December 2006
IMF Country Report No. 06/430

Russian Federation: Selected Issues

The Selected Issues paper for the Russian Federation was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on September 27, 2006. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the government of the Russian Federation or the Executive Board of the IMF.

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International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

RUSSIAN FEDERATION

Selected Issues

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Approved by European Department

September 27, 2006

Contents Page

I. Managing Russia's Oil Wealth: An Assessment of Sustainable Expenditure Paths 3
A. Introduction 3
B. Dealing with Oil and Gas Wealth 4
C. The Situation in Russia 12
D. Assessing Sustainable Expenditure Paths for Russia 16
E. Conclusion 24

Figures
1. Standard Permanent Consumption Rule and Alternative Permanent Consumption Rule 6
2. Unchanged Policy Scenario 19
3. Bird-in-Hand Rule 20
4. Standard Permanent Consumption Rule 21
5. Alternative Permanent Consumption Rule 22
6. Comparison of Different Fiscal Rules 23

Tables
1. Selected Oil Funds: Main Features 11
2. Selected Indicators, 2001–05 13
3. Simulation Results for Different Fiscal Rules 18

Boxes
1. Fiscal Indicators 9
2. Oil Taxation in Russia 14
3. The Russian Oil Stabilization Fund 15

Appendices
I. The Model 26
II. The Detrended Model 34
III. Calibration and Simulation 37

References....42

II. What Explains Weakening Growth Linkages Between Russia and Other Countries in the Region? 44
A. Possible Transmission Channels....45
B. Foreign Trade Linkages 47
C. Financial Flows 54
D. Labor Mobility and Associated Transfers in the Region 58
E. Regression Analysis 65
F. Conclusions....71

Figure
1. FSU Countries: Selected Economic Indicators, 1993–2004....48

Tables
1. Simple Correlation Coefficients Between Real GDP Growth in Russia and the Other FSU Countries, 1993–2004....45
2. FSU Countries: Merchandise Exports as a Percent of GDP, 1993–2004....49
3. Share of Barter in Export and Import Transactions of CIS Countries 1993–2004....53
4. Contribution of External Demand and Exports to Russia to Real GDP Growth in the CIS and Baltic Countries, 1993–2004 55
5. FSU Countries: FDI Inflows as a Percent of GDP, 1993–2004 57
6. Loans, Trade Credits, and Investments from Russia to CIS Countries 58
7. Migration Between Russia and the Other FSU Countries 60
8. Distribution of Workers from the CIS Countries by Sectors of the Economy 60
9a. FSU Countries: Net Current Transfers-to-GDP Ratio 63
9b. FSU Countries: Workers Remittances-to-GDP Ratio....63
10. Transfers and Remittances from/to Russia to/from CIS Countries, 1993–2004 64
11. Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1998, CIS and Baltic Countries, 1993–2004 66
12. CIS and Baltic Countries: Arellano-Bond Estimates of Real GDP Growth Regressions with a Structural Break in 1998, 1993–2004....70
13. Coefficient Estimates in Real GDP Growth Regressions with Structural Break in in 1998, FSU Countries, 1993–2004....71

Boxes
1. Demographic Developments, Labor Market Flexibility, and Immigration 61
2. Labor Mobility Within Russia 62

Appendix
I. Reestimation of the Set of Equations in Shiells, Pani, and Jafarov (2005) 73

References....82

I. Managing Russia's Oil Wealth: An Assessment of Sustainable Expenditure Paths[1]

A. Introduction

1. **Russia's large oil and gas reserves play a key role in its economic development**. Having the world's largest gas reserves and seventh-largest oil reserves, Russia is one of the world's main energy exporters. The share of the oil and gas sector in GDP is estimated at about 20 percent, generating more than 60 percent of Russia's export revenues and more than 30 percent of fiscal revenues. In addition, rising oil prices have generated large terms of trade and real income gains, which have fueled strong domestic demand growth. Apart from their contemporaneous contribution to growth, Russia's oil and gas reserves, if spent well, also offer an opportunity to raise long-run growth and accelerate Russia's transition to a high-income, market economy.

2. **As with many other large oil exporters, Russia's energy wealth is also posing numerous challenges to macroeconomic management**. How should monetary and fiscal policy deal with the swings in large external inflows associated with volatile oil prices? How much can be spent out of current oil revenues without risking a large fiscal correction in the future when oil and gas reserves have been depleted? How large is Russia's oil wealth? How much should be saved for a "rainy day" and how much for future generations? While these are all important questions, this chapter is more limited in scope and will focus mainly on the challenges to fiscal policy, particularly those with a bearing on fiscal sustainability and, to a lesser extent, those that affect the contribution of fiscal policy to macroeconomic stabilization.

3. **Fiscal policy has been key in recent years to maintaining macroeconomic stability amid rapidly rising oil prices**. Russia is taxing and saving a large share of the oil windfall as the economy is running increasingly close to full capacity. Without this policy, the economy might have overheated, and a considerably faster real ruble appreciation would have risked choking the economic recovery under way since the 1998 crisis. The practice of using conservative macroeconomic assumptions in preparing the budget and the introduction of an Oil Stabilization Fund (OSF) based on a price trigger mechanism have been helpful institutional arrangements that have allowed the government to save a large share of what is in effect a permanent income gain.

4. **Although fiscal policy has saved a large part of the oil windfall in the OSF, this has not been guided by a consistent long-term framework**. Long-term sustainability considerations are lacking in Russia's budget process. This chapter will highlight the importance of sustainability analysis for fiscal policymaking. It will argue that Russia's fiscal framework could be strengthened by (i) using sustainability analysis to back fiscal targets; (ii) adopting a medium-term budgetary framework in which the non-oil balance (i.e., the balance net of oil-related revenues) plays a key role; and (iii) defining a clear rationale and

[1] Prepared by Fabrizio Balassone, Hajime Takizawa, and Harm Zebregs.

transparent rules for the oil fund to gather public support for prudent fiscal policies. The chapter will also emphasize the need for periodic reassessments of long-term sustainability in the face of shocks affecting estimates of oil wealth, but will caution against abrupt policy adjustments following such reassessments.

5. **This chapter presents a framework for fiscal sustainability analysis applied to Russia**. The framework is illustrated with numerical simulations of different fiscal spending rules that are consistent with sustainable paths of consumption out of oil and gas wealth over time. Using a neoclassical growth model calibrated to match the growth experience of the Russian economy since 2000, the chapter provides a range of estimates for sustainable fiscal expenditure paths. The estimates generally indicate that government spending in Russia is below levels that would be unsustainable over the long run. This result is robust to oil price shocks of two standard deviations, based on historical prices. However, the model is very stylized, and several caveats should be noted. It does not consider short-run macroeconomic stability issues, nor does it have real exchange rate or monetary variables. Therefore, it does not take into account the potential for major negative effects on growth arising from rapid real effective exchange rate appreciation resulting, in turn, from heavy spending out of oil wealth (e.g., the Dutch disease). In addition, the model is deterministic and is not designed to shed light on how fiscal policy should respond to unexpected shocks. The main objective of the model simulations is to show how fiscal targets can be derived based on long-term sustainability analysis and to provide some illustrative scenarios for different fiscal rules.

6. **The rest of the chapter is organized as follows.** Section B discusses approaches to determine sustainable fiscal policy targets for oil-exporting countries and the institutional supports that may facilitate the implementation of policies based on such targets. Section C assesses Russia's recent fiscal performance and its institutional framework. Section D presents estimates of sustainable expenditure paths for Russia. Section E concludes by summarizing the policy implications of the analysis.

B. Dealing with Oil and Gas Wealth

Maintaining fiscal sustainability

7. **The finiteness of revenues from oil and gas reserves raises the question of how to avoid a large fiscal correction once these resources have been depleted.** To assess the sustainability of given levels of expenditure and non-oil revenues, it is helpful to consider oil and gas reserves as assets that are part of the government's financial wealth.[2] The value of these assets is simply the net present value of the future stream of revenues they are expected to generate. If the revenues are consumed when they materialize, the wealth of the government declines. If, on the other hand, the revenues are invested in a financial asset, the composition of the government's asset portfolio changes, but not its total value. By investing

[2] In this Chapter, the non-oil sector includes all sectors in the economy excluding oil and gas.

oil and gas revenues in financial assets, the government is preserving its wealth as it is merely converting one asset, natural resource wealth in the ground, into another one, a financial claim.

8. **Under certain conditions, the optimal distribution of spending over time follows the so-called *permanent consumption rule***. Assuming that the taxation of the non-oil sector is constant at a given level and that utility is only a function of government spending, the maximization of the sum of discounted utility over an infinite horizon subject to a present-value budget constraint yields a constant level of spending and, therefore, a constant non-oil deficit.[3] The optimal non-oil deficit is then equal to the return on the present discounted value of oil wealth.[4] This deficit is less than the annual flow of oil and gas revenues (i.e., there is an overall surplus), thus allowing enough financial assets to be built up to finance the same deficit once oil and gas reserves have been depleted. This permanent consumption approach is becoming the standard in the analysis of fiscal sustainability for oil-exporting countries (OECs).[5] In the standard formulation of this approach, all variables are scaled by non-oil GDP and, hence, the government targets a constant ratio of expenditure to non-oil GDP.

9. **A practical *alternative formulation of the permanent consumption rule* obtains if variables are scaled by overall GDP and a constant expenditure-to-GDP ratio is targeted.** Similar to the standard permanent consumption rule, this alternative formulation also defines a constant expenditure level that can be sustained indefinitely, without the need to increase the level of taxation in the non-oil sector (the ratio of non-oil tax revenues to non-oil GDP) after oil reserves have been depleted. The difference is in the variable by which expenditure is scaled: in this case it is overall GDP, whereas it is non-oil GDP in the standard permanent consumption approach.[6] Another difference is that the alternative formulation tends to generate more front-loaded expenditure paths. Front-loading, of course, means that, under the alternative formulation, less is saved than under the standard formulation and that, therefore, a smaller primary deficit can be sustained once oil and gas reserves have been depleted (Figure 1).

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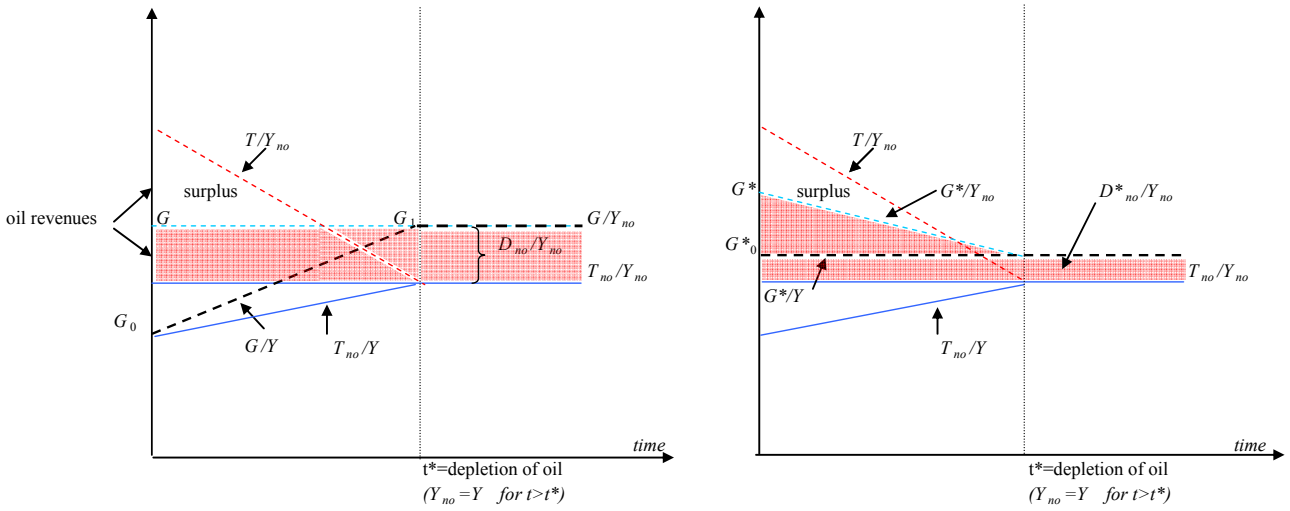
[3] See Appendix I of Barnett and Ossowski (2003) for a simple algebraic exposition of the maximization problem.

[4] The discounted value of oil wealth also depends on the assumed depletion path. This path is typically treated as exogenous and we follow this practice in this chapter. However, the depletion rate of oil resources is, in fact, a policy variable because the fiscal authorities can influence it both directly (if they are shareholders of oil companies) and indirectly (through the tax treatment of oil).

[5] See, for instance, Barnett and Ossowski (2003).

[6] See Balassone (2006) for an application to a sample of OECs.

Figure 1. Standard Permanent Consumption Rule (Left panel) and Alternative Permanent Consumption Rule (Right panel)



Given a constant ratio of non-oil revenue to non-oil GDP (T_{no}/Y_{no}), keeping constant the ratio of expenditure to non-oil GDP (G/Y_{no}), as recommended under the permanent consumption approach, implies a constant ratio of non-oil deficit to non-oil GDP (D_{no}/Y_{no}). However, this policy implies a gradually rising expenditure-to-GDP ratio (G/Y) because the share of non-oil GDP in total GDP grows over time. By keeping expenditure constant as a share of overall GDP, expenditure becomes more front-loaded than under the permanent consumption rule, both as a share of GDP—G^*/Y— and as a share of non-oil GDP—G^*/Y_{no} (compare points G_0 and G in the left panel to points G^*_0 and G^*, respectively, in the right panel). The ensuing smaller surpluses in the phase of oil exploitation (compare the white triangles in the two panels) imply that only a smaller deficit (and a lower expenditure ratio) can be sustained after oil depletion.

10. **Revenues from oil and gas are also highly uncertain, suggesting the need for additional precautionary savings.** There is much uncertainty about the quantity, quality, and cost of extraction of oil reserves, which, in combination with uncertainty about future oil prices, makes it difficult to assess a country's oil wealth and, correspondingly, its need for savings. In this context, a very conservative approach to dealing with oil wealth uncertainty is the so-called ***bird-in-hand rule***. According to this rule, the non-oil deficit must not exceed the real return on oil revenues that have already been saved and transformed into financial assets. This rule mandates saving the entire proceeds from oil and, therefore, generates a more back-loaded spending profile. It has the practical advantage that it does not require estimates of oil wealth. Norway has implemented this rule since 2001,[7] but the rule might be less appropriate for countries with significant needs in terms of basic infrastructure and investment in human capital.

11. **The more expenditure is front-loaded, the bigger the risk of an excessive real exchange rate appreciation**. Rapid appreciation of the real effective exchange rate can

[7] See Skancke (2003) for a discussion.

cause deindustrialization (the Dutch disease) as it reduces the competitiveness of the country's manufacturers and, conversely, makes imports more attractive. More generally, heavy dependence on resource revenues tends to skew economic incentives away from competition in the product markets and toward appropriation of rents.

Dealing with volatility

12. **A crucial issue for the implementation of prudent fiscal policy is the identification of the temporary and permanent components of oil price changes**. Oil prices are subject to permanent shocks, but most oil price changes also have a significant temporary component. Macroeconomic stabilization would require that expenditure policy should not be influenced by the temporary component of oil price changes.[8] In that way, fiscal policy automatically tightens during peaks when revenues rise and relaxes during troughs when revenues fall.[9] However, the permanent component of price shocks does alter oil wealth and, therefore, calls for a reassessment of the sustainable fiscal position.

13. **In light of these price changes, a strong macroeconomic case can be made for decoupling public expenditure from oil revenues**. Barnett and Vivanco (2003) present evidence that year-on-year fluctuations in the oil price have a large temporary component and, therefore, only a minor impact on oil wealth.[10] The volatility of oil prices generates corresponding volatility in government revenues. If such volatility is transferred to expenditures, significant macroeconomic costs will ensue, including the reallocation of resources to accommodate changes in demand and relative prices, and real exchange rate volatility (Barnett and Ossowski, 2003).

14. **A prudent strategy would require minimizing the adjustment of fiscal positions in response to oil price changes.** Barnett and Vivanco (2003) argue that, given the cost of expenditure volatility, the risk that expenditure increases become "entrenched" and difficult to reverse, and the uncertainty surrounding the temporary/permanent breakdown, governments would be well advised to undertake only gradual adjustments, so as to avoid overshooting. In the same vein, Wakeman-Linn and others (2004) caution against large and sudden adjustments, as they can strain the government's institutional capacity for planning, executing, and monitoring expenditures, resulting in substantial waste.

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[8] A discussion of stabilization policy typically involves reference to a trend around which output fluctuates over a business cycle. However, trend output may be difficult to estimate in OECs. Many of these are emerging economies, often are embarking on major reforms that can change the structural characteristics and performance of the economy. Export concentration in the oil sector exposes OECs to sustained shocks in terms of trade.

[9] It is also possible that certain expenditure categories fluctuate with swings in the cycle; for example, unemployment benefits.

[10] Inter alia, they point out that futures price data imply about 60 percent of any given price shock is expected to be reversed within the following year.

Helpful institutions

15. **OECs have implemented a number of institutional arrangements to address the special challenges they face**. These arrangements include "institutional supports", such as fiscal responsibility legislation, fiscal rules or guidelines, medium-term expenditure frameworks, and nonrenewable resource funds (NRFs). With the exception of NRFs, these institutional arrangements are of course not specific to resource-rich economies.

16. **A medium-term budgetary framework is a key institutional arrangement for OECs.** The emphasis on the medium term allows annual deviations from average fiscal targets but at the same time calls for clear justifications for such deviations and provides limits to their extent. Such a framework can also be instrumental in gradually adjusting to permanent changes in oil prices.

17. **Setting policy in terms of non-oil fiscal indicators is also helpful.** Compared with traditional headline indicators, the non-oil balance is better suited to focus the political process governing the budget on fiscal sustainability. In addition, the non-oil balance provides information about the effect of fiscal policy on aggregate demand that complements the information gleaned from traditional indicators based on the overall balance (Box 1).

18. **NRFs, if appropriately designed, are another example of "supporting" fiscal institutions.** They are not a substitute for a strong commitment to sound policymaking, but a well-designed fund can help "sell" to the public and policymakers the importance of saving oil revenue and garner public support for prudent fiscal policies. Two critical ingredients of good fund design are: (i) integration with the budget in the context of a medium- and long-term fiscal framework; and (ii) stringent mechanisms to ensure transparency, good governance, and accountability that help prevent the misuse of resources.

19. **NRFs can take various forms, ranging in scale from separate bodies to just government accounts.** They can be set up as "stabilization funds," aimed at reducing the impact of volatile revenues on the budget by transferring uncertainty and volatility from the budget to the fund. Or they can be set up as "savings funds," aimed at addressing the issue of the exhaustibility of oil and creating a vehicle to store wealth for future generations. NFRs can also be arranged so as to pursue both objectives.

Box 1. Fiscal Indicators

What is the "final effect" of fiscal policy on economic activity? is a question far beyond what can be asked of any summary indicator. Only simulations of full-scale macroeconomic models can shed light on final effects. On the contrary, summary indicators can provide only an indication of the impact of fiscal policy on aggregate demand (albeit ignoring the distortions to individual decisions caused by the tax system).

Among deficit/surplus measures, the overall balance is arguably the best indicator of the impact of fiscal policy. Blanchard (1990) argues that any improvement on the inflation-adjusted overall balance as an indicator of the impact of fiscal policy would involve estimating marginal propensities to consume, taking into account consumers' expectations, and forecasting fiscal and macroeconomic variables.

The issue, however, arises of the appropriate measurement of the overall balance. The distinction between transactions "above the line" and those below it—that is, between non-financial and financial transactions—has a direct bearing on the size of the measured balance and entails some unavoidable degree of arbitrariness (Blejer and Cheasty, 1993).

In this respect, the special nature of oil-related revenues suggests the use of the "non-oil balance" as a supplementary indicator in the analysis of fiscal policy in OECs. Oil resources represent government wealth. Therefore, oil revenues can be seen as the result of the transformation of oil wealth into financial wealth.[1] As such, they should not be included among income items in the government budget. They should be considered as financing items (i.e., "below the line") to the extent that they are used to finance the excess of government spending over non-oil revenues.

The possibility of changes in oil taxation introduces further complications and suggests the need to monitor a third indicator, the "balance at constant oil price." Pursuing further the analogy between oil and financial wealth, changes to oil taxation can be seen as determining changes in government wealth. By decreasing (increasing) tax rates on oil extraction, the government is in fact making (receiving) a capital transfer to (from) the private companies that have acquired the right to extract and sell oil. Such "transfers" will have an impact on aggregate demand. By definition, however, the non-oil balance is not affected by changes in oil taxation. The balance at a constant oil price will, on the contrary, generally highlight revenue changes due to changes in legislation.

Nevertheless, changes in the balance at a constant oil price provide very imprecise indications and should be used with care. The size of the change is not necessarily invariant to the assumed reference price. In extreme cases, where new legislation affects only revenues if the oil price is above a given threshold, the indicator may or may not signal a change in the impact of fiscal policy, depending on whether the reference price is above or below that threshold.

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[1] The definition of oil revenues will depend on the specific arrangements in place in each country. In general, it should include all revenues from extractive industries: dividends from the government's participation in the sector, profit taxes, royalties, and export duties.

20. **NRFs need to be integrated into the budget.** In that way, the link between fiscal policy and asset accumulation is made clear and the emergence of two budgets and related fiscal management problems are avoided. Integration is realized, for instance, if the NRF is set up as a "financing fund." Under such a fund, the budget is required to transfer oil revenues to the fund. In turn, the fund provides the budget with a reverse transfer equal to all budgetary outlays minus non-oil revenue (i.e., the non-oil balance). Hence, if oil revenue is larger than the non-oil deficit (i.e., if there is an overall surplus) resources are transferred to the fund; otherwise, the fund finances the overall deficit. This arrangement allows for easy monitoring of the relations between the relevant policy variables within a consistent framework. Assets are accumulated to the extent there is an overall surplus and the role of the non-oil balance in determining such a surplus is brought into sharp focus.

21. **Integration of NRFs into a longer-term fiscal framework is also necessary because NRFs are tools of fiscal policy and do not constitute fiscal policy per se.** For instance, in the absence of a commitment to a target for the non-oil balance, a fund would not directly curtail government spending. Since resources are fungible, governments could even borrow or run down other assets while accumulating resources in the fund, thus leaving government savings unchanged and failing to stabilize spending despite more stable budgetary revenues. Indeed, governments are likely to find borrowing particularly easy when resource prices are high.

22. **Finally, transparency, good governance, and accountability are needed for the public to see how oil revenue is managed and spent.** While a financing fund is little more than a government account, its operation will entail the accumulation of assets the effective management of which will be key to the success of the fiscal framework. Responsibilities concerning the management of the assets accumulated in a financing fund need to be assigned to a dedicated body and subject to specific guidelines. An asset management strategy would need to be defined, including prudential investment rules targeting the desired levels of risk, liquidity, and return. A clear allocation of responsibilities is important to ensure that those who manage and oversee the operation of the funds are held accountable. Transparency and freedom from political interference are key, as is regular and audited reporting.

23. **Most oil funds are not set up as financing funds, because few OECs highlight the non-oil balance in their budgets or use a medium-term budget framework.** In a sample of 17 OECs with NRFs, only 1 has a financing fund, and only one country follows a rules-based fiscal policy integrated in a medium-term framework (Table 1). Withdrawals from NRFs are typically managed on a discretionary basis. The prevailing purpose of NRFs in this sample of countries is stabilization. A savings motive is considered in only 6 countries. As a consequence, budgetary targets seldom reflect sustainability considerations.

Table 1 - Selected Oil Funds: Main Features

Country	Objective	Financing	Date	Link with rules/MTBF	Accumulation rule	Withdrawals	Use of resources
Algeria	Stabilization	No	2000	No	oil revenues>budgeted	discretionary	Local currency
Azerbaijan	Mixed	No	1999	No	oil revenues	discretionary, with cap	Foreign assets
Bahrain	Stabilization	No	2000	No	oil revenues>budgeted	discretionary	Foreign assets
Chad	Stabilization	No	2000s	No	x% oil revenues	…	Foreign assets
Equatorial Guinea							
Gabon	Savings	No	1998	No	10% of budgeted oil rev. + oil rev.>budgeted	discretionary	Foreign assets
Iran	Stabilization	No	2000	No	oil revenue>budgeted	discretionary	Foreign currency
Kazakhstan	Mixed	No	2001	No	oil price > reference	oil price < reference, with cap	Foreign assets
Kuwait	Mixed	No	1960	No	residual surpluses	discretioniary	Domestic assets
	Savings	No	1976	No	10% of total revenues	discretioniary	Foreign assets
Libya	Stabilization	No	1995	No	oil revenue > budgeted	discretionary	Local currency
Mexico	Stabilization	No	2000	No	x% total revenue>budgeted	x% total revenue<budgeted	…
Norway	Mixed	Yes	1990(1995)	No	oil revenues	discretionary	Foreign assets
	Mixed	Yes	2001	Yes	oil revenues	discretionary	Foreign assets
Oman	Savings	No	1980	No	oil revenues > budgeted	discretionary	Foreign assets
	Oil investment	No	1993	No	mkt value of 15k bpd	…	Foreign assets
Qatar	Stabilization	No	2000	No	oil reveneus>budgeted	discretionary	…
Russia	Stabilization	No	2004	No	oil revenues > reference	oil revenues<reference, debt repayment	Local currency
Trinidad & Tobago	Stabilization	No	2001	No	2/3 of oil revenue>budgeted+10%	oil revenue<budgeted, with cap	…
Venezuela	Stabilization	No	1998	No	50% oil orevenues>reference v.	discretionary	Foreign assets
	Investment	No	1975	No	discretionary	discretionary	…

24. **Unsurprisingly, therefore, the experience with oil funds is mixed.** Funds have been associated with a variety of fiscal policy outcomes. Davis and others (2003), for instance, analyze a sample of 12 OECs and conclude that "in some countries with NRFs, expenditure has tended to be less correlated with changes in the price of the resource" (p. 299) but add that "the establishment of the NRF did not have an impact on [the level of] government spending" (p. 302).

C. The Situation in Russia

25. **The general government surplus has increased sharply, as oil prices have more than doubled since 2001**. The price for the Urals oil blend rose from $23 per barrel in 2001 to almost $50 per barrel in 2005, contributing to robust real GDP growth of about 6 percent per annum (Table 2), and a strong fiscal position. The headline surplus increased by 5.4 percent of GDP during 2001–05; meanwhile, the primary surplus increased somewhat less (3.8 percent of GDP), because the reduction in outstanding liabilities and a negative real interest rate lowered interest spending from 2.7 percent of GDP in 2001 to 1.1 percent of GDP in 2005. With oil revenues rising from 6 percent of GDP in 2001 to 14 percent in 2005 (Box 2), the budget would still have balanced at an oil price of $26 per barrel in 2005 (against $19 per barrel in 2001).

26. **The strong fiscal performance is partly a reflection of certain key features of Russia's fiscal framework.** The law establishing the OSF mandated that revenues from the two major oil taxes (the extraction tax and the export tariff) should be deposited in the fund for the part corresponding to oil prices above $20 per barrel (Box 3).[11] This requirement, together with the practice of using conservative oil price assumptions in the formulation of budget plans (the assumption for the 2004 budget was $20 per barrel), helped to set apart a large part of the revenue increase due to the rapid rise in oil prices during 2004.

27. **However, in 2005 the increase in the overall surplus was accompanied by a deterioration of the non-oil deficit**. The improvement in the headline balance of 3.2 percent of GDP with respect to 2004 was lower than the rise in oil revenues, which increased from 9.2 percent of GDP to 14 percent over the same period. Meanwhile, the non-oil primary deficit widened by 1.8 percent of GDP, largely because of a decline in non-oil revenues. Further underlying fiscal relaxation is expected in 2006–07.

[11] The cutoff price was raised to $27 per barrel on January 1, 2006.

Table 2. Russian Federation: Selected Indicators, 2001-05
(In percent of GDP unless otherwise indicated)

	2001	2002	2003	2004	2005
GDP real growth rate	5.1	4.7	7.3	7.2	6.4
Change in the output gap	2.5	1.8	2.6	0.7	0.1
Oil price[1/]	23.0	23.5	27.3	34.3	49.9
General government balance	2.7	0.6	1.4	4.9	8.1
General government primary balance	5.4	2.7	3.3	6.3	9.2
Expenditure	34.6	37.0	34.9	31.9	31.9
Primary expenditure	31.9	34.9	33.0	30.5	30.8
Revenue	37.3	37.6	36.3	36.8	40.0
Oil revenues	6.0	5.7	6.0	9.2	14.0
Oil price balancing the budget	19.0	22.4	24.1	20.0	26.0
General government primary non-oil balance	-0.6	-3.1	-2.7	-3.0	-4.8
Fiscal impulse[2/]	2.8	3.2	0.3	-2.8	-2.9
Non-oil fiscal impulse[3/]	2.1	3.0	0.6	0.4	1.8

[1/] U.S. dollar per barrel of Urals blend, year average.

[2/] Change in the cyclically adjusted primary balance.

[3/] Change in the cyclically adjusted non-oil primary balance.

Box 2. Oil Taxation in Russia

Oil operations are governed primarily by a tax/royalty regime. Oil revenues accrue through three main instruments: (i) the corporate income tax (CIT) and dividends; (ii) the natural resources extraction tax (RET); and (iii) the export tariffs (ET).[1] In 2005, oil revenues amounted to about 14 percent of GDP, of which 6 percent from ETs, 4½ percent from RET, and 3½ percent from CITs and dividends. The Russian tax system has been subject to frequent and unpredictable changes, which have had a negative impact on the business climate. Recently, with the gradual enactment of a comprehensive Tax Code, changes have aimed at streamlining the system.

The current CIT rate is 24 percent. Prior to the enactment of Part II of the Tax Code in 2002, the statutory rate was 35 percent. The Tax Code has improved the structure of corporate taxation in several respects, including (i) the definition of profit, as many expenses were allowed to be deducted that previously were not (e.g., interest on long term loans); (ii) the rules governing depreciation, as rates have become more closely linked to the economic life of the related asset; and (iii) the rules controlling "transfer pricing" (though these are not yet in line with international best practice). The CIT is mainly a regional tax. While there is a single profit tax system, the statutory tax rate of 24 percent is made up of federal component (5 percent), regional (17 percent), and local (2 percent) components.

The RET is a "royalty" levied on all extracted oil at a rate of 22 percent on the excess of c.i.f. Urals price over $9 per barrel. This has been effective since July 1, 2005. The tax rate has been gradually increased over the last three years, rising from 18.5 percent in 2003, to 18.8 percent in 2004, and 21.0 percent in the first half of 2005. The extraction tax mainly accrues to the federal budget (roughly 80 percent).

ETs are levied on oil, at increasing rates, on the excess of c.i.f. Urals prices over $15 per barrel.[2] The rate is 35 percent for the excess over $15 per barrel up to $20 per barrel; 45 percent for the excess over $20 per barrel up to $25 per barrel; and 65 percent for the excess over $25 per barrel). This schedule has been effective since August 2004. Previously, the rate was 35 percent for the excess over $15 per barrel up to $25 per barrel, and 40 percent for the excess over $25 per barrel. ETs are an exclusively federal revenue source.

The tax/royalty mix appears rather unbalanced, with production-based instruments (the RETs and ETs) providing about two-thirds of revenues. However, the progressive rate schedule of ETs allows the government to share in the upside of oil price cycles. At the same time, the deduction of prices below $9 per barrel from the RET base and of prices below $15 per barrel from the ET base limits the fixed cost imposed on firms. The low reliance on the CIT reflects concerns with tax avoidance in a context of much intrafirm trade and relatively high corruption. The deduction and the sliding-scale elements of the Russian royalty system attempt to reconcile the resilience to tax avoidance of a quantity-based system with the investment incentives provided by a profit-based system. Figure A plots the marginal (MTR) and average (ATR) tax rates at different oil prices under the old (OE) and new (NE) RET and ET regimes. Figure B plots the producer's take per barrel (PTPB) in dollars using a weighted average of the rates applying to exported and "domestic" oil under the new (AN) and old (AO) tax regimes.

Figure A. Combined RET and ET Rates

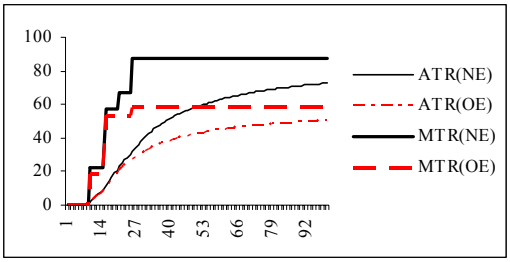
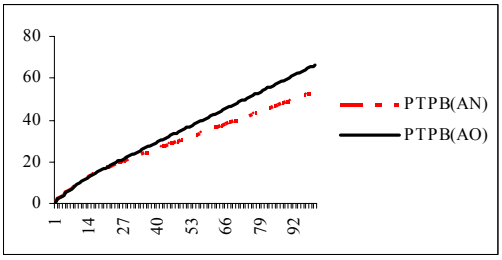


Figure B. Producer's Take Per Barrel



[1] Revenues from VAT on oil products are not considered here since the focus is on taxes on production.

[2] Oil products are also subject to ETs, with rates linked to those applying to crude but lower.

Box 3. The Russian Oil Stabilization Fund

The Oil Stabilization Fund (OSF) was established in 2004 with the objective of reducing the impact of fluctuations in oil prices on the resources available to the budget. The design of the fund—including accumulation, withdrawal, and investment rules—is subject to government regulation and the Budget Code of the Russian Federation. The government reports to the Parliament quarterly and annually. As of end-2005, the balance of the OSF stood at Rub 1,237 billion (5.7 percent of GDP).

Deposits. The OSF receives revenues from the export duty on crude oil and the resource extraction tax on oil. Specifically, the OSF receives the share of those taxes that is estimated to be due to the difference between actual oil prices and a threshold level, currently set at US$27 per barrel (Urals blend).[1] Revenues from the export of gas and oil products are not included. In addition, federal budget surpluses are transferred to the fund at the end of the fiscal year. The taxes financing the OFS accounted for roughly 40 and 50 percent of overall oil and gas revenues in 2004 and 2005, respectively. The amounts derived from such taxes and deposited to the OSF in 2004 and 2005 (Rub 533 and Rub 1,393 billion rubles, respectively), corresponded approximately to one-fourth and one-third of overall oil and gas revenues in those years. In addition, the OSF received the unspent surpluses from 2003 and 2004 (Rub 106 and Rub 218 billion, respectively; in January 2006, the unspent surplus from 2005, Rub 222 billion, was deposited in the OSF).

Withdrawals. Money from the fund can be used to cover the budget deficit when the prices for oil in the world market are below the cutoff price. In addition, if the fund's balance exceeds a predetermined threshold (currently set at Rub 500 billion), the difference between the actual balance and the threshold can be used for purposes specified in the budget law. As the fund had exceeded the threshold level in 2005, its surplus resources were used to prepay foreign debt (Rub 94 billion to the IMF; Rub 430 billion to Paris Club creditors; Rub 124 billion to Vnesheconombank), as well as to provide funding for the Russian Pension Fund (about Rub 30 billion).

Investment. The OSF is held in an foreign currency denominated account at the Central Bank with a remuneration determined by the yield on a basket of first-rate foreign sovereign bonds.

OSF: Deposits and withdrawals 2004-2005

(Billion Rubles)

	Deposits		Withdrawals	
		2004		
Unspent surplus from 2003	106			
Oil Revenues	416			
Balance at 12/31		522.30		
		2005		
Unspent surplus from 2004	218		94	prepayment of debt to IMF
Oil Revenues	1,175		430	prepayment of debt to "Paris Club"
			124	prepayment of debt to Vnesheconombank
			30	transfers to Pension Fund
Balance at 12/31		1,237.00		

28. **These developments suggest that despite a satisfactory performance so far, the Russian fiscal framework may not be robust to spending pressures from high oil prices.** With respect to the discussion in Section B, several areas for improvements can be identified. First, budgetary targets are not grounded in sustainability analysis, which makes them susceptible to being seen as arbitrary. The assumptions concerning oil prices underlying the budget formulation have typically been conservative. However, lacking a formal link with sustainability, they can be (and have been) criticized as unrealistic. Second, budgetary targets are not set within a medium-term framework. This implies that there is no provision for gradual adjustment in the face of structural changes, and that pressure can mount for large, potentially wasteful, year-on-year adjustments.[12] Third, the non-oil balance plays no official role in the budget process,[13] and the OSF is not structured as a financing fund; this creates the impression that resources accumulated in the fund are "somewhat" additional with respect to those on which the budget is based, and therefore expendable.

D. Assessing Sustainable Expenditure Paths for Russia

29. **To provide firmer foundations for medium-term budgetary targets, we use numerical simulations based on a long-run neoclassical growth model.** Appendixes I and II provide full details of the model, while Appendix III discusses how it was calibrated to replicate the main trends in the Russian economy since the recovery from the 1998 financial crisis. Simulations are run to assess the sustainability of current fiscal policies and derive policy indications from the alternative fiscal rules discussed in Section B. The scenarios are purely illustrative, designed to show the effect of different fiscal rules on the long-term spending envelope.

30. **This calibration and simulation exercise is based on assumptions about several exogenous variables**. These exogenous variables include the rate of extraction of hydrocarbons (i.e., oil and natural gas) and the real rate of return on foreign financial assets. On the basis of current data on reserves and extraction rates, we project that oil will be depleted in 50 years and gas reserves in 300 years. The long-run real rate of return on foreign financial assets is assumed to be 3 percent. Appendix III provides further details about the way other exogenous variables are set.

31. **The calibrated model is used to conduct long-run simulation exercises based on different spending rules.** The simulated policy scenarios include (i) unchanged policy; (ii) the bird-in-hand rule; (iii) the "standard" permanent consumption rule scaled by non-oil GDP; and (iv) the "alternative" permanent consumption rule, with variables scaled by overall GDP. All simulations cover a 200-year span and are constrained to converge to a balanced

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[12] The Russian authorities are considering the introduction of a three-year medium-term budget framework.

[13] A proposal to introduce the indicator in official budget documents was recently put forward by the Ministry of Finance.

growth path in the long run. Tax policy is invariant across the policy scenarios. Specifically, the average tax rate on non-oil income is the same across scenarios (35 percent, the 2005 level). Moreover, tax legislation applying to the oil and gas sector is assumed to stay the same as in 2005, so that the *absolute level* of oil and gas revenues is the same across all scenarios.[14] These assumptions imply that in all scenarios overall revenues (excluding interest earnings on accumulated financial assets) decline over time as a share of GDP, eventually converging to 35 percent after oil and gas resources have been depleted. The assumptions also imply that the policy choice variable in all simulations is primary expenditure.

32. **Each policy scenario is simulated for three different oil price assumptions.** The central price scenario is based on the *World Economic Outlook* (WEO) world oil price forecasts: $66.5 per barrel in 2006, and $69.75 per barrel in 2007, followed by a gradual decline to $66 per barrel by 2011. Oil prices are assumed to remain constant in real terms from 2012 onward. Starting at the end of 2006, low- and high-price scenarios differ from the central one by ±$21.6 per barrel, or 1.96 times the standard deviation of nominal world crude oil prices over 1970–2005. In 2007, under the low-price assumption, revenues would be 1.5 percent of GDP lower than under the central price assumption; under the high-price assumption, revenues would be 1.3 percent of GDP higher than under the central price assumption (both in real terms). The differences across price scenarios decline monotonically from 2007 onward and gradually disappear as hydrocarbon resources approach the point of depletion. Because under each price scenario tax revenues from gas are projected to decline to less than 1 percent of GDP by 2100, we simplify computations by assuming that oil and gas revenues become nil after 100 years in all simulations (recall that oil is projected to be depleted in 50 years).

Unchanged policies

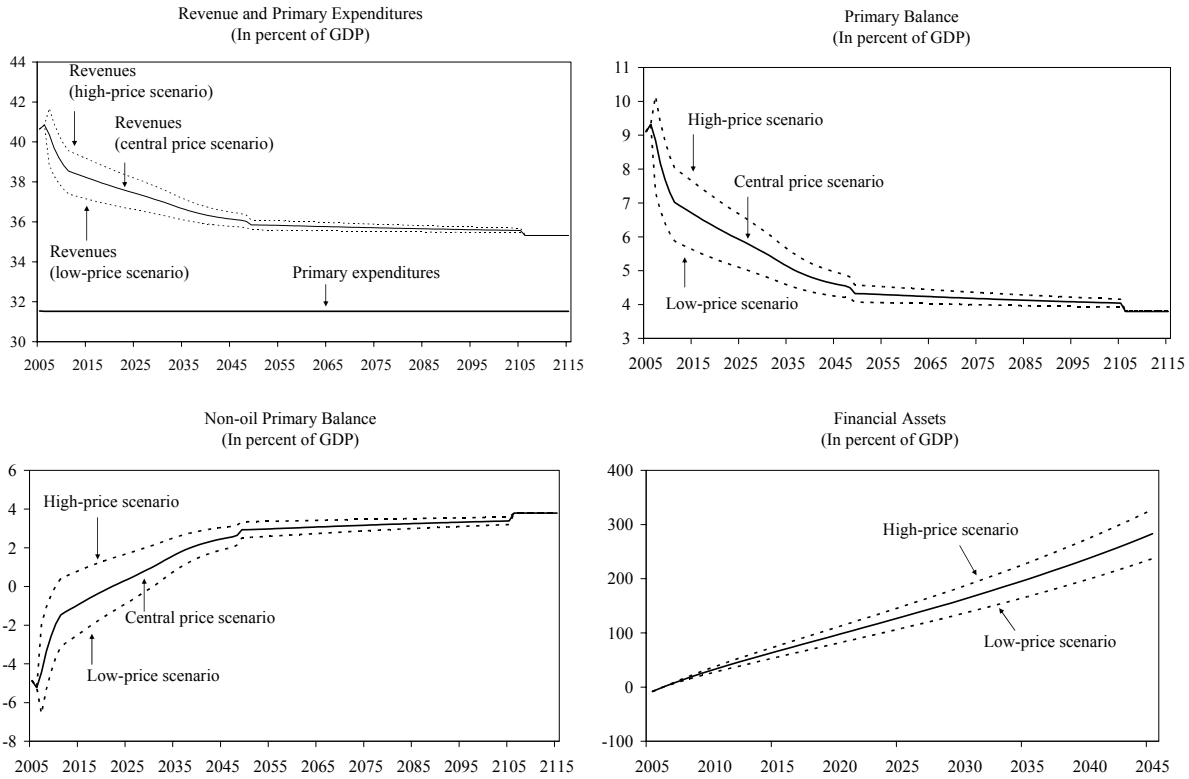
33. **The unchanged policy scenario assumes that primary expenditures remain constant as a share of GDP at the 2005 level** (32 percent; Table 3 and Figure 2). Reflecting the assumed path for revenues, the primary surplus would gradually decline from 9 percent of GDP in 2005 to 6–8 percent of GDP in 2010 (depending on the oil price assumption). However, the non-oil primary deficit would also decline, from 5 percent of GDP in 2005 to 0–4 percent of GPD in 2010, as non-oil revenues increase as a share of GDP. The two balances would eventually converge to the same value (a surplus of 4 percent of GDP) once oil and gas resources have been depleted.

[14] The rate of extraction of oil and gas reserves is fixed exogenously.

Table 3. Russia: Simulation results for different fiscal rules
(In percent of GDP)

	t (2005)	*t*+1 (2006)	*t*+2 (2007)	*t*+5 (2010)	*t*+10 (2015)	*t*+50 (2055)	Steady State
Primary balance							
Unchanged policy	9.1	9.3	8.8	7.3	6.7	4.3	3.8
Standard permanent consumption rule	9.1	12.2	10.9	6.7	5.0	-1.7	-3.1
Bird-in-hand rule	9.1	14.6	13.2	8.7	6.5	-2.0	-4.3
Alternative permanent consumption rule	9.1	4.5	4.0	2.5	1.8	-0.6	-1.1
Non-oil primary balance							
Unchanged policy	-4.9	-5.2	-4.4	-1.9	-0.9	3.0	3.8
Standard permanent consumption rule	-4.9	-2.3	-2.4	-2.6	-2.7	-3.0	-3.1
Bird-in-hand rule	-4.9	0.0	-0.1	-0.6	-1.2	-3.3	-4.3
Alternative permanent consumption rule	-4.9	-10.1	-9.3	-6.8	-5.7	-1.9	-1.1
Noninterest revenues							
Unchanged policy	40.6	40.9	40.4	38.8	38.2	35.8	35.3
Standard permanent consumption rule	40.6	40.9	40.4	38.9	38.2	35.8	35.3
Bird-in-hand rule	40.6	40.9	40.4	38.9	38.2	35.8	35.3
Alternative permanent consumption rule	40.6	40.9	40.4	38.8	38.2	35.8	35.3
Primary expenditures							
Unchanged policy	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Standard permanent consumption rule	31.5	28.6	29.5	32.1	33.3	37.6	38.4
Bird-in-hand rule	31.5	26.3	27.2	30.1	31.7	37.8	39.6
Alternative permanent consumption rule	31.5	36.4	36.4	36.4	36.4	36.4	36.4
Net financial assets							
Unchanged policy	-8.3	1.2	10.0	33.1	66.3	391.7	5,512.0
Standard permanent consumption rule	-8.3	4.1	14.9	38.7	65.0	162.6	206.4
Bird-in-hand rule	-8.3	6.4	19.5	49.8	84.6	220.5	282.9
Alternative permanent consumption rule	-8.3	-3.5	0.4	8.9	18.6	54.4	70.0

Figure 2. Unchanged Policy Scenario



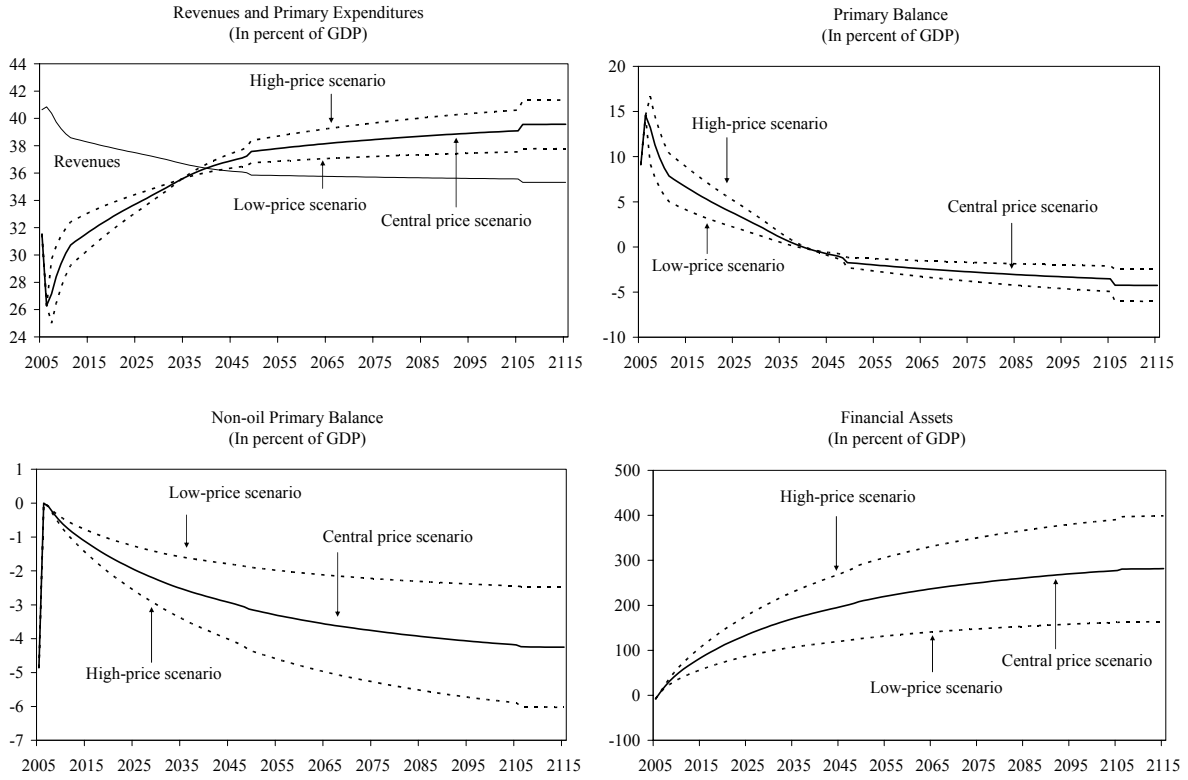
34. **The unchanged policy scenario shows a very large buildup of international assets.** The primary surpluses sustained throughout the simulation horizon, under all price assumptions, generate what seems an excessive accumulation of financial assets. The ratio of net foreign financial assets to GDP surpasses 500 percent by end-2065. The non-oil primary deficit would narrow rapidly, turning into a surplus even before the depletion of oil and gas resources. Such a policy would likely sooner or later become untenable as spending pressures rise, given the need for improving infrastructure and social services in Russia.

Bird-in-hand rule

35. **Implementing the bird-in-hand rule would call for an immediate fiscal tightening, which would then be gradually unwound over the medium term.** This rule stipulates up-front savings of oil revenues and spending only out of the return on accumulated financial assets. As Russia is running a non-oil deficit in excess of the return on the assets in the OSF, this rule would stipulate an initial tightening of the fiscal stance: primary expenditures are brought into line with non-oil revenues before they are allowed to rise following the increase in accumulated financial assets. In particular, primary expenditures would first decline by about 5 percent of GDP in 2006 from the 2005 level under all price scenarios (and by an additional one percent of GDP in 2007 under the high-price scenario; Figure 3). Subsequently, they would rise to 29–32 percent of GDP—

depending on the price assumption—by 2010. After the tightening in 2006 (and also in 2007 under the high-price scenario), the primary surplus would be reduced rapidly, reflecting both higher spending and lower revenues. By 2010, it would be below the 2005 level under the central and low price scenarios. The non-oil primary deficit would increase more slowly (recall that the share of non-oil revenue in GDP is assumed to increase over time) and remain higher than the 2005 level in 2010 by about 4 percent of GDP.

Figure 3. Bird-in-Hand Rule

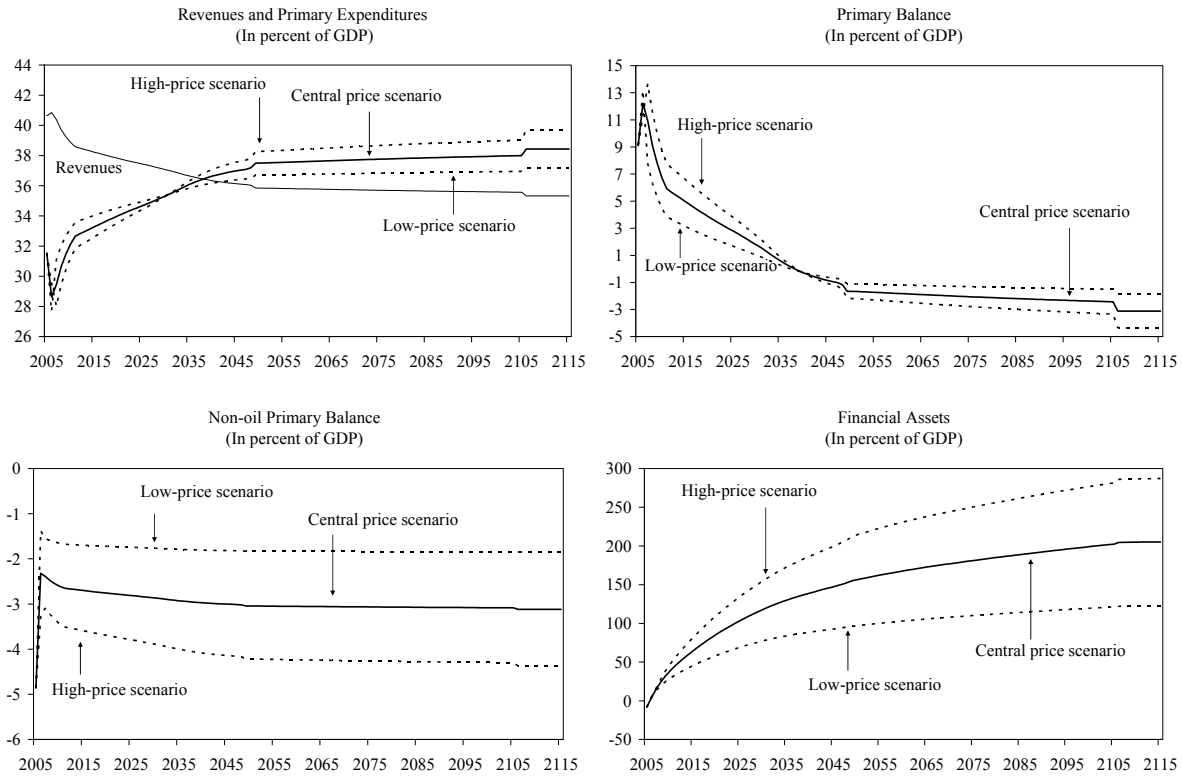


36. **However, the bird-in-hand rule would lead to a significant fiscal relaxation in the steady state, accompanied by a large accumulation of financial assets**. The large up-front savings generate a significant accumulation of assets—already at 36–62 percent of GDP by 2010, and ranging between 164 and 402 percent of GDP in the steady state. This, in turn, allows the primary expenditure-to-GDP ratio to rise by 5–10 percent of GDP during 2010–55 to eventually reach 38–41 percent of GDP in the steady state. Over the same period, both the primary and the non-oil primary balance would continue to deteriorate (by 7–14 and 2–4 percent of GDP, respectively), eventually converging to a steady state primary deficit of 2–6 percent of GDP, to be financed out of the return from the large positive net asset position.

Standard permanent consumption rule (scaled by non-oil GDP)

37. **Simulation of the standard permanent consumption rule suggests tightening of the fiscal stance over the short run but a mild relaxation in the medium term**. The mechanics of the rule would call for a short-lived tightening under all price scenarios. The primary expenditure-to-GDP ratio is lower than the 2005 level by 2–4 percentage points in 2006 under all price scenarios (and by additional 1½ percentage points in 2007 under the high-price scenario; Figure 4). Thereafter, the primary expenditure-to-GDP ratio would rise by 0.5–1.5 percent of GDP per year, depending on price assumptions, to reach 31–33 percent of GDP in 2010—roughly the same level as in 2005. Given the declining path of overall revenues, the primary surplus would fall to 4–9 percent of GDP by 2010 from 9 percent of GDP in 2005; meanwhile, the non-oil primary deficit would fall to a range of 2–3 percent of GDP by 2010 from 7 percent of GDP in 2005.

Figure 4. Standard Permanent Consumption Rule (Scaled by non-oil GDP)



38. **A significant fiscal relaxation—but smaller than under the bird-in-hand rule—materializes in the steady state, reflecting the benefits of a steady accumulation of financial assets.** The primary expenditure-to-GDP ratio would rise by 4–7 percent of GDP during 2010–55, eventually reaching levels 4–8 percent of GDP higher than in 2010. Over the same period, both the primary and the non-oil primary balances continue to deteriorate (by 6–11 and 0–1 percent of GDP, respectively), eventually converging to a steady state

deficit of 2–4 percent. Financial assets converge to a steady state level of 123–289 percent of GDP.

Permanent consumption rule (scaled by overall GDP)

39. **This rule would call for an immediate fiscal relaxation.** As estimates of the constant sustainable primary expenditure level range from 36 to 37 percent of GDP, depending on price scenarios (Figure 5), this implies an increase in primary expenditures of 4–5 percent of GDP as of 2006. As expected, expenditures are higher than under the standard permanent consumption rule over the same period (Figure 6). The primary surplus keeps declining also after 2006, reflecting the reduction of revenues. By 2010, the primary surplus would be 6–7 percent of GDP lower than in 2005. The mechanics of the rule also imply a sudden widening of the non-oil primary deficit, which is then gradually reduced. By 2010, under the low-price scenario, the non-oil primary deficit would be roughly the same as in 2005; under the high-price scenario, the deficit would still be 4 percent of GDP higher than in 2005.

Figure 5. Alternative Permanent Consumption Rule (Scaled by overall GDP)

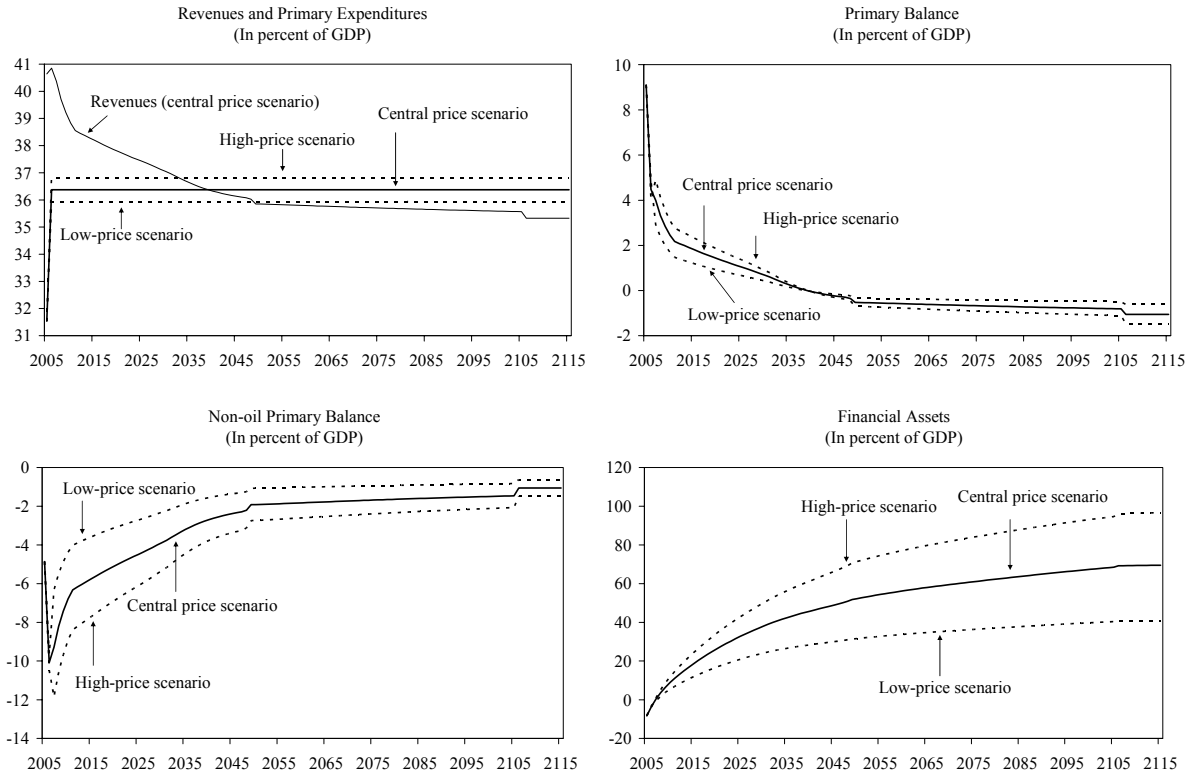
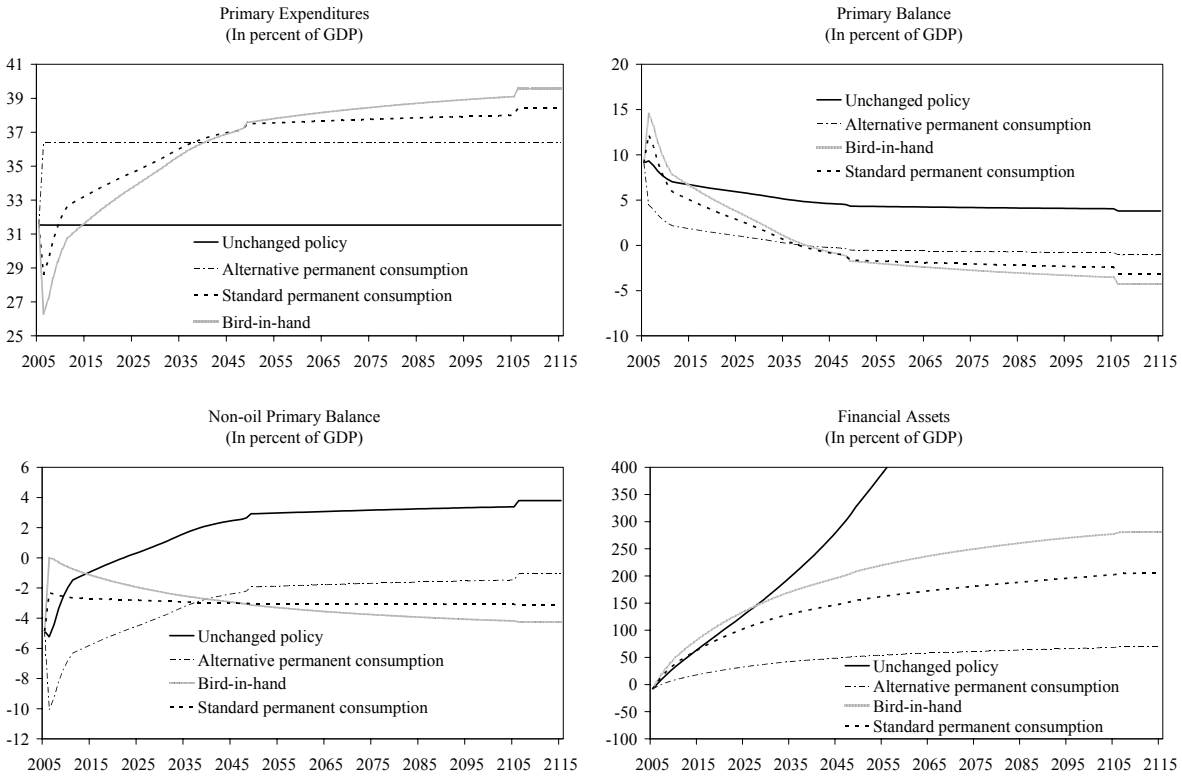


Figure 6. Comparison of Different Fiscal Rules



40. **The overall primary balance deteriorates further in the steady state, while the non-oil deficit declines.** In the steady state, the two balances converge to a deficit of 1 percent of GDP. As expenditure remains constant as a share of overall GDP in this variant of the permanent consumption rule, the dynamics of fiscal balances mechanically reflect the assumptions concerning tax policy, whereby overall revenues decline and non-oil revenues increase as a share of GDP until they reach the common steady state value of 35 percent. The equilibrium deficit would be financed by the return on accumulated assets (amounting to 41–98 percent of GDP in the steady state).

A comparison across scenarios

41. **The simulated growth paths of the non-oil economy are similar across scenarios, except for the bird-in-hand rule**. Growth rates under all scenarios eventually converge to the same exogenously determined rate and differ only during the transition to the steady state.

42. **For all rules, the framework underling the simulations provides a measure of welfare**. In particular, one way to measure the welfare of the economy is to calculate the sum

of a discounted utility stream of a representative household for an equilibrium consumption path.[15] Simulation results suggest that welfare tends to be higher the more front-loaded the expenditure path is. The alternative permanent consumption rule (scaled by overall GDP) ranks highest, followed by the standard permanent consumption rule (scaled by non-oil GDP), the unchanged policy scenario, and, finally, the bird-in-hand rule.

43. **Both welfare and growth comparisons need to be interpreted with great care**. Underlying the welfare ranking is the large catch-up potential of the Russian economy. The initial capital stock of the simulated economy turns out to be a mere 30 percent of the steady state capital stock. During the transition to the steady state, household consumption remains below the steady-state level. Under these conditions, it is not surprising that saving more today for higher spending in the future (bird-in-hand) produces a lower welfare ranking. However, owing to the nature of the model, the welfare ranking discussed above ignores the limitations of absorptive capacity of the economy or administrative capacity of the government, which could constrain the speed of expenditure adjustments. If government spending is adjusted rapidly, resources might be wasted. Furthermore, any cost associated with high inflation or Dutch disease are not considered in the analysis since the model includes only real variables and does not distinguish between tradables and non-tradables.

44. **The expenditure paths under the two variants of the permanent consumption rule differ less than it appears at first sight.** Once the larger front-loading allowed in the alternative scenario (with scaling by overall GDP) is tempered to take into account the possible risks to the economy of an abrupt spending increase, the resulting medium-term spending envelope is unlikely to be very different from the one implied by the standard scenario (with scaling by non-oil GDP). Since the results are close and the former rule is perhaps more transparent and easier to implement, as it expresses expenditure as a percent of overall GDP rather than non-oil GDP, it would seems to be the preferred rule for Russia at this juncture.

E. Conclusion

45. **The sharp rise in oil prices in recent years has boosted Russia's GDP growth, but has also posed serious challenges to policymakers.** With the absorptive capacity of the economy nearly exhausted, taxing and saving a large part of the oil windfall have helped to avoid higher inflation and excessive real ruble appreciation. Furthermore, because administrative capacity is limited, this policy has also prevented the waste that could have resulted from very large increases in government expenditures, especially since structural reforms—an area where the oil wealth might be well spent—have stalled. However, strong pressures to spend more of the oil windfall continue to mount.

[15] Indeed, the method that is used to solve the model for an equilibrium path entails calculating the sum of a discounted utility stream for all possible private capital stock levels for the entire simulation period.

46. **Russia's fiscal institutions have helped to insulate oil revenues from spending pressures, but further strengthening is needed.** Institutions cannot be a substitute for a commitment to sound fiscal policy, but, if well-designed, strong institutions can help garner support for fiscal discipline. The employment of conservative macroeconomic assumptions in the preparation of the budget and the creation of the OSF in 2004 have been useful in this regard. This chapter has suggested a number of additional improvements. Specifically, it has suggested that fiscal targets should be embedded in a multiyear fiscal plan that is consistent with the government's long-term view on the use of Russia's oil wealth. In this context, the OSF could be transformed into a financing fund to which all hydrocarbon revenues accrue. This change would help focus the budget process more on long-term considerations as fiscal policy would be framed with reference to the non-oil balance—which is the relevant measure when assessing fiscal sustainability in an oil-exporting country.

47. **To illustrate how fiscal targets can be given firmer foundations, this chapter has estimated long-term spending envelopes based on a calibrated neoclassical general equilibrium model.** Simulations assuming unchanged tax policy have been carried out for different spending rules. The alternative permanent consumption rule, based on constant expenditure as a share of overall GDP, would seem to be most appropriate for Russia at this juncture. This rule allows sufficient room to accommodate many of Russia's spending needs over the medium term without creating a potentially unsustainable fiscal position. Estimates suggest that under this rule Russia could increase primary expenditure by about 5 percent of GDP over the medium term (and sustain the same level over the long run).[16] The results are sensitive to several important assumptions, not least the future path of oil prices and world interest rates, and to the preferred degree of front-loading. This sensitivity also highlights the need to update long-term forecasting exercises routinely to ensure that the budget process is based on accurate estimates of oil wealth and takes into account ongoing structural changes in the economy. In addition, because of the highly stylized nature of the model, the estimated spending envelopes should be interpreted as indicative.

48. **Any fiscal relaxation implied by a spending rule should be gradual and supported by structural reforms or other expenditures or tax cuts that support long-term growth.** Fiscal loosening should allow industries sufficient time to adjust through improvements in productivity and, hence, avoid overshooting the real effective exchange rate. Strengthening the public administration would help to make spending more efficient, while structural reforms and other expenditures (or tax cuts) that promote the accumulation of human capital and improve the investment climate would help to expand the absorptive capacity of the economy, thereby creating room for fiscal relaxation without causing macroeconomic instability.

[16] At the same time, the non-oil primary deficit would be about 5 percent of GDP higher than under unchanged policies, which assumes the expenditure-to-GDP ratio to be fixed at the 2005 level.

Appendix I: The Model

1. This appendix builds a long-term analytical framework to study preferred fiscal rules in countries endowed with exhaustible resources. It builds a neoclassical growth model that is augmented to take into account the effects of public capital on productivity of firms. A preferred fiscal rule for economies facing exhaustible resource-related revenues is identified based on the welfare ranking.

2. The analysis in this chapter is based on some simplifying assumptions. In particular, the rate of extraction (i.e., output) of natural resources, the amount of resources in the ground, and the tax system are taken as given and will not be endogenized. Furthermore, for modeling purposes, it is assumed that the government has a savings technology of holding the worlds' financial assets, while the only savings technology available to households is to accumulate physical capital.

3. The economy is a decentralized economy and is populated by three types of economic agents. First, a large number of households whose measure is normalized to unity. They are indexed by $\eta \in [0,1]$. The size of each household grows at an exogenous rate, n. Hence, n represents the growth rate of the population. Households own capital stock that can be used for producing output in the nonnatural resources sector. They also own natural resource reserves that generate a stream of output at exogenous rates over a finite period.[17] Second, the economy is populated by a single firm in the nonnatural resources sector which takes prices as given in making its decisions.[18] Third, the government also engages in economic activity: taxing households and making expenditures. The government announces and commits itself to its fiscal policy for future dates. Households and the firm make their decisions after observing the announced fiscal policy. The government is assumed always to implement the announced policy. Therefore, no time-inconsistency problem arises.

4. Timing of events in the economy is discrete, and no uncertainties exist. At the start of each period, households rent their capital stock and labor services to the firm. The firm employs them and uses public capital available for free to produce a single consumption-capital good. After production, payments for production factors, taxation, government expenditures, sales and purchase are made simultaneously. The firm returns the undepreciated portion of the capital stock to the households and also makes payments for the use of production factors. The natural resources sector also generates output. The generated output is exchanged for consumption-capital goods in international markets, which are then distributed to households. Income from the natural resources sector is taxed at an exogenous

[17] For computational simplicity, the natural resources sector is assumed to employ no domestic production factors. While this will not be entirely realistic, it is a good approximation for oil-rich countries, many of which rely on foreign capital and labor for exploration, development, and extraction activities, with the government collecting part of the rents.

[18] The assumption of a single firm is made to simplify presentation, but it does not alter the results.

rate. Households are also subject to a lump-sum tax. The government purchases investment goods, makes lump-sum transfers to households, and also purchases consumption goods. Any primary fiscal surplus is saved in foreign financial assets, while fiscal deficits can be financed by withdrawing the financial assets already accumulated. Households use their after-tax/transfer incomes to purchase consumption and investment goods from the firm. After all transactions are made, households consume consumption goods. Undepreciated private capital is augmented by investment goods and is carried over into the following period. Undepreciated public capital is augmented by investment goods the government purchased. The government consumes consumption goods.[19]

5. Some conventions about notation follow. Throughout this appendix, the superscript *f* indicates quantities chosen by the firm, while the subscript *t* indicates quantities either in period *t* (in the case of flow variables) or at the beginning of period *t* (in the case of stock variables). The subscripts *p* and *g* indicate variables chosen by the private sector and the government, respectively. Uppercase and lowercase variables represent aggregate and individual (both firm and household) variables, respectively.

The firm

6. A constant-returns-to-scale production technology is available for the firm to transform labor input, l_t^f, private capital, $k_{p,t}^f$, and aggregate public capital normalized by aggregate labor input, $K_{g,t}/L_t$, into a y_t unit of consumption-capital good, where $K_{g,t}$ and L_t are aggregate public capital stock and labor input, respectively. Inputs l_t^f and $k_{p,t}^f$ are under the direct control of the firm, while an aggregate variable, $K_{g,t}/L_t$, is outside the control of the firm.

7. The following Cobb-Douglas production function is assumed:

$$y_t = y_t(k_{p,t}^f, l_t^f) = \left[\phi\left(A_t, \frac{K_{g,t}}{L_t}\right)\cdot l_t^f\right]^{1-\alpha}\left(k_{p,t}^f\right)^{\alpha}, \tag{A1}$$

where $\alpha \in (0,1)$ is the substitution parameter and $\phi_t(\cdot) > 0$ represents the level of total factor productivity (TFP), which is a function of the technology level, A_t, and the ratio of public

[19] The government consumption adds nothing to the model since neither the utility nor the production of the nonnatural resources sector is affected by the government consumption.

capital to labor. The technology level is assumed to grow at a constant rate, γ, that is exogenous to the economy.

8. We assume that production depends on the normalized public capital, $K_{g,t}/L_t$, not on the absolute level of the public capital, $K_{g,t}$, to capture congestion effects. The assumption implies that, the higher the level of economic activity (approximated by the economy-wide labor input) is, the larger is the public capital stock required to maintain its efficiency in production.[20] This assumption also ensures consistency of a particular class of the model with balanced growth in the steady state, one of the *stylized facts* of economic growth documented by Kaldor (1963). Given a constant ratio of $K_{g,t}$ to aggregate output, and given a function $\phi(\cdot,\cdot)$ that is linear in A_t and $K_{g,t}/L_t$, the model can generate a balanced growth path on which private capital and output grow at a constant rate $(1+\gamma)(1+n)-1$, driven by the exogenous productivity growth, $1+\gamma$, and the exogenous population growth, $1+n$.[21] As a result, public capital also grows at the rate $(1+\gamma)(1+n)-1$. Therefore, the model can be redefined using detrended variables. Throughout the chapter, a linear function

$$\phi(A_t, \frac{K_{g,t}}{L_t}) = A_t + \theta \frac{K_{g,t}}{L_t}$$

is assumed. Appendix II discusses the detrending in detail.

9. The firm maximizes the profit in each period, given the price of single consumption-investment goods, p_t, the rental rate, $p_t \cdot r_t$, and the wage rate, $p_t \cdot w_t$. r_t and w_t are functions of *aggregate* private capital $K_{p,t}$ and public capital $K_{g,t}$, which the firm takes as given. These factor prices are written as $r_t(K_{p,t}, K_{g,t})$ and $w_t(K_{p,t}, K_{g,t})$, respectively. Specifically, the firm produces a single consumption-investment good by employing labor and capital, and then sells consumption goods $c^f_{p,t}$ and investment goods $i^f_{p,t}$ to the households at price p_t. Therefore, the firm's maximization problem can be written as

$$\max_{\{c^f_{p,t}, i^f_{p,t}, k^f_{p,t}, l^f_t\}} p_t \cdot \left[\left(c^f_{p,t} + i^f_{p,t} \right) - r_t(K_{p,t}, K_{g,t}) \cdot k^f_{p,t} - w_t(K_{p,t}, K_{g,t}) \cdot l^f_t \right], \qquad \text{(A2)}$$

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[20] This congestion effect in the use of public goods is also analyzed by Barro and Sala-i-Martin (1992 and 1995, pp. 158–59).

[21] That the production function is consistent with balanced growth can be confirmed by multiplying A_t by $(1+\gamma)$, l_t and L_t by $(1+n)$, and $k_{p,t}$ and $K_{g,t}$ by $(1+\gamma)(1+n)$ in the production function. It is straightforward to confirm that output grows at the rate $(1+\gamma)(1+n)-1$.

subject to the constraint

$$c_{p,t}^{f} + i_{p,t}^{f} \leq y_t .$$

This problem can be rewritten as

$$\max_{\{k_{p,t}^{f}, l_t^{f}\}} p_t \cdot \left[y_t(k_{p,t}^{f}, l_t^{f}) - r_t(K_{p,t}, K_{g,t}) \cdot k_{p,t}^{f} - w_t(K_{p,t}, K_{g,t}) \cdot l_t^{f} \right]. \tag{A3}$$

10. The aggregation of firm variables is straightforward. Since there is only one firm in the economy, y_t, $k_{p,t}^{f}$, and l_t^{f} are all aggregate variables.

Households

11. Households are assumed to derive utility by consuming consumption goods and services, denoted by $c_{p,t}$.[22] The discounted sum of period-by-period utility is written as

$$\sum_{t=0}^{\infty} \beta^t u(c_{p,t}), \tag{A4}$$

where β is the discount factor. As a baseline case, we study the following constant relative risk aversion (CRRA) utility function:

$$u(c_{p,t}) = \frac{c_{p,t}^{1-\sigma}}{1-\sigma}, \ \sigma > 0. \tag{A5}$$

12. The households provide labor services and capital to the firm. Since households' utility does not depend on labor, households provide all their labor endowment inelastically. We normalize the initial period labor input to unity: $l_0 = 1$. Private capital is solely owned by a household and is denoted by $k_{p,t}$. The households receive factor payments from the firm equal to $w_t \cdot l_t + r_t \cdot k_{p,t}$. The households also receive income generated by the natural resources sector, $o_{p,t} \cdot q_t$, where $o_{p,t}$ is the oil output (in per capita terms, net of taxes) and q_t is the export price normalized by the price of consumption-investment goods, p_t.

[22] A typical model designed to study the consumption-savings decision of the government endowed with natural resources tends to assume that social welfare is a function of government spending. This assumption is often given an interpretation that government spending is akin to consumption. While this assumption can be easily accommodated in our model, we do not consider such an extension for simplicity.

13. Aggregation of household variables is straightforward. Given the capital stock held by individual households at the beginning of period *t*, aggregate private capital is defined by $K_{p,t} = \int_0^1 k_{p,t} d\eta$, while aggregate labor services at the beginning of period *t* is $(1+n)^t$. In a similar manner, aggregate consumption and aggregate oil output (net of taxes) are defined as $C_{p,t} = \int_0^1 c_{p,t} d\eta$ and $O_{p,t} = \int_0^1 o_{p,t} d\eta$, respectively.

14. In each period *t*, the households split their incomes into consumption and investment in private capital. We assume that the economy is small and open and that the households and the firm of this economy can freely engage in international trade to exchange the domestically produced consumption-capital good with the identical good produced abroad. An arbitrage condition for this good ensures that the domestic price is equal to the international price. We normalize the international price of this good to one, which implies that the domestic price is always equal to one in equilibrium (see below). We also assume that households receive transfers net of any lump-sum taxes from the government, denoted by x_t. Households face a budget constraint that sets their total spending less than or equal to their income:

$$c_{p,t} + i_{p,t} \leq w_t \cdot l_t + r_t \cdot k_{p,t} + x_t + o_{p,t} \cdot q_t, \tag{A6}$$

where $i_{p,t}$ is the investment in private capital. Note that households do not have any savings technology other than accumulating physical capital. Private capital follows the following law of motion:

$$k_{p,t+1} = i_{p,t} + (1-\delta_p) k_{p,t}, \tag{A7}$$

where δ_p is the depreciation rate and satisfies $0 < \delta_p < 1$.

15. The state of the economy that affects households' decision making is summarized by a triple $(k_{p,t}, K_{p,t}, K_{g,t})$. This reflects the fact that the households' incomes are affected by rental and wage rates that are functions of aggregate private capital, $K_{p,t}$, and public capital, $K_{g,t}$. Moreover, the households maximize their lifetime utility (A4), and thus the future path of aggregate states matter to the households' decision making. By denoting aggregate private and public investments by $I_{p,t}$ and $I_{g,t}$, respectively, the future path of aggregate states is represented by the following laws of motion of the aggregate private capital and public capital:

$$K_{p,t+1} = (1-\delta_p) K_{p,t} + I_{p,t} \tag{A8}$$

and

$$K_{g,t+1} = (1-\delta_g)K_{g,t} + I_{g,t}, \tag{A9}$$

respectively, where δ_g is the depreciation rate of public capital and satisfies $0 < \delta_g < 1$.

16. A representative household's maximization problem can be written as follows:

$$\max_{\{c_{p,t}, i_{p,t}, k_{p,t+1}\}} \sum_{t=0}^{\infty} \beta^t u(c_{p,t}), \tag{A10}$$

subject to the budget constraint (A6), the law of motion of private capital (A7), and the laws of motion of aggregate capitals (A8 and A9).

The government

17. One of the government's sources of revenue is the tax on export receipts of the endowment (oil) sector, $o_{g,t} \cdot q_t$, where $o_{g,t}$ is the volume of oil tax (in per capita terms) and q_t is the export price. Aggregate volume of oil tax is defined as $O_{g,t} = \int_0^1 o_{g,t} d\eta$. The government also collects a lump-sum tax from the households. We assume that the government can save tax revenues to increase its holding of the world's financial assets (e.g., U.S. treasury bonds) which yields a net return of $r_{e,t}$. Alternatively, the government can use tax revenues to purchase a consumption-investment good to augment the stock of public capital or consume the good. Lastly, the government can simply transfer tax revenues to the households. The lump-sum transfer, net of lump-sum taxes, is denoted by x_t in per capita terms. The aggregate lump-sum net transfer is defined as $X_t = \int_0^1 x_t d\eta$.

18. The government faces a sequence of budget constraints (a period-by-period budget constraint). Any fiscal deficit or surplus in period *t*, including interest payments on the government's holdings of the world's financial assets at the beginning of period *t*, is reflected in a change in the government's holdings of the world's financial assets at the beginning of period *t*+1. The government's budget constraint can be written as

$$I_{g,t} + C_{g,t} + X_t + B_{t+1} = q_t \cdot O_{g,t} + (1+r_{e,t})B_t, \tag{A11}$$

where $I_{g,t}$ is the public spending to augment public capital stock, $C_{g,t}$ is the public spending on the consumption good, X_t is the aggregate lump-sum net transfer, B_t is the government's

beginning-of-the-period holdings of the world's financial assets, and $r_{e,t}$ is the return on world's financial assets.

Equilibrium

19. A sequence of market equilibrium is a set of prices and quantities, $\{r_t, w_t\}$ and $\{c_{p,t}, c_{g,t}, l_t, l_t^f, i_{p,t}, i_{g,t}, k_{p,t}, k_{p,t}^f\}$ and transfers $\{x_t\}$ such that

- given transfers and prices, the quantities solve the household problem;
- given the prices, the quantities solve the firm problem;
- factor market-clearing conditions

  $L_t = l_t^f$ and $K_{p,t} = k_{p,t}^f$

  are satisfied;
- given the prices and quantities, the government's budget constraint is satisfied; and
- the resource constraint

$$C_{p,t} + C_{g,t} + I_{p,t} + I_{g,t} \leq y_t + q_t \cdot (O_{p,t} + O_{g,t}) + (1 + r_{e,t}) \cdot B_t - B_{t+1} \tag{A12}$$

  is satisfied.

Solution of the model

20. The firm's optimization implies marginal returns of inputs are equal to marginal products:

$$r_t(K_{p,t}, K_{g,t}) = \frac{\partial y_t}{\partial k_{p,t}^f} = \alpha \frac{y_t}{k_{p,t}^f} \tag{A13}$$

and

$$w_t(K_{p,t}, K_{g,t}) = \frac{\partial y_t}{\partial l_t^f} = (1-\alpha) \frac{y_t}{l_t^f}. \tag{A14}$$

Since $k_{p,t}^{f} = K_{p,t}$ and $l_{t}^{f} = L_{t}$ in equilibrium, these conditions can be rewritten as

$$r_t(K_{p,t}, K_{g,t}) = \alpha \frac{y_t}{K_{p,t}} \tag{A15}$$

and

$$w_t(K_{p,t}, K_{g,t}) = (1-\alpha)\frac{y_t}{L_t}. \tag{A16}$$

21. The first-order condition for the household's problem is

$$u_{c_p,t} = \beta u_{c_{p,t},t+1}\left(r_{t+1} + 1 - \delta_p\right). \tag{A17}$$

Given the functional forms, the firm's first-order condition, and the market-clearing condition, this Euler equation reduces to

$$\left(\frac{c_{p,t+1}}{c_{p,t}}\right)^{\sigma} = \beta\left[\alpha \frac{y_{t+1}}{K_{p,t+1}} + 1 - \delta_p\right]. \tag{A18}$$

22. The value of the domestically produced consumption-capital good is equal to the factor payments by the firm. As a result, the households' factor income is equal to the value of inputs.

23. (A18) is a variant of the familiar second-order Euler difference equation in $\left\{k_{p,t}, k_{p,t+1}, k_{p,t+2}\right\}$ for the optimal growth model. However, the state space method cannot be used to solve this difference equation since TFP in the production function is not assumed to follow a stochastic process with Markov properties. The problem can be expressed using value functions, and thus the value function iterations method can be used to obtain an equilibrium.[23]

[23] See Stokey and Lucas (1989).

Appendix II: The Detrended Model

1. The model economy exhibits a balanced growth if investment in public capital grows at the rate $(1+\gamma)(1+n)-1$ and, as a result, $K_{g,t}$ grows at the same rate $(1+\gamma)(1+n)-1$. A heuristic explanation for the existence of a balanced growth path is provided later in this appendix. On a balanced growth path under this assumption, l_t grows at the rate n and $c_t, i_{p,t}, k_{p,t}$, and y_t grow at the rate $(1+n)(1+\gamma)-1$. By assumption, A_t grows at a constant rate γ.

2. Detrended variables are defined by dividing the original variables by their respective growth rates. Specifically, detrended variables, represented by notations with hats, are defined as follows:

$$\hat{l}_t = \frac{l_t}{(1+n)^t}, \hat{l}_t^f = \frac{l_t^f}{(1+n)^t}, \hat{A}_t = \frac{A_t}{(1+\gamma)^t}, \hat{o}_{p,t} = \frac{o_{p,t}}{\left[(1+n)(1+\gamma)\right]^t}, \hat{o}_{g,t} = \frac{o_{g,t}}{\left[(1+n)(1+\gamma)\right]^t},$$

$$\hat{c}_{p,t} = \frac{c_{p,t}}{\left[(1+n)(1+\gamma)\right]^t}, \hat{c}_{g,t} = \frac{c_{g,t}}{\left[(1+n)(1+\gamma)\right]^t}, \hat{i}_{p,t} = \frac{i_{p,t}}{\left[(1+n)(1+\gamma)\right]^t}, \hat{i}_{g,t} = \frac{i_{g,t}}{\left[(1+n)(1+\gamma)\right]^t},$$

$$\hat{k}_{p,t} = \frac{k_{p,t}}{\left[(1+n)(1+\gamma)\right]^t}, \hat{k}_{p,t}^f = \frac{k_{p,t}^f}{\left[(1+n)(1+\gamma)\right]^t}, \text{ and } \hat{x}_t = \frac{x_t}{\left[(1+n)(1+\gamma)\right]^t} \quad .$$

The detrended aggregate economy-wide variables, $\hat{L}_t, \hat{C}_{p,t}, \hat{C}_{g,t}, \hat{I}_{p,t}, \hat{X}_t, \hat{I}_{g,t}, \hat{K}_{p,t}, \hat{O}_{p,t}, \hat{O}_{g,t}$ and $\hat{K}_{g,t}$ can be defined in a similar manner. These definitions imply that public capital per worker, $k_{g,t} = K_{g,t} / L_t$, grows at the rate γ, and the detrended variable is defined as $\hat{k}_{g,t} = k_{g,t} / (1+\gamma)^t$.

3. The original economy can be recast in a detrended version. To define such an economy, both the firm's problem (A2) and the households' problem (A10) need to be reformulated as problems based on detrended variables, as discussed below. Detrended output is defined as

$$\hat{y}_t \equiv \left(\hat{A}_t + \theta \hat{k}_{g,t}\right)^{1-\alpha} \left(\hat{l}_t^f\right)^{1-\alpha} \left(\hat{k}_{p,t}^f\right)^{\alpha}.$$

By substituting detrended variables and defining prices for the detrended economies as $\hat{r}_t \equiv r_t(\hat{K}_{p,t}, \hat{K}_{g,t})$ and $\hat{w}_t \equiv w_t(\hat{K}_{p,t}, \hat{K}_{g,t})$, the first-order conditions for the firm's optimization problem (A13) and (A14) become

$$\hat{r}_t = \alpha \frac{\hat{y}_t}{\hat{k}^f_{p,t}} \tag{A19}$$

and

$$\hat{w}_t = (1-\alpha)\frac{\hat{y}_t}{\hat{l}^f_t}. \tag{A20}$$

Similarly, by substituting detrended variables into the household's utility function, the budget constraint, and the law of motion of capital in (A7), (A8), and (A9), the household's transformed maximization problem becomes

$$\begin{aligned} &\max_{\{\hat{c}_t, \hat{i}_{p,t}\}} \sum_{t=0}^{\infty} \left\{ \beta \left[(1+\gamma)(1+n) \right]^{1-\sigma} \right\}^t \frac{\hat{c}_t^{\,1-\sigma}}{1-\sigma} \\ &\text{s.t.} \quad \hat{c}_{p,t} + \hat{i}_{p,t} \le \hat{r}_t \cdot \hat{k}_{p,t} + \hat{w}_t \cdot \hat{l}_t + \hat{x} + q_t \cdot \hat{o}_{p,t}, \\ &\qquad (1+\gamma)(1+n)\hat{k}_{p,t+1} = (1-\delta_p)\hat{k}_{p,t} + \hat{i}_{p,t}, \\ &\qquad (1+\gamma)(1+n)\hat{K}_{p,t+1} = (1-\delta_p)\hat{K}_{p,t} + \hat{I}_{p,t}, \\ &\qquad\qquad \text{and} \\ &\qquad (1+\gamma)(1+n)\hat{K}_{g,t+1} = (1-\delta_g)\hat{K}_{g,t} + \hat{I}_{g,t}, \end{aligned} \tag{A21}$$

given $\hat{r}_t$, and $\hat{w}_t$.

The Euler condition for the household's optimal intertemporal substitution, equation (A17), is rewritten as

$$\frac{u'(\hat{c}_{p,t+1})}{u'(\hat{c}_{p,t})} = \frac{(1+n)^{\sigma}(1+\gamma)^{\sigma}}{\beta\left(\hat{r}_{t+1} + 1 - \delta_p\right)}. \tag{A22}$$

The government's budget constraint can be redefined as

$$\hat{I}_{g,t} + \hat{C}_{g,t} + \hat{X}_t + (1+\gamma)(1+n)\hat{B}_{t+1} = q_t \cdot \hat{O}_{g,t} + (1+r_{e,t})\hat{B}_t. \tag{A23}$$

4. Given the reformulated problem of the firm and households, as well as the government's budget constraint, the competitive equilibrium of the detrended model can be defined in a similar way to the original model.

5. With the reformulated detrended model, it is straightforward to confirm that the model exhibits balanced growth. $\hat{l}_t$ is constant by definition. Under fiscal rules that ensure

constant per capita expenditures after the depletion of oil and gas, $\hat{I}_{g,t}$, $\hat{C}_{g,t}$, and $\hat{K}_{g,t}$ remain constant after the depletion of gas and oil. Suppose that $\hat{k}_{p,t}$ is constant. Then all detrended variables that appear in optimization problems for households and firms are constant. From (A19) and (A20), the rental rate, $\hat{r}_t$, and the wage rate, $\hat{w}_t$, are constant since they are functions of constant aggregate variables $\hat{K}_{p,t}$, $\hat{K}_{g,t}$, and $\hat{L}_t$ in equilibrium. A constant $\hat{k}_{p,t}$ implies a constant $\hat{i}_{p,t}$ by virtue of the law of motion of $\hat{k}_{p,t}$. By virtue of the household's budget constraint, $\hat{c}_{p,t}$ is also constant, which also satisfies the Euler equation (A22).

6. Now that the detrended economy has been defined, it is possible to solve analytically for the balanced growth path of a competitive economy of the detrended model. From the Euler equation (A22),

$$\hat{r} = \frac{(1+\gamma)^{\sigma}(1+n)^{\sigma}}{\beta} - 1 + \delta_p . \tag{A24}$$

For any value of the government's financial asset on a balanced growth path, $\hat{B}$, $\hat{I}_g$ and $\hat{X}$ are determined to satisfy the government's detrended budget constraint (A23). From the law of motion of $\hat{K}_{g,t}$, $\hat{K}_g = \frac{1}{(1+\gamma)(1+n)-(1-\delta_g)}\hat{I}_g$. Given $\hat{r}$ and $\hat{K}_{g,t}$, the firm's optimization condition (A19) implies that

$$\hat{k}_p = \left(\frac{\alpha}{\hat{r}}\right)^{\frac{1}{1-\alpha}} \left(\hat{A}\hat{L} + \theta \hat{K}_g\right). \tag{A25}$$

Given $\hat{k}_p$ and $\hat{K}_g$, consumption, $\hat{c}_p$, and the wage rate, $\hat{w}$, follow from the household's budget constraint in (A21) and the first-order condition for the firm's profit maximization (A20), respectively:

$$\begin{aligned} \hat{c}_p &= \hat{w}\hat{l} + \hat{r}\hat{k}_p + \hat{x} + q_t \cdot \hat{o}_{p,t} - \hat{i}_p \\ &= \hat{y} + \hat{x} + q_t \cdot \hat{o}_{p,t} - \left[(1+\gamma)(1+n)\hat{k}_p - (1-\delta_p)\hat{k}_p\right] \\ &= \left(\hat{A} + \theta\frac{\hat{K}_g}{\hat{L}}\right)^{1-\alpha} \hat{l}^{1-\alpha}\hat{k}_p{}^{\alpha} + \hat{x} + q_t \cdot \hat{o}_{p,t} - \left[(1+\gamma)(1+n)\hat{k}_p - (1-\delta_p)\hat{k}_p\right], \end{aligned} \tag{A26}$$

and

$$\hat{w} = (1-\alpha)\left(\hat{A}\hat{L} + \theta\hat{K}_g\right)^{1-\alpha} \frac{\hat{K}_p{}^{\alpha}}{\hat{L}}. \tag{A27}$$

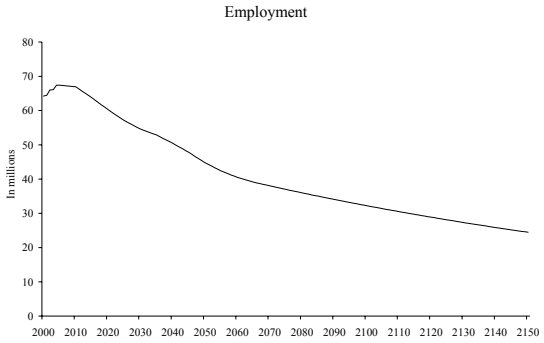
Appendix III: Calibration and Simulation

1. This appendix provides a detailed discussion on the calibration of the model and the simulations that are summarized in the main text. It first discusses the exogenous variables that are necessary for conducting simulations, then how parameter values underlying household preference and production technology, as well as initial conditions, are chosen.

Exogenous variables

2. In order to conduct a simulation exercise based on the model, several exogenous variables need to be set in advance. Paths of the following exogenous variables, along with fiscal policy variables that are discussed below, are predetermined for the entire simulation period:

- **Labor force**. As a proxy for the labor force, employment is used as a factor input. Historical data on employment are available from official sources. The long-term projection of Russia's labor force is approximated by a fraction of the projected working-age population (available in the UN population database that covers the period up to 2050). The average growth rate of working-age population for 2045-50 (-0.55 percent) is applied to extend the projection of labor force from 2050 to 2150.



- **Government hydrocarbon revenues**. Historical data on hydrocarbon revenues are available for 2000-05. The projection is set to keep the hydrocarbon revenues-to-projected hydrocarbon GDP ratio constant at the 2005 level. Projected hydrocarbon GDP is based on the following long-term assumptions about output and prices. **Oil output growth** gradually picks up over 2006-11 to reach 4 percent per annum in 2011-12, followed first by a gradual deceleration of growth and then declines in output itself. The stock of proven, probable, and possible reserves, estimated at 149.3 trillion barrels for 2004, will be depleted in 2048. **Gas output growth** is assumed to be 2 percent annum until 2011, 1 percent per annum for 2012-31, 0.5 percent per annum for 2032-51, and zero afterward. The stock of proven and unproven reserves, estimated at 236.1 trillion cubic meters for 2004, will not be depleted for another 300 years. However, government gas revenues are assumed to disappear in 2105. **Oil and gas export prices** for the period 2006-11 are based on the WEO assumptions, with some adjustments made to take into account differences between international and Russian export prices. For 2012 onwards, prices are

assumed to remain constant in real terms vis-à-vis advanced economies' long-term projected consumer price inflation of 2 percent per annum. Nominal oil and gas export prices are normalized by non-oil and gas prices deflator (both for historical and projection periods) to derive real values of oil and gas export receipts.

- **Long-run rate of technological progress**. This rate has been set to ensure 1.5 percent per annum long-term real output growth rate, given the labor force discussed above. In particular, a 2.05 percent long-run rate of technological progress is implied by the 1.5 percent growth rate of long-run real non-oil output and the -0.55 percent growth rate of labor force, since balanced growth in the model is driven purely by technological progress and labor force growth. Somewhat higher rates of technological progress are assumed for 2000-30 to capture the catch-up process and to be consistent with the growth accounting exercise under an assumed effect of public capital on growth (discussed in more detail below). In particular, rates of technological progress are assumed to be 4.05 percent for 2000-11, 3.55 percent for 20012-18, 3.05 percent for 2019-24, and 2.55 percent for 2025-30.[24]

- **Long-run real return on foreign financial assets and government's external debt**. The long-run real return is set equal to 3 percent.[25]

- **Public capital stock**, both for the historical part and for the projection horizon. Historical data on public capital are estimated, while public capital for the projection horizon can be generated using a perpetual inventory method, once the future fiscal policy has been identified. Official historical data on real public capital are not available, but official data on initial-period public capital stock in current prices are available. Starting from this public capital stock for the beginning of 2000, a historical path of public capital is constructed using the perpetual inventory method, given estimated government capital expenditures in constant 2000 prices and an assumed depreciation rate. Details of the derivation of the depreciation rate are discussed below. Public capital stock for the projection horizon can also be generated using the perpetual inventory method, once the future path of capital expenditures has been identified.

[24] Using a standard Cobb-Douglas production function, Oomes (2006) estimates TFP growth for 1999-2004 is 4.1 percent.

[25] Alternatively, the rate can be set equal to the steady state marginal product of private capital net of a depreciation rate implied by the calibrated model. The calibration that is discussed below implies a 9.5 percent marginal product of capital. While this rate is high compared with historical real returns on safe financial assets, such as U.S. treasury bonds, simulation results under this alternative assumption are likely to result in less bias in welfare rankings across different fiscal rules than the results discussed in the text.

Calibration

3. The model is calibrated to replicate the growth experience of the Russian economy following the 1998 financial crisis. In particular, the following parameters and initial conditions need to be chosen so that the model replicates the recent growth pattern of the Russian economy:

- the capital elasticity of the aggregate production function;
- the time preference;
- the rate of depreciation of private and public capital;
- the initial level of private capital;
- the holdings of foreign financial assets and the stock of government external debt for the end of the final year of the historical portion of the simulation (i.e., 2005);
- a parameter that captures the contribution of public capital to aggregate production (coefficient of public capital);
- the initial technology level; and
- the intertemporal elasticity of substitution in households' utility function that represents the degree to which consumption will be postponed in response to additional rewards.

4. The **capital elasticity** of the production function is set equal to the historical ratio of capital income (i.e., gross profits of economy and gross mixed income) to real GDP by revenue source net of net taxes.[26,27] The **time preference** is set to 0.98, implying a subjective discount rate of 2 percent. Rates of **capital depreciation** are set to 7 percent per annum, so that the aggregate capital stock that is estimated using a perpetual inventory method roughly mimics the official data on the stock of fixed capital. In particular, starting from the official data on fixed capital for the beginning of 2000, a path for the capital stock can be generated using the perpetual inventory method and given the data on gross fixed capital formation for any depreciation rate. An exact depreciation rate that precisely replicates the official data on fixed capital can be calculated for each year. The average depreciation rate for 2000-04 is 7.654 percent. In the simulation, we use a slightly lower depreciation rate of 7 percent for

[26] The first-order condition of the firm's maximization problem implies that capital (labor) elasticity is equal to the share of capital (labor) income in output.

[27] Net taxes on production and imports are excluded since they accrue to neither capital nor labor.

both private and public capital stocks. The holding of **foreign financial assets** is set equal to the end-2005 stock of the oil stabilization fund, while the stock of **government external debt** is available from official sources.

5. The initial-period technology level is derived from a growth-accounting exercise, given an assumed coefficient of public capital. A simple growth-accounting exercise based on the Cobb-Douglas function implies a Solow residual, given private capital stock, employment, and non-oil output for 2000-05.[28,29] The Solow residual in our model reflects two components: technological progress and public capital stock. Only one of these components can be identified from the implied Solow residual, given an exogenous assumption about the other component. We assume that the coefficient of public capital is 0.01. Implied technological progress is roughly 4 percent for 2000-05, close to previous estimates of TFP growth from other studies. The assumed coefficient of public capital, together with the Solow residual and historical data on public capital stock and employment for 2000, implies an initial-period technology level of 8.4767.

6. The **intertemporal elasticity of substitution** remains as a free parameter that is used to match the annualized growth rate of simulated non-oil GDP under the unchanged policy to the actual annualized growth rate for the period 2000-05.

Parameters and initial conditions

Parameter values		
Capital elasticity of output (α)		0.552
Risk aversion parameter (σ)		5.35
Time preference (β)		0.98
Depreciation rate of private capital (δ_p)		0.070
Depreciation rate of public capital (δ_g)		0.070
Coefficient of Kg for the augmented TFP (θ)		0.010
Initial conditions		
Initial level of TFP adjusted for efficiency (A_0)		8.477
Initial public capital stock ($K_{g,0}$)	In Rb billion	7,140
Initial private capital stock ($K_{p,0}$)	In Rb billion	9,465
End-2005 stock of Oil Stabilization Fund	In Rb billion	1,237
End-2005 stock of gross external debt	In Rb billion	3,142

[28] The data on private capital stock are derived starting with the data on beginning- 2000 private capital stock, estimated gross fixed capital formation by private sector in 2000 prices, and the 7 percent depreciation rate just discussed.

[29] In the growth-accounting exercise and the simulation, factor inputs are adjusted for respective factor utilization rates. See Oomes (2006) for a detailed discussion of this approach.

Solution method

7. Given the exogenous variables, fiscal policy variables, and parameter values, a full equilibrium path can be calculated using a technique designed to solve a standard optimal growth model.[30] The paths of world financial assets and government external debt are simulated for 2006 onward only, given the data on end-2005 stocks.[31]

[30] In order to work with a detrended version of the model elaborated in Appendix II, all fiscal aggregates are first deflated by the GDP deflator and then detrended by the long-term rate of population-cum-technological progress. Working-age population is detrended by the long-term growth rate of working-age population, while the technology level is detrended by the long-term rate of technological progress.

[31] To study fiscal policies that finance at least a part of the primary deficit on a balanced growth path by the return from the holding of financial assets, it is necessary to set the real return on foreign financial assets to be greater than the output growth rate implied by exogenous technological progress and labor force growth. Otherwise, financial assets cannot be maintained over time.

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II. What Explains Weakening Growth Linkages Between Russia and Other Countries in the Region?[32]

Since the dissolution of the former USSR, the 15 countries that emerged from it have undergone deep economic, social, and political transformations. Each country has introduced its own currency, seven have joined the World Trade Organization (WTO), and the three Baltic countries have become members of the European Union (EU). Several countries have attained market economy status, while the remaining countries have made significant progress in their transition to a market economy. In this process, the structures of these economies have changed so that the strong interconnections that characterized these economies at the start of their independence have weakened, while links to the rest of the world have strengthened.

While one would expect this reorientation of economic links to happen gradually over time, there are indications that the Russian financial crisis in 1998 precipitated this process. For example, simple correlations between real GDP growth in Russia, on the one hand, and in the other former Soviet Union (FSU) countries, on the other, dropped significantly following the Russian crisis (Table 1). In a recent IMF working paper, Shiells, Pani, and Jafarov (2005) (henceforth SPJ) investigate whether this drop is evident after controlling for other factors that have been claimed in the previous literature to be determinants of growth in the transition countries.[33] They conclude that Russian growth was a significant determinant of regional growth before the Russian crisis, but this link weakened significantly following the crisis.

Results of reestimations of the set of equations presented in SPJ using the latest (and slightly revised) data available are similar to those in the original paper. While there are a few changes in the coefficients, the main findings of the original paper remain robust. Specifically, the results suggest that the growth linkages between Russia and the other FSU countries weakened significantly following the Russian crisis (Appendix I).

This chapter tries to explain what might have weakened the linkages between growth in Russia and growth in other countries in the region.[34] Sections A-D consider possible transmission channels, including trade linkages, capital flows, and labor flows. Section E presents the results of a regression analysis built on the work presented in SPJ. Section F concludes.

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[32] Prepared by Etibar Jafarov.

[33] Researchers studying the international correlation of output changes have mainly analyzed the transmission of business cycles among the industrial countries, although some papers have studied the business cycles of developing countries (see, for instance, Backus, Kehoe, and Kydland, 1992; Backus and Kehoe, 1992; Agénor, McDermott, and Prasad, 1999; Doyle and Faust, 2002; and Helbling and Bayoumi, 2003). Given difficulties in defining business cycles in transition economies, SPJ, as well as this paper, focus on growth correlations.

[34] Turkmenistan is excluded from the analysis because of data availability problems.

Table 1. Simple Correlation Coefficients Between Real GDP growth in Russia and the Other FSU Countries, 1993–2004

	1993–97	1998–2004	1993–98	1999–2004
Armenia	0.27	0.06	0.26	-0.35
Azerbaijan	0.88	-0.06	0.73	0.52
Belarus	0.81	-0.22	0.73	0.28
Estonia	0.73	0.29	0.73	0.23
Georgia	0.73	0.23	0.72	-0.19
Kazakhstan	0.88	0.72	0.86	-0.11
Kyrgyz Republic	0.93	0.53	0.91	0.53
Latvia	0.53	0.41	0.51	0.09
Lithuania	0.84	-0.22	0.78	-0.09
Moldova	0.72	0.61	0.71	-0.28
Tajikistan	0.93	0.44	0.74	-0.04
Ukraine	0.98	0.62	0.82	0.07
Uzbekistan	0.95	0.30	0.87	-0.05
Average	0.78	0.29	0.72	0.05

Sources: IMF, World Economic Outlook database; and Fund staff estimates.

A. Possible Transmission Channels

The Russian crisis caused significant disruptions in trade and financial flows in the FSU area, which reduced growth in the whole region. In Russia, real GDP declined by more than 5 percent in 1998 after a 1.4 percent increase in 1997. Average growth in the other FSU countries declined to 2.7 percent in 1998–99 from 6.1 percent in 1997. These disruptions, however, cannot explain the drop in the correlation between Russian growth and growth in other FSU countries after the Russian crisis. Interestingly, this correlation remained low even after growth picked up again across all these countries, including Russia, suggesting that recent high growth in the other FSU countries was not driven by growth in Russia.

It is possible that the Russian crisis triggered changes in patterns of trade, investments, and labor flows, and thus had a knock-on impact in the FSU countries. For example, exports of these countries to the rest of the world surged shortly after the Russian crisis. There are also signs of improvements in efficiency of production (see Sections B-D). Accordingly, the rest of the paper focuses on flows of trade, capital, and labor to and from FSU countries, as well as on other factors that enhanced the supply response to positive shocks these economies experienced.

Flows of trade, capital, and labor can affect growth both in the short and long term. While the literature on growth focuses mainly on determinants of long-term growth, short-term determinants of growth are discussed mainly in the context of transmission of business cycles. This paper takes into account both the short- and long-term impact of flows of trade, capital, and labor.

A number of theoretical models suggest that trade and financial openness promote long-term growth through knowledge spillover, development of the financial sector, augmentation of domestic savings, higher productivity, and investment growth. [35] Many empirical papers support these claims (Edwards, 1992; Dollar, 1992; and Sachs and Warner, 1995). The robustness of the findings of these empirical papers, however, has been criticized. Levine and Renelt (1992), for example, explain that, since policies correlated with growth (trade openness, macroeconomic stability, small government consumption, rule of law, etc.) are highly correlated among themselves, it can be difficult to identify separate effects of any of these policies, including trade openness, when all these policies are included in regression analyses. Rodriguez and Rodrik (2001) make a similar claim, suggesting that the findings of the rapidly increasing literature on the relationship between trade openness and growth are not robust to different specifications, and that the openness measures used in these studies may be capturing other policy and institutional features.

Regarding foreign financing, there is general agreement that long-term investments can enhance growth through various channels. First, long-term investments encourage the incorporation of new inputs and foreign technologies in the recipient economy. Some forms of investment, in particular foreign direct investment (FDI), usually affect growth directly by increasing the stock of physical capital. Second, they facilitate knowledge transfers through labor training and skill acquisition, as well as alternative management practices and organizational arrangements. As a result, foreign investments may increase productivity in the recipient economy and become a catalyst for domestic investment and technological development, thus enhancing growth permanently. The extent to which foreign investments are growth enhancing depends on the degree of complementarity and substitution of foreign investment and domestic investment (de Mello, 1999).

As for the impact of trade and capital flows on business cycle transmission, the existing theoretical literature does not provide definitive guidance. International trade could produce both demand- and supply-side spillovers across countries. While demand-side spillovers usually increase the degree of business cycle synchronization (e.g. greater output in trading-partner countries would raise net exports and thus growth in a given country), the impact of supply-side spillovers depends on the specialization patterns. For example, trade flows could increase specialization of production, which would weaken business cycle correlations. Financial linkages, in turn, usually increase business cycle correlations by strengthening comovements of consumption across countries. However, it is also possible that international financial linkages could stimulate specialization of production, which could result in more exposure to asymmetric shocks and thus reduce correlation in business cycles (Kose, Prasad, and Terrones, 2003).

[35] See Grossman and Helpman (1991) and Baldwin and Seghezza (1996).

Views on the impact of labor outflows and related inflows of remittances on growth and business cycle correlations differ widely. Some analysts argue that remittances help increase savings and investments (e.g., in real estate or starting up small businesses), allow for increased expenditures on education and health, raise output through the multiplier effect, and lead to "brain gain." Therefore, they assert that remittances can help improve a country's development prospects, maintain macroeconomic stability, mitigate the impact of adverse shocks, and reduce poverty (Adelman, Taylor, and Vogel, 1988; Meyer and Brown, 1999; and IMF, 2005). On the contrary, other researchers argue that remittances could weaken growth prospects in the recipient country due to reduced incentives to work (Addleton, 1992; and Chami, Fullenkamp, and Jahjah, 2003), appreciation of the recipient country's currency because of "Dutch disease"-type effects of remittances (Bourdet and Falck, 2003), and "brain drain" (Desai, Kapur, and McHale, 2001). In any case, it would be safe to conclude that remittances can support the development process if the economic environment in the recipient countries is conducive to growth.

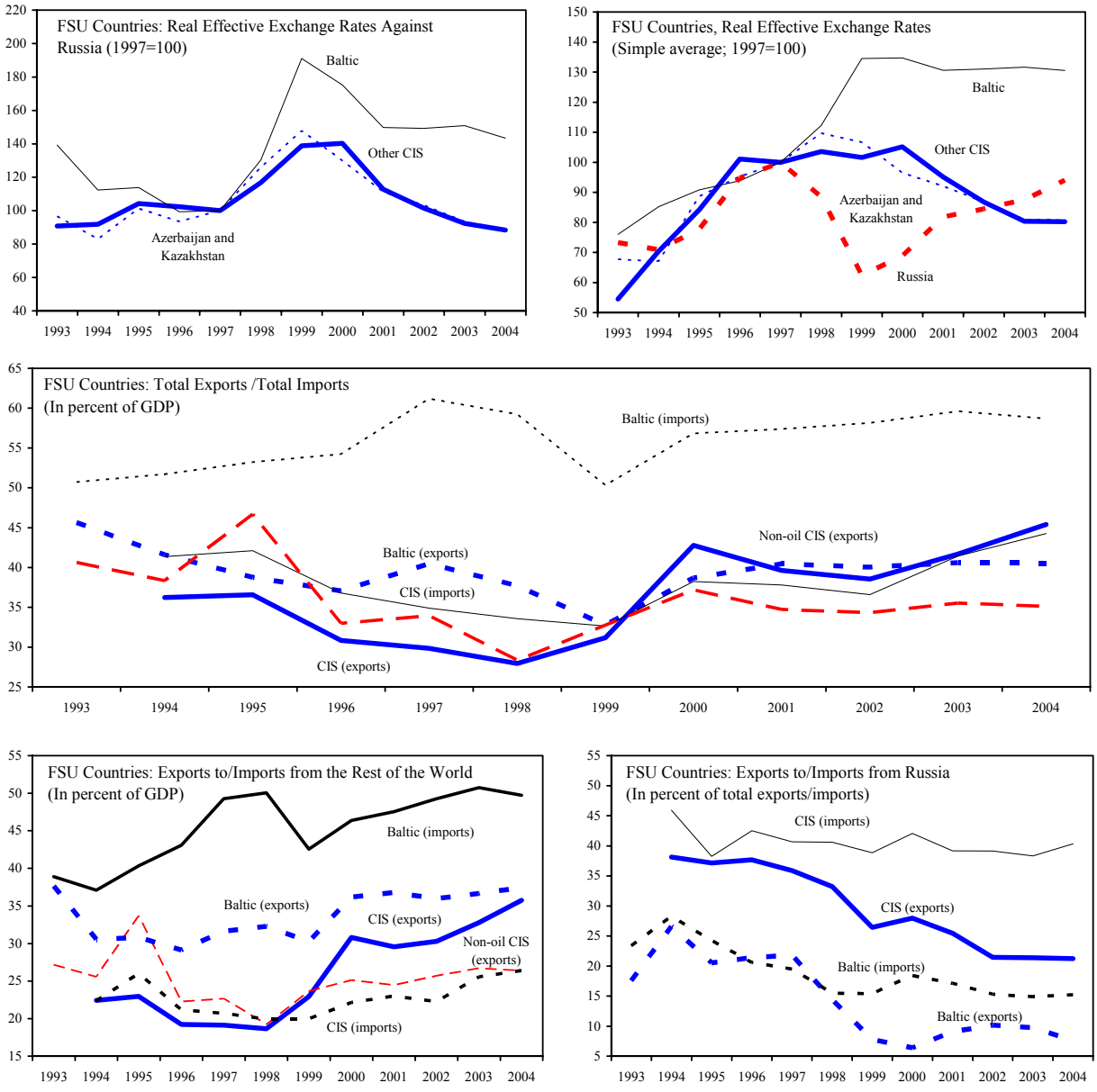
To conclude, there is no definitive guidance on how and to what extent the above factors affect growth, especially in the medium term (or over the business cycle). Ultimately, an empirical analysis is needed to estimate the impact of each factor in a given country or region. In sections B, C, and D we analyze the role respectively of trade, financing, and labor-associated flows in descriptive terms. In section E, the analysis is conducted with econometric tools.

B. Foreign Trade Linkages

With the disintegration of the former USSR and transition to a market economy, FSU countries reoriented their trade away from the FSU area, including Russia, and toward markets in western countries.[36] Most of the decline in the share of trade with Russia in the total trade of the other FSU countries was due to declining shares of exports to Russia (in total exports). The drop in this ratio was especially pronounced for the Baltic countries, which were pursuing EU membership. The shares of Russia in the imports of the other FSU countries declined less and more gradually (Figure 1).

[36] This process was mainly related to (i) significant inefficiencies in production and trade within the USSR; (ii) the collapse of the ruble zone and introduction of new currencies; (iii) the imposition of trade barriers and political problems among some FSU countries; and (iv) increased access to foreign markets (Jafarov and Svirydzenka, forthcoming).

Figure 1. FSU Countries: Selected Economic Indicators, 1993-2004



Sources: IMF, International Financial Statistics, Directions of Trade Statistics, and World Economic Outlook databases; and Fund staff estimations.

The Russian crisis accelerated the trade diversification of the FSU countries This outcome was mainly related to reduced demand in the region, due to lower growth, and to significant changes in the competitiveness of the FSU countries vis-à-vis Russia and the rest of the world after the crisis. In 1998-2001, the currencies of the countries of the Commonwealth of Independent States (CIS) appreciated against the Russian ruble but depreciated against the U.S. dollar and other convertible currencies.[37, 38] Accordingly, these countries lost in competitiveness against Russia, but gained in competitiveness against other countries. The three Baltic countries that were pursuing memberships in the EU defended their pegs against hard currencies despite the significant adverse impacts on their external balance of the Russian crisis.

The large devaluations significantly improved the current account balances of the CIS countries. Imports declined significantly due to both (i) import substitution, caused by the devaluations; and (ii) declines in overall demand, caused by the "wealth effects" of the devaluations and reduced growth. As a result, imports in 1999 on average fell by more than 3 percent of GDP, and the current account balances improved significantly.[39] While growth in imports picked up after 1999, it was offset by a surge in exports.[40]

Table 2. FSU Countries: Merchandise Exports as a Percent of GDP, 1993–2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1994–97	1998–99	2000–04
Armenia	20.5	37.1	27.8	18.2	14.2	11.6	12.6	15.7	16.1	21.2	24.7	16.7	24.3	12.1	18.9
Azerbaijan	75.9	28.2	22.6	19.9	19.7	13.7	20.4	33.2	40.6	34.8	25.6	28.0	22.6	17.0	32.4
Belarus	52.2	50.7	44.1	39.2	51.5	46.7	48.9	57.4	60.0	54.7	55.8	60.1	46.4	47.8	57.6
Estonia	49.2	54.4	49.0	44.7	59.3	58.5	54.2	69.9	67.2	61.7	61.2	51.6	51.9	56.3	62.3
Georgia	29.7	18.9	8.0	6.5	6.4	9.1	12.9	10.7	9.9	10.3	11.7	14.2	10.0	11.0	11.4
Kazakhstan	...	27.7	31.7	28.4	29.4	25.5	33.0	54.0	41.0	39.3	41.9	51.1	29.3	29.3	45.5
Kyrgyz Republic	54.0	30.6	32.4	27.9	34.6	31.2	36.6	36.8	31.2	30.2	30.3	31.8	31.4	33.9	32.1
Latvia	47.9	27.1	26.2	25.5	27.2	27.4	23.9	24.1	24.8	25.1	26.1	29.2	26.5	25.6	25.9
Lithuania	41.7	46.6	42.3	40.6	39.2	33.4	27.7	33.5	37.9	39.0	39.0	41.8	42.2	30.6	38.2
Moldova	35.9	39.2	51.8	46.9	45.3	37.3	39.6	36.6	38.4	38.7	39.9	38.0	45.8	38.4	38.3
Tajikistan	51.6	59.3	142.0	74.0	71.4	45.2	63.4	77.7	61.7	60.8	50.9	44.1	86.7	54.3	59.0
Ukraine	...	40.3	40.8	32.3	28.4	30.2	36.7	46.6	42.8	42.3	48.4	50.2	35.4	33.4	46.1
Uzbekistan	...	30.5	26.7	18.8	19.7	15.5	11.5	15.9	17.9	16.2	22.6	26.0	23.9	13.5	19.7
CIS, excl. Russia	...	36.2	36.6	30.8	29.8	27.9	31.2	42.8	39.6	38.5	41.7	45.4	33.4	29.5	41.6
Baltics	45.6	41.6	38.8	37.1	40.5	37.7	32.8	38.7	40.5	40.0	40.6	40.5	39.5	35.2	40.1

Sources: IMF, Direction of Trade database; and Fund staff estimates.

[37] All the FSU countries, except Estonia, Latvia, and Lithuania, are members of the CIS. In 2005, Turkmenistan ceased its permanent membership and became an associated member of this organization.

[38] From August 1998 to August 1999, the Russian ruble lost about 75 percent of its value against the U.S. dollar. Since many FSU countries were de facto targeting the U.S. dollar (or other "hard currencies"), their currencies initially appreciated against the Russian ruble. Later, most CIS countries allowed their currencies to depreciate against the U.S. dollar.

[39] This shift was facilitated by substantial reductions in public expenditures.

[40] In 7 out of 13 countries, the ratios of exports to GDP increased during the 2000-04 period from those in the precrisis period (Table 2).

The surge in exports of the FSU countries was mainly due to increased exports to the rest of the world (excluding Russia). This growth was related to gains in competitiveness following sizable devaluations (in the CIS countries) and improvements in the terms of trade, including higher oil prices for oil-exporting countries, after the Russian crisis. Several other factors enhanced the supply responses to the positive shocks these countries faced, including (i) ample idle resources; (ii) the imposition of harder budget constraints; (iii) improvements in financial discipline; (iv) achievement of macroeconomic stability; and (v) accumulated structural reforms.

i. **A collapse of output during the initial years of the transition generated ample idle resources in all the FSU countries.** For example, estimates by the Institute for the Economy in Transition (IET), the Russian Economic Barometer (REB, 2004), and the Center for Economic Analysis (CEA) all suggest significant declines in capacity utilization in Russia from 1993 to 1998 (see also Oomes and Dynnikova, 2006). Berengaut and others (2002) provide evidence of idle capacities in Ukraine. Anecdotal evidence suggests that such idle resources were abundant in other FSU countries as well. When demand picked up after the Russian crisis, these idle capacities helped increase output with minimal investment.

ii. **The Russian crisis heightened the sense of urgency among policymakers in all of the FSU countries to reduce loss-making activities.** The heavier debt burden, related to the devaluations, together with foreign lenders' desire to reduce their exposure to the FSU countries, forced the governments to tighten fiscal policies. Tighter fiscal policies, in turn, facilitated the imposition of harder budget constraints on loss-making activities and increasing the efficiency of production.

- General government budget balances improved in all CIS countries with the exception of Belarus. In Russia, the government was able to produce a "remarkable fiscal adjustment at the general government level" amounting to 10 percent of GDP from 1997 to 2001 (Owen and Robinson, 2003).

- Reported budgetary subsidies were (further) reduced in Azerbaijan, Kazakhstan, Lithuania, Ukraine, and Uzbekistan (EBRD Transition Reports, various issues).

- There are indications that in many FSU countries a tighter financial situation caused further restructuring at the enterprise level. For example, there were significant declines in employment and jumps in unemployment rates in a number of FSU countries: employment declined in Georgia, Lithuania, Moldova, Tajikistan, Kazakhstan, and Ukraine; unemployment rates rose in Armenia, Georgia, and Ukraine. In addition, the sectoral distribution of labor resources changed significantly, with the share of the industrial sector in total

employment declining and the shares of the agriculture and service sectors increasing.[41]

- Country case studies also indicate that budget constraints hardened in some countries. Berengaut and others (2002), for example, suggest that after the Russian crisis budget constraints were hardened in Ukraine.

iii. **Better payment discipline in the aftermath of the Russian crisis improved the business climate.** Chains of arrears were broken due to pressure from the governments, better enforcement of the existing rules against nonpayments, and greater liquidity in the financial systems, which was in part related to the increases in export revenues. Barter, payment arrears, wage arrears, and tax arrears declined significantly, which accelerated growth in economic activity, including investments.[42]

iv. **These factors also helped achieve macroeconomic stability, which shifted the focus of producers away from inflation-hedging activities toward productive activities.** In particular, hardening the budget constraints on state-owned enterprises and narrowing the budget deficits allowed inflationary financing from central banks and inflation to be reduced.

v. **Finally, the FSU countries benefited from the accumulated reforms they had undertaken prior to the Russian crisis.** These reforms obviously were not enough to produce sustainable growth before the crisis, in part due to overvalued exchange rates, but were enough to enhance the supply response to positive impulses to the economy after the crisis. Havrylyshyn and De Souza (forthcoming), for example, consider the levels of reforms achieved by the Central and Eastern European countries before growth resumed in these countries (measured by the EBRD transition index) as the threshold needed to stimulate local economic activity. They suggest that Kazakhstan, Georgia, and Armenia reached the threshold level of reforms in 1996-97, just before the Russian crisis, and Ukraine, Azerbaijan, and Tajikistan reached the threshold level in 2000-03.

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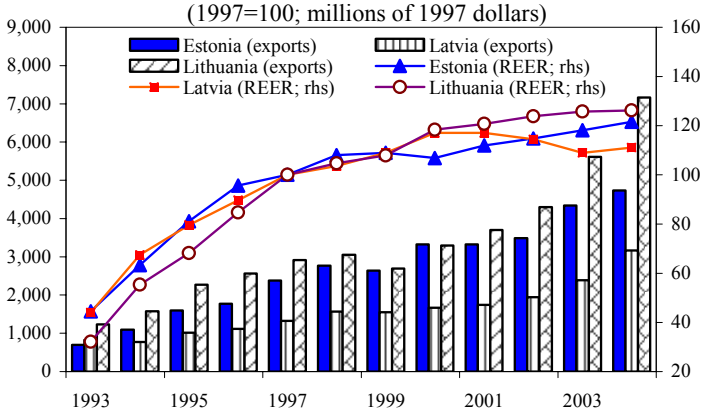
[41] During 2000–04, the industrial sector shed labor in all the FSU countries from the levels of the 1993–97 period, while the share of the agriculture sector in total employment increased in Azerbaijan, Armenia, Kazakhstan, the Kyrgyz Republic, Moldova, and Ukraine. The share of the service sector increased in Azerbaijan, Armenia, Belarus, Baltic countries, and Ukraine. Also, in 6 out of the 13 countries, the increases in the share of agriculture in total employment coincided with declines in the share of this sector in GDP, while declines in the share of the industrial sector in total employment coincided with increases in the share of this sector in GDP.

[42] Guriev and Ickes (1999) argue that barter reduces transparency in governing enterprises and the economy and is associated with a lack of restructuring.

It is also possible that the Russian crisis forced exporters in the other FSU countries to incur significant "sunk entry costs" to access global markets.[43] These exporters redirected their exports from Russia toward other markets as they lost in competitiveness to their competitors in Russia and demand in Russia declined during the crisis. In this process, these enterprises may have gained new connections and marketing knowledge. For example, after 1999, the Baltic countries' exports to the rest of the world continued to rise rapidly despite the significant real appreciation of their currencies.[44]

Baltic Countries: Real Effective Exchange Rate and Trade Vis-à-vis Non-FSU Countries
(1997=100; millions of 1997 dollars)



Sources: IMF, International Financial Statistics and Directions of Trade Statistics databases; and Fund staff estimations.

Exports to Russia (in U.S. dollar terms), however, declined significantly after the Russian crisis. In 11 out of the 13 countries, exports to Russia did not reach the 1997 levels before 2003, even though the Russian ruble appreciated in real terms against the currencies of many FSU countries in 2001-03 (Figure 1). In 2004, only Belarus, Kazakhstan, and Ukraine recorded significantly more exports to Russia than the 1997 levels, while 7 out of the 13 countries recorded less exports than the 1997 levels.

The decline in exports to Russia was in part related to Russia's tightening of the terms of payments for delivered goods and services and curtailing of its financing of other FSU countries.[45] Before the Russian crisis, the FSU countries paid in-kind for a large share of their imports (mainly energy) from Russia, which increased these countries' exports to Russia. Russia was also generally lenient on nonpayments for delivered goods. After the crisis, Russia demanded cash payments for its exports, which led to declines in its imports from the FSU countries. For example, in 1997, the shares of barter in export and import

[43] Roberts and Tybout (1997) and Bernard and Jensen (2004) suggest that sunk entry costs affect trade patterns.

[44] Caution is needed in interpreting changes in the real effective exchange rate (REER) indices. First, these indices are based on official exchange rates, whereas some FSU countries (e.g., Belarus and Uzbekistan) have operated under systems of multiple exchange rates. Second, these indices are based on trade weights at a certain time and do not reflect changes in the trade structure of these countries. Third, while the consumer price index (CPI) may be a highly inaccurate index of price competitiveness, possibly more appropriate indicators, such as the producer price index (PPI), are not available for all countries and all years in the sample.

[45] On financial flows from Russia to the other FSU countries, see next section.

transactions between Russia and the CIS countries were about 20 percent and 24 percent, respectively. Following the Russian crisis, these ratios declined, reaching 1 percent and 5 percent, respectively, in 2004 (Table 3).

Table 3. Share of Barter in Export and Import Transactions of CIS Countries, 1993–2004
(In millions of U.S. dollars; unless otherwise indicated)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Export, f.o.b. based	14,880	14,124	14,614	15,895	16,624	13,699	10,707	13,801	14,617	15,711	20,540	29,462
of which: barter	…	1,435	2,703	3,639	3,287	2,896	1,993	1,703	1,239	898	519	323
Share of barter in total export transactions (in percent)	…	10.2	18.5	22.9	19.8	21.1	18.6	12.3	8.5	5.7	2.5	1.1
Imports	9,699	10,317	13,592	14,549	14,234	11,314	8,361	11,610	11,202	10,163	13,139	17,721
of which: barter	…	2,346	3,336	3,868	3,417	3,182	2,004	1,919	1,753	1,160	904	847
Share of barter in total import transactions (in percent)	…	22.7	24.5	26.6	24.0	28.1	24.0	16.5	15.6	11.4	6.9	4.8

Source: Central Bank of Russia.

Exports of other FSU countries to Russia may also have been adversely affected by the reduction in energy subsidies from Russia to other FSU countries. Russia has provided some FSU countries with subsidies in the form of cheap prices for energy products, mainly gas, but for some time now it has been trying to reduce these subsidies. To the extent that these subsidies are reduced far more for producers in the other FSU countries than for Russian producers, the price increases for imported energy in the FSU countries reduced the competitiveness of producers in these countries against Russian producers.[46]

Growth decompositions suggest that the contribution made by exports to Russia to growth in other FSU countries declined following the Russian crisis (Table 4).[47] On average, exports (net exports) to Russia contributed almost 2.5 percentage points (1 percentage point) of GDP growth in the other FSU countries during 1994–97.[48] This number declined to less than 1 percentage point (about -1 percentage point) after the Russian crisis. These figures should be interpreted with caution, however, due to weaknesses in data, including many missing observations for the early years of transition.

[46] Prices for gas have been raised also for domestic use in Russia, but much less than the increases for the other FSU countries. Under an EU-Russia agreement signed in May 2004, Russia agreed to gradually increase gas prices for industrial Russian users from US$27-28 in 2004 to between US$49-57 by 2010 (EU, 2004). It is not clear if these prices will be revised due to a significant increase in market prices since then. For comparison, starting in 2006, Russia charges Georgia at US$110 and Moldova at US$160 per thousand cubic meters of its gas exports.

[47] The contribution of exports to Russia from one of the CIS and Baltic countries to growth in the latter is estimated as follows: $100 \times \Delta[(XR_t / X_t)x_t] / y_{t-1}$ where XR_t and X_t are the values of exports to Russia and total exports of merchandise, respectively, x_t is real total exports of goods and services, and y_{t-1} is real GDP.

[48] Strictly, only net exports should be compared with GDP. Caution is needed in comparing exports and GDP because the former includes the imported intermediate inputs used to produce exports, whereas the latter includes only value added. In addition, the data underlying these decompositions have substantial shortcomings, such as weaknesses in the expenditure decomposition of GDP. Furthermore, the estimates are based on the assumption that deflators for exports to Russia and to the rest of the world are same.

A gravity model further suggests that the FSU countries reduced their regional trade and increased their trade with the rest of the world after the Russian crisis (see Jafarov and Svirydzenka, forthcoming).[49] Nevertheless, the results also indicate that everything else given (e.g., levels of income and development, geographic location, etc.), among themselves, the FSU countries trade several times more than the estimates of the same model for non-FSU countries. The latter conclusion is consistent with the fact that the share of the regional trade in total trade of the FSU countries remains large, despite the large declines in this share. Russia, which has the largest economy in the region, remains a very important trading partner for the CIS countries. In 7 out of the 11 CIS countries, exports to Russia were more than 15 percent of total exports in 2004. In Belarus, this ratio was 47 percent.

C. Financial Flows

FSU economies have attracted large amounts of foreign savings since the beginning of their transition. Early in the transition, the bulk of foreign financing was from official sources to the public sector. As the transition progressed, the share of inflows from the private sector, including FDI and portfolio inflows, increased. Of these, FDI inflows were concentrated in the energy-rich Caspian countries and the Baltic countries. Weak FDI inflows to the other CIS countries, especially in the 1990s, reflected problems in the investment climate in these countries.[50] The Baltic countries, Russia, and Ukraine attracted significant amounts of portfolio investment, but in the latter two countries these inflows dried up in 1998-99, following the Asian crisis and declines in oil prices.

[49] Gravity models relate trade between countries to income of the countries and distances between them. Jafarov and Svirydzenka (forthcoming) also control for a number of other variables that are believed to affect trade flows.

[50] Empirical studies suggest that the main determinants of FDI in transition economies are institutions, natural resources, trade openness, market size, agglomeration economies, and labor costs. In the case of the CIS countries, abundant natural resources and economic reforms are the main determinants of FDI inflows (Campos and Kinoshita, 2003).

Table 4. Contribution of External Demand and Exports to Russia to Real GDP Growth in the CIS and Baltic Countries, 1993–2004
(In percentage points of real GDP)

														Averages			
		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1994–97	1998–2004	1999–2004	2000–04
Armenia	Real GDP	-14.1	5.4	6.9	5.9	3.3	7.3	3.3	6.0	9.6	13.2	13.9	10.1	5.4	9.1	9.3	10.6
	Domestic demand	...	-4.9	-3.8	15.0	10.9	8.0	3.1	7.7	8.5	4.6	11.6	25.1	4.3	9.8	10.1	11.5
	Net exports	...	...	10.7	-9.1	-7.5	-0.7	0.2	-1.7	1.1	8.6	2.3	-15.0	-2.0	-0.7	-0.7	-0.9
	Exports	...	14.0	14.7	-4.4	-3.3	0.5	0.2	4.9	4.4	11.1	6.1	-9.6	5.2	2.5	2.8	3.4
	o/w Russia	...	5.1	0.1	0.4	-2.3	-1.7	-0.7	0.8	1.5	0.2	1.1	-1.6	-0.6	-0.1	0.2	0.4
	Imports	...	-3.7	-4.0	-4.7	-4.3	-1.2	0.0	-6.5	-3.3	-2.5	-3.8	-5.3	-4.2	-3.2	-3.6	-4.3
	o/w Russia	...	1.1	6.3	2.1	-6.4	1.5	-0.2	2.4	-3.1	-0.4	1.1	1.7	0.8	0.4	0.2	0.3
Azerbaijan	Real GDP	-23.1	-19.7	-11.8	1.3	5.8	10.0	7.4	9.2	6.5	8.1	11.5	10.2	-6.1	9.0	8.8	9.1
	Domestic demand	…	-36.4	-28.1	10.0	16.3	13.3	8.7	7.5	0.2	-9.0	5.2	27.7	-9.5	7.7	6.7	6.3
	Net exports	…	16.7	16.3	-8.7	-10.5	-3.3	-1.3	1.7	6.3	17.1	6.3	-17.5	3.4	1.3	2.1	2.8
	Exports	...	21.1	23.7	-6.6	-4.2	0.8	0.2	5.9	6.8	17.8	8.8	-13.0	8.5	3.9	4.4	5.3
	o/w Russia	...	4.6	1.8	-1.3	0.6	-1.5	-1.9	-0.6	-0.7	1.2	0.4	-0.4	1.4	-0.5	-0.3	0.0
	Imports	...	-4.4	-7.4	-2.1	-6.3	-4.1	-1.6	-4.2	-0.5	-0.7	-2.5	-4.6	-5.1	-2.6	-2.3	-2.5
	o/w Russia	...	5.4	0.5	-2.1	-2.7	-0.1	-2.5	-0.6	4.0	-2.4	0.3	-1.1	0.3	-0.4	-0.4	0.0
Belarus	Real GDP	-7.6	-11.7	-11.3	2.8	11.4	8.4	3.4	5.8	4.7	5.0	7.0	11.0	-2.2	6.5	6.2	6.7
	Domestic demand	...	...	...	4.7	12.3	11.4	2.6	9.4	2.1	7.4	11.4	14.0	8.5	8.4	7.8	8.9
	Net exports	...	...	...	-2.0	-0.9	-3.0	0.7	-3.6	2.6	-2.4	-4.4	-3.0	-1.4	-1.9	-1.7	-2.2
	Exports	...	...	...	17.4	27.5	-11.5	11.4	8.0	6.7	8.2	9.4	12.4	22.5	6.4	9.4	8.9
	o/w Russia	...	...	...	13.7	24.8	-6.7	-0.9	1.2	5.5	1.2	4.2	4.0	19.3	1.2	2.5	3.2
	Imports	...	...	...	-19.4	-28.4	8.5	-10.6	-11.6	-4.1	-10.6	-13.8	-15.5	-23.9	-8.3	-11.0	-11.1
	o/w Russia	...	...	...	-6.9	-17.3	3.6	-7.3	-14.5	-3.4	-6.5	-9.7	-13.0	-12.1	-7.2	-9.1	-9.4
Estonia	Real GDP	-8.2	1.0	4.5	4.4	11.1	4.4	0.3	7.9	6.5	7.2	6.7	7.8	5.3	5.8	6.1	7.2
	Domestic demand	-8.6	5.4	5.2	7.6	13.0	5.8	-4.6	8.5	8.5	9.9	11.2	8.4	7.8	6.8	7.0	9.3
	Net exports	0.4	-4.4	-0.7	-3.2	-1.9	-1.3	5.0	-0.7	-2.1	-2.6	-4.6	-0.6	-2.5	-1.0	-0.9	-2.1
	Sum	-8.2	1.0	4.5	4.4	11.1	4.4	0.3	7.9	6.5	7.2	6.7	7.8	5.3	5.8	6.1	7.2
	Exports	13.8	12.2	3.2	1.6	17.3	8.3	0.6	21.1	-0.1	0.7	4.5	12.4	8.6	6.8	6.5	7.7
	o/w Russia	...	3.0	-2.6	-0.5	4.6	-2.7	-3.0	-0.4	1.6	1.2	1.7	-3.8	1.1	-0.8	-0.4	0.1
	Imports	-13.4	-16.6	-3.9	-4.8	-19.2	-9.6	4.4	-21.8	-1.9	-3.3	-9.1	-12.9	-11.1	-7.7	-7.4	-9.8
	o/w Russia	...	-2.5	-0.3	1.0	-3.4	1.5	-1.4	-2.8	0.6	0.0	0.6	-0.3	-1.3	-0.3	-0.5	-0.4
Georgia	Real GDP	...	-10.4	2.6	10.5	10.6	2.9	3.0	1.9	4.7	5.5	11.1	6.2	3.3	5.0	5.4	5.9
	Domestic demand	...	...	...	...	11.9	-5.5	-2.8	11.8	5.0	7.3	11.6	5.4	11.9	4.7	6.4	8.2
	Net exports	...	...	...	...	-1.4	8.4	5.8	-9.8	-0.3	-1.8	-0.5	0.8	-1.4	0.4	-1.0	-2.3
	Exports	...	...	...	...	2.6	9.4	1.9	-3.7	0.3	2.3	5.2	6.2	2.6	3.1	2.0	2.1
	o/w Russia	...	...	...	...	1.0	-0.7	-0.7	1.5	0.9	-1.4	1.1	0.5	1.0	0.2	0.3	0.5
	Imports	...	...	...	...	-4.0	-0.9	3.9	-6.1	-0.6	-4.0	-5.7	-5.4	-4.0	-2.7	-3.0	-4.4
	o/w Russia	...	...	...	...	0.9	1.5	1.0	-3.7	0.5	-1.9	-0.3	-0.7	0.9	-0.5	-0.8	-1.2
Kazakhstan	Real GDP	-9.2	-12.6	-8.3	0.5	1.6	-1.9	2.7	9.8	13.5	9.8	9.3	9.4	-4.7	7.5	9.1	10.4
	Domestic demand	...	...	-27.8	-10.2	4.5	-1.1	8.0	1.3	21.5	12.3	3.9	8.1	-11.2	7.7	9.2	9.4
	Net exports	...	...	19.5	10.7	-2.9	-0.8	-5.3	8.5	-8.0	-2.5	5.4	1.3	9.1	-0.2	-0.1	1.0
	Exports	...	...	22.7	15.9	0.9	-0.7	-6.7	14.4	-3.2	1.0	11.2	6.8	13.2	3.3	3.9	6.1
	o/w Russia	...	...	7.6	0.6	-0.6	-2.7	-2.5	3.5	0.4	-1.3	1.0	2.8	2.6	0.2	0.7	1.3
	Imports	...	...	-3.1	-5.2	-3.8	-0.1	1.4	-5.9	-4.8	-3.5	-5.8	-5.5	-4.1	-3.5	-4.0	-5.1
	o/w Russia	...	...	-6.5	-5.0	1.5	2.5	1.4	-7.5	-0.4	1.5	-2.4	0.0	-3.3	-0.7	-1.2	-1.8
Kyrgyz Rep.	Real GDP	-13.0	-19.8	-5.8	7.1	9.9	2.1	3.7	5.4	5.3	0.0	7.0	7.1	-2.1	4.4	4.8	5.0
	Domestic demand	...	-22.6	-7.3	20.2	-3.5	5.8	5.1	2.7	2.9	2.5	9.2	8.0	-3.3	5.2	5.1	5.1
	Net exports	...	2.8	1.5	-13.1	13.3	-3.7	-1.4	2.7	2.4	-2.5	-2.2	-1.2	1.1	-0.8	-0.4	-0.2
	Exports	...	-6.3	-5.8	4.6	6.7	-3.1	-3.3	2.8	-0.9	1.9	2.7	4.8	-0.2	0.7	1.3	2.3
	o/w Russia	...	-5.9	0.8	2.1	-2.2	-0.4	-0.8	-0.3	0.1	1.1	0.5	1.6	-1.3	0.2	0.4	0.6
	Imports	...	9.1	7.4	-17.6	6.6	-0.6	1.9	-0.2	3.4	-4.5	-4.9	-5.9	1.4	-1.5	-1.7	-2.4
	o/w Russia	...	7.6	0.0	-2.2	-0.6	0.9	2.8	-2.1	2.5	-1.3	-2.8	-0.5	1.2	-0.1	-0.3	-0.9
Latvia	Real GDP	-11.4	2.2	-0.9	3.8	8.3	4.7	3.3	6.9	8.0	6.4	7.5	8.5	3.3	6.5	6.8	7.5
	Domestic demand	-13.9	6.6	4.0	7.8	6.1	11.9	3.2	4.5	11.4	6.2	12.4	13.4	6.1	9.0	8.5	9.6
	Net exports	2.5	-4.4	-4.9	-4.0	2.2	-7.2	0.1	2.4	-3.4	0.3	-5.0	-4.9	-2.8	-2.5	-1.8	-2.1
	Exports	9.9	-0.6	3.0	7.4	5.6	2.2	-2.8	4.9	2.9	2.6	1.8	3.6	3.9	2.2	2.2	3.2
	o/w Russia	...	-0.3	-0.3	1.1	0.2	-3.7	-2.6	-0.8	0.8	0.2	-0.1	0.6	0.2	-0.8	-0.3	0.2
	Imports	-7.3	-3.8	-7.9	-11.5	-3.4	-9.4	2.9	-2.5	-6.3	-2.4	-6.8	-8.5	-6.7	-4.7	-3.9	-5.3
	o/w Russia	...	0.4	-1.1	-1.8	1.8	0.8	1.0	-0.9	0.6	0.0	-0.5	-0.8	-0.2	0.0	-0.1	-0.3

Table 4. Contribution of External Demand and Exports to Russia to Real GDP Growth in the CIS and Baltic Countries, 1993-2004 (continued)
(In percentage points of real GDP)

		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1994–97	1998–2004	1999–2004	2000–04
Lithuania	Real GDP	-16.2	-9.8	3.3	4.7	7.0	7.3	-1.7	3.9	6.4	6.8	9.7	6.7	1.3	5.6	5.3	6.7
	Domestic demand	...	...	...	...	10.7	8.5	-0.3	2.2	5.9	6.8	12.1	12.7	10.7	6.8	6.6	7.9
	Net exports	...	...	...	...	-3.7	-1.2	-1.3	1.8	0.5	-0.1	-2.4	-6.0	-3.7	-1.3	-1.3	-1.2
	Exports	...	...	...	...	8.6	2.4	-8.4	4.2	9.5	10.0	4.0	2.4	8.6	3.4	3.6	6.0
	o/w Russia	...	...	...	...	2.4	-3.7	-5.4	0.3	2.8	1.8	-0.7	-0.3	2.4	-0.7	-0.2	0.8
	Imports	...	...	...	...	-12.3	-3.6	7.1	-2.4	-9.1	-10.0	-6.4	-8.4	-12.3	-4.7	-4.9	-7.2
	o/w Russia	...	...	...	...	-2.8	1.7	2.0	-4.4	-1.2	0.2	-1.9	-2.6	-2.8	-0.9	-1.3	-2.0
Moldova	Real GDP	-1.2	-30.9	-15.3	-5.9	1.6	-6.5	-3.4	2.1	6.1	7.8	6.6	7.3	-12.6	2.9	4.4	6.0
	Domestic demand	23.5	-38.4	-9.5	8.8	10.8	-0.5	-24.5	18.4	7.2	12.9	27.4	19.2	-7.1	8.6	10.1	17.0
	Net exports	-24.7	7.5	-5.8	-14.6	-9.1	-6.0	21.2	-16.3	-1.1	-5.1	-20.9	-12.0	-5.5	-5.8	-5.7	-11.1
	Sum	-1.2	-30.9	-15.3	-5.9	1.6	-6.5	-3.4	2.1	6.1	7.8	6.5	7.2	-12.6	2.8	4.4	5.9
	Exports	-94.0	-5.1	12.3	-5.1	1.0	-15.5	1.4	4.8	8.7	11.6	10.9	17.6	0.8	5.7	9.2	10.7
	o/w Russia	...	2.3	4.8	0.7	3.0	-10.9	-5.1	3.7	3.4	0.5	5.5	4.0	2.7	0.2	2.0	3.4
	Imports	69.4	12.6	-18.1	-9.6	-10.1	9.4	19.7	-21.2	-9.8	-16.7	-31.8	-29.6	-6.3	-11.4	-14.9	-21.8
	o/w Russia	...	1.2	-0.5	-0.8	-1.8	7.9	3.5	2.5	-2.2	-1.2	-2.4	-2.5	-0.5	0.8	-0.4	-1.2
Tajikistan	Real GDP	-11.1	-21.4	-12.5	-4.4	1.8	5.2	3.8	8.3	10.2	9.1	10.2	10.6	-9.1	8.2	8.7	9.7
	Domestic demand	…	…	…	…	…	…	…	…	19.6	6.5	21.8	18.2	…	16.5	16.5	16.5
	Net exports	…	…	…	…	…	…	…	…	-9.4	2.6	-11.6	-7.6	…	-6.5	-6.5	-6.5
	Exports	…	…	…	…	…	…	…	…	-9.1	7.2	-4.9	-0.7	…	-1.9	-1.9	-1.9
	o/w Russia	…	…	…	…	…	…	…	…	-16.5	-2.0	-3.7	0.0	…	-5.5	-5.5	-5.5
	Imports	…	…	…	…	…	…	…	…	-0.4	-4.5	-6.7	-6.9	…	-4.6	-4.6	-4.6
	o/w Russia									-3.2	-4.0	0.5	-1.4	…	-2.0	-2.0	-2.0
Ukraine	Real GDP	-14.2	-22.9	-12.2	-10.0	-3.0	-1.9	-0.2	5.9	9.2	5.2	9.6	12.1	-12.0	5.7	6.9	8.4
	Domestic demand	...	-23.7	-20.7	-9.2	-3.4	-4.1	-1.9	0.4	9.5	3.3	11.4	9.5	-14.3	4.0	5.4	6.8
	Net exports	...	0.8	8.6	-0.9	0.4	2.1	1.7	5.4	-0.4	1.9	-1.8	2.5	2.2	1.6	1.6	1.5
	Sum	...	-22.9	-12.2	-10.0	-3.0	-1.9	-0.2	5.9	9.2	5.2	9.6	12.1	-12.0	5.7	6.9	8.4
	Exports	...	-4.7	1.6	3.6	-1.3	-5.8	-4.3	8.0	3.6	3.2	4.5	6.1	-0.2	2.2	3.5	5.1
	o/w Russia	...	-1.9	0.5	1.0	-6.2	-2.8	-1.9	3.2	0.2	-1.5	0.8	1.2	-1.7	-0.1	0.3	0.8
	Imports	...	5.5	7.0	-4.5	1.7	8.0	6.0	-2.6	-4.0	-1.3	-6.4	-3.6	2.4	-0.6	-2.0	-3.6
	o/w Russia	...	3.0	9.9	-7.5	3.0	2.6	3.2	1.1	0.5	-0.6	-1.8	-4.0	2.1	0.1	-0.3	-1.0
Uzbekistan	Real GDP	-2.3	-4.2	-0.9	1.6	2.5	2.1	3.4	3.3	4.1	3.1	1.6	7.4	-0.3	3.6	3.8	3.9
	Domestic demand	…	…	-6.2	6.5	1.5	5.1	5.5	5.0	5.9	10.7	1.3	6.4	0.6	5.7	5.8	5.9
	Net exports	…	…	5.3	-4.9	1.0	-3.0	-2.0	-1.7	-1.8	-7.6	0.3	1.0	0.4	-2.1	-2.0	-2.0
	Sum	…	…	5.3	-4.9	1.0	-3.0	-2.0	-1.7	-1.8	-7.6	0.3	1.0	0.4	-2.1	-2.0	-2.0
	Exports	…	…	8.1	-1.1	4.2	-2.9	-2.8	0.6	0.0	-6.0	3.1	4.4	3.7	-0.5	-0.1	0.4
	o/w Russia	…	…	-1.7	-2.7	3.7	-3.5	-0.4	1.1	-0.5	-2.5	1.3	0.9	-0.2	-0.5	0.0	0.1
	Imports	…	…	-2.8	-3.8	-3.2	-0.1	0.8	-2.2	-1.8	-1.6	-2.8	-3.4	-3.3	-1.6	-1.8	-2.4
	o/w Russia	…	…	2.3	0.8	0.3	0.8	1.6	-0.9	-0.8	-1.8	-0.2	-2.2	1.1	-0.5	-0.7	-1.2
Average (excluding Uzbekistan, Tajikistan, Turkmenistan, and Russia)																	
GDP growth		-11.8	-11.7	-4.4	2.3	6.1	3.3	2.0	5.9	7.3	6.8	9.1	8.8	-1.8	6.0	6.4	7.3
Domestic demand		0.3	-16.3	-11.0	6.1	8.1	4.9	-0.3	6.8	7.5	5.8	11.6	13.8	0.4	7.0	7.4	8.8
Net exports		-7.3	3.2	5.6	-5.0	-2.0	-1.5	2.3	-0.9	-0.2	1.0	-2.5	-5.0	-0.2	-1.1	-1.0	-1.6
Total exports		-23.5	4.4	9.4	3.8	5.6	-1.2	-0.9	6.8	3.5	6.4	6.3	4.5	6.4	3.3	4.1	5.1
Exports to Russia		…	1.0	1.6	2.0	2.3	-3.4	-2.3	1.1	1.5	0.3	1.4	0.8	2.2	-0.1	0.4	0.9
Total imports		16.2	-0.2	-3.8	-8.8	-7.6	-0.3	3.2	-7.7	-3.7	-5.4	-8.8	-9.6	-6.4	-4.4	-5.0	-6.7
Imports from Russia		…	2.3	1.0	-2.6	-2.5	2.2	0.3	-2.8	-0.2	-1.2	-1.8	-2.2	-1.1	-0.8	-1.2	-1.6
Memorandum items:																	
Russia	Real GDP	-8.7	-12.7	-4.1	-3.6	1.4	-5.3	6.3	10.0	5.1	4.7	7.3	7.2	-4.8	5.1	6.8	6.9
	Domestic demand	-9.7	-12.3	-4.2	-4.3	1.6	-9.6	-0.3	11.7	7.0	4.4	7.0	8.4	-4.8	4.1	6.4	7.7
	Net exports	1.0	-0.4	0.1	0.7	-0.2	4.3	6.7	-1.7	-1.9	0.4	0.3	-1.2	0.1	1.0	0.4	-0.8
	Sum	-8.7	-12.7	-4.1	-3.6	1.4	-5.3	6.3	10.0	5.1	4.7	7.3	7.2	-4.8	5.1	6.8	6.9
	Exports	-0.4	1.0	1.4	1.0	-0.1	0.5	3.5	3.1	1.4	3.3	4.2	4.3	0.8	2.9	3.3	3.2
	o/w FSU																
	Imports	1.4	-1.4	-1.3	-0.3	-0.1	3.7	3.2	-4.7	-3.3	-2.9	-3.8	-5.6	-0.8	-1.9	-2.9	-4.1
	o/w FSU																

Sources: IMF, Direction of Trade and World Economic Outlook databases; and Fund staff estimates.

Compared with the 1993-97 period, total foreign financing declined after the Russian crisis in all the FSU countries, except the three Baltic countries, mirroring the improvements in their current account balances (see Section B).[51] The main factor contributing to this outcome was a decline in external borrowing. Meanwhile, FDI inflows in U.S. dollar terms declined during 1999-2000, but rebounded thereafter. During 2000-04, compared with the 1993-97 period, the ratio of FDI inflows to GDP increased in all the FSU countries with exceptions of the Kyrgyz Republic, Latvia, and Uzbekistan (Table 5).[52] Portfolio investments rose in the Baltic countries but remained insignificant in the CIS countries.

Table 5. FSU Countries: FDI Inflows as a Percent of GDP, 1993–2004

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average for 1993–97	Average for 1998–99	Average for 2000–04
Armenia	…	0.4	2.0	1.1	3.2	11.6	6.6	5.5	3.3	7.3	2.8	3.3	1.7	9.1	4.4
Azerbaijan	…	1.0	11.4	20.8	27.3	26.0	18.5	13.1	14.7	32.6	55.0	53.4	15.1	22.3	33.8
Belarus	0.5	0.2	0.1	0.7	2.5	1.3	3.7	0.9	0.8	1.7	1.0	0.7	0.8	2.5	1.0
Estonia	9.4	9.0	5.4	3.2	5.4	10.3	5.4	7.1	9.0	4.1	10.1	9.3	6.5	7.9	7.9
Georgia	0.0	1.0	0.3	1.8	6.6	6.1	2.2	5.0	2.5	3.8	8.7	7.4	1.9	4.2	5.5
Kazakhstan	9.2	5.5	5.8	7.1	6.9	6.2	9.4	7.0	13.8	10.5	6.8	10.5	6.9	7.8	9.7
Kyrgyz Republic	1.5	4.0	4.1	1.7	4.7	5.3	3.1	-0.5	-0.1	0.3	2.4	6.5	3.2	4.2	1.7
Latvia	2.4	4.2	3.7	6.8	8.5	5.4	4.8	5.3	1.6	2.8	2.7	4.8	5.1	5.1	3.4
Lithuania	…	…	…	1.9	3.6	8.3	4.5	3.3	3.7	5.2	1.0	3.5	2.7	6.4	3.3
Moldova	1.0	1.2	4.6	1.4	4.1	4.5	3.2	10.6	9.9	7.0	3.0	3.1	2.5	3.8	6.7
Tajikistan	1.4	1.5	3.8	2.4	2.7	1.8	1.9	2.4	0.0	0.0	0.0	13.1	2.4	1.9	3.1
Ukraine	1.4	0.4	0.7	1.2	1.2	1.8	1.5	1.9	2.1	1.6	2.8	2.6	1.0	1.6	2.2
Uzbekistan	0.9	1.1	1.0	0.4	1.1	0.9	0.7	0.5	0.7	0.4	0.7	0.9	0.9	0.8	0.7
Average for CIS, excl. Russia	2.0	1.6	3.4	3.9	6.0	6.6	5.1	4.6	4.8	6.5	8.3	10.2	3.4	5.8	6.9
Average for Baltics	5.9	6.6	4.5	4.0	5.8	8.0	4.9	5.3	4.8	4.0	4.6	5.8	5.4	6.5	4.9

Sources: IMF, World Economic Outlook database; and Fund staff estimates.

Regarding financial flows from Russia to the other FSU countries, available data suggest that these flows also declined significantly after the Russian crisis. While there are no data available for individual countries, aggregate figures for financial flows from Russia to the CIS countries suggest that the CIS countries received significant amounts of financial inflows (from Russia) in the early years of their transition. Most of these inflows were trade credits and loans between governments. After the Russian crisis, these inflows almost halved. As for other types of financial inflows to the CIS countries from Russia, FDI picked up starting only in 2003, while portfolio investments never were significant, with the exception of 1995 (Table 6).

Growth correlations between Russia and other FSU countries have likely been weakened by these foreign financing trends. Specifically, declining financial flows from Russia to the other FSU countries, at the same time when FDI to the FSU countries from

[51] Total foreign financing is defined as the difference between the current account balance and international reserve accumulation.

[52] Anecdotal evidence suggests that a significant share of FDI resulted from the repatriation of capital that had fled from these countries.

other countries was increasing, may have loosened the relationship between growth in Russia and growth in the other FSU countries. Moreover, this dampening effect may have been exacerbated by the tighter payment terms and the reduction in implicit subsidies for Russian exports mentioned in Section B, which could be regarded as a form of financing to other FSU countries.

Table 6. Loans, Trade Credits, and Investments from Russia to CIS Countries 1/
(In millions of U.S. dollars)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Loans and trade credits	-2,833	-65	-2,087	1,386	-622	673	224	-117	-778	166	-733	-1,493
Total loans	-1,633	497	-545	1,042	26	844	515	383	-246	-432	66	260
Government (net)	-1,633	497	-545	1,042	274	848	559	386	-69	52	137	23
Newly issued and restructured debt	-1,670	-216	-1,172	-13	-1,330	-47	-1,245	-79	-313	-448	-80	-254
Newly issued debt	-1,670	-216	-37	-13	-67	-47	-15	0	-60	-40	0	-175
Restructured	0	0	-1,135	0	-1,263	0	-1,229	-79	-253	-408	-80	-79
Principle	0	0	-969	0	-1,169	0	-980	-12	-141	-334	-14	-14
Interest rate	0	0	-166	0	-94	0	-250	-67	-112	-74	-66	-65
Repaid	37	713	627	1,055	1,604	895	1,804	466	244	500	217	277
Central Bank	0	0	0	0	0	0	0	0	-51	-95	0	160
Banks	…	…	…	…	21	7	-48	-4	-116	-353	-125	58
Nonbank entrprises					-269	-11	3	1	-10	-36	53	20
Trade credits	-1,200	-562	-1,542	344	-648	-171	-291	-500	-532	598	-799	-1,753
Direct investments	…	-7	-127	-35	-400	-128	-518	-278	-498	-274	-694	-945
Portfolio investments	…	…	-1,400	81	-51	223	92	-43	55	9	175	-31

Source: Central Bank of Russia.

1/ Minus (plus) signs means an increase (decrease) in credits/investments from Russia.

D. Labor Mobility and Associated Transfers in the Region

The FSU countries were characterized by extremely rigid labor markets in the early years of their transition. These rigidities were in large part due to legacies of socialism, such as little self-employment and entrepreneurship, the residential permit (*propiska*) system, the compressed administrative wage scale, the scarcity of part-time jobs, poorly targeted social assistance, sizable fringe benefits (housing, kindergartens, education, health services, etc.), rigid hiring and firing procedures, and in-kind payments. The misallocation of human resources under the planned economy, as well as transition-related factors, such as declines in output and weak enforcement of existing laws, exacerbated the negative impact of these rigidities.

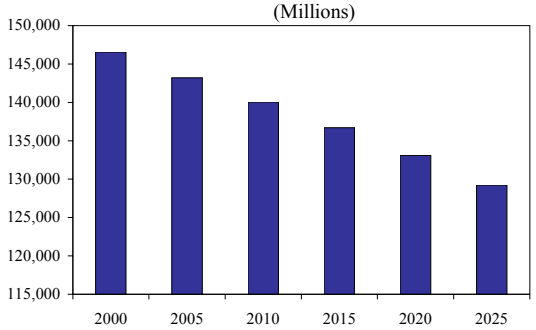
Reducing these rigidities contributed to a more efficient allocation of labor resources in the economy.[53] The Baltic countries pursued reforms vigorously, which initially led to rapid increases in unemployment. Subsequently, these economies' capacity to create jobs expanded, and unemployment rates started to decline. In the CIS countries, a slower pace of reforms led to less dramatic increases in unemployment rates. Most of the adjustment came from large reductions in real wages and a buildup of large wage arrears during the 1990s. Poverty increased rapidly throughout the region (EBRD, 2000).

[53] Labor market segmentation, impediments to labor mobility, and other rigidities hinder growth (Agenor 1996; and Filer and others, 2000).

The lack of job opportunities at home and the possibility of earning more income abroad forced millions of people in FSU countries to migrate to other countries. Political tensions, wars, and increased levels of nationalism, as well as rapid population growth in some FSU countries, have further contributed to this trend. As a result, during 1991-2004, net emigration from the CIS countries, excluding Turkmenistan, Georgia, and Russia (data were not available for the first two countries) totaled more than 4.2 million.[54] The structure of migration flows has also changed: while involuntary migration related to wars and regional conflicts dominated in the early 1990s, income motivated-emigration has been prevailing recently (Ivakhnyuk, 2003).

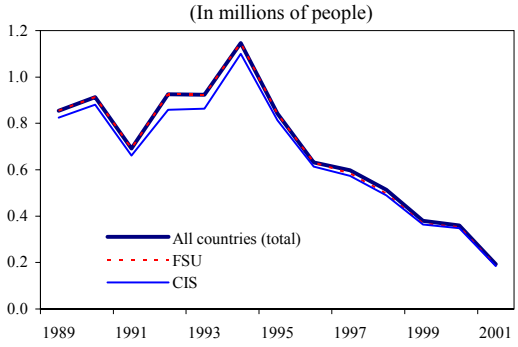
Russia has been a top destination for emigrants from many FSU countries. This outcome is due to cultural and linguistic ties, relatively low moving costs, the absence of a visa regime, the validity of diplomas and licenses issued in the other FSU countries, and the adverse demographic developments in Russia (Box 1). During 1993-2004, for example, accumulated (net) migration to Russia from Kazakhstan, Uzbekistan, and Ukraine was more than 2.5 million, according to Rosstat (Table 7).[55] The actual numbers could have been much higher because a large share of labor inflows to Russia (estimated to be 2-5 million) are not reflected in official statistics. These significant labor force inflows suggest that labor markets in Russia or at least some segments thereof may have been considerably more flexible than previously thought (Box 2). For example, according to Rosstat, more than 43 percent of workers from the CIS countries in Russia were employed in the booming construction sector in 2004, suggesting that at least this segment of labor markets may have been rather flexible (Table 8).

Russia: Total Population Estimates 1/
(Millions)



Source: UN Population Database.
1/ Medium variant.

Russia: Inflow of Foreign Population
(In millions of people)



Source: Migration Information Source (MIS).

[54] This number may include double counting since not all outflows are to non-FSU countries.

[55] Among the CIS countries, only Belarus registered net immigration from Russia. Anecdotal evidence suggests that this outcome was mainly due to the return of a large number of military servicemen of Belarusian nationality upon their retirement from service in the Russian army.

Data on transfers and remittances to the FSU countries, especially from Russia, are sketchy. Migrants often use unofficial channels to transfer money because of tax issues and the low credibility of financial institutions. For example, the IMF (2005) reports that elimination of the taxation of remittances in Tajikistan increased recorded remittances to $56 million in the first quarter of 2004 from $4 million in the first quarter of 2002.

Table 7. Migration between Russia and the Other FSU Countries

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total for 1993–2004
Migration to Russia													
Total FSU	982,524	1,192,425	869,081	648,324	593,755	501,551	370,602	353,806	188,802	179,560	123,433	113,522	6,117,385
Total CIS	863,248	1,100,273	813,929	614,022	571,903	488,087	362,708	346,774	183,650	175,068	119,661	110,314	5,749,637
Azerbaijan	54,684	49,495	43,442	40,310	29,878	22,210	15,902	14,906	5,587	5,635	4,277	2,584	288,910
Armenia	29,806	46,480	34,112	25,419	19,123	16,780	14,677	15,951	5,814	6,802	5,124	3,057	223,145
Belarus	34,670	43,383	35,337	23,903	17,575	13,760	11,549	10,274	6,520	6,841	5,309	5,642	214,763
Georgia	69,934	66,847	51,412	38,551	24,517	21,059	19,626	20,213	9,674	7,128	5,540	4,886	339,387
Kazakhstan	195,672	346,363	241,427	172,860	235,903	209,880	138,521	124,903	65,226	55,706	29,552	40,114	1,856,127
Kyrgyz	96,814	66,489	27,801	18,886	13,752	10,997	10,370	15,536	10,740	13,139	6,948	9,504	300,976
Moldova	19,344	21,364	18,715	17,847	13,750	10,762	9,037	11,652	7,569	7,562	6,391	4,811	148,804
Tajikistan	68,761	45,645	41,799	32,508	23,053	18,396	12,116	11,043	6,742	5,967	5,346	3,336	274,712
Turkmenistan	12,990	20,186	19,129	22,840	16,501	10,509	7,998	6,738	4,402	4,531	6,299	3,734	135,857
Uzbekistan	91,164	146,670	112,312	49,970	39,620	41,800	41,615	40,810	24,873	24,951	21,457	14,948	650,190
Ukraine	189,409	247,351	188,443	170,928	138,231	111,934	81,297	74,748	36,503	36,806	23,418	17,698	1,316,766
Baltic countries	59,638	46,076	27,576	17,151	10,926	6,732	3,947	3,516	2,576	2,246	1,886	1,604	183,874
Estonia	14,340	11,250	8,591	5,869	3,483	1,771	852	786	535	534	445	446	48,902
Latvia	25,891	26,370	14,859	8,227	5,658	3,577	2,108	1,785	1,283	990	906	819	92,473
Lithuania	19,407	8,456	4,126	3,055	1,785	1,384	987	945	758	722	535	339	42,499
Migration from Russia													
Total FSU	370,697	232,810	230,164	192,205	150,163	133,567	127,807	82,312	61,570	52,099	47,310	37,988	1,718,692
Total CIS	362,941	227,830	225,876	188,453	146,961	131,050	127,807	82,312	61,570	52,099	46,081	36,950	1,689,930
Azerbaijan	11,543	6,124	5,614	4,902	4,302	3,915	3,847	3,187	2,170	1,704	1,771	1,336	50,415
Armenia	1,953	1,906	2,840	2,997	2,578	2,356	2,243	1,519	1,362	1,114	1,098	654	22,620
Belarus	46,058	27,751	25,229	21,542	18,928	19,035	19,151	13,276	11,175	8,829	7,016	5,663	223,653
Georgia	4,922	4,671	4,109	4,106	3,286	2,933	2,574	1,802	1,339	964	939	740	32,385
Kazakhstan	68,703	41,864	50,388	38,350	25,364	26,672	25,037	17,913	15,186	13,939	14,017	12,457	349,890
Kyrgyz	10,142	9,947	9,551	8,472	6,296	5,310	3,681	1,857	1,333	1,080	959	655	59,283
Moldova	14,881	9,386	8,264	6,894	5,715	4,766	4,275	2,237	1,660	1,385	1,234	907	61,604
Tajikistan	5,898	3,676	3,290	2,613	2,474	1,977	1,799	1,158	993	827	922	549	26,176
Turkmenistan	6,165	2,817	1,934	1,380	1,532	1,537	1,237	676	352	272	251	168	18,321
Uzbekistan	20,545	11,318	15,235	13,384	7,370	5,231	5,041	3,086	1,974	1,400	1,130	716	86,430
Ukraine	172,131	108,370	99,422	83,813	69,116	57,318	58,922	35,601	24,026	20,585	16,744	13,105	759,153
Baltic countries	6,174	3,922	3,411	2,930	2,500	1,967	…	…	…	…	878	773	…
Estonia	1,582	1,058	877	822	702	550	…	…	…	…	351	265	…
Latvia	2,223	1,339	1,167	856	636	612	…	…	…	…	259	226	…
Lithuania	2,369	1,525	1,367	1,252	1,162	805	…	…	…	…	268	282	…
Net migration to Russia													
FSU	611,827	959,615	638,917	456,119	443,592	367,984	…	…	…	…	76,123	75,534	…
CIS	500,307	872,443	588,053	425,569	424,942	357,037	234,901	264,462	122,080	122,969	73,580	73,364	4,059,707
Baltics	53,464	42,154	24,165	14,221	8,426	4,765	…	…	…	…	1,008	831	…

Sources: Federal State Statistics Service (Rosstat); and Fund staff estimates.

Table 8. Russia: Distribution of Workers from the CIS Countries by Sectors of the Economy
(In percent)

	2000	2001	2002	2003	2004
Industry	17.2	17.8	17.8	16.7	17.8
Agriculture	14.6	12.2	10.8	6.4	6.7
Transport	7.9	7.0	7.5	11.3	8.0
Construction		45.1	42.5	40.6	43.4
Other sectors	20.0	17.9	21.3	25.0	24.2
Total	100	100	100	100	100

Source: Rosstat; and Fund staff estimates.

Box 1. Russia: Demographic Developments, Labor Market Flexibility, and Immigration

Russia is suffering from a notable population decline, caused by low fertility and high mortality rates. The World Bank (2005a) reports that from 1992 to 2003 Russia's population declined by about 6 million, mainly due to sharp increases in mortality and declines in fertility rates. While many developed countries experience low fertility rates, Russia's mortality rate is high by comparison. This is mainly related to deaths from non-communicable diseases and injuries—specifically, heart disease, traffic accidents, and alcoholism— which account for 68 percent of deaths. If current trends continue, Russia's population is expected to decline by over 30 percent during the next 50 years. Furthermore, the country's population is aging rapidly, and significant numbers of people are emigrating. Enhancing internal migration and international immigration can, therefore, help reduce strains on Russia's labor markets. In addition, migrants contribute to the development of their countries of destination by injecting social, cultural, and intellectual dynamism into these societies (GCIM, 2005).

Reportedly, net immigration into Russia surged from 130,000 persons a year during 1985-92 to a peak of 810,000 in 1994 and gradually declined since then (see also text figure on p. 15). In fact, in terms of both stock and flow of immigrants, Russia is second in the world only to the United States. Yet, many analysts believe that Russia needs more labor inflows. For example, Andrienko and Guriev (2005) estimate that, to compensate for the above demographic developments, Russia needs an annual inflow of 1 million immigrants —about 10 times the number officially recorded in recent years.

Recently, officially recorded immigration to Russia has slowed because of the winding down of inflows of ethnic Russians from the other FSU countries and enforced emigration, as well as the restrictions imposed on immigration. The introduction of the Law on Entry and Exit to/from the Russian Federation in 1996, as well as the amendments to it in 2000 and 2003, for example, raised the cost of residence permits. Many analysts argue that the present migration policy is too restrictive and, combined with high levels of corruption among government officials, forces otherwise legal immigrants into illegal immigration. Andrienko and Guriev (2005), for instance, suggest announcing an amnesty for the current illegal immigrants and introducing a point system to control the admission of new legal immigrants.

Box 2. Labor Mobility Within Russia

The very low interregional labor mobility in Russia (at about 1 percent)—despite substantial differences in wages and unemployment rates across regions—suggests that there are frictions in the labor markets. Explanations offered in the literature include the remnants of the Soviet style registry system (*propiska*); underdevelopment of the financial and property markets, which causes problems for people in selling and renting their houses; in-kind payments; and liquidity constraints.[1] Kwon and Spilimbergo (2005) show that this situation was made worse by procyclical fiscal budgets in the regions.

The moderate levels of labor mobility between Russia and other countries, contrary to the low levels of interregional mobility within Russia, however, suggest that there can also be other explanations for regional disparities in unemployment rates. First, it is likely that elderly and less skilled labor, who would have difficulty finding jobs in any region, constitute a large share of unemployment. Anecdotal evidence suggests that many of these people resort to subsistence self-employment, primarily in agriculture, rather than moving to other areas.[2] Second, there can be region-specific explanations as well. For example, very high rates of unemployment in the northern Caucasus and northern areas can in part be explained, respectively, by demographic trends in the northern Caucasus and privileges given to the people living in the north. The former is one of the few areas where the population continues to grow, due to its higher birth rates and life expectancy (World Bank, 2005b). Regarding the north, the current legislation requires that workers in this area be compensated with higher wages because of the arduous living conditions (World Bank, 2005a). It is possible that administratively determined higher wages reduce the competitiveness of enterprises in the north, causing (further) output declines and thus raising unemployment rates.

_____

1/ See Andrienko and Guriev (2004), Friebel and Guriev (2005), and Andrienko and Guriev (2005).
2/ The share of immigrants in Russia working in the agriculture sector has been declining, perhaps due to lower wages in this sector (see Table 8).

Available data suggest that transfers and remittances (both from Russia and the rest of the world) constitute an important component of foreign financing for the FSU countries. On average, net transfers to the FSU countries (excluding Russia) rose from about 4 percent of their GDP during 1993-97 to 5 percent of GDP during 2000-04. During 2000-03, workers' remittances, including workers' compensation, amounted to about 4 percent of GDP. In 2003, remittances exceeded FDI inflows in Armenia, the Kyrgyz Republic, Moldova, and Tajikistan. In Moldova, for example, workers' remittances totaled about 24 percent of GDP, compared with 3 percent of GDP in FDI inflows (Tables 9A and 9B).[56] In Tajikistan, remittances were estimated at 14 percent of GDP in 2004 (Kireyev, 2006).

[56] Cuc, Lundback, and Ruggiero (2005) estimate remittances, including workers' compensation, to Moldova at 27 percent of GDP in 2004.

Table 9a. FSU Countries: Net Current Transfers-to-GDP Ratio
(In percent)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1993–97	1998–99	2000–04
Armenia	16.4	42.0	12.9	11.6	13.1	9.3	9.4	9.8	8.2	7.2	6.4	5.8	19.2	9.4	7.5
Azerbaijan, Rep. of	2.3	3.3	4.6	2.1	1.1	1.4	1.8	1.4	1.3	1.1	1.8	2.1	2.7	1.6	1.6
Belarus	1.4	0.5	0.7	0.6	0.6	0.6	0.9	1.2	1.2	1.4	1.2	1.2	0.8	0.7	1.3
Estonia	6.4	4.7	3.4	2.2	2.4	2.7	2.0	2.1	2.5	1.6	1.3	1.5	3.8	2.3	1.8
Georgia	15.9	20.7	9.7	4.5	5.7	6.3	6.5	6.8	7.1	5.4	6.4	6.5	11.3	6.4	6.4
Kazakhstan	2.1	0.8	0.4	0.3	0.3	0.6	0.9	1.4	1.1	0.5	-0.5	-1.2	0.8	0.7	0.2
Kyrgyz Republic	2.5	2.6	5.5	4.2	3.4	3.0	5.5	7.9	4.7	6.7	6.9	7.3	3.6	4.2	6.7
Latvia	3.6	1.7	1.4	1.7	1.3	1.9	0.8	1.5	1.1	1.8	2.7	2.7	1.9	1.3	2.0
Lithuania	0.0	0.0	0.0	1.8	2.3	2.1	1.5	2.1	2.1	1.7	1.6	1.5	0.8	1.8	1.8
Moldova	1.4	1.6	3.9	4.3	2.8	3.9	7.4	12.9	16.0	15.1	15.4	13.6	2.8	5.6	14.6
Tajikistan	-1.5	-1.0	-0.8	-0.4	-0.3	-0.5	-0.2	3.7	10.5	11.9	14.6	11.4	-0.8	-0.3	10.4
Ukraine	0.9	0.8	0.5	1.1	1.7	1.9	2.2	2.7	3.8	4.5	4.4	4.0	1.0	2.1	3.9
Uzbekistan	0.2	0.2	0.2	0.0	0.2	0.3	0.3	0.1	0.4	1.0	1.6	1.0	0.2	0.3	0.8
Average	4.0	6.0	3.3	2.6	2.7	2.6	3.0	4.1	4.6	4.6	4.9	4.4	3.7	2.8	4.5
Average for the CIS countries	4.2	7.2	3.8	2.8	2.9	2.7	3.5	4.8	5.4	5.5	5.8	5.2	4.2	3.1	5.3
Average for the Baltic countries	...	2.2	1.6	1.9	2.0	2.2	1.4	1.9	1.9	1.7	1.9	1.9	2.2	1.8	1.9
Memorandum item:															
Russia	1.5	-0.1	0.0	0.0	-0.1	-0.1	0.3	0.0	-0.2	-0.1	-0.1	-0.1	0.3	0.1	-0.1

Sources: IMF, World Economic Outlook database; and Fund staff estimates.

Table 9b. FSU Countries: Workers Remittances-to-GDP Ratio
(In percent)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	1993–97	1998–99	2000–03
Armenia	...	...	5.1	5.3	8.3	4.8	5.1	4.6	4.4	5.5	6.1	6.2	5.0	5.1
Azerbaijan, Rep. of	...	...	...	...	...	...	1.2	1.1	1.8	2.9	2.4	...	1.2	2.0
Belarus	...	...	0.3	2.4	2.1	2.1	1.6	1.1	1.2	1.0	0.9	1.6	1.8	1.0
Estonia	...	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.4	0.1	0.0	0.2
Georgia	...	...	...	...	7.9	10.3	12.9	9.0	5.7	7.0	6.2	7.9	11.6	7.0
Kazakhstan	...	...	...	0.4	0.3	0.3	0.4	0.7	0.7	0.8	0.5	...	...	0.7
Kyrgyz Republic	0.3	0.1	0.1	0.1	0.2	0.1	0.7	3.7	1.8	4.2	5.6	0.1	0.4	3.8
Latvia	...	...	...	0.7	0.7	0.7	0.7	1.7	2.5	1.5	1.5	0.7	0.7	1.8
Lithuania	...	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.8	0.6	0.0	0.0	0.6
Moldova	...	...	0.1	5.1	5.9	7.3	9.6	12.6	15.8	18.7	23.5	3.7	8.4	17.6
Tajikistan	...	...	...	...	...	...	...	...	...	6.5	9.4	...	...	8.0
Ukraine	...	...	...	0.0	0.0	0.0	0.1	0.1	0.4	0.5	0.7	...	...	0.4
Uzbekistan	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Average	0.3	0.1	0.9	1.6	2.6	2.6	2.9	3.2	3.2	4.1	4.8	2.6	3.3	4.0
Average for the CIS countries	0.3	0.1	1.4	2.2	3.5	3.6	3.9	4.1	4.0	5.2	6.1	3.9	4.7	5.1
Average for the Baltic countries	...	0.1	0.0	0.3	0.3	0.3	0.2	0.7	1.1	0.8	0.9	0.3	0.3	0.9
Memorandum item:														
Russia	...	1.6	0.8	0.7	0.6	0.7	0.7	0.5	0.5	0.4	0.3	0.9	0.7	0.4

Sources: World Bank, World Development Indicators database; and Fund staff estimates.

Total net transfers from Russia to the other CIS countries were initially negative, but in recent years have turned positive and are growing rapidly. No data are available for individual FSU countries. However, aggregate figures for the CIS countries suggest that transfers from Russia to these countries were less than transfers from these countries to Russia for most of the 1990s. This was mainly due to migration-related transfers (migrants' moving their financial assets from their home countries to their host countries) from the CIS countries to Russia, which peaked in 1994. Since then, these transfers have been declining, mirroring drops in the number of migrants from the CIS countries to Russia. In 2001, net transfers from Russia to the CIS countries turned positive as net remittances from Russia to

the CIS countries exceeded migration-related transfers. From 2001 to 2004, net transfers from Russia to the CIS countries rose sixfold, due mainly to an eightfold increase in remittances (Table 10).

Table 10. Transfers and Remittances from/to Russia to/from CIS countries, 1993–2004
(In millions of U.S. dollars)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
From Russia to CIS countries, net	539	-1,683	439	-467	-133	-329	-263	-307	393	604	1,294	2,916
Compensation of employees received	0	0	216	309	378	303	136	148	329	327	613	1,194
Remittances	…	…	…	…	…	…	…	…	202	410	712	1,785
Transfers related to migration	539	-1,683	223	-776	-511	-632	-399	-455	-138	-133	-31	-63
From CIS countries to Russia	1,428	3,961	2,036	2,660	1,983	1,578	836	752	443	446	370	616
Compensation of employees received	0	0	0	0	1	0	0	0	0	0	0	4
Remittances	…	…	…	…	…	…	…	…	44	75	93	318
Transfers related to migration	1,428	3,961	2,036	2,660	1,982	1,578	836	752	399	371	277	294
From Russia to CIS countries	1,967	2,278	2,475	2,193	1,850	1,249	573	445	836	1,050	1,664	3,532
Compensation of employees received	0	0	216	309	379	303	136	148	329	327	613	1,198
Transfers of employees	…	…	…	…	…	…	…	…	246	485	805	2,103
Transfers related to migration	1,967	2,278	2,259	1,884	1,471	946	437	297	261	238	246	231
Memorandum items:												
Migration to Russia from the CIS countries	863,248	1,100,273	813,929	614,022	571,903	488,087	362,708	346,774	183,650	175,068	119,661	110,314
Migration to the CIS countries from Russia	362,941	227,830	225,876	188,453	146,961	131,050	127,807	82,312	61,570	52,099	46,081	36,950
Total remittances to the CIS countries 1/	…	…	…	…	…	…	…	269	516	729	888	…

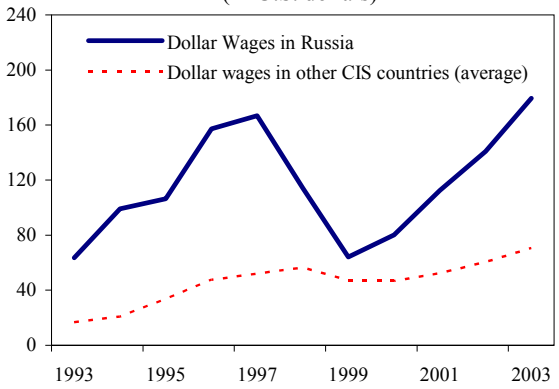
Sources: Central Bank of Russia; IMF, World Economic Outlook database; and Fund staff estimates.

1/ Balance of payments data; Belarus, Turkmenistan, and Uzbekistan are excluded since data for these countries were not available.

The recent increase in remittances from Russia to the CIS countries is in part related to wage growth in Russia, the increase in the number of illegal immigrants, booms in housing markets in the CIS countries, and weaknesses in data for the early years of transition:

- Faster wage growth in Russia is likely to affect remittances in two ways. First, more income allows immigrants to increase their remittances, either for altruistic or investment purposes. Second, increases in the differences between wages in Russia and wages in the other CIS countries attract more labor inflows to Russia from these countries, including illegal immigrants.

Wages in the CIS Countries, 1993-2003
(In U.S. dollars)



Source: National authorities; and Fund staff estimates.

- It can be argued that illegal immigrants tend to save and remit more than legal immigrants since illegal emigrants cannot integrate fully into their host countries and have limited options for investing in them.[57]

[57] The experience of other countries suggests that people who stay abroad for short periods tend to remit more than those who stay longer, since the latter establish bonds in their host countries, and have more options to invest in their host countries, including in real estate (GCIM, 2005).

- The increases in remittances to the CIS countries may also be related to housing market booms in these countries, as those migrants who want to invest in real estate in their home countries have to pay higher prices for these assets.

- As discussed, the low remittance numbers reported in the earlier years of transition did not fully reflect actual flows (since many people avoided the official channels in transferring their savings).

- It is difficult to measure the impact of the above factors on remittances, however, due to data shortcomings.

On balance, the weakening correlations between growth in Russia and growth in the FSU countries do not seem to be related to changes in remittances. In the CIS countries, the recent large and growing inflows of transfers and remittances from Russia may have strengthened domestic savings and investment, contributing to high growth in these countries (see Section A). These developments would suggest stronger rather than weaker correlations between growth in Russia and growth in the CIS countries.

E. Regression Analysis

In SPJ, growth in FSU countries was explained by initial conditions, growth abroad, and a number of variables to control for macroeconomic stability, progress in reforming, and trade openness. Two initial condition indices from Havrylyshyn and van Rooden (2000) were used to capture macroeconomic distortions and distortions related to the level of socialist development, of which only the second was statistically significant. Inflation and government expenditures as a percent of GDP (instead of the fiscal balance measure, which was not comparable across countries and had breaks in series) were included to measure the impact of macroeconomic stability. The EBRD transition index was used to measure the impact of reforms. The change in the relationship between growth in Russia and growth in the other FSU countries before and after the Russian crisis was measured by running piecewise regressions, where Russian growth was included as an explanatory variable and the coefficients on the explanatory variables were allowed to change. The latter was done by using the interactions of the dummy variable for the Russian crisis (0 before the crisis and 1 thereafter) with the explanatory variables. Both 1998 and 1999 were considered (separately) as a break point in the relationships, but it was eventually judged that the break point occurred in 1998 (see Appendix I).

This section enhances the analysis in SPJ by considering the role of some additional explanatory variables. Specifically, the FDI-to-GDP and transfers-to-GDP ratios were added to the specifications in Tables A1a and A1b to control for the impact of these two

variables.[58] In addition, this study employs the generalized least squares (GLS) method, adjusting the calculations using cross-section weights, instead of the least-squares dummy variable (LSDV) method.

The new variables improve the fit of the regressions (Table 11). This is reflected in the higher values for the coefficients of determination (R^2) and/or log likelihood as well as the smaller values of the Akaike information criterion (*AIC*) for the regressions in Table 11, compared with those for the regressions in Tables A1a and A1b. The coefficients on transfers have the expected signs and are statistically significant (at the 5 percent level). The coefficient on transfers' interaction with the Russian crisis dummy have minus signs, meaning that the impact of transfers on growth declined after the Russian crisis. The coefficients on FDI also have the expected signs and drop after the Russian crisis in all specifications except the second and third; however, FDI is significant only in the sixth specification.

Table 11. Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1998, CIS and Baltic Countries, 1993–2004 1/ 2/ 3/

	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.
	EQ1		**EQ2**		**EQ3**		**EQ6**		**EQ7**		**EQ8**		**EQ9**		**EQ10**	
C	18.19	1.73	8.55	1.55	**23.00**	3.65	12.97	1.25	18.51	1.65	5.32	1.10	15.13	1.47	-19.52	-1.46
GR1	0.18	2.01	**0.45**	6.23	**0.40**	5.70	0.17	1.84	0.20	2.22	**0.46**	6.51	**0.24**	2.85	0.04	0.41
CPI	0.00	-1.90	0.00	1.19	0.00	0.66	*0.00*	-2.30	**0.00**	-1.27	0.00	1.20			*0.00*	-2.36
INF													**-2.89**	-3.10		
EXP	-0.10	-0.96	-0.12	-1.85	-0.15	-2.16	-0.08	-0.77	-0.11	-1.16	-0.10	-1.76	-0.11	-1.09	*-0.19*	-2.07
GRRUS	**0.90**	5.26	**0.55**	4.26	**0.81**	5.48	**0.98**	5.35	0.80	4.37	**0.53**	4.20	**0.64**	3.70	**0.67**	4.21
EURGR	**-3.68**	-2.84	-3.55	-2.64	**-4.29**	-3.25	*-3.30*	-2.50	-4.05	-3.02	**-3.60**	-2.74	-2.50	-1.93		
WORLDGR															*6.59*	2.58
RER	*-0.06*	-3.15	-0.03	-1.94	**-0.04**	-2.67			*-0.09*	-2.23	-0.03	-1.82	*-0.05*	-2.45	*-0.05*	-2.54
RRUS							*-0.05*	-2.48	0.05	1.03						
RI	-2.41	-0.76	*3.14*	2.55	-1.32	-0.78	-2.07	-0.64	-1.29	-0.39	**3.93**	3.53	-3.50	-1.15	-0.86	-0.28
OPEN	-0.02	-1.16	0.00	0.39	-0.02	-1.67	-0.02	-0.75	-0.02	-1.15	0.00	0.32	0.01	0.46	-0.03	-1.46
IC2			0.86	1.14												
FDI	0.30	1.78	0.05	0.53	0.03	0.28	*0.35*	2.06	0.24	1.41	0.08	0.83	0.21	1.36	0.24	1.51
TRS	*0.59*	3.27	**0.36**	3.30	**0.52**	4.31	**0.74**	4.48	*0.48*	2.23	**0.40**	4.01	**0.69**	3.79	**0.62**	3.08
DGR1	0.10	0.71	-0.09	-0.64	-0.01	-0.06	0.13	0.90	0.09	0.61	-0.03	-0.19	0.03	0.18	0.22	1.53
DCPI	-0.01	-0.72	-0.01	-0.81	-0.01	-0.35	-0.01	-0.72	-0.01	-0.61	-0.01	-0.39			-0.01	-0.50
DINF													0.87	0.34		
DEXP	*-0.34*	-1.99	-0.05	-0.48	-0.09	-0.89	-0.31	-1.71	-0.26	-1.44	0.02	0.21	*-0.35*	-2.10	-0.21	-1.29
DGRRUS	**-0.83**	-4.27	*-0.39*	-2.53	**-0.65**	-3.85	**-0.90**	-4.39	**-0.74**	-3.64	*-0.35*	-2.36	**-0.58**	-2.94	**-0.67**	-3.46
DEURGR	**3.75**	2.68	*3.23*	2.25	**4.18**	2.97	*3.35*	2.37	**4.09**	2.85	*3.51*	2.49	2.61	1.88		
DWORLDGR															*-6.17*	-2.38
DRER	0.07	1.58	0.01	0.15	0.01	0.37			*0.13*	1.99	0.00	0.03	0.05	1.21	0.06	1.41
DRRUS							0.03	0.85	-0.08	-1.28						
DRI	6.84	1.16	**-4.60**	-2.83	1.17	0.55	4.70	0.75	4.41	0.70	**-4.10**	-2.80	7.85	1.35	6.45	1.21
DOPEN	*0.08*	2.11	0.02	1.16	0.02	1.08	0.06	1.60	0.07	1.83	0.02	1.03	0.05	1.23	**0.09**	2.64
DIC2			0.54	0.52												
DFDI	-0.20	-1.10	0.01	0.09	0.08	0.65	-0.25	-1.36	-0.14	-0.78	-0.01	-0.11	-0.11	-0.66	-0.17	-0.96
DTRS	-0.31	-1.29	*-0.31*	-2.04	*-0.41*	-2.58	*-0.50*	-2.15	-0.22	-0.83	*-0.37*	-2.54	-0.41	-1.61	-0.35	-1.38
GRRUS	0.90		0.55		0.81		0.98		0.80		0.53		0.64		0.67	
GRRUSxD98	-0.83		-0.39		-0.65		-0.90		-0.74		-0.35		-0.58		-0.67	
Sum	0.07		0.16		0.16		0.07		0.05		0.18		0.06		0.01	
F-test	0.54		3.80		3.99		0.64		0.35		4.70		0.48		0.01	
P-value	0.46		0.05		0.05		0.42		0.56		0.03		0.49		0.94	
R^2	0.90		0.85		0.87		0.90		0.90		0.85		0.90		0.91	
Adjusted R^2	0.85		0.82		0.84		0.85		0.85		0.82		0.85		0.86	
Unweighted statistics																
AIC	2.7		2.9		2.8		2.7		2.7		3.0		2.7		2.8	
R^2	0.87		0.77		0.81		0.87		0.87		0.76		0.87		0.86	

Source: Fund staff estimates.

1/ The fourth and fifth specifications in Tables A1a and A1b, which estimate subsamples of the data set, are excluded from this table.
2/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
3/ Country/region fixed effects (for the first, third, sixth, seventh, ninth, and tenth specifications) are available upon request.

[58] The remittances-to-GDP ratio was not included because of data problems. Specifically, a large number of observations are missing for this variable, and data do not reflect actual flows for most of the 1990s (see also the penultimate paragraph in Section D).

Controlling for FDI and transfers reduces the coefficients for Russian growth compared with those estimated in SPJ. However, Russian growth remains a statistically significant explanatory variable before the Russian crisis in all specifications, since FDI and transfers were not the only channels through which Russian growth affected growth in other countries. The coefficients on the interactions of the Russian crisis dummy with Russian growth have minus signs and are also statistically significant in all specifications.

The trade openness (*OPEN*) measure affects growth positively, but is not significant in many specifications. While the coefficient on trade openness is not significant in all specifications, the coefficient on its interaction with the Russian crisis dummy is significant in the first and tenth specifications and has the expected plus sign. This outcome might be related to the rather short sampling period, since trade openness usually affects growth in the medium and long term. Regarding the short-term impact of trade flows, the growth decomposition estimations in Section B suggest that trade flows were important factors of growth in the FSU countries.

The results suggest that, although Russian growth was a strong determinant of regional growth before the Russian crisis, this link weakened after the crisis. In the first specification (column 1), our benchmark, the coefficient on Russian growth is 0.9 while the coefficient on the interaction of Russian growth with the Russian crisis dummy is -0.8. This means that while 1 percent growth in Russia raised growth in other FSU countries by 0.9 percent before the Russian crisis, this effect declined to 0.1 percent after the crisis. Moreover, the sum of these two coefficients is statistically insignificant. The coefficient on growth in the EU has a minus sign and is statistically significant, which appears to be a reflection of declining output in the CIS countries when output in the EU was growing. The coefficient on the interaction of EU growth with the Russian crisis has a plus sign and is significant, suggesting that the EU took up the role that Russia used to play. Regarding other variables, the consumer price index (*CPI*), the reform index (*RI*), and the interactions of these two variables with the Russian dummy are not statistically significant. The coefficients on government expenditures (in percent of GDP) and trade openness are not significant, but the coefficients on their interactions with the Russian crisis dummy are significant and have, as expected, minus and plus signs, respectively. The coefficient on the real effective exchange rate (*REER*) has a minus sign and is significant. The coefficient on the interaction of *REER* and the Russian crisis dummy, however, has a plus sign and is not significant.[59]

[59] Results obtained by including real effective exchange rates should be interpreted with care, owing to several shortcomings in the calculation of these indices. See footnote 13.

The conclusion that the growth linkages between Russia and other FSU countries weakened after the Russian crisis is robust to different specifications:

- The results in the second specification —which includes an initial condition measure (*IC2*) but does not have country fixed effects— are broadly similar to those in the first specification. The coefficient for Russian growth was 0.6 before the crisis and dropped to 0.2 after the crisis. The sum of the two coefficients is not significant. The main differences from the results of the first specification are that (i) the coefficient on the interaction of government expenditures with the Russian crisis is not significant and (ii) the coefficients on the reform index and its interactions with the Russian crisis dummy have different signs and are significant. The sum of the latter two coefficients, however, is not significant. The coefficients of the initial conditions index and its interaction with the Russian crisis dummy are not significant.

- The results of the third specification, which includes regional dummy variables for the Baltic, Caucasian, and Central Asian countries instead of dummies for each country, are similar to those in the first specification. The main difference from the results of the first specification is that the sum of the coefficients on Russian growth and its interaction with the Russian crisis dummy is significant in the third specification. The results of the sixth specification, which replaces the real effective exchange rate (*REER*) with the real exchange rate against the Russian ruble, as well as the results of the seventh specification, which includes both exchange rate variables (*REER* and the real exchange rate against the Russian ruble), are also similar to those in the first specification.[60]

- The results of the eighth specification, which excludes both country fixed effects and initial conditions, are similar to those in the second specification, which also excludes country dummy variables. The main difference here too is that the sum of the coefficients on Russian growth and its interaction with the Russian crisis dummy becomes significant.

- The ninth specification, which tries to explore possible nonlinearity in the response of growth to inflation by including the natural logarithm of percent changes in CPI inflation (*INF*) instead of percent changes in CPI, also produces results similar to those in the first specification. The main difference is that the coefficients on EU growth and its interaction with the Russian crisis dummy become insignificant. Interestingly, the coefficient on (log of) inflation has a minus sign and is significant. The last specification, which includes world growth in place of EU growth, also

[60] The fourth and fifth specifications in SPJ, which use subsets of the data set, and which are similar to the third specification in that paper, are not reestimated here.

produces similar results. Here, the coefficient on government expenditures has a minus sign and is significant at the 5 percent level.

The results should be interpreted with caution, however, because the right-side variables themselves, including Russian growth, could be endogenous and correlated among themselves. Moreover, it is well known that the inclusion of the lagged dependent variable in fixed-effect and random effect models creates biases in fixed-effect and random effect estimators. Therefore, the above results are compared with Arellano and Bond (1991) estimations, which use consistent instrumental variables. As can be seen in Table 12, the results from the Arellano-Bond estimations are similar to the results in Table 11, discussed above. In particular, the coefficients on Russian growth and their interactions with the Russian dummy variable are comparable to those in the equations presented in Table 11 and are significant. Arellano-Bond estimators, however, may exhibit a large bias in finite samples and will have larger standard errors than ordinary least squares. Therefore, the estimates presented in Table 12 should not necessarily be presumed superior to the GLS estimates presented in Table 11.

Table 12. CIS and Baltic Countries: Arellano–Bond Estimates of Real GDP Growth Regressions with a Structural Break in 1998, 1993-2004 1/

	GLS Estimates		Strictly Exogenous Explanatory Variables				Endogeneity Correction 2/		Endogeneity Correction 3/	
	(1)		(11)		(12)		(13)		(14)	
	Coefficient	*t*-statistic	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic	Coefficient	z-statistic
CONSTANT	18.19	1.73	0.27	0.91	0.23	0.94	0.10	0.40	-0.17	-0.51
GR $_{-1}$	*0.18*	2.01	**0.27**	3.91	**0.38**	5.76	**0.38**	5.71	**0.57**	5.28
CPI	0.00	-1.90	0.00	-0.40	0.00	0.18	0.00	1.38	0.00	-0.01
EXP	-0.10	-0.96	-0.07	-0.74	*-0.23*	-2.36	**-0.46**	-4.37	-0.20	-1.66
RI	-2.41	-0.76	1.88	0.63						
GRRUS	**0.90**	5.26	**0.76**	4.92	**0.75**	5.26	**0.74**	5.57	**0.64**	3.65
EURGR	**-3.68**	-2.84	*-3.38*	-2.62						
WORLDGR					0.07	0.13	0.20	0.37	0.10	0.16
RER	**-0.06**	-3.15	-0.03	-1.56						
OPEN	-0.02	-1.16	0.00	-0.12						
FDI	0.30	1.78	0.11	0.67	0.05	0.28	0.02	0.16	0.14	0.72
TRS	**0.59**	3.27	**0.47**	3.16	**0.53**	3.59	**0.51**	3.59	**0.55**	2.83
D98	-21.24	-1.16	4.46	0.63	*-1.93*	-1.15	-2.10	-1.32	-2.29	-1.14
GR $_{-1}$ ×D98	0.10	0.71	-0.15	-1.10						
CPI×D98	-0.01	-0.72	-0.01	-0.74						
EXP×D98	*-0.34*	-1.99	*-0.24*	-2.24						
RI×D98	6.84	1.16	*-4.16*	-2.07						
GRRUS×D98	**-0.83**	-4.27	**-0.71**	-4.41	**-0.62**	-3.53	**-0.63**	-3.87	-0.43	-1.88
EURGR×D98	**3.75**	2.68	*3.25*	2.41						
RER×D98	0.07	1.58	0.02	0.37						
OPEN×D98	*0.08*	2.11	*0.06*	2.05						
FDIxD98	-0.20	-1.10	-0.01	-0.05	0.03	0.20	0.09	0.62	0.06	0.30
TRSxD98	-0.31	-1.29	-0.09	-0.40	-0.23	-0.98	-0.23	-1.23	-0.01	-0.03
Memorandum items:										
Sargan test of overidentifying restrictions			82.04	0.01 4/	43.18	0.85 4/	95.70	1.00 4/	7.61	0.57 4/
Arellano-Bond test for AR(1)			-2.61	0.01 4/	-3.90	0.00 4/	-3.60	0.00 4/	-3.88	0.00 4/
Arellano-Bond test for AR(2)			-0.64	0.52 4/	0.42	0.67 4/	0.28	0.78 4/	0.51	0.61 4/

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
2/ Coefficient estimates in this column assume that *CPI* and *EXP* are endogenous. First-order lagged values of these variables are used as instruments.
3/ Coefficient estimates in this column assume that Russian growth and its interaction with the Russian crisis dummy is endogenous. First-order lagged values of these variables are used as instruments.
4/ These figures refer to p-values instead of t-statistics.

Finally, the results in Table 11 are compared with the ordinary least squares (OLS) estimations without country dummy variables (in Table 13) since small T (=12) may produce a bias in fixed-effect estimators as well as in Arellano-Bond estimations. The fit of the OLS regressions is uniformly worse than that in the regressions presented in Table 11, as reflected in the lower values for the R^2 and/or log likelihood, as well as the higher values of the *AIC* for the OLS regressions. The main results, however, are similar to those above.

Table 13. Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1998, FSU Countries, 1993–2004 (OLS) 1/

EQ1	EQ1		EQ6		EQ7		EQ9		EQ10	
Variable	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.	Coef.	*t*-stat.
C	5.41	0.93	2.43	0.43	7.14	1.28	5.62	0.92	5.98	0.45
GR1	**0.40**	5.40	**0.40**	5.31	**0.47**	6.33	**0.38**	5.20	**0.41**	5.05
CPI	0.00	1.22	0.00	1.13	0.00	1.76	-0.15	-0.14	0.00	1.14
EXP	-0.09	-1.24	-0.07	-0.96	-0.10	-1.54	-0.08	-1.19	-0.11	-1.62
GRRUS	**0.66**	4.66	**0.68**	4.80	*0.39*	2.51	**0.63**	3.85	**0.71**	4.29
EURGR	*-3.48*	-2.15	*-3.53*	-2.17	**-4.54**	-2.88	-3.24	-1.93	-2.14	-0.72
RER	-0.03	-1.66			**-0.14**	-3.67	-0.03	-1.58	-0.04	-1.78
RRUS			0.00	0.18	**0.15**	3.24				
RI	**3.60**	2.71	**4.23**	3.12	**4.45**	3.43	3.18	1.89	**3.82**	2.83
OPEN	0.00	0.16	0.01	0.35	0.01	0.50	0.00	0.09	0.00	-0.02
FDI	0.07	0.52	0.12	0.90	0.09	0.66	0.06	0.46	0.04	0.28
TRS	**0.39**	3.78	**0.41**	3.83	0.22	1.96	**0.47**	4.69	0.38	3.61
D98	-0.13	-0.02	2.20	0.32	-1.75	-0.26	-0.24	-0.03	-2.21	-0.16
DGR1	0.08	0.51	0.09	0.60	0.00	0.03	0.09	0.61	0.09	0.65
DCPI	-0.01	-0.62	-0.01	-0.64	-0.01	-0.72	-1.19	-0.35	-0.01	-0.66
DEXP	0.00	0.00	-0.01	-0.07	0.03	0.31	-0.01	-0.07	0.03	0.32
DGRRUS	*-0.42*	-2.42	**-0.51**	-2.83	-0.23	-1.22	*-0.39*	-2.04	*-0.49*	-2.29
DEURGR	3.15	1.83	*3.47*	2.00	**4.44**	2.64	2.90	1.62	2.25	0.74
DRER	0.00	0.07			*0.19*	2.56	0.00	0.04	0.00	-0.09
DRRUS			-0.05	-1.39	**-0.22**	-3.55				
DRI	*-4.16*	-2.44	**-4.72**	-2.75	**-5.07**	-3.08	-3.71	-1.80	*-4.32*	-2.49
DOPEN	0.02	0.84	0.01	0.56	0.01	0.49	0.02	0.89	0.02	0.92
DFDI	-0.01	-0.08	-0.06	-0.44	-0.03	-0.18	-0.01	-0.05	0.02	0.11
DTRS	*-0.41*	-2.65	**-0.42**	-2.68	-0.24	-1.53	**-0.49**	-3.16	*-0.40*	-2.49
R^2	0.77		0.77		0.79		0.76		0.76	
Adjusted R^2	0.73		0.72		0.75		0.72		0.72	
Log likelihood	-393		-393		-385		-394		-395	
Akaike information criterion	5.80		5.81		5.72		5.82		5.84	
F-statistic	18.87		18.77		19.46		18.54		18.01	
P-value (*F*-statistic)	0.00		0.00		0.00		0.00		0.00	
GRRUS	0.66		0.68		0.39		0.63		0.71	
GRRUSxD98	-0.42		-0.51		-0.23		-0.39		-0.49	
Sum	0.24		0.18		0.16		0.24		0.22	
F-test	*5.59*		2.69		*5.68*		*5.36*		2.69	
P-value	0.02		0.10		0.02		0.02		0.10	

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.

F. Conclusions

Several transmission channels were considered as possible explanations for the weakening correlation between growth in Russia and growth in the other FSU countries following the Russian crisis. It appears that this weakening was related to changes in trade patterns and reduced capital flows from Russia to the other FSU countries. On the contrary, recent increases in remittances from Russia to the other FSU countries are expected to strengthen the growth linkages between Russia and other FSU countries in the future.

Following the Russian crisis, producers in the other FSU countries further diversified their trade away from Russia and toward markets in the rest of the world. The large devaluations in many FSU countries caused significant import substitution and boosted exports to the rest of the world. The latter process may have also strengthened the marketing skills and knowledge of exporters in the FSU countries. However, exports to Russia slowed, owing to the large devaluation of the Russian ruble in 1998-99 and reduced demand in Russia during the crisis. As a result, the contribution to growth in the FSU countries of exports to Russia declined from 2.2 percent in 1993-97 (the period of falling output in Russia) to less than 1 percent during 2000-04 (a high-growth period in Russia).

A number of other factors weakened the growth linkages between Russia and other FSU countries by enhancing the supply responses to positive shocks. For example, FSU countries built up sizable idle capacities due to the collapse of output during the first years of transition. When demand picked up, these capacities allowed output to increase with little investment. The supply responses were further boosted by the imposition of harder budget constraints, improvements in financial discipline, achievement of macroeconomic stability, positive impacts of the surge in export revenues, and accumulated structural reforms. Some of these factors, however, are temporary in nature. For example, excess capacities in the FSU countries are rapidly disappearing because of the surge in growth after the Russian crisis.

Capital flows from Russia to the other FSU countries were adversely affected by the Russian crisis. Specifically, trade credits and government loans from Russia to the other FSU countries halved during the Russian crisis, while Russian exporters tightened the terms of payments for delivery of goods and services supplied, in particular, energy products. Furthermore, Russia has been trying to reduce subsidies provided to some FSU countries in the form of cheap energy products. On the contrary, FDI inflows from other countries to the region increased during 2000-04 from 1993-97. A combination of these factors is likely to have weakened the growth linkages between Russia and other FSU countries.

Recent changes in the patterns of labor flows and remittances indicate that growth linkages between Russia and the other FSU countries may be strengthening again after the significant decline in the 1990s. The empirical analysis in this study suggests that transfers raise growth in the FSU countries. Therefore, it can be said that the recent increases in net transfers from Russia to other FSU countries have been stimulating growth in the recipient countries, perhaps through multiplier effects of consumption and increases in investments, including construction of new houses.

Appendix I. Reestimation of the Set of Equations in Shiells, Pani, and Jafarov (2005)

Shiells, Pani, and Jafarov (2005) (henceforth SPJ) specify an econometric model that includes standard growth determinants, as well as Russian economic growth, and allows for a possible shift in the regression coefficients following the Russian crisis. Specifically, they estimate the following equation:

$$(A1) \qquad y_{it} = \alpha + \gamma_0 d_t + \beta_1 y_{Rt} + \gamma_1 d_t y_{Rt} + b_2 x_{it} + \gamma_2 d_t x_{it} + \beta_3 y_{i,\,t-1} + \gamma_3 d_t y_{i,\,t-1} + \mu_i + v_{it},$$

where y_{it} is real GDP growth for country i in year t, y_{Rt} is real GDP growth for Russia in year t, x_{it} is a vector of exogenous determinants of growth in country i, d_t is a dummy variable equal to 0 prior to the Russian crisis and 1 thereafter, and μ_t and v_{it} are disturbance terms.[61]

Shiells, Pani, and Jafarov (2005) run different specifications of the above equation to check for the robustness of their results. First, they try different exogenous determinants of growth (x_{it}). Second, they repeat their estimations assuming break points in both 1998 and 1999 because of some uncertainty regarding the precise timing of the shift in output correlations.[62] Third, they calculate Arellano-Bond estimators, given that the inclusion of a lagged dependent variable gives rise to a bias in standard estimators of either the fixed- or random effects model. However, Shiells, Pani, and Jafarov do not use lags of explanatory variables. Their results therefore should be interpreted with caution since lagged explanatory variables may be important.

Tables A1a and A1b present the results for the equations assuming that the structural break point was 1998.[63] The specification presented in the first column includes lagged own-country growth, country dummies, the CPI, government expenditure in percent of GDP, the EBRD transition index, EU growth, the real exchange rate, Russian growth, the trade

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[61] Under the assumption of fixed country effects, the restrictions that the sums of μ_i s and $d_t\mu_i$ s are equal to zero need to be imposed on the estimation of equation (A1) to avoid the dummy variable trap. Initial conditions must also be excluded from x_{it} under the assumption of fixed effects (but can be included under the assumption of random effects) since the initial conditions vary across countries but not over time and hence are perfectly collinear with the country effects.

[62] Maddala and Kim (1998, p. 398) argue that prior information on the regime switch point should be used if it is available—thereby raising the question of whether there was a structural change around that period—rather than simply endogenizing the break point.

[63]The regressions in Tables A1 and A2 use LSDV estimators while Table 11 of the main text uses GLS estimators (see the second paragraph of Section E of the main text of this paper).

openness ratio, and interactions between a post-Russian crisis dummy variable and all of the other explanatory variables. The coefficient on Russian growth is quite substantial (1.08) and significant.[64] The coefficient on the interaction of the Russian crisis dummy with Russian growth is -0.96 and highly significant. These results imply that, on average, a 1 percentage point increase in Russian growth was associated with a similar size increase in another country's growth rate, holding other factors constant, before the Russian crisis. After the crisis, this effect dropped to 0.12 percentage points and was not significantly different from zero.

Based on the results in column (1), the coefficient on CPI inflation is not significant and is near zero, as is the coefficient on the interaction between CPI inflation and the Russian crisis dummy. While the coefficients on government expenditure (as a percent of GDP) and its interaction with the Russian crisis dummy have negative signs, they are statistically insignificant. Growth in the EU has a negative coefficient (–3.7) and is significant (at the 5 percent level) prior to 1998, while in the 1998–2004 period it changes its sign (3.7).

Estimation of an alternative specification, including initial condition measure *IC2* but not country effects, is shown in column (2) of Tables A1a and A1b. The results are broadly similar to those obtained above. The estimated coefficient on Russian growth is 0.64 and highly significant prior to 1998, while thereafter it fell to 0.23. However, in contrast with the original paper, the variable remains significant at the 5 percent level. Estimated coefficients corresponding to the CPI and government expenditure in percent of GDP are statistically significant in this specification, although the coefficient on the CPI is still near zero.

A regression equation including regional dummy variables (Baltics; the Caucasus and Moldova; and Central Asia—Belarus and Ukraine constitute the reference group) contains the same variables as in column (1) except that all terms involving country dummies are omitted, and the following variables involving regional dummies are added: (i) the regional dummies themselves; and (ii) the interactions of regional dummies with the Russian crisis dummy. Results reported in column (3) of Table A1 are broadly similar to the results in column (2).

[64] This result is broadly consistent with the finding in Arora and Vamvakidis (2005) that a 1 percentage point increase in economic growth of trading partners is correlated with as much as a 0.8 percentage point increase in domestic growth.

Table A1a. CIS and Baltic Countries: Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1998, 1993–2004 1/

	(1)	(2)	(3)	(4) 2/	(5) 3/	(6)	(7)	(8)	(9)	(10)
CONSTANT	**32.73**	*12.60*	**20.69**	**47.62**	21.39	*26.00*	**29.70**	7.64	**33.81**	7.86
	(2.77)	(2.09)	(2.83)	(3.87)	(0.41)	(2.10)	(2.65)	(1.28)	(2.89)	(0.52)
GR $_{-1}$	0.11	**0.39**	**0.39**	*0.23*	-0.53	0.12	*0.23*	**0.44**	0.11	0.04
	(1.3)	(5.173)	(5.20)	(2.50)	(-1.71)	(1.29)	(2.57)	(5.69)	(1.31)	(0.42)
CPI	0.00	**0.00**	**0.00**	0.00	*-0.47*	0.00	0.00	**0.00**		0.00
	(-0.02)	(3.41)	(3.27)	(0.41)	(-2.23)	(0.29)	(0.08)	(3.68)		(-0.39)
INF									-0.41	
									(-0.39)	
EXP	-0.05	**-0.19**	-0.16	0.10	0.00	-0.03	-0.12	-0.11	-0.04	-0.12
	(-0.44)	(-2.69)	(-1.95)	(0.83)	(0.01)	(-0.24)	(-1.10)	(-1.60)	(-0.37)	(-1.03)
RI	-3.93	2.64	-0.66	*-8.97*	-3.66	-2.52	-2.03	**3.64**	-4.56	-3.37
	(-1.05)	(1.91)	(-0.32)	(-2.28)	(-0.19)	(-0.64)	(-0.57)	(2.62)	(-1.19)	(0.86)
GRRUS	**1.08**	**0.64**	**0.84**	**1.51**	0.06	**1.16**	**0.78**	**0.65**	**1.07**	**0.96**
	(5.65)	(4.52)	(4.94)	(6.65)	(0.15)	(5.63)	(3.91)	(4.39)	(5.56)	(4.96)
EUGR	*-3.68*	-3.08	*-3.54*	**-7.00**	-2.05	*-3.73*	**-4.53**	-3.31	*-3.59*	
	(-2.43)	(-1.91)	(-2.17)	(-3.89)	(-0.56)	(-2.33)	(-3.11)	(-1.97)	(-2.35)	
WORLDGR										3.89
										(1.22)
RER	**-0.07**	*-0.05*	*-0.05*	**-0.06**	0.13		**-0.17**	*-0.04*	**-0.07**	**-0.06**
	(-3.22)	(-2.29)	(-2.55)	(-2.69)	(0.70)		(-4.82)	(-2.01)	(-3.20)	(-2.66)
RRUS						-0.01	**0.14**			
						(-0.50)	(3.48)			
OPEN	-0.03	0.00	-0.02	-0.15	0.10	-0.01	-0.01	0.00	-0.03	-0.03
	(-1.23)	(0.02)	(-1.03)	(-0.56)	(1.04)	(-0.20)	(-0.60)	(-0.17)	(-1.02)	(-1.25)
IC2		**2.15**								
		(2.73)								
D98	-35.00	-0.22	-7.09	*-57.59*	-5.30	-24.96	-27.22	-2.42	-36.88	-14.53
	(-1.73)	(0.03)	(-0.74)	(-2.37)	(-0.09)	(-1.16)	(-1.39)	(-0.34)	(-1.83)	(-0.70)
IC2×D98		-0.55								
		(-0.504)								
GR $_{-1}$ ×D98	0.17	0.03	0.08	0.04	0.57	0.19	0.08	0.08	0.17	0.26
	(1.08)	(0.19)	(0.52)	(0.24)	(1.36)	(1.16)	(0.51)	(0.52)	(1.09)	(1.59)
CPI×D98	-0.01	-0.02	-0.01	0.00	0.71	-0.01	-0.01	-0.01		-0.01
	(-0.44)	(-1.069)	(-0.91)	(0.25)	(1.49)	(-0.50)	(-0.57)	(-0.74)		(-0.45)
INF×D98									-0.38	
									(-011)	
EXP×D98	-0.26	-0.01	-0.06	-0.38	-0.19	-0.24	-0.14	0.02	-0.27	-0.19
	(-1.42)	(-0.10)	(-0.48)	(-1.85)	(-0.48)	(-1.16)	(-0.74)	(0.25)	(-1.47)	(-0.98)
RI×D98	8.19	*-4.27*	-0.36	*16.05*	3.05	5.41	4.41	*-4.17*	9.12	8.92
	(1.23)	(-2.34)	(-0.14)	(2.07)	(0.15)	(0.75)	(0.67)	(-2.34)	(1.36)	(1.37)
GRRUS×D98	**-0.96**	*-0.41*	**-0.62**	**-1.37**	-0.11	**-1.05**	**-0.65**	*-0.41*	**-0.95**	**-0.86**
	(-4.42)	(-2.38)	(-3.13)	(-5.30)	(-0.23)	(-4.49)	(-2.80)	*(-2.27)*	(-4.36)	(-3.69)
EUGR×D98	*3.37*	2.69	3.30	**6.51**	-1.78	*3.56*	**4.29**	3.06	*3.28*	
	(2.06)	(1.57)	(1.90)	(3.37)	(0.47)	(2.07)	(2.73)	(1.72)	(1.97)	
WORLDGR×D98										-3.83
										(-1.17)
RER×D98	0.08	0.02	0.02	0.09	-0.33		**0.22**	0.01	**0.08**	0.07
	(1.67)	(.397)	(0.423)	(1.70)	(-1.58)		(3.27)	(0.14)	(1.67)	(1.33)
RRUS×D98						-0.01	**-0.19**			
						(-0.18)	(-3.20)			
OPEN×D98	*0.11*	0.02	0.03	0.09	-0.10	0.07	0.08	0.02	*0.11*	*0.11*
	(2.15)	(1.06)	(1.33)	(1.45)	(-1.02)	(1.27)	(1.61)	(0.95)	(2.06)	(2.12)

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
t-statistics are in parentheses beneath the coefficient estimates.
2/ Regression (4) includes the CIS countries only (i.e., the Baltics are excluded).
3/ Regression (5) includes the Baltic countries only (i.e., the CIS countries are excluded).

Table A1b. CIS and Baltic Countries: Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1998, 1993–2004 1/

	(1)	(2)	(3)	(4) 2/	(5) 3/	(6)	(7)	(8)	(9)	(10)
D2	**-12.19**			**-10.88**		**-10.85**	**-9.20**		**-12.46**	**-12.10**
D3	-5.84			**-8.78**		-6.81	-4.20		-6.15	-4.49
D4	2.29					1.80	6.77		2.10	0.99
D5	-0.46			1.22		-1.08	2.49		-0.27	-1.16
D6	**-11.23**			*-6.97*		*-7.39*	*-7.37*		**-11.03**	**-12.56**
D7	*-6.54*			-1.92		-3.95	-2.41		*-6.48*	*-7.67*
D8	-1.97					-0.25	1.63		-2.06	-3.23
D9	-1.17					-1.61	1.07		-1.23	-2.11
D10	**-15.82**			**-14.66**		**-15.44**	**-10.80**		**-16.25**	**-16.06**
D11	*-9.24*			**-10.98**		**-12.59**	-5.95		*-9.95*	-8.32
D12	**-15.59**			**-15.30**		**-15.17**	**-12.45**		**-15.80**	**-15.36**
D13	**-7.36**			*-6.80*		-5.67	*-5.30*		**-7.26**	**-7.37**
BALT			*6.42*							
CASIA			-1.11							
CAU			0.27							
D2×D98	**15.46**			**16.45**		**14.21**	**12.58**		**15.90**	**15.14**
D3×D98	16.74			*28.38*		18.18	15.45		16.76	15.06
D4×D98	-8.52					-8.07	-13.18		-8.60	-6.15
D5×D98	-3.85			-6.63		-3.25	-6.81		-4.15	-3.12
D6×D98	**9.50**			5.12		5.70	5.66		**9.23**	**10.89**
D7×D98	4.32			0.05		1.85	0.26		4.16	5.60
D8×D98	4.46					2.89	0.99		4.33	6.45
D9×D98	-0.56					-0.04	-2.79		-0.70	1.05
D10×D98	**13.44**			**12.93**		**13.20**	8.48		**13.72**	**13.96**
D11×D98	3.74			10.64		7.07	0.26		4.51	2.29
D12×D98	**19.16**			**20.63**		**18.96**	**16.21**		**19.33**	**19.11**
D13×D98	*11.58*			*15.39*		10.12	9.77		*11.38*	**11.22**
BALT×D98			-6.78							
CASIA×D98			-2.80							
CAU×D98			-3.05							
Memorandum items:										
GRRUS	**1.08**	**0.64**	**0.84**	**1.51**	0.06	**1.16**	**0.78**	**0.65**	**1.07**	**0.96**
GRRUS×D98	**-0.96**	*-0.41*	**-0.62**	**-1.37**	-0.11	**-1.05**	**-0.65**	*-0.41*	**-0.95**	**-0.86**
Sum	0.12	0.23	0.22	0.14	-0.05	0.11	0.14	0.24	0.11	0.10
F-test	1.28	*4.98*	*17.09*	1.40	0.04	1.02	0.93	*5.07*	1.18	0.61
P-value	0.26	0.03	0.00	0.24	0.84	0.31	0.34	0.03	0.28	0.44
Number of parameters	42	20	24	36	18	42	44	18	42	42
Log likelihood	-364.45	-394.93	-392.45	-277.03	-59.11	-371.04	-355.29	-401.55	-364.44	-367.62
AIC	2.86	2.97	2.99	2.88	1.97	2.96	2.77	3.03	2.86	2.91
R^2	0.84	0.76	0.77	0.88	0.86	0.83	0.86	0.74	0.84	0.84
Adjusted R^2	0.78	0.72	0.72	0.82	0.70	0.76	0.80	0.70	0.78	0.77

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.

2/ Regression (4) includes the CIS countries only (i.e., the Baltics are excluded).

3/ Regression (5) includes the Baltic countries only (i.e., the CIS countries are excluded).

The results are insensitive to the choice of whether the Baltics are included in the sample, which suggests importantly that the paper's findings are quite robust with respect to changes in the country sample. Column (4) of Table A1 presents estimates based on the previous specification but excluding the Baltics. The coefficient on growth in Russia is 1.51 and highly significant, while the coefficient on the interaction of the Russian

crisis dummy with Russian growth is –1.37 and highly significant; their difference is 0.14 and insignificant. For completeness, column (5) includes estimates using data only for the Baltics. In this case, the coefficients on growth in Russia and its interaction with the Russian crisis dummy are both insignificant.

Two other specifications comprise a CPI-based bilateral real exchange rate vis-à-vis Russia either instead of, or in addition to, the multilateral real effective exchange rate index used in the previous specifications. Results from these regressions—reported in columns (6) and (7) of Tables A1a and A1b—are very similar to those reported above for the key variables of interest. In column (7), for instance, the coefficient on Russian growth is 0.78 and highly significant prior to 1998, while it falls to 0.14 and becomes insignificant thereafter.

Tables A1a and A1b include estimates for a variety of other specifications, results of which are all broadly similar for the key variables of interest— Russian growth and its interaction with the crisis dummy. Column (8) provides estimates for a specification that excludes both country fixed effects and initial conditions. Possible nonlinearity in the response of growth to inflation is explored in column (9) by including *INF*, the natural logarithm of percent changes in CPI inflation, in place of *CPI*. The coefficient on (log) CPI inflation is still insignificant, while the coefficients on Russian growth are similar to those reported earlier, indicating that the results are robust to changes in the functional form. Column (10) includes estimates based on substituting world growth for EU growth. While the coefficient on world growth is insignificant, once again the coefficients on Russian growth are similar to the earlier results.

Tables A2a and A2b present results for the same specifications as in Tables A1a and A1b but assuming that the break occurred in 1999 rather than 1998. The fit of these regressions, with the exceptions of the second, fifth (the Baltics-only regression), and eighth specifications, are worse than those of regressions using a break point of 1998, as reflected in the lower values of the log-likelihood function, the higher values of the *AIC*, and the smaller number of significant *t*-statistics. While Russian growth and its interaction with the Russian financial crisis dummy are not significant in the fifth specification, assuming a break point of 1999, in the case of the second and eighth specifications, estimations using a break point of 1998 yield a larger number of significant variables.

While the coefficients are generally less precisely estimated when using a break point of 1999, the results are very similar in many respects to those presented in Tables A1a and A1b above. In particular, the coefficient on Russian growth is broadly similar in magnitude to the estimates based on a 1998 break point and highly significant in all but one specification. The coefficient on the interaction of the Russian crisis dummy with Russian growth ranges widely and is significant in only one of the specifications. Taken together, these results provide support for the choice of 1998 as the structural break point.

Since the inclusion of a lagged dependent variable in the error components model generates a bias in the LSDV estimators, the results based on LSDV estimation, presented in column (1), are compared with the results based on Arellano-Bond estimation in columns (11) and (12) in Table A3.[65] As can be seen from this table, coefficients on Russian growth are broadly comparable to those obtained using the LSDV estimation. Arellano-Bond estimates of the coefficient on the interaction between the crisis dummy and Russian growth are also comparable to the LSDV estimates and are significant in both specifications.[66] Results of the Sargan test do not reject the null hypothesis that the overidentifying restrictions underlying the Arellano and Bond (1991) estimation method are satisfied in the twelfth specification, suggesting that the instruments are valid. Finally, the null hypotheses of second-order serially uncorrelated errors are not rejected, fulfilling a necessary condition for consistency of the Arellano-Bond estimation procedure. Column (13) presents Arellano-Bond estimates that also correct for possible endogeneity of the explanatory variables *CPI* and *EXP*, using one-period lagged values of these variables as instruments. These estimates are very similar to estimates based on the assumption that the explanatory variables are exogenous.

[65] The Arellano and Bond (1991) estimates presented in Table A3 correspond to a one-step procedure, using one-period lags of the independent variables as instruments.

[66] Because the Arellano-Bond procedure uses first differences of strictly exogenous regressors as instruments, time-invariant strictly exogenous regressors, such as the country fixed effects, drop out.

Table A2a. Coefficient Estimates in Real GDP Growth Regressions with Structural Break in 1999, CIS and Baltic Countries, 1993–2004 1/

	(1)	(2)	(3)	(4) 2/	(5) 3/	(6)	(7)	(8)	(9)	(10)
CONSTANT	16.80	**16.69**	**21.20**	*22.89*	49.20	8.06	**30.02**	*11.31*	20.19	*23.36*
	(1.86)	(3.12)	(3.42)	(2.27)	(1.26)	(0.88)	(3.30)	(2.10)	(2.13)	(2.00)
GR$_{-1}$	**0.26**	**0.44**	**0.48**	**0.36**	**-0.71**	**0.28**	**0.26**	**0.49**	**0.22**	**0.20**
	(3.65)	(6.95)	(7.35)	(4.28)	(-3.53)	(3.77)	(3.91)	(7.51)	(3.09)	(2.79)
CPI	0.00	**0.00**	**0.00**	*0.00*	**-0.55**	***0.00***	0.00	**0.00**		0.00
	(1.70)	(3.46)	(3.51)	(2.17)	(-3.27)	(2.04)	(2.12)	(3.73)		(1.40)
INF									-0.33	
									(-0.32)	
EXP	-0.12	**-0.23**	**-0.24**	-0.05	0.19	-0.14	-0.18	*-0.12*	-0.09	-0.14
	(-1.14)	(-3.10)	(-3.29)	(-0.38)	(0.72)	(-1.18)	(-1.78)	(-2.03)	(-0.77)	(-1.28)
RI	1.87	1.30	0.04	0.43	-13.72	4.24	-1.33	2.37	-0.10	0.31
	(0.66)	(1.10)	(0.29)	(0.14)	(-0.94)	(1.47)	(-0.48)	(1.98)	(-0.03)	(0.10)
GRRUS	**0.78**	**0.69**	**0.71**	**1.00**	0.29	**0.80**	**0.72**	**0.70**	**0.78**	**0.93**
	(5.37)	(5.19)	(4.97)	(5.57)	(1.35)	(5.20)	(5.24)	(5.01)	(5.06)	(5.19)
EUGR	-1.61	-2.60	-2.39	*-3.52*	-4.35	-1.40	**-3.81**	*-3.07*	-1.29	
	(-1.16)	(-1.80)	(-1.61)	(-2.09)	(-1.83)	(-0.93)	(-2.71)	(-2.04)	(-0.92)	
WORLDGR										-1.50
										(-1.23)
RER	**-0.07**	**-0.05**	**-0.06**	**-0.07**	0.24		**-0.16**	-0.05	-0.08	-0.74
	(-1.44)	(-2.78)	(-2.88)	(-3.08)	(1.74)		(-5.41)	(-2.30)	(-3.59)	(-3.46)
RRUS						0.00	**0.13**			
						(-0.09)	(3.97)			
OPEN	-0.04	0.00	-0.01	-0.03	0.13	-0.02	-0.04	0.00	-0.04	*-0.05*
	(-1.84)	(0.06)	(-0.69)	(-1.36)	(1.74)	(-0.96)	(-1.69)	(-0.11)	(-1.65)	(-2.09)
IC2		**2.53**								
		(3.61)								
D99	-39.58	-11.47	-17.05	-52.66	-35.94	-28.11	-49.60	-10.54	-42.96	-48.70
	(-1.77)	(-1.44)	(-1.83)	(-1.52)	(-0.78)	(-1.19)	(-2.32)	(-1.53)	(-1.91)	(-2.16)
IC2×D99		-1.64								
		(-1.49)								
GR$_{-1}$×D99	0.04	0.02	0.04	-0.03	0.87	0.04	0.04	0.04	0.08	0.06
	(0.22)	(0.13)	(0.22)	(-0.13)	(2.58)	(0.21)	(0.21)	(0.24)	(0.41)	(0.33)
CPI×D99	0.00	-0.01	-0.01	0.00	0.83	-0.01	0.00	-0.01		0.00
	(-0.25)	(-0.83)	(-0.75)	(-0.11)	(1.83)	(-0.31)	(-0.30)	(-0.70)		(-0.26)
INF×D99									-0.76	
									(-0.21)	
EXP×D99	-0.05	0.11	0.14	-0.09	-0.27	0.05	0.13	0.07	-0.08	-0.06
	(-0.21)	(1.02)	(1.09)	(-0.32)	(-0.81)	(0.20)	(0.55)	(0.73)	(-0.38)	(-0.27)
RI×D99	8.06	-2.00	-0.54	11.80	11.64	4.23	9.58	-2.42	10.02	11.11
	(1.08)	(-1.16)	(-0.28)	(1.21)	(0.71)	(0.53)	(1.33)	(-1.45)	(1.32)	(1.54)
GRRUS×D99	-0.24	0.13	0.12	-0.48	0.47	-0.28	-0.24	0.13	-0.24	**-0.93**
	(-0.56)	(0.31)	(0.29)	(-0.96)	(0.81)	(-0.63)	(-0.60)	(0.30)	(-0.55)	(-5.19)
EUGR×D99	0.97	1.45	1.33	2.86	2.80	0.86	3.23	2.04	0.69	
	(0.58)	(0.87)	(0.78)	(1.43)	(1.02)	(0.48)	(1.96)	(1.17)	(0.41)	
WORLDGR×D99										1.75
										(1.32)
RER×D99	0.06	0.00	0.00	0.06	*-0.44*		**0.20**	-0.02	0.06	0.07
	(1.06)	(-0.02)	(-0.09)	(1.06)	(-2.72)		(2.73)	(-0.35)	(1.10)	(1.21)
RRUS×D99						-0.03	**-0.18**			
						(-0.73)	(-3.10)			
OPEN×D99	0.08	0.02	0.02	0.07	-0.13	0.05	0.07	0.02	0.08	0.10
	(1.56)	(0.82)	(1.09)	(1.01)	(-1.58)	(0.88)	(1.41)	(0.78)	(1.49)	(1.88)

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
t-statistics are in parentheses beneath the coefficient estimates.
2/ Regression (4) includes the CIS countries only (i.e., the Baltics are excluded).
3/ Regression (5) includes the Baltic countries only (i.e., the CIS countries are excluded).

Table A2b. Coefficient Estimates in Real GDP Growth Regressions
with Structural Break in 1999, CIS and Baltic Countries, 1993–2004 1/

	(1)	(2)	(3)	(4) 2/	(5) 3/	(6)	(7)	(8)	(9)	(10)
D2	-4.40			-2.96		-4.26	-4.36		*-6.54*	-5.26
D3	0.91			-0.42		0.78	0.87		-1.97	0.17
D4	-2.40					-0.62	-1.00		-2.05	-1.05
D5	-4.38			-3.63		-3.86	-4.02		-2.60	-4.49
D6	**-10.12**			**-8.21**		**-8.30**	**-8.76**		**-10.04**	**-10.17**
D7	*-6.09*			-4.56		-4.78	-4.85		*-6.06*	-5.86
D8	-2.94					-1.63	-1.91		-3.00	-2.14
D9	-2.64					-2.22	-2.10		-2.44	-1.95
D10	**-12.13**			**-11.82**		**-10.91**	**-11.20**		**-14.31**	**-12.09**
D11	-5.43			-4.81		-5.05	-5.21		*-8.59*	-6.18
D12	**-9.50**			**-8.96**		**-8.79**	**-8.99**		**-11.89**	**-9.99**
D13	-3.54			-3.54		-3.34	-3.35		-4.51	-3.83
BALT			3.14							
CASIA			-3.15							
CAU			-1.92							
D2×D99	10.27			11.14		9.54	9.45		*12.43*	*9.72*
D3×D99	19.24			25.37		16.83	14.66		21.66	12.34
D4×D99	-10.51					-12.33	-12.95		-10.57	-9.95
D5×D99	-0.43			-1.30		-0.60	-0.37		-2.33	0.13
D6×D99	*9.69*			7.46		*7.94*	*8.24*		*9.57*	**9.91**
D7×D99	5.02			2.83		3.20	2.47		4.91	3.63
D8×D99	-5.77					-3.33	-4.11		-0.38	-2.14
D9×D99	-5.40					-6.30	-7.34		-5.48	-5.62
D10×D99	10.99			9.14		9.40	8.66		*13.08*	9.75
D11×D99	8.20			11.47		9.26	9.23		11.21	8.94
D12×D99	*14.42*			13.47		*12.42*	11.52		**16.78**	*12.28*
D13×D99	12.74			18.13		11.26	10.64		13.31	8.57
BALT×D99			-2.77							
CASIA×D99			1.11							
CAU×D99			0.84							
Memorandum items:										
GRRUS	**0.78**	**0.69**	**0.71**	**1.00**	0.29	**0.80**	**0.72**	**0.70**	**0.78**	**0.93**
GRRUS×D99	-0.24	0.13	0.12	-0.48	0.47	-0.28	-0.24	0.13	-0.24	-0.93
Sum	0.54	0.82	0.83	0.52	0.75	0.52	0.48	0.83	0.54	0.00
F-test	1.85	*4.40*	*4.33*	1.20	1.99	1.54	1.59	*4.13*	1.75	2.18
P-value	0.18	0.04	0.04	0.28	0.18	0.22	0.21	0.04	0.19	0.14
Number of parameters	42	20	24	36	18	42	44	18	42	42
Log likelihood	-368.98	-392.25	-392.55	-285.78	-55.62	-376.36	-357.66	-400.03	-370.90	-368.58
AIC	2.93	2.93	2.99	3.04	1.76	3.03	2.80	3.01	2.95	2.92
R^2	0.83	0.77	0.77	0.86	0.89	0.81	0.86	0.74	0.83	0.83
Adjusted R^2	0.76	0.73	0.72	0.79	0.76	0.74	0.79	0.71	0.76	0.77

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
2/ Regression (4) includes the CIS countries only (i.e., the Baltics are excluded).
3/ Regression (5) includes the Baltic countries only (i.e., the CIS countries are excluded).

Table A3. Arellano–Bond Estimates of Real GDP Growth Regressions
with a Structural Break in 1998, CIS and Baltic Countries, 1993-2004 1/

	LSDV Estimates		Strictly Exogenous Explanatory Variables				Endogeneity Correction 2/	
	(1)		(11)		(12)		(13)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
CONSTANT	**32.73**	2.77	0.47	1.59	0.35	1.42	0.27	1.05
GR $_{-1}$	0.11	1.30	**0.31**	4.42	**0.45**	6.64	**0.44**	6.57
CPI	0.00	-0.02	0.00	1.04	*0.00*	2.43	**0.00**	2.93
EXP	-0.05	-0.44	-0.07	-0.72	*-0.21*	-2.17	**-0.31**	-2.81
RI	-3.93	-1.05	1.10	0.38				
GRRUS	**1.08**	5.65	**0.68**	4.43	**0.67**	4.74	**0.75**	5.60
EURGR	*-3.68*	-2.43	*-3.10*	-2.38				
WORLDGR					-0.02	-0.03	0.05	0.08
RER	**-0.07**	-3.22	*-0.05*	-2.30				
OPEN	-0.03	-1.23	-0.01	-0.39				
D98	-35.00	-1.73	6.81	0.98	*-3.25*	-2.30	*-3.11*	-2.24
GR $_{-1}$ ×D98	0.17	1.08	-0.20	-1.40				
CPI×D98	-0.01	-0.44	-0.02	-1.23				
EXP×D98	-0.26	-1.42	-0.24	-2.20				
RI×D98	8.19	1.23	**-5.51**	-2.76				
GRRUS×D98	**-0.96**	-4.42	**-0.63**	-3.87	**-0.52**	-3.06	**-0.61**	-3.78
EURGR×D98	*3.37*	2.06	*2.84*	2.07				
RER×D98	0.08	1.67	0.03	0.74				
OPEN×D98	*0.11*	2.15	**0.08**	2.77				
Memorandum items:								
Sargan test of overidentifying restrictions			83.66	0.01 3/	40.20	0.92 3/	96.31	1.00 3/
Arellano-Bond test for AR(1)			-1.92	0.05 3/	-3.37	0.00 3/	-3.27	0.00 3/
Arellano-Bond test for AR(2)			-0.64	0.52 3/	0.35	0.72 3/	0.25	0.80 3/

Source: Fund staff estimates.

1/ Bold indicates statistically significant at the 1 percent level; italics indicates significance at the 5 percent level.
2/ Coefficient estimates in this column assume that *CPI* and *EXP* are endogenous. First-order lagged values of these variables are used as instruments.
3/ These figures refer to *p* -values instead of *t* -statistics.

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