specific endowment is so poor that adoption of market reforms would lead to a shift of labor and capital out of the region. For example, regions that are distant from markets and are in very cold regions, and were over-industrialized in Soviet times. More important, market liberalization may require the value of capital to be written off. The correct market response is for the region to shrink, for people to move out, and for $y < 0$. These are true loser regions.²¹ If subsidies are eliminated regional *GDP* (at least as measured) goes down. So the net change in taxable resources goes down. How does this change the analysis? We treat this in steps.

4.4.1 Inter-regional transfers

If in some regions j , $y_j < 0$, it follows that pro-growth policies will not be adopted even if a "perfect" form of federalism is chosen. That is, even setting $a = 1$ and letting $p \rightarrow \infty$, condition (4.1) will not be satisfied for the loser region.²² One solution to this problem is to have a differentiated value of a that would allow $a < 0$ for loser regions. This is because the only way to implement pro-growth policies in loser regions is to have the winner regions buy them off. But this means that a cannot be set equal to one for all regions, since winner regions will have to contribute to the treasury to compensate the loser regions. Winners would have an $a < 1$.²³

Consider the decision in loser region j . To choose pro-growth a side payment is required to offset the negative value of y_j . For simplicity assume

²¹Lant Pritchett introduced the notion of "Zombie Countries" which captures a similar intuition on the international dimension. Consider a country that experiences a negative shock to labor demand. Then, if "...the negative shock is large and other regions prevent labor mobility then potential ghost countries become unrealized ghosts or zombie countries (the living dead) as nothing, besides out-migration, can prevent an extended and permanent downward movement in wages." (Pritchett, 2004).

²²What would it mean for $p \rightarrow \infty$? This means that with 100% certainty the governor is fired for not pursuing reform. But even this does not cause reform because no stick is sufficient when $y < 0$. Now you need new kind of carrots (that come from outside the region).

²³Although we do not analyze this, one could argue that foreign aid or a budget deficit is required to maintain high incentives for winner regions. This allows the budget balance condition to be broken. In our analysis, however, α is fixed.

$a = 1$ for this region. Thus for this region $pay_j < b$, so a special transfer, ϕ , is needed so that:²⁴

$$p[y_j + \phi] > b_j \quad (4.2)$$

or

$$\phi > \frac{b_j}{p} - y_j. \quad (4.3)$$

Thus ϕ is the minimum additional transfer payment required to get the loser region j to choose pro-growth.²⁵

Notice that in this case we must already alter the model from "perfect" federalism. Now there is a cross-region budget constraint to consider. While $a_j = 1$ is still feasible for the loser region, in some other regions that are winners we must have $a_i < 1$ in order to finance the additional transfers. Suppose that there are only two regions. Then in region i (the "winner region") we must have $\phi_j \leq (1 - a_i)y_i$.²⁶ The additional transfers are also constrained by the requirement that i has to have the incentive to reform, which takes place if:

$$pa_i y_i > b_i. \quad (4.4)$$

In the two-region case a necessary condition for reform to be viable is that overall reform is efficient: i.e., $y_i > |y_j|$. That is, the marginal gains in region i must be greater than the losses in the loser region. We assume that this is indeed the case.²⁷ Of course this is not a sufficient condition for reform to be *chosen*. But it is the interesting case if we want to analyze when federalism may impede reforms.

²⁴In this formulation the additional transfer payment covers the loss and the governor's payoff from pro-reform is then pa times the sum $y_j + \phi$. Alternatively, you could calculate the additional transfer payment, $\hat{\phi}$ such that $\hat{\phi} + pay_i > 0$.

²⁵Introducing ϕ is a simple way to make the net transfer to a region dependent on its growth possibilities.

²⁶In the general case this constraint would be

$$\sum_{j \in J} \phi_j \leq \sum_{i \in I} (1 - a_i) y_i$$

where J and I are the sets of loser and winner regions, respectively.

²⁷Indeed, we are quite certain that this is the case in Russia.

4.4.2 Inter-regional migration

Does the introduction of differentiated transfer payments – that satisfy conditions (4.3) and (4.4) – suffice to insure reform in both regions? Not necessarily. There are additional considerations for both loser and winner regions that result from the movement of factors caused by reforms. We consider these in turn.

Migration: loser regions

If an additional transfer payment induces reform in a loser region it will shrink both demographically and economically. A governor who considers only net income will choose reform. It may be, however, that governors of loser regions are not indifferent to shrinkage. The status, prestige and other sources of wealth may depend on the size and importance of a region. Hence, from the viewpoint of the governor, reform may incur an additional cost. Therefore, governors of loser regions may require payments larger than ϕ_j to choose reform.

Migration: winner regions

Recall that pro-growth policies in j lead to out-migration to the winner region. So the excess labor moves to the winner region i . If productivity is higher in the winner region this will raise national income, and income in region i . However, it is crucial to note that migration will also impose additional *costs* on region i . These costs take the form of congestion costs, given that land and infrastructure are given at any point in time.²⁸ There are also losses to workers due to downward pressure on wages. Of course employers gain, but they are outnumbered by workers. On balance, the net gain could be positive or negative in the winner regions.²⁹ If the net gains were positive we would expect Moscow to embrace immigration from the rest

²⁸Of course there are also benefits to certain owners of assets. We assume for now that the cost of congestion outweighs the gain to rentiers. Otherwise, it would be hard to understand why rich countries limit migration. The gains to international migration dwarf all other known policies.

²⁹It could also be argued, for example, that the benefits take longer to accrue than the costs. This may be especially true in Russia where any capital flow to the winner regions is likely to be very gradual if at all.

of Russia.³⁰ Instead, we see the opposite, which suggests that congestions costs outweigh the benefits of immigration. Our assumption in the remainder is that net congestions costs are positive. Hence, let η_i be the *net* congestion costs in region i .

Now the governor of region i must look at two costs: the additional transfer payment and the congestion cost. Pro-growth is supported by i only if

$$pa_i y_i - \eta_i > b_i. \quad (4.5)$$

Clearly the size of η_i will matter. If there are many loser regions for each winner region congestion costs could be large. Taken to an extreme, if there a single winner region and many loser regions, the real and perceived congestion costs could be enormous.³¹

Whether (4.5) will be satisfied or not is open to question. But even if it is satisfied, and the governor of i is willing to reform despite being forced to pay an additional transfer to region j to reform, the payoff is now much lower. The congestion costs are reducing the payoff to the winner region. There may, however, be an alternative. What if the winner region could figure out a way to prevent the loser region from reforming?

4.4.3 Lights On

Suppose that Moscow can make a side payment to region j that keeps enterprises open in j – keeps "the lights on" – and prevents out-migration. Region i no longer must bear congestion costs. It can reform without having to suffer from region j 's reform.

Let $\gamma y_i = \theta$ be the payment that i needs to make to keep the lights on in region j and prevent out-migration. Then if $\theta > \phi$ region j does not reform.³² In that case the payoff to region i under "lights on" is $p(1 - \gamma)y_i \equiv p\tau y_i$ because in this case there is no taxation (so $a_i = 1$). Clearly for this to be beneficial for region i we need $p\tau y_i > b_i$. For "lights on" to be

³⁰Of course, labor productivity in the US and other leading industrialized countries is so much higher than in India that world income would rise dramatically with a large reallocation of labor to high productivity countries. Citizens of rich countries do not appear to be sufficiently persuaded of these benefits to open their borders. See [9] for estimates of the potential gains.

³¹Recall the quote that opens this chapter.

³²If j does not reform it does not receive the additional transfer, which means that i does not pay the additional tax.

preferable to pro-growth with side payments we also require that:

$$p\tau y_i > pa_i y_i - \eta_i \quad (4.6)$$

or

$$\eta_i > py_i[a_i - \tau]. \quad (4.7)$$

Notice what (4.7) implies. Lights on is preferred to pro-growth even if the tax rate is low, as long as the congestion cost is high.

It is important to note that if (4.7) holds region i reforms while the loser region does not reform, choosing instead to keep the lights on utilizing the payments made by region i . Moscow reforms and pays Perm to keep the lights on and prevent out-migration. Over time, this leads to an even greater divergence in economic performance across these regions. This increases the incentive for migration were Moscow to turn off the lights. Hence, embarking on this path may create a trap where the winner region has to continue to keep the lights on.³³

What we have demonstrated is that under reasonable conditions it makes sense for loser regions to resist reforms if the transfer payments from winner regions are sufficient. The key condition is that congestion costs in the winner region be high enough. Basically, the winner region pays a tax to keep population in the loser regions. As long as economic performance in the winner regions is not dependent on an inflow of labor this condition is likely to hold. The fact that Moscow has utilized a residence permit system to limit in-migration since the early days of economic reform suggests that this condition is likely satisfied.³⁴

4.5 Fictitious Capital

We now add capital to the model. In particular, we examine what happens if in some regions the capital stock has a nominal value greater than its effective

³³There is an extra effect from lights on that we have not analyzed. By encouraging Perm not to reform Moscow not only saves congestion costs, it becomes relatively more attractive for FDI. This happens at the cost of losing some domestic investment that could come from Perm. But it may well be that Moscow values the FDI much greater. And in fact the concentration of FDI in Moscow has been increasing in recent times.

³⁴Moscow's economic success is not predicated on cheap labor. It has utilized migrant labor for construction, but continues to limit in-migration of permanent population. Moscow's economic success has more to do with being the financial and economic capital of the country, and headquarters of the companies that dominate the resource sectors.

productivity. Hence, without subsidies the regional production structure would unravel. We show that there are conditions where the winner regions will prefer to keep the fictitious capital employed in the regions. "Lights on" in this setting involves maintaining the fictitious capital in place.

Imagine that the economy is a chain of n enterprises (indexed by $l = 1, \dots, n$) ala Blanchard-Kremer. Production is sequential, with each enterprise (l) using the output of the preceding enterprise ($l - 1$) as an input into its production. The only difference is that each enterprise is in a different region, so there are n total regions as well. Production is sequential. Region 1 produces a primary resource that is used in production by region 2, which produces an intermediate good used by region 3, etc. At the end of n steps a good is produced that has value normalized to equal 1. Let the alternative value – export value – of the primary resource be c .

In Blanchard-Kremer the value of producing in the chain is greater than the alternative value of the primary resource. One of the problems they analyze is inefficient bargaining.³⁵ In their setup only $(1/2)^n - c$ is left to split due to bargaining at all previous stages. Let us suppose, however, that the value of production in the chain is less than the alternative value of the product. That is, $c > 1$. Then it is best to shut down production in the $n - 1$ regions, and finance consumption out of exports alone. Export of the primary product is more efficient. Less is wasted in the chain. But if the first region defects and exports the primary product all the other regions are devastated. It is quite easy to think of the first region as Tyumen Oblast

³⁵Each unit in the chain must bargain with a supplier and a customer. There is Nash bargaining at each step, so that the surplus is split given the symmetry of the situation. The value of the surplus in the last stage (bargaining between the final producer and the last intermediate producer) is 1. This follows because the value of the good at stage n is still zero. So the last intermediate producer gets one-half of the surplus, $1/2$. Now what happens at the prior stage? The surplus here is $1/2$, so the next-to-last intermediate producer and the last producer each get $1/4$. Continue in this fashion and it follows that the first intermediate producer gets $(1/2)^n$. The surplus available to split at the first stage is $(1/2)^n - c$, since the first producer must purchase the primary input to produce. Clearly then we must have $c < (1/2)^n$ in order for there to be positive surplus to split. If $c > (1/2)^n$, then the primary producer will prefer to sell to someone else. Notice that c does not need to be all that large to trigger defection. Suppose the primary producer defects. The magnitude of the fall in output? Notice that it could be as large as $1 - (\frac{1}{2})^n$. Thus rather meager private opportunities can cause a rather large fall in output. We can interpret n as the level of complexity of production. As n increases the likelihood of defection increases exponentially. The problem is inefficient contracting causes an inefficient output fall.

producing oil and all other oblasts as industrial regions that process oil into products, for example.

If the country is a federal region then the majority can force the winner region to compensate. Notice that the efficient policy would be to tax the export and rebate some amount to each citizen in the loser region. This, however, will not be the preferred policy of any Governor if agents are mobile. The reason is that if the enterprises are shut down in the loser regions there is no reason to stay there. Households can take their checks and move away. This is socially efficient – why pay the costs involved in having people live in far-away regions if that is not necessary. But this is disadvantageous for the Governor whose power and prestige is lost.

The Governors will prefer an alternative policy of forcing the winner region to subsidize production by diverting some of the primary resource at below the export price ("keeping the lights on" once again). This adds value to the fictitious capital. And it ties the subsidy to the region rather than to the individual. From the perspective of the Governor this is significantly better. It keeps people in the region, and keeps them important.

The obvious point is that subsidies are more efficient if they are individual-specific rather than region-specific. But politically, in a federal region, the reverse is true.

"Lights on" versus Wage Subsidies

Rather than keep the lights on one could just pay a wage supplement to prevent migration. But that is likely to be costlier than lights on. In Germany the FRG effectively paid such a supplement to keep the East Germans from moving. In [[1, 46]] respondents point out that what makes them move is not wage differentials but absence of a job. "Wage differentials will not induce them to move, but lack of work for a sufficiently long period will drive them to it." This is a form of "lights on" policy. So the cost to Muscovites in terms of subsidies to prevent moving is just the cost of keeping the lights on in the home factories. Hence, lights on may be cheaper for Moscow than wage supplements.

Another advantage of lights on over wage supplements is that the former does not require that a major problem slowing migration: liquidity constraints be removed.. Andrienko and Guriev [[2]] study migration across Russia's regions and find that liquidity constraints are a major hurdle to migration. Indeed, they find that for the poorest regions – our "loser" regions

– an increase in income raises rather than reduces outmigration. Hence, for a winner region intent on preventing in-migration, lights-on is bound to be preferred to wage subsidies..

Summary

The problem with loser regions is that they impose a negative externality on winner regions. So regions likely to win from reform would still prefer to pay loser regions not to. For example, Moscow is better off with Perm not reforming even as Moscow does.

This may sound unrealistic. But Moscow has *propiska* and winner regions subsidize activity in loser regions all the time. So we observe that people stay in Perm, even though income differences are huge, reform does take place in Moscow, and dinosaurs stay open in Perm. Perm governors are happy and Moscow governors are happy.

4.6 Historical Digression

The preceding analysis has shown that with "lights on" the governors of both winner and loser regions may be happy. But this equilibrium is inefficient. Moreover, one might expect that this unhappy status quo could unravel as people vote with their feet. One of the key advantages of federalism is, in fact, the competitive discipline on regional policies imposed by mobility of the factors of production. This mechanism is often forgotten in the literature on market-preserving federalism because of the emphasis on center-region relations. But once we consider regional differences this is in fact paramount.

Essential to the "lights on" equilibrium are restrictions on mobility that prevents it from unraveling. It is important to understand that restrictions to mobility is not a new problem in Russia. Indeed, it has been a crucial element of Russian economic development for something like 500 years. It is useful to recall Domar's (1970's) analysis of the rise of serfdom in Russia, which begins with a summary of Kliuchevsky that goes something like this [pp. 18-19]:

1. From about mid-1400s, Russia fights wars that eventually require a military too big to support by taxes.

2. Government solves problems by assigning land to servitors in exchange for service.
3. But system breaks down after mid-1500s when peasants start to migrate to newly conquered areas in east and southeast.
4. Under pressure from serving class, government steadily restricts peasants' freedom, resulting in serfdom by mid-1600s.

"The economist would recast Kliuchevsky's account as follows: The servitors tried to live off rents (in one form or another) to be collected from their estates. But the estates could not yield a significant amount of rent for the simple reason that land in Russia was not sufficiently scarce relative to labor, and ironically, was made even less scarce by Russian conquests. The scarce factor of production was not land but labor. Hence it was the ownership of peasants and not of land that could yield a income to the servitors or to any non-working landowning class." [p. 19]

The two essential ingredients for the development of serfdom are: (1) "a high land/labor ratio" and (2) "the government's determination to create a large class of servitors."

Taking this analysis to the current problem of Russia, our story, then, is that the governors and enterprise directors of low-productivity (cold and remote) regions are the "servitors" of today, their physical capital (manufacturing assets) in those locations is the "land" they received from the state, the workers in those manufacturing plants are the "peasants," and the opportunity to move back west to Moscow and so on is the analogue to the opening up of new and fertile land in the Volga valley in the mid-1500s.

Therefore, a strict analogue would be:

The peasants [workers] migrate eastward [westward], leaving the servitors' [governors'] land [factories] with a shortage of labor. Under pressure by the servitors [governors], the government restricts the peasants' [workers'] mobility, resulting in serfdom.

But can we really consider loser regions to have high capital-labor ratios? The key point here is to distinguish actual capital and fictitious (virtual) capi-

tal.³⁶ In loser regions there are enterprises that appear to be capital-intensive (the τ -effect once again). They actually are lossmaking, but subsidies and transfers allow them to keep producing. In a virtual sense they have high capital-labor ratios. But if labor left the regions this would destroy the pretense that these enterprises are productive, and the pretense that the capital has value.³⁷ Hence, to maintain the pretense the governors need the labor to stay put.

But the important parallel is the one between Domar's two essential conditions then and the ones today. The combination of (1) the high manufacturing capital/labor ratio and (2) the government's commitment to preserve the status of the governors and local capital-owners are leading to a new serfdom.³⁸

Discussion

Because the Soviet system scattered industry across regions lots of fictitious capital remains in regions that happen to be the median voter – the cold distant regions. This is important because it affects decisions about the pace of reform made in the center. It would be much less of a problem if these regions were just poor; in that case income transfers would be a sufficient policy response. If the region were poor and of little political weight policy could provide transfers that also support mobility.

Problems occur when regions are less transparently poor. It is the presence of fictitious capital which provides the alternative method of subsidy. If regions have fictitious capital specific types of subsidies – such as low energy and transport costs – can be used to make the assets appear to have value. This, of course, ends up wasting more resources. But it is far superior for the political prospects of local officials. These subsidies make regions appear to be viable, or at least less disadvantaged than they actually are. And these subsidies necessarily involve addiction so that they represent claims to fu-

³⁶There is an important contrast between real capital and fictitious capital. The former requires a compensating differential to locate in the east. Existing capital may be sunk but new investment would follow labor to warmer regions. Indeed, if labor migrated and the capital-labor ratio led to a rise in the real wage this would make it more difficult to earn rents in the east, further inhibiting new investment in the east. But fictitious capital is sunk.

³⁷The reason is that subsidies can only be attracted if there is labor – population – in the regions.

³⁸See [[7]] for an analysis of Russia's industrial feudalism.

ture resources. The optimal policy involves subsidies that dissipate and then disappear over time. This is clearly not the case for addiction.

4.6.1 Federalism versus Efficiency

Our argument suggests that there is in Russia a conflict between two key goals of reform: democratic federalism and economic efficiency. The reason is that Soviet federal regions did not evolve as a result of economic activity. Rather they are the result of administrative efforts at occupation and control (by the Russian Empire), and Soviet efforts to invest independent of cost considerations. The Soviets achieved a balance of economic activity across regions through its peculiar pricing system and subsidies (though hidden by the circus mirror).

But why did an arbitrary system of investment and location decisions lead to *systematic* inefficiency in regional borders? One might suppose that if decisions were arbitrary regions would be inefficient in their own ways but not in any systematic way. This ignores, however, that Soviet location decisions (and Tsarist administrative policies) ignored the economic implications of size and cold. And size and cold are not randomly, but systematically distributed across the Soviet landscape. This creates a systematic regional bias in terms of economic efficiency. The relative economic advantages of regions are not randomly distributed across the federation. They are almost perfectly correlated with cold and distance.³⁹

When liberalization took place in Russia the systematically-biased nature of political boundaries becomes critical. During Soviet times regions were not economic units that had to cover their costs – they were administrative units supporting centralized decisionmaking. With market federalist reform, however, the situation is drastically changed. Regions must cover their costs net of fiscal transfers. To offset this governors seek subsidies to support their regions. Because each unit has an equal vote, and because regions are heavily skewed towards inefficiency the median region votes for pretense and subsidies.

One important feature of federalism is its role as a diversification and insurance mechanism. There should be gains from trade across regions that are subject to idiosyncratic shocks. When regions experience adverse shocks income and tax payments to the center fall. Other regions that did not

³⁹The exception being especially resource rich regions such as Tyumen or Yakutia.

experience adverse conditions can pick up the slack. But this insurance mechanism cannot work if shocks are systematic. Federalist insurance can arise from a veil of ignorance. Regions can expect to not be net contributors or net beneficiaries. But this will not work if there are clear winner and loser regions. Then subsidization replaces insurance. Insurance does not work if the risks are systematic and predictable federalism will break down, or you get chronic fiscal transfers that contradict reform.

We see this effect in the United States where the equal numbers of senators results in perpetual agricultural subsidies. These would not survive if states voted according to population or if state boundaries were re-drawn to account for changes in relative economic importance.⁴⁰ Notice, however, that US states did not form for arbitrary reasons. At one time they reflected comparative advantage.⁴¹ So the inefficiencies are not *systematic*. The problem in Russia is that they are, and that the median governor is very far from the reform end of the spectrum.

Because the Soviet system equalized industry across regions you have lots of fictitious capital in the regions which are the median voter – the cold distant regions. And plenty of labor is associated with that fictitious capital to act as hostages to continue addiction.

4.7 Conclusion

During the 1990's the inefficiency of federalism in Russia was paramount. With locally elected Governors the owners of fictitious capital provided natural allies in the effort to attract rents. One of Putin's first policies upon coming to power was to reduce the authority of Governors, primarily by eliminating direct elections. But even centrally appointed governors tend to be captured by the interests in their own regions.

Because of Russia's Soviet-era territorial legacy, it is not enough for allocation of assets to be made on the basis of market-economy logic alone. It also has to be made from a national point of view. That is, the owners of assets have to be able to consider, without prejudice, the costs and benefits

⁴⁰Imagine the US when all dying industries just happened to be in the Dakotas, Kansas, and other plain states. If the rust belt was not in the northeast, but in the less populated plains states.

⁴¹When the Constitution was adopted agriculture was still the dominant industry in America.

of location as well as all other aspects of potential profitability. Financial oligarchs who were truly national oligarchs – freed of territorial ties—would be able to do that. They would chose to invest in Western locations. The irony is that the oligarchs are the one positive force in terms of viewing the economy in national terms, but the concentration of power has negative impacts in terms of democracy.⁴²

⁴²But when the oligarchs' financial capital is married with regional relational capital, the result is doubly destructive.

Bibliography

- [1] Akerlof, George, Andrew Rose, and Janet Yellen, "East Germany in from the Cold: The Economic Aftermath of Currency Union", *Understanding Brookings Papers on Economic Activity* 1:1990, pp. 1-105.
- [2] Andrienko, Yuri, and Sergei Guriev, "Determinants of Interregional Mobility in Russia: Evidence from Panel Data," *Economics of Transition*, Volume 12 (1) 2004: 1-27.
- [3] Andrienko, Yuri, and Sergei Guriev, "Understanding Migration in Russia," NES/CEFIR Working Paper, 23, November 2005.
- [4] Blanchard, Olivier, and Michael Kremer, "Disorganization," *Quarterly Journal of Economics*,
- [5] Blanchard, Olivier, and Andrei Shleifer, "Federalism With and Without Political Centralization. China versus Russia," *IMF Staff Papers*, Volume 48, Special Issue, December 2001.
- [6] Domar, Evsey, "The Causes of Slavery and Serfdom: A Hypothesis," *Journal of Economic History*, 30, 1, March 1970: 18-32.
- [7] Ericson, Richard E., "The Russian Economy: Market in Form but Feudal in Content," in Michael Cuddy and Ruvim Gekker, ed., *Institutional Change in Transition Economies* (London, UK: Ashgate, 2002), pp. 3-34.
- [8] Ickes, Barry W. and Gur Ofer, "The Political Economy of Structural Change in Russia," *European Journal of Political Economy*, vol., 22, issue 2, June 2006: 409-434.
- [9] Klein, Paul and Gustavo Ventura, "TFP Differences and the Effects of Factor Mobility," Working Paper, Penn State University, July 2004.

- [10] Mikhailova, Tatiana, " *Essays on Russian Economic Geography: Measuring Spatial Inefficiency*, Ph.D. Dissertation, The Pennsylvania State University, 2004.
- [11] Narayan, R. Badri, *An Examination of Intergovernmental Transfers in the Russian Federation*, Ph.D. Dissertation, The Pennsylvania State University, 1999.
- [12] Pritchett, Lant, "Boom Towns and Ghost Countries: Geography, Agglomeration, and Population Mobility," Center for Global Development, Working Paper 36, February 2004.
- [13] Qian, Yingyi, and Barry R. Weingast, "Federalism as a Commitment to Preserving Market Incentives," *Journal of Economic Perspectives*, 11, 4, Fall 1997: 83-92.
- [14] Smith, Adam, *An Inquiry into the Nature and Causes of the Wealth of Nations*, New York, Modern Library, 1937.
- [15] Zhuravskaya, E., , "Incentives to Provide Local Public Goods: Fiscal Federalism, Russian Style," *Journal of Public Economics*, Vol. 76, No. 3, 2000: 337–68.

Chapter 5

Human Capital

5.1 Introduction

There are some parallels between Russia's physical capital and its human capital. There are similar pitfalls, bear traps. Measured simply by numbers of people and years of education, Russia has a very large human capital stock. The question is what is happening to the quantity, and more importantly, the quality of that stock.

Russia's population is shrinking. On average, 840,000 more Russians have died than were born each year since 1993. The country is now on track for a population of 130 million by 2030 and 110 million by 2050. This decline in population has alarmed the country's leaders. Of particular immediate concern is the declining number of draft-age males. Within five years, the number of 18 year-olds will be only half what it was five years ago. But more generally, both the political leaders and many citizens are convinced that Russia's shrinking population is a threat to the country's economic development.

Here's the bear trap: this focus on numbers does not address — and can even undermine — the true concern, which is the quality of Russia's human capital. A proper human capital approach looks at not only the numbers of the population but their quality. That quality includes skills acquired through schooling and on-the-job experience and the state of health of the worker. An under-appreciated element of the quality of human capital is its geographical location. Even more than physical capital, human capital can be disadvantaged by climate and remoteness. More fundamentally, human

capital needs to be seen in terms of the appropriateness of its match with the other factor of production, physical capital.

Issues such as population health, age structure, education, living standards, and even location are therefore the subjects of an investigation into human capital.

We will refer also to demography. Human capital and demography are closely related and partially overlapping concepts. Demography is about how many people there are, their ages, and how healthy they are. The size of the population is determined by three factors: how many people are born, how many die, and how many people (net) move into the country from outside. The age structure is important because it allows one to forecast the size of the future labor force as well as how many other people (the ones too young or too old to work) that those productive members will have to support. The ratio of productive component to nonproductive is the dependency ratio.

There are some main stylized facts about Russia's demographic and human capital situation:

1. Russia's population is shrinking, more and for a longer time than almost any other country's today.
2. Russia's working age population in particular is collapsing. The number of young and old people each productive worker will have to support (the "dependency ratio") is going to rise sharply.
3. Birth rates are down. Russia shares this trend with other countries.
4. Death rates are up. This the most anomalous trend of all. Not only are they much higher than those of the rest of the world, but they have grown worse in Russia over recent decades.
5. The overall health of the population in all age groups is poor. This is of course connected to mortality.
6. The stock of skills is in question. The education system appears to be performing poorly, despite high levels of education per worker.
7. The phenomenon of "de-urbanization" is reported.

We will organize our discussion of Russia's human capital around these stylized facts of (1) population size; (2) age structure; (3) fertility; (4) mortality; (5) health; (6) education; and (7) location. For each of these elements of



Figure 5.1: Russia's Population, 1897-2010

human capital, we will illustrate the situation, mention the proposed causes of the trend (discuss the extent to which the causes of the trend can be identified), discuss the consequences, and ask if remedies can be suggested. Causes, consequences, and remedies are of course connected. We are interested in knowing whether there are specific identifiable causes and consequences of a trend. But we are also concerned with whether it reflects something more fundamental that exists independent of the demographic phenomenon we are examining. In other words, is it a symptom rather than a factor in itself. As in the previous chapters on physical capital, our goal is to find if there are margins of investment in human capital which offer promise of raising Russia's economic growth in the future.¹

5.2 Population Size

Russia's population has been shrinking without interruption since 1993. Few other countries have lost as much of their population in recent years as Russia. Between 1995 and 2009 Russia lost a larger share of its population than all but five other countries in the world.

¹The most comprehensive summary of Russia's current demographic condition is Eberstadt (2010). Our descriptive statistics in the following are based on many of the same and similar sources as Eberstadt. Our interpretations of the causes and consequences of the phenomena and trends often differ from his, however.

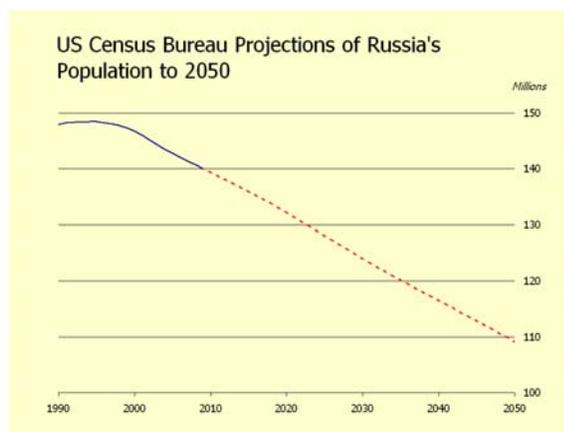


Figure 5.2: US Census Projections of Russia's Population to 2050

Closer inspection, however, suggests that the problem of population loss may not be so much a problem of Russia's policies during this period but one of its Communist legacy. Of the 19 countries of the world that lost any population at all in these years, 18 were former Communist countries of Eastern and Central Europe.² Not all the successor states of the USSR lost population. The Muslim countries of Central Asia grew. But here, too, the Communist legacy seems important, since even though they are growing, Muslim former Soviet countries have population growth rates that are considerably lower than Muslim countries without a Communist past.

Compared to the other non-Muslim republics of the former USSR, Russia did not fare so poorly. Combined, those other non-Muslim former Soviet republics (Armenia, Belarus, Estonia, Georgia, Latvia, Lithuania, Moldova, and Ukraine) had a population loss rate that was 56 percent higher than Russia's.³

Not only has Russia lost population for 17 years in a row, but it is projected to continue along that negative growth path for decades to come. The US Census Bureau presents a particularly dire picture, forecasting a steady drop to below 110 million by 2050. (See figure 5.2) The Russian State Committee on Statistics (ROSSTAT) is not as pessimistic. They offer three

²The sole exception was Lesotho, which lost only 0.2%.

³The world leader in population loss, incidentally, was NATO and EU member Bulgaria, which shrank more than twice as fast as Russia.

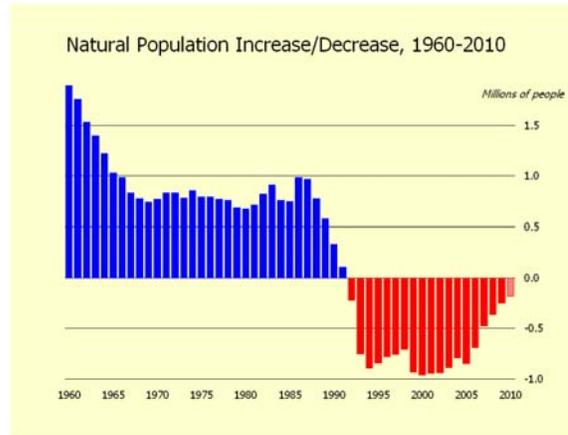


Figure 5.3: Natural Population Increase/Decrease, 1960-2010

scenarios — high, low, and middle — and their forecasts only extend to 2030. But even the lowest scenario is higher than the US forecast for 2030. The high scenario is some 20 percent higher.

Russia has actually seen a net increase in migration into the country over the period when its overall population shrank. In other words, its population dynamics are driven mainly by its fertility and mortality trends: birth rates exceed death rates. The net result of births and deaths is referred to as the “natural” increase or decrease of the population. Within a brief period of a few years before and after 1990 that net figure shifted from plus one million a year to negative one million a year, as is evident in figure 5.3.

Russia’s negative population growth has alarmed its leaders, its citizens, and many observers in the West. It is perhaps the major component of the proclaimed demographic “crisis” in Russia. Surely, something strange is happening in Russia. This sustained population decrease is indeed anomalous. And we will describe other demographic trends that are even more unusual, sometimes bewilderingly so. But our concern is economics. And no matter how unusual a phenomenon is, we still need to ask, “so what?” How does it matter for economic growth? In the context of this report, to deserve the label of “crisis” the trend in question must be shown to have strong negative consequences for Russia’s future economic development.

Is that the case for negative population growth? Why should the Russians or anyone else, care about population size per se? Prestige might be

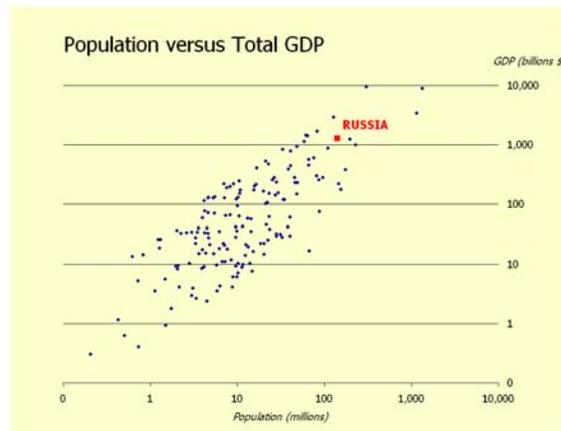


Figure 5.4: Population and GDP Across Countries

a reason. Russians — both the leadership and many of its citizens — are concerned about Russia’s status as a “Great Power.” For them there is no question that a necessary attribute of Greatness is Bigness. At the time of its disappearance, the Soviet Union was the third most populous country in the world, considerably bigger than the United States. Russia today is in eighth place, and for the prestige-minded the prospect of slipping further down in the ranks is bitter. Of course, population size is but one dimension of “bigness.” Territory is another. Russia is the largest country in the world by territory. But what about economic size? There is a rather obvious positive correlation between population size and total wealth: big countries are big economically; and Russia fits in precisely where one would expect. Russia is the eighth largest country in the world by both population and total wealth (see figure.5.4).

Is there a relationship between population growth and measures of economic performance, e.g., growth in per capita GDP? Is a growing population a boon or bane for efforts to improve per capita GDP? A simple scatter plot (figure 5.5) of these two indices measured over the period of 1970-2008 shows that there is a correlation, but that it is negative: the slower the country’s population growth, the faster its per capita GDP growth. This follows of course from the neoclassical growth model, where the steady state capital-labor ratio and the level of per-capita income are inversely related to the

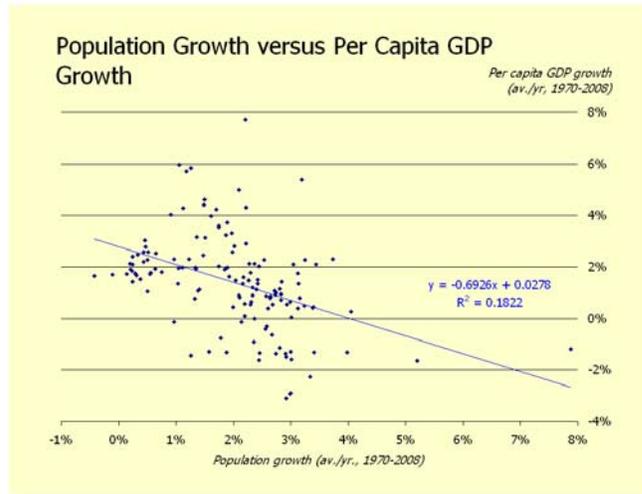


Figure 5.5: Population Growth versus Per Capita GDP Growth

population growth rate.⁴

The bottom line is that while concerns about population size and population growth may be important for the exponents of Great Power thinking in Russia today, there is no reason to think that the country needs to have a growing population if its main goal is economic welfare. In fact, efforts targeted to promote population growth in itself may be at odds with the goal of increasing individual wealth and welfare.

5.2.1 Age Structure

There are several concerns about the age structure of Russia's population that are worth consideration. One is that Russia's working age population is expected to shrink at an even faster rate than the overall population (see figure 5.6).⁵ Another age-structure concern is the cohort of women of child-bearing age. The number of babies born in the future depends on the number

⁴And it is also apparent in the growth regressions we report in chapter 2. In the Levine-Renelt equation and in our own variation the coefficient on population growth was negative.

⁵Note that the definition of "working age" can and does vary. We will discuss this later. Here we use a range of 20-64 years for both men and women, in contrast to the Russian legislated definition of 16-59 for men and 16-54 for women.

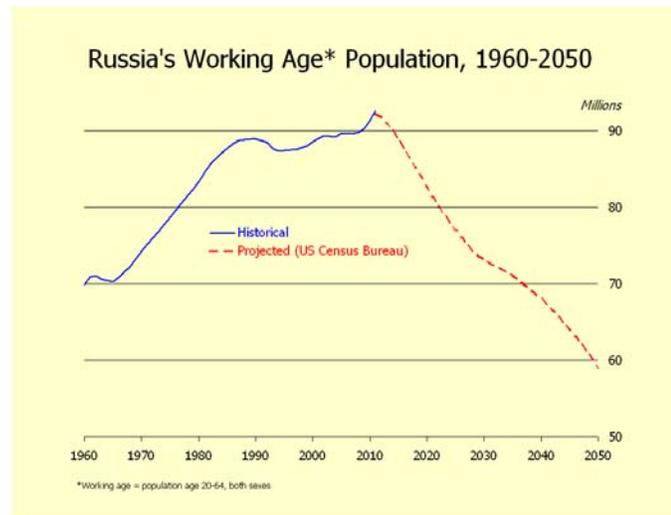


Figure 5.6: Russia's Working Age Population

of women capable of giving birth as well as the number each one is likely to bear (fertility rate). If the forecasts of Russia's population made by the US Census Bureau are borne out, it is apparent why it is likely that births will decline. Those forecasts show the cohort of women aged 16-39 decreasing by over one-third by 2030.

A third specific widely discussed age-structure concern is the number of 18 year old males, since these represent the pool of draft-age men. Five years ago Russia had more 18-year olds than ever before in its history. But with the next ten years that number may drop to the lowest in 100 years. Adding to the issue is the ethnic composition of the draft pool (a growing share of Muslims). This prospect has produced near-panic among military establishment. They propose increasing the pool of draft-eligible men by extending the age of selection for service to 30, and so on. The effects of such a measure on the civilian economy would be huge. The unavoidable reality of a very much reduced pool of men is more likely to lead to more radical reform. The military doctrine already has abandoned the idea of a mass "mobilization army."

All this said, the most important aspect of age structure of the population is the ratio of productive members of the population (those active in the labor

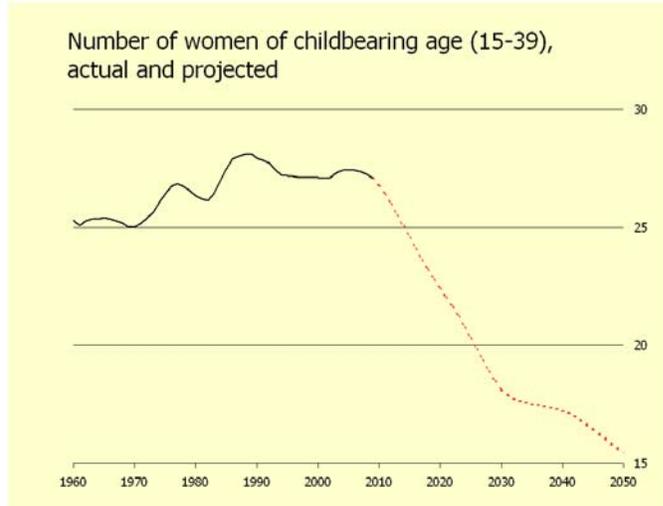


Figure 5.7: Number of Women of Childbearing Age (15-39), actual and projected

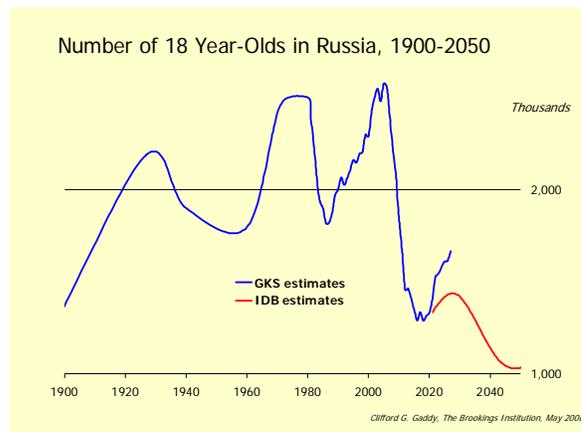


Figure 5.8: Number of 18 Year-Olds in Russia, 1900-2050

force) to others not in the labor force. This is the dependency ratio.⁶ When the dependency ratio is low economies experience a "demographic dividend," as savings per-capita will be higher. When the dependency ratio rises growth prospects deteriorate since the same pool of workers must support a larger pool of young and old.

Since working age differs, the definitions of "young" and "old" necessarily also differ. But if we define the working age segment of the population as all men and women between the ages of 20 and 64, the picture of past, present and future dependency ratios for Russia is given in figure 5.9.

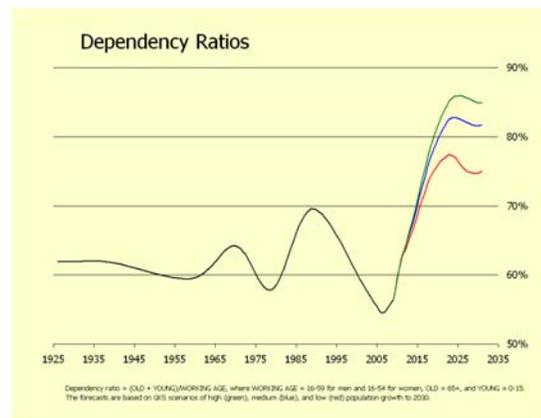


Figure 5.9: Dependency Ratios

It is clear that the dependency ratio in Russia is increasing from the relatively favorable ratios of the mid 2000's period. By this measure the productive part of the population has seen its burden reduced for nearly 20 years or so. But the burden is now about to rise steeply. How does the picture for Russia compare with other countries'? In figure 5.10 we display the dependency ratios of the US, Sweden, Australia, Japan, and Russia. In addition we show the forecast for Russia. This shows that Russia is not going to be entering totally uncharted territory. Japan and others have had dependency ratios that high before. The problem for Russia is that it may

⁶The importance of the dependency ratio for growth prospects of developing countries has been studied by Bloom and Williamson (1997) and Bloom, Canning and Sevilla (2001), who emphasized the role of the demographic dividend in explaining the performance of the Asian Tigers.

be reaching such levels of the dependency ratios as lower levels of per-capita income than other countries.

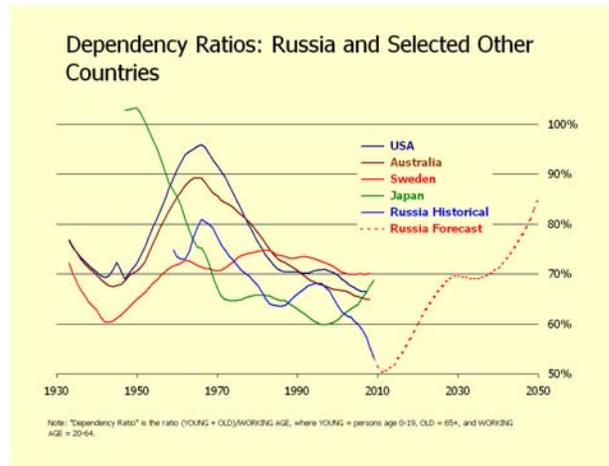


Figure 5.10: The Dependency Ratio in Selected Countries and Forecasts for Russia

It is important to note that there may be a difference in how the dependency ratio is composed. The “burden” part — the numerator of the ratio — is the sum of *young* and *old*. Eberstadt (2009) points out that the old in all societies consume more than the young and that therefore their burden is greater. This trend is likely to become even stronger with improvements in medical care, which focus expenditure on the last years of an extending life span. A breakdown of the aggregate dependency ratio into separate ratios for *young* and *old* might therefore be instructive.

The data in table 5.2 shows that even in the pessimistic scenarios of population dynamics published by the US Census Bureau, it would not be until after 2030 that Russia’s dependency ratios exceed those of other developed countries today. The question for Russia is then whether it can reach per-capita income levels consistent with those dependency ratios by then.

5.2.2 Mortality

This is the most anomalous trend of all. Some of these statistics can only evoke wonder and worry. Figure 5.11 below shows that death rates (deaths

Table 5.1: Composition of Dependency Ratios

	$\frac{Young}{WA}$	$\frac{Old}{WA}$	$\frac{Old+Young}{WA}$
Sweden (2008)	40%	30%	70%
Japan (2009)	31%	38%	69%
USA (2007)	46%	21%	66%
Russia (2009)	33%	20%	53%
Russia (2030)	34%	36%	70%
Russia (2050)	36%	49%	85%

Note: YOUNG = ages 0-19; OLD = 65 and over; WA (workingage) = 20-64.

Historical data from the Human Mortality Database [www.mortality.org]. The figures for Russia for 2030 and 2050 are based on population projections by the US Census Bureau

Table 5.2:

per 1,000 population) rose almost continuously in Russia from the early 1960s until the mid-1990s. Only a few years in the mid-1980s were an exception.⁷ Since 1995 the picture has been mixed. The modest good news is that death rates have declined for the past 5-6 years, although they still remain nearly double what they were a half century ago. It is especially male death rates that alarm. The picture is striking. It is hard to exaggerate how bad male death rates are. Russian males in prime working age — 25 to 55 — are dying at rates 4 to 4.5 times higher than Americans, and 7 to 11 times higher than Swedes. But the biggest discrepancy of all is among the youngest groups, those in their 30s. Russia has a death rate for 30-34 year-old men that is around five times that of the US and a whole order of magnitude higher than Scandinavia, the Netherlands, and Japan. The last time Sweden had a death rate as high as Russia's today for its 30-34 year olds was 1876 (except for the single year of the 1918 epidemic). Russian 26 year old men die at the same rate as Swedish 56 year olds. Equally strange is that the death rates have increased so much over time, and have been increasing since 1960 at the

⁷This break in the trend is generally attributed to Mikhail Gorbachev's anti-alcohol campaign.



Figure 5.11: Death Rates, 1950-2010

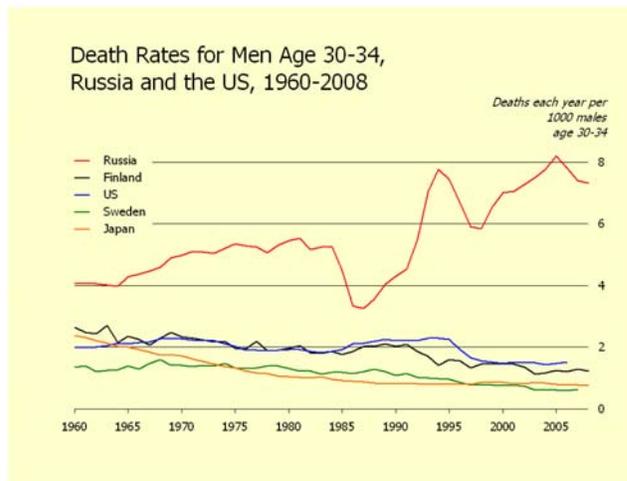


Figure 5.12: Death Rates for Men Age 30-34, Russia and the US, 1960-2008

latest. Figure 5.13 shows that the deterioration of mortality among Russian males has been highest in the prime working ages of 35-50. The reasons for

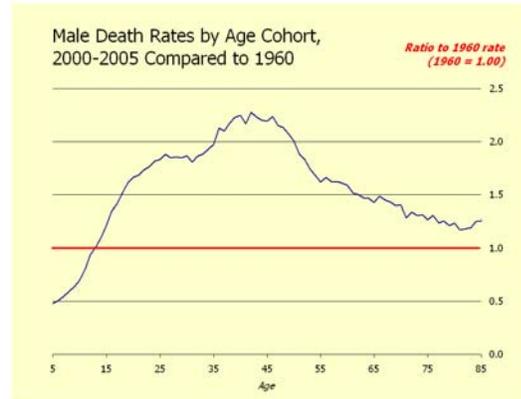


Figure 5.13: Male Death Rates by Age Cohort, 2000-2005 Compared to 1960

the high mortality are surely complicated.⁸ Life-style choices play a key role. All too many Russian men are drinking themselves to death.⁹ Smoking is another factor, shown in a recent study to be comparable in effect to drinking.¹⁰

Whatever the causes, the deaths of so many men in these ages represents a significant loss of Russia's potential labor force. One way to gauge how big the loss is, would be to take a country such as Sweden as a benchmark. We follow the current Russian definition of working age — 16-59 for men and 16-54 for women — and calculate how many potential working years

⁸See Denisova (2009) for a recent independent analysis and discussion of other studies, Russian and Western.

⁹Exactly what is causing the heavy drinking itself, however, is not clear. On the one hand, the real (inflation-adjusted) price of vodka today is roughly one-tenth of what it was in 1988 under Gorbachev. Some of that relative cheapening of alcohol occurred immediately after abandonment of Gorbachev's anti-alcohol campaign. But much of it happened since 2000. Add to that the rise in workers' wages in the past few years and we have the following fact: in 1999, the average industrial worker could buy 28 liters of vodka for his monthly wage. Today, he can buy 78 bottles. This would suggest that incomes and relative prices have played a role in rising rates of alcohol consumption and (therefore) rising death rates. But in her micro-analysis Denisova (2009) finds that the relative price of alcohol is a statistically insignificant factor in mortality.

¹⁰Denisova (2009).

are lost in aggregate due to excess deaths (the excess of Russia's age-specific death rates for males and females over Sweden's). We include the other so-called BRIC countries (Brazil, India, and China) for further reference. As figure 5.14 shows, Russia is losing some 18 percent of working years for men compared to less than three percent for Sweden. This is quite a dramatic difference.

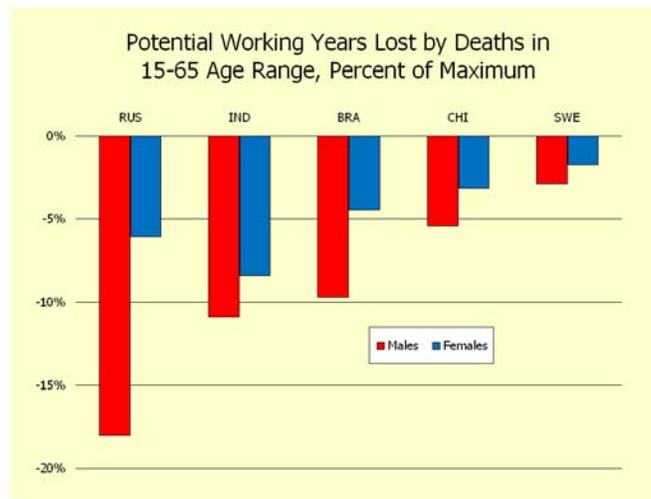


Figure 5.14: Potential Working Years Lost by Deaths in 15-65 Age Range, Percent of Maximum

If measures could be taken to reduce the gap in excess deaths among working age men and women, that would, of course, expand the pool of productive workers. It could help compensate for the declining size of birth cohorts in the future. If nothing else were changed, it would also mean that the dependency ratios would improve (be reduced). However, this does not take into consideration the fact that an improvement in survival rates among those of working age will likely also be accompanied by an improvement for older ages as well. Therefore the ratio of OLD/WA might not improve at all. That would imply that moving to a “Swedish” survival pattern would not improve (reduce) that part of the dependency ratio. Recall from the Table above that Russia's ratio of OLD/WA today is 0.20; Sweden's is 0.30.

If, then, improved survival does not lead to lower dependency ratios, it is clear that the only way to raise per capita wealth for the entire population

is to make each working age person more productive. This brings us back to the economic growth exercise. In particular, we must move beyond mere numbers of workers to consider the other attributes of human capital, those that reflect quality: health, education, and location. These are considered in the next three sections.

5.3 Health

The evidence for the effects of health on economic growth is decidedly mixed. The main arguments for including measures of health in measures of human capital are summed up in the introductory section of a recent volume entitled *Health and Economic Growth*:

“Good health raises levels of human capital, and this has a positive effect on individual productivity and on economic growth rates. Better health increases workforce productivity by reducing incapacity, debility, and the number of days lost to sick leave, and increases the opportunities an individual has of obtaining better paid work. Further, good health helps to forge improved levels of education by increasing levels of schooling and scholastic performance.”¹¹

Morbidity (illness), of course, is closely connected to and correlated with mortality. Indeed, empirical work on health frequently uses measures of mortality — life expectancies, survival rates, death rates — as proxies for health because the data is more readily accessible. Strictly speaking, the concepts are different and at least in theory they might have different implications for economic analysis. The death of an individual will reduce the actual or potential stock of human capital (if the person is of working age or younger). If that person were instead to fall victim to a permanently debilitating illness but survive, there would be the same loss of human capital but in addition there would be an extra burden as the person also now joins the ranks of the nonproductive. In that sense morbidity can be worse than mortality.¹²

¹¹Lopez-Casanovas et al., 2005.

¹²This could be another example of the τ -effect. Suppose that Russia has significantly higher morbidity than other countries. Since Russian has high educational attainment it accumulates significant human capital. But if morbidity is high much of this human capital cannot be used. So measured human capital is higher than actual, effective, human capital.

The sticking point is that while better health might lead to greater productivity on the part of the individual worker (following the apparently obvious line of argument presented in the quote above), the overall societal effect can be different. For one thing, better health usually means better survival rates for the dependent part of the population. Therefore, the greater wealth produced by the individually more productive worker has to be shared among more dependents. There is also a so-called capital dilution argument: as more workers survive, a given stock of physical capital is shared among more workers.

Research on the contribution of good health to economic growth in the 1990s and early 2000s seemed to show that health has a strong positive impact on economic growth, at least for developing countries (and over the long period of Western economic development). At the macro level there is no question of a correlation between health and wealth. The issue is the causality. Does health promote wealth, or does wealth lead to better health? Or are both the result of unmeasured third factors? A number of more recent studies argue that improved health leads to little, no, or even negative results for economic growth.¹³

The data for this research was drawn primarily from developing countries. The reason for this is that the variation in both health outcomes and growth performance is higher amongst these countries, so the effects should be easier to tease out in this setting.¹⁴ Bhargava et al. (2001) used a cross-section of poor and rich countries. They found a positive effect of increased adult survival rates (ASRs) on GDP growth rates. But the effect was small, even for the poorest countries: a 1 percentage point increase in ASR was associated with a 0.014 percentage point increase in the growth rate. (In other words, increasing the ASR from, say, 40 percent to 60 percent — a very substantial improvement — would result in an extra 0.25 percent of annual growth.) More important for our analysis, Bhargava et al. concluded that the positive effects of ASR on economic growth rates disappeared entirely for richer countries. For countries at Russia's current level of per capita GDP, the net effect of raising the survival ratio was negative.

Perhaps a more serious problem for analyzing Russia in this context of wealth versus health is that Russia already enjoys a level of wealth (per

¹³See Acemoglu and Johnson (2007), Ashraf, Lester, and Weil (2008), and Weil (2007).

¹⁴This is important because research shows how hard it is to find a statistically significant effect.

capita GDP) that would seem to be thoroughly unwarranted given the poor health of the population. A scatter plot of adult survival ratios (ASR) versus per capita GDP (figure.5.15) illustrates the point. Russia appears to be a huge outlier. One way to view Russia's position in figure 5.15 is that given

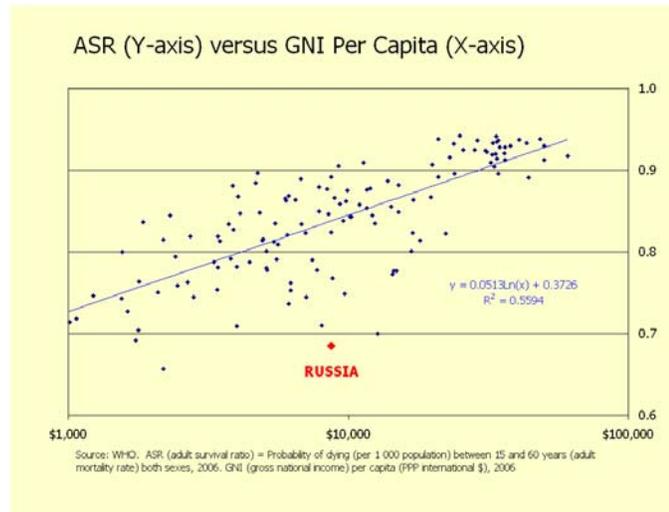


Figure 5.15: Adult Survival Rate versus GDP per-capita

Russia's GDP it should have a much higher ASR. The most likely reason is that Russia's resource wealth has given it a per-capita income much greater than its social capital would suggest. This suggests that the impact on GDP per-capita would be small from improving Russia's health. It is not at all clear that per capita incomes would rise very much.

At the micro level it is apparent that one of the channels through which better health and survival ratios exert a positive impact on wealth is by inducing individuals to invest more in their education. This is why many analysts presume that better health will lead to faster growth. The fact that this effect does not appear in the macro data is surprising, but robust. Moreover, as we will see below, Russians already invest in education at a very high rate. The problem for Russia is not the measured quantity of education, but rather its quality. That is not something likely to be affected by improvements in health.

In sum, health investment is properly treated not as investment at all but as consumption. As virtually everyone would agree, "Good health is a

crucial component of overall well-being.”¹⁵ But that is it. As counterintuitive as it may seem, there is no evidence that Russia’s growth prospects are impaired by its abysmal health performance. Hence, we conclude that improving health is not a silver bullet for ensuring Russia’s future economic growth. While it almost certainly can be justified to spend money to improve citizens’ health for welfare or humanitarian reasons, it would be a mistake to assume that this is an investment that will “pay for itself” by contributing to more economic growth. Russia could spend great amounts on preventive and curative health care, enlightenment, and so on, and succeed in reducing deaths, and yet find that economic performance fails to improve at all because the factors that led to high mortality in the absence of the remedies are still there, and it is those factors, not the mortality per se, that was causing bad performance.

5.4 Education

As in the case of physical capital investment, human capital investment is assumed to be appropriate to what the market demands. We do not worry that measuring the stock of human capital by accumulated investments will lead to systematic errors. This is because in normal economies, we do not worry that a country will accumulate “the wrong education” on a systematic scale. But in the Russian case, this is an important consideration, since the Soviet economy demanded a different kind of education stock, one appropriate for a planned economy. Moreover, even if this inherited stock was overvalued, is this disappearing as a problem? This will be true only to the extent that the post-Soviet education system is properly suited to the market. As we shall explain, the forces that preserve legacies in relation to physical capital, operate in a similar, if not stronger, manner with regard to human capital. Hence, education investments currently being made are still being overvalued.

Education has traditionally been the main measure of the quality of human capital. Human capital is a stock of “skills.” Those skills are typically measured by years of education. This is primarily the result of a lack of alternative data, and for most countries this does not introduce serious biases. But in Russia this is problematic. The education component of Russia’s hu-

¹⁵Lopez-Casnovas et al. (2005), p. 3.

man capital is mismeasured. If the quality and appropriateness of education are not matched to the needs the quantity is overestimated.

There is much we do not know about the quality of Russian education. Eberstadt (2010) cites statistics on Russian youths' poor performance in subjects compared to other countries (the so-called PISA study). But these are averages for the entire population. We know that there is great inequality in so many other indicators, from health, life expectancy, income. It is likely that this carries over to educational quality. Perhaps extraordinarily high levels for some substantial part of the population are being pulled down by very low levels among others. The issue for productivity is then whether having a population that is moderately well-educated across the board is better than having one that is generally less well educated but with a pool of superstars. To put it differently, which is better for growth: having a critical mass of Sergey Brins or just a general average level of education? Growth theory has not, as of yet, dealt with the distribution of human capital. And there does not appear to be any empirical studies that answer that question either.

There may be other considerations – equity is one – for desiring broad-based educational improvement. These may lead to increased welfare, and to the sustainability of democracy. But there is little evidence that these factors affect a country's long-term growth potential, despite what may seem to be an intuitive connection.

In general, however, one could conclude that for an economy with a tightening supply of labor (the “shrinking” potential labor force) as Russia appears to becoming, education programs that maximize ability to adapt, to change occupational track, may be more important than absolute levels of education that is suited only to specific technologies. Indeed, if having a higher level of specialized education makes an individual less likely to “re-tool” oneself for a new occupation, it may be the case that more education is worse, not better.

The argument here is consistent with addiction. The dinosaur factory inherited from the Soviet Union commands rents precisely because it represents so much sunk investment. This is investment not only in physical capital – the machines, buildings, and so on – but also in human capital, including education. In fact, the argument for allotting more rents to the Soviet-era dinosaur factories is strengthened by the argument that “the workers cannot move, and they cannot change occupation.” The more that has been spent

to develop the current structure, the greater the claim for future rents.¹⁶

“Appropriateness” is important concept. Human capital enhances productivity if it is complimentary to physical capital. If human capital is inappropriate for what is needed it will not contribute to production. The education might have been the right one for the Soviet system, with its incentives, but not right for a market economy.

Individuals of course can and have indeed chose different tracks as the market economy has developed. For example, there has been a big shift towards business and economics training in Russia. This represents a positive development. But the overall level of education has not improved.

There is a one important difference between mismeasured human capital and mismeasured physical capital. The latter means that less is returned for a given level of sacrifice. It must means that you have actually invested less than you thought, and that more sacrifice is needed to get what you expected to earn. In the case of human capital the problem is different. Here it is not a question of the *level* but of the *type*. With misallocated human capital more is not a solution. Two humanities PhD’s cannot substitute for an accountant.

In the case of human capital what is needed is reform of the educational system to produce the right kinds of human capital – those that are demanded by the market economy. The problem is that the addictive nature of the system makes it hard to reform education.

5.4.1 Location

We examined the general problem of mislocation of factors of production in Chapter 3. The temperature per capita (TPC) index we introduced in that chapter was intended to give us a crude instrument to estimate the extent of mismeasurement (the τ factor) that might be attributed to spatial misallocation of Russia’s capital. The TPC applies to human capital as well as physical capital. (In fact, of course, the TPC is a measure of human population in different regions, because population was used as a proxy for all economic activity.). Thus if we studied Russian economic growth using a human capital augmented production function, say of the form:

$$Y_t = K_t^\alpha H_t^\beta [A_t L_t]^{1-\alpha-\beta} \quad (5.1)$$

¹⁶Addiction and subsidization are thus both related to ignoring the dictum that sunk costs are sunk.

where $\alpha, \beta \in [0, 1]$, $\alpha + \beta \in [0, 1]$, and t denotes time. Here K and H are physical and human capital respectively, and AL is productivity augmented labor. If we measure the contributions to growth with this model, *and if* there is a measurement problem with human capital, then we will attribute inferior results to low productivity. Just as we argued that $\tau < 1$ ought to be applied as a discount factor to K to control for mismeasurement of physical capital, we require a similar factor for human capital. We would have something of the form:

$$Y_t = \tau_K K_t^\alpha \tau_H H_t^\beta [A_t L_t]^{1-\alpha-\beta} \quad (5.2)$$

where $\tau_K, \tau_H \in [0, 1]$ are discount factors to offset the impact of spatial and legacy effects on the measurement of asset stocks in Russia.

Applying the τ -factor argument to human capital, we can say that one of the reasons Russia's human capital is less than it appears to be is because it is located in the wrong place. But the primary problem is that the *stock* of human capital is less effective than its aggregate measure implies.

De-urbanization?

There has been some discussion of the trend that "Russia is becoming de-urbanized."¹⁷ Indeed, by aggregate statistics alone, the trend would appear indisputable. Between 1991 and 2009, Russia's official statistics on the percentage of the population classified as urban show a declining urban share in 42 of the country's 78 regions. In the country as a whole, the urban share declined from 73.8 percent to 73.1 percent.

However, it turns out that the decline in the number reflects changes in the definition of urban versus rural — changes apparently implemented unevenly and inconsistently throughout the country.¹⁸ The statistical decline did not reflect a shift of population out of cities to the countryside.

A more meaningful concept to measure urbanization or deurbanization in the Russian context would be the population dynamics of large cities. If one looks at cities that had a population of over half a million in 1991 (a

¹⁷Eberstadt, pp. 26ff.

¹⁸The case of Sverdlovsk oblast is a good example. Between 2004 and 2005, its urban share allegedly dropped from 88 percent to 83 percent, a fact which, if true, would have involved a sudden mass migration of city dwellers to the countryside. What actually happened was that the regional statistics agency reclassified some 70 "population points" as rural rather than urban. No real population shift took place.

total of 33 in all), that group has on net gained population in absolute terms since then. Admittedly, most of the gain was due to Moscow. Not including Moscow, these large cities showed a modest loss in population (-1.8 percent in total over 18 years). But that is a substantially slower rate than Russia's overall population loss in the period (-4.4 percent). That means that Russia did not "de-urbanize" in this sense. Relatively speaking, Russia urbanized by 7.8 percent between 1991 and 2009.

But of course the real problem is that some of this urban growth was in cities that should not have grown. Russia's problem of shrinking cities, if there is one, is not that the trend represents "de-urbanization." In one sense Russia badly needs to "de-urbanize." That is, it needs to shrink cities that are mislocated. Moscow is the bright spot. But it should be even brighter. When cities like Novosibirsk, and Omsk, and Perm lose population it is nothing to lament. They are far larger than they by rights should be.

5.5 Conclusion

To deal with physical capital problem you deal with addiction. To deal with human capital education problems you need to fix education policy. The current educational system limits mobility and so fuels lock-in. This reinforces the persistence of educational legacies that are not conducive to a market economy. A better educational system would enhance labor mobility and then would make it hard to keep labor in the regions. If you fixed the educational system it would exacerbate regional differences because graduates would want to locate in the winner regions. The current educational system is more likely to produce young people for loser regions than a reformed educational system.

So the current educational system supports industrial feudalism. Hence, it is not a surprise that industrial feudalists support the current educational system. The current system helps to produce more claims for addiction. Each new miseducated young person is a forty-year claim on resources for a loser region. This is the primary force that makes education is so hard to reform.

Bibliography

- [1] Acemoglu, Daron, and Simon Johnson. “Disease and Development: The Effect of Life Expectancy on Economic Growth.” *Journal of Political Economy*. Vol. 115, No. 6, 2007
- [2] Ashraf, Quamrul H., Ashley Lester, and David N. Weil. “When Does Improving Health Raise GDP?” *National Bureau of Economic Research Working Paper 14449*, October 2008.
- [3] Bhargava, Alok, Dean Jamison, Lawrence J. Lau, and Christopher Murray. “Modeling the Effects of Health on Economic Growth,” *Journal of Health Economics*, Volume 20, Issue 3, May 2001, Pages 423-440.
- [4] Bloom, David and Jeffrey Williamson, “Demographic Transitions and Economic Miracles in Emerging Asia” NBER Working Paper, 6268, 1997.
- [5] Bloom, David, David Canning, and Jaypee Sevilla, “Economic Growth and the Demographic Transition,” NBER Working Paper, 8685, 2001.
- [6] Denisova, Irina. Mortality in Russia: Microanalysis. *Centre for Economic and Financial Research at New Economic School*. Working Paper No. 128, March 2009.
- [7] Eberstadt, Nicholas. *Russia’s Peacetime Demographic Crisis: Dimensions, Causes, Implications*. National Bureau of Asian Research, 2010.
- [8] Lopez-Casnovas, Guillem, Berta Rivera, and Luis Currais. *Health and Economic Growth. Findings and Policy Implications*. MIT Press, 2005.
- [9] Weil, David N., “Accounting for the Effect of Health on Economic Growth,” *Quarterly Journal of Economics*, August 2007, 122 (3), 1265-1306.

Chapter 6

Conclusion

6.1 Introduction

In this report we have analyzed the potential barriers to Russia's long-term growth, and the mistaken policy directions that might result from misunderstanding those barriers. Our argument throughout this report has been that it is too easy to misdiagnose the sources of Russia's problems. In a general way it is easy to understand the nature of the barriers to Russia's long term growth. The Russian economy is less efficient than it should be, its market institutions are less effective than they can be, and its political economy is more problematic than it should be. But the key analytic problem is to understand the specific sources of these problems.

It is critical, for example, to understand the nature of Russia's institutional problems. We can think of two types of such problems:

- "typical set"— efficiency loss due to weak property rights, corruption, etc.
- legacy preserving institutions

It is easy to collect information about the problems that make up the "typical set." Russia always fares very low in corruption rankings (taking high as good). Problems with property rights enforcement are legion. But these problems are symptoms of deeper underlying problems. Focus on the "typical set" makes it seem that these problems can simply be overturned with sufficient will. But they stem from deeper causes. They are the outgrowth of legacy-preserving institutions.

Russian institutions serve to preserve a legacy of misallocation. They preserve the poor location choices and the poor use of assets that is endemic in Russia. This makes the bad equilibrium self-reinforcing. Normally, when assets are woefully misallocated the decisions will be undone over time. New investments and new activities will reallocate resources. The costs would then dissipate over time. In Russia this does not happen. Its bad institutions provide incentives to preserve the misallocations, and its resource wealth makes it feasible to preserve them.

The problem is that the symptoms (like corruption) cannot be fixed without attacking fundamental factors. As long as Russia remains a resource dependent country the key element of its political economy will be its rent management system (see Appendix).

This report has been about “Bear Traps.” That is, our aim has been to warn about what not to do, as we emphasized the kinds of seemingly self-evident policies that would have either no effect at all on growth or even negative effects. It might appear that we have offered nothing in the way of a positive agenda of what should be done? While a comprehensive attempt to draw up such an agenda would require a separate study, in fact, there are some basic points that flow from what we have said so far.

A fundamental theme of our findings is that Russia’s problem with its stocks of physical and human capital, at present and in the future, is less about the pure quantity of the capital and more about its quality. And the dimension of quality that counts the most is the capacity of that capital to react and adapt to new and changing circumstances — in short, its capacity for reallocation. The goal of investment policy as well as institutional reform is to make physical and human capital as potentially mobile as possible.

The critical difference is between what we referred to as installed capital versus new capital. This applies to both the physical capital and to the dimension of human capital associated with education. Enhancing the stocks of physical capital and educational capital is important for growth but only if conditions exist to free these investments from the constraints of the inherited structures. Otherwise, big investment programs could end up making Russia’s problems worse. They would perpetuate the inherited economic structures and thus inhibit opportunities for long-term growth.

And as far as investment in health and human capital is concerned, we showed that such investment is unlikely to produce any positive growth effects at all. In fact, spending to improve health in Russia is properly regarded not as investment at all but as consumption. Improving Russia’s human capital

is important for welfare, but it should not be seen as a solution to Russia's long-term growth prospects.

Another of our findings was that even under optimal conditions for investment, any dream of creating a “non-oil” Russia that could perform as well as today's commodity-based economy is unrealistic. The proportion of GDP that would have to be invested in non-oil sectors is impossibly high. This suggests that the only realistic future for Russia is one that continues to be based on the commodity sectors.

Yet, contrary to conventional views, this does not have to be a negative outlook. Russia would, however, need to take a radically different approach to its energy and commodity sectors than at present. Right now, Russia is constrained by its addiction to commodity rents. In this environment, oil and gas abundance reinforce the inherited structures at the expense of entry and thus creation of new structures. This means that it is impossible to truly modernize Russia without modernizing the oil and gas sectors. They need to be in the forefront. Truly modern oil and gas companies would not support addiction. They would not participate in the various informal schemes to share their rents with dinosaur enterprises. The playing field would be leveled for new entrants in all sectors of the economy. Meanwhile, oil and gas companies themselves would be relieved of the heavy burden of informal taxes and political constraints on their business activity. With the oil and gas companies in the lead for modernization, Russia would become a genuine energy superpower, an “energy superpower in depth.”

Chapter 7

Appendix