

## **Russian Federation: Selected Issues**

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RUSSIAN FEDERATION

**Selected Issues**

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Approved by the European Department

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## I. THE MACROECONOMIC EFFECTS OF PENSION REFORM<sup>1</sup>

### A. Introduction

1. **Russia's population will age rapidly in the coming decades with serious implications for the pension system.** The share of the population above the retirement age is projected to rise from 20 percent at present to about 30 percent by 2050. In addition, demographic trends suggest that Russia's population is likely to continue to shrink rapidly, at an expected rate of about 0.5 percent per year until 2050. These trends imply a notable decline in contributions to the pension system, while payouts will increase.

2. **The existing pension system is ill-prepared for this challenge.** In a no-reform scenario, the replacement rate<sup>2</sup> of the public system is projected to decline to about 17 percent by 2030. This is far below the current level of about 26 percent—which is widely perceived as inadequate and already implies that many state pensions are below subsistence. Thus, as Russia's per capita income rises, its replacement rate will increasingly be out of line with international benchmarks for countries with similar income levels, as 26 percent is already lower than in any OECD country today. Indeed, former president Putin has called for an increase in the average replacement rate to 40 percent within five years.<sup>3</sup> At the same time, private pension provision, through corporate plans or personal savings, remains in its infancy and is unlikely to be able to make up for the decline in the public system, particularly over the next few decades during which much of the above demographic transition will take place. Moreover, international experience suggests that *voluntary* private-pension saving tends to fall short of levels required for reasonable replacement rates, thus ultimately resulting in a political contingent liability for the government to prevent old-age poverty.

3. **This chapter makes a case for putting Russia's public pension system on a sustainable footing, and examines the macroeconomic effects of various policy options.** It first discusses why the current system is likely to be unsustainable, and thus why it will ultimately require an increase in either the retirement age or government pension expenditure. Emphasizing that a gradual increase in the retirement age would be the first-best policy, the chapter then examines the macroeconomic effects of various alternative options for financing a stable replacement rate of 30 percent through the budget, including debt

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<sup>1</sup> Prepared by David Hauner (FAD).

<sup>2</sup> The replacement rate is defined as the value of a pension as a proportion of a worker's base wage; such as the wage enjoyed during the last year before retirement, or the entire lifetime average wage. The OECD uses the last pre-retirement salary as the base, while in Russia the calculation of the replacement rate is based on the average wage.

<sup>3</sup> According to press reports on former president Putin's meeting with United Russia leaders on November 17, 2007.

accumulation, increases in the VAT, United Social Tax (UST), or profit tax, and cuts in government investment or consumption. The chapter concludes with a number of policy recommendations on the design and financing of the pension system.

## **B. The Case for Pension Reform**

4. **The 2002 reform introduced a multi-pillar system whose design is generally in line with international best practice.**<sup>4</sup> It consists of three pillars: (i) The basic pension is the redistributive part of the system; it is independent of contributions and is intended to provide a minimum standard of living. The replacement rate provided by the basic pension has gradually declined since the increases in benefits under this pillar have tended to fall short of average wage increases. (ii) The notional defined contribution (NDC) scheme places contributions in individual accounts that earn a return based on a discretionary average between wage and CPI growth. The benefit at retirement is an annuity based on the accumulated savings in the account at the retirement date. (iii) The mandatory funded scheme provides for the investment of 6 percentage points of the contributions of workers who were young at the time of the 2002 reform. The contributions are invested in mutual funds chosen by the worker or—if no choice is specified—by the government. The initial overall contribution rate is 20 percent for the three pillars combined, and this rate is even lower for higher income brackets.

5. **However, the system suffers from two key shortcomings, the first being that it provides few incentives to work beyond the low statutory retirement age.** Unlike in a typical NDC scheme, benefits have not been adjusted in line with the changing (usually increasing) life expectancy at the time of retirement, and the retirement age has remained unchanged at 55 for women and 60 for men. Moreover, the notional rate of return is low, owing to: the valorization of the notional capital with a rate of return below the average growth rate of wages; the large share of the contributions allocated to the basic pension, which reduces accrual in the NDC account; and the generous recognition of notional capital for working time acquired in the old. Finally, there are strong incentives for making use of various early retirement programs (Sinyavskaya, 2005). In particular, many occupations still benefit from early retirement, although working conditions have greatly improved since these privileges were established.

6. **The second main shortcoming is that the design of the third funded pillar severely limits its ability to improve replacement rates.** First, the contribution rate of only up to 6 percent is relatively low by international standards. While reducing the funding gap of the NDC during the transition period, the low rate of contributions to the funded pillar limit the contribution it can make to benefits in the longer term. Moreover, in part due to

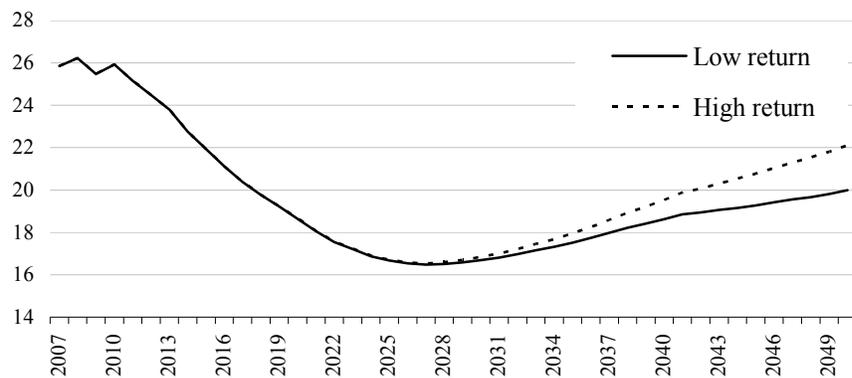
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<sup>4</sup> See World Bank (2002) for a more detailed discussion of the system including shortcomings discussed below.

limited trust in the financial system,<sup>5</sup> most workers (about four fifths at end-2007) have so far chosen not to specify an investment manager. By default, their funds are invested in government bonds by the Development Bank (formerly Vneshekonombank). However, real returns on these bonds have been negative for several years as the decline in public debt has implied excess demand for government securities. In contrast, the real returns of the funds managed by private companies and invested in a wider range of securities have been on average highly positive, although not in 2007.

7. **The three-pillar replacement rate is projected to decline from about 26 percent in 2007 to 17 percent in 2027, and then recover to 22 percent in 2050 (Gurvich, 2007).**<sup>6</sup> Already since 2000, the average replacement rate has fallen by 7 percentage points. This is due to three factors: (i) the declining share of the working-age population; (ii) the valorization of the basic pension benefit and notional capital with prices that usually grow more slowly than wages; and (iii) the regressive UST scale, which, in the absence of price indexation, entails erosion in revenue. However, even these modest expected replacement rates will require that the budget transfer to the pension fund of 1.6 percent of GDP in 2010, as envisaged in the 2008–10 budget, will remain in place until 2050 (Gurvich, 2007).

Figure 1. Replacement Rate of Public System



Source: Gurvich (2007).

8. **In addition, even this baseline projection assumes a substantial improvement in the real rate of return on the investment portfolio in the mandatory funded pillar.** As discussed above, the real rate of return of the mandatory pillar has so far been negative. The “low return” baseline scenario discussed above assumes a real rate of return of 3.7 percent annually (Figure 1). Higher returns than under the baseline projection could make a substantial difference, but only after the trough in the replacement rate has already occurred.

<sup>5</sup> Surveys suggest that two thirds of the population distrust banks and prefer to save money in cash.

<sup>6</sup> Labor productivity and real wages are assumed to grow at average rates of about 4 and 5 percent, respectively.

For example, a real return of 4.5 percent would raise the replacement rate to 22 percent by 2050, 2 percentage points higher than in the baseline scenario.

9. **The current replacement rate is already far below international standards.** Convention 102 of the International Labor Organization recommends 40 percent as the minimum replacement rate. Among OECD countries, the lowest replacement rates are around 40 percent, but most are well above that level. International experience also suggests that to allow a typical full-career worker to maintain a subsistence income in retirement, the overall replacement rate of public and private pension systems needs to be around 40 percent (Holzmann and others, 2004, p. 33). Russia's current replacement rate of 24 percent (in 2007) is well below this level, although it is actually somewhat higher than it first appears, as it is based on average salaries which are (in Russia's particular case) higher than the last pre-retirement salary used for international figures. Moreover, it does not include the sizeable non-pension benefits for pensioners. Estimates of the effect of these two factors on the replacement rate are not available. However, the often-heard argument that lower replacement rates will be mitigated by wage incomes of pensioners misses the point, as these incomes do not accrue to workers whose age or health does not allow them to work and who are thus most dependent on old-age insurance.

10. **The projected decline in the replacement rate suggests that the incomes of pensioners may erode even further.** Large discretionary increases in pensions have therefore been adopted to increase the average level of pensions at least to the subsistence level, against which it had still fallen short by one third in 2000. However, given that the *average* pension is still only 100 percent of the subsistence level, a substantial number of pensioners receive less than that. Sustaining merely the absolute real value of pensions, while allowing them to decline further relative to wages is unlikely to be socially acceptable. Indeed, the 2008–10 federal budget envisages an increase in the transfers to the pension fund by 0.7 percent of GDP from 2007 to 2010 to stabilize the replacement rate and bring the basic pension in line with the subsistence level. To stabilize the replacement rate beyond 2010, substantial additional measures will be needed.

### C. Encouraging Private Saving

11. **The government envisages that the declining replacement rate of the public system will be compensated by rising benefits from occupational and private pensions.** To further encourage voluntary private saving, a subsidy will be introduced in 2008. This subsidy doubles individual contributions of between RUB 2,000 and RUB 10,000 a year, at an estimated budgetary cost of RUB 6 billion (0.02 percent of GDP) in 2008. Under the extreme assumption that all workers contribute 3 percent of their earnings to the scheme, the average fiscal cost of matching these contributions would amount to about 0.5 percent of GDP per year until 2020 on average. The funds will be managed by the Pension Fund of Russia and, at least initially, will be invested in government bonds. Withdrawals before

retirement will be prohibited, and there will be no explicit guarantee of the capital or a minimum return.

12. **Encouraging higher private saving is, in principle, a welfare-enhancing policy.** Increased savings reduce the real interest rate (as long as capital is not perfectly mobile across borders), leading to greater capital accumulation and gains in output. Moreover, private pension savings can contribute to financial development by increasing the demand for stocks and corporate bonds. Providing an increasing pool of domestic capital may also facilitate privatizations and allow the economy to benefit from efficiency gains that usually result from private ownership of previously state-owned enterprises. These factors have motivated the increasing reliance on funded pensions around the world, in addition to their potentially higher rates of return compared to pay-as-you-go pension systems, particularly under adverse demographics.

13. **However, it is unlikely that voluntary private pensions will be sufficiently large to compensate for the drop in the replacement rate of Russia's public pension system.** Most importantly, according to government estimates, less than one tenth of workers are likely to participate. And currently, less than 10 percent of workers are covered by private pension funds. Moreover, the participants are very likely to come mostly from above-average income levels, implying that those workers that will be most at risk of old-age poverty will not benefit.<sup>7</sup> International experience, including in Chile and the United Kingdom, also suggests that voluntary pension saving tends to fall short of levels required for acceptable replacement rates. This is typically explained by a high preference for earlier consumption, myopia, lack of financial literacy, and—if the phenomenon concerns a large part of the population—moral hazard in expectation of a government bail-out. As Chile's example demonstrates, these issues are further exacerbated in countries with large informal sectors where workers do not save for pensions. An additional issue in Russia is that, as already noted, four fifths of the workforce prefer holding government bonds, despite the negative real return, rather than allowing their funds to be managed by private financial institutions.

14. **Current limitations on the asset allocation of private pension funds also harm their performance.** More than half of the funds are invested in bank deposits and government bonds that yield negative real returns, which on a compounded basis implies a large loss in future benefits compared to a situation free of such limitations. This allocation is primarily due to the limited free-floating capitalization of the domestic equity market, estimated at about 30 percent of GDP, and the very small size of the corporate bond market (about 5 percent of GDP).

15. **While a voluntary pillar can be a useful supplement to the mandatory system, it will likely be of little help during the most difficult phase of the demographic transition.**

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<sup>7</sup> From a distributional perspective, it also means that the subsidy is likely to be highly regressive.

Even assuming that all workers contribute 3 percent of their earnings (matched by the state and compounded at a real rate of 4.5 percent), the benefits from the voluntary pillar will not be sufficient to increase the average replacement rate to 25 percent before 2040, and only in 2050 will the average replacement rate reach 30 percent (Gurvich, 2007). If just a fifth of workers were to contribute to the scheme—double the amount the government expects to participate—the resulting replacement rate will only be 24 percent in 2050.

**16. Given that a steep decline in the replacement rate of the public system is unlikely to be sustainable, and that private pensions can only make a small contribution, the funding of a reasonable replacement rate should be considered a contingent fiscal liability.** Experience suggests that governments, as long as they are expected to remain solvent, cannot credibly shift the burden of the pension system to the private sector if this implies a decline in replacement rates to socially unacceptable levels: for example, in Chile and the United Kingdom insufficient private saving ultimately required new social benefits that were fiscally expensive. The only realistic alternative to increased pension funding from the federal budget is an increase in the retirement age. These two options will be discussed in the next section. Other policies that have been suggested by some, including improvements in taxpayer compliance with social contribution payments, immigration, or a higher fertility rate are not considered in this chapter and would at this stage not be sufficient to make more than a marginal contribution to the solution of Russia's pension problem, particularly given the already advanced stage of the problem.

#### **D. Stabilizing the Replacement Rate of the Public System**

**17. The preferred policy for stabilizing the replacement rate of the public system would be a gradual increase in the retirement age.** Many transition economies with similarly low life expectancy have adopted a gradual rise in the retirement age over the last ten years (Holzmann and others, 2004, p. 85). Russia's current retirement age of 60 for men and 55 for women is relatively low in an international context. Life expectancy at the official retirement age is currently 14 years for men and 23 years for women, suggesting that there is indeed room for raising the retirement age. This adjustment would also help to buffer against the negative output effects of the decline in the labor force.

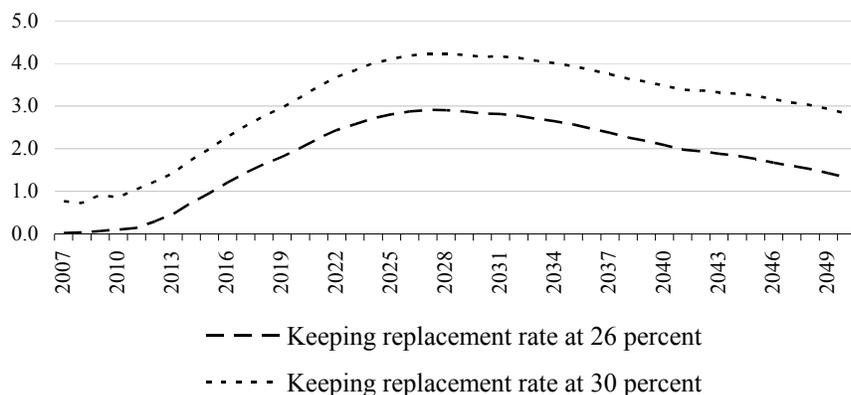
**18. Raising the retirement age would substantially increase the replacement rate.** Gradually raising the retirement age of women to 60 in 2020 (by 5 months per year) would increase the average replacement rate by 5 percentage points. Gradually raising the retirement age of both genders to 65 in 2040 (by 2 months per year for men and 4 months per year for women) would increase the average replacement rate by 10 percentage points (World Bank, 2002).<sup>8</sup>

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<sup>8</sup> The calculations by the World Bank (2002) did not account for the subsequent reduction in the contribution rate that reduces the replacement rate. The figures given here are adjusted downward to account for this effect.

19. **Alternatively, the replacement rate could be stabilized by increasing the federal transfer to the pension fund by up to 3 percent of GDP until approximately 2030** (Figure 2). After that, the transfer could gradually decline to about 1.5 percent of GDP in 2050. This would allow stabilizing the average replacement rate at its 2006 level of 26 percent. Stabilizing the average replacement rate at its 2003 level of 30 percent—still 10 percentage points below the minimum in OECD countries—would require an increase in transfers by as much as 4 percent of GDP until approximately 2030, then declining to 3 percent of GDP in 2050. These projections are based on the pension model used by Gurvich (2007). While long-term projections are of course subject to substantial uncertainties, projections in other recent studies suggest a similar outcome: for example, IET (2007) finds that additional transfers of 3.2 percent of GDP would result in a replacement rate of 27.2 percent in 2025.

Figure 2. Additional Funding Need under Two Scenarios, Percent of GDP



Source: Gurvich (2007).

20. **Even under the current favorable outlook for oil prices, Russia's oil wealth will be insufficient to sustain the present replacement rate.** The annual withdrawal from the oil<sup>9</sup> funds of 3.7 percent of GDP, as stipulated in the budget law, implies that, at oil prices of US\$80 (in 2007 prices), the combined oil funds would be depleted by 2030.<sup>10</sup> This is because the consumption of the oil wealth is fixed in percent of GDP, which is growing much faster than oil revenues.<sup>11,12</sup> Additional withdrawals to finance a replacement rate of 30 percent

<sup>9</sup> Throughout this chapter, oil is always understood to include natural gas and oil products.

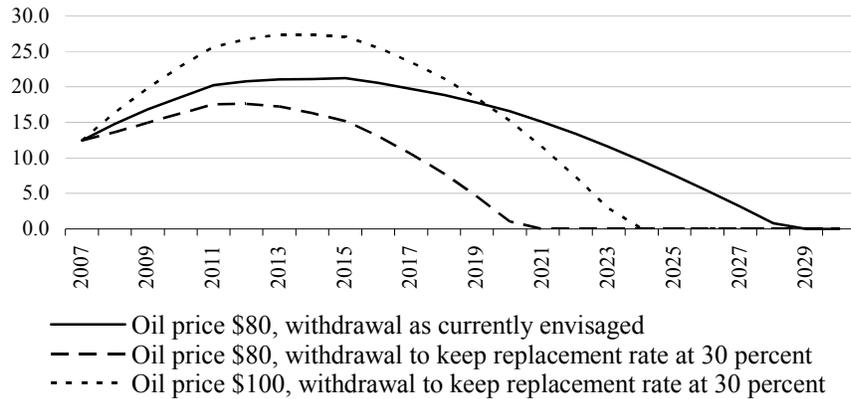
<sup>10</sup> Figures 3 and 4 are based the assumptions of annual growth of real GDP and the GDP deflator by 4 percent and a nominal interest rate of 8 percent. The return on the oil wealth is assumed to be 7 percent in US dollars.

<sup>11</sup> The depletion of oil funds might be mitigated, in the event that the authorities implement a successful agenda of structural reform that materially boosts the rate of investment and oil-sector output growth.

<sup>12</sup> IMF (2006) determined that an annual withdrawal even higher than 3.7 percent of GDP would imply a balance in the oil funds of about 40 percent of GDP in 2025. However, these projections assumed substantially higher oil sector growth and lower real appreciation than suggested by the developments of the past two years.

would deplete the funds by 2020, already a decade before the peak of the financing need around 2030. At a real oil price of US\$100, this strategy would deplete the funds by 2025. Moreover, larger government deficits would lead to appreciation in the real exchange rate and change the intergenerational distribution that is implicit in the new budget framework.

Figure 3. Oil Stabilization and National Welfare Funds in Percent of GDP



Source: Fund staff calculations.

21. **Privatizations would be an attractive way to fund these transfers, but it is unclear whether the proceeds could be sufficient.** Privatizations would avoid the adverse macroeconomic consequences of funding the pension gap through higher taxes or lower public investment (see next section), although using privatization revenues to finance pensions gives rise to the same questions regarding inter-generational equity as using the oil wealth or debt financing, which leave future generations with lower net assets. However, the value of all state-owned companies, which is estimated at 20 percent of GDP (Gaidar, 2007) would cover only about half of the present value of the funding gap relative to the 2006 replacement rate (Gurvich, 2007). Of course, such estimates are subject to great uncertainty.

22. **As neither voluntary savings, nor the oil funds, nor privatizations are a “magic bullet,” it is likely that taxes will have to be raised, or non-pension spending be cut.** As discussed, the first-best policy from a macroeconomic perspective would be an increase in the retirement age that could stabilize the replacement rate without fiscal adjustment or higher debt and would even have added positive macroeconomic effects through greater labor supply. However, if no or only an insufficient increase in the retirement age is adopted, a package of fiscal measures will be needed to fund the shortfall in the replacement ratio. The options on the budgetary side include higher borrowing, tax increases, or cuts in non-pension expenditure. Their respective macroeconomic effects are discussed in the following section.

### E. Macroeconomic Effects of Financing Options

23. **The macroeconomic effects of various options for closing the financing gap in the pension system can be analyzed with a multi-country dynamic general equilibrium model.** The Global Integrated Monetary and Fiscal Model (GIMF) was developed at the IMF (see Kumhof and Laxton, 2007) to examine fiscal and monetary policy issues. Some of its features render agents non-Ricardian, making the model well equipped to analyze fiscal policy issues that involve permanent changes in government assets or debt. The model also includes several nominal and real rigidities, as well as an inflation-targeting central bank. A summary of the model and details on the calibration are presented in the appendix.

24. **The simulations assume an increase in government transfers that is sufficient to achieve a replacement rate of 30 percent.** This assumption implies that the additional financing requirement peaks at 4 percent of GDP around 2030 (see Figure 2). It requires a sizeable short-term increase in transfers given the current replacement rate of 26 percent, which explains the large short-term response in all variables shown in the figures. All simulations are quarterly until 2050. (In figures 4–6, HO refers to the home country (Russia), as opposed to the rest of the world.) To demonstrate the relative macroeconomic effects of the different options, in each simulation the full adjustment burden falls entirely on a single policy instrument, although in reality a mix of measures is more likely. Given the uncertainties surrounding long-term simulations and the model's unavoidable simplifying assumptions, the policy considerations should focus on the model's relative and qualitative lessons, rather than on absolute magnitudes.

25. **Debt financing of a replacement rate of 30 percent is unlikely to endanger debt sustainability, but would be inconsistent with the borrowing limit in the budget code.** In this scenario, federal gross debt is projected to peak at about 60 percent of GDP<sup>13</sup> in the late 2030s (Figure 4).<sup>14</sup> This debt level is likely to be sustainable considering the expected intermittent improvement in the country's wealth and institutions, although concerns could arise if it were financed externally, as private sector external debt was already 32 percent of GDP at the end of 2007. Debt financing that exceeds 1 percent of GDP would require an amendment of the 2007 budget code. Concerns about intergenerational equity would of course be the same as in the case of a faster consumption of the oil wealth or privatizations.

26. **However, debt financing would have a significant negative effect on the economy.** The resulting higher real interest rates (up to 1 percentage point more in 2050) substantially reduce private investment relative to the baseline scenario of only very low

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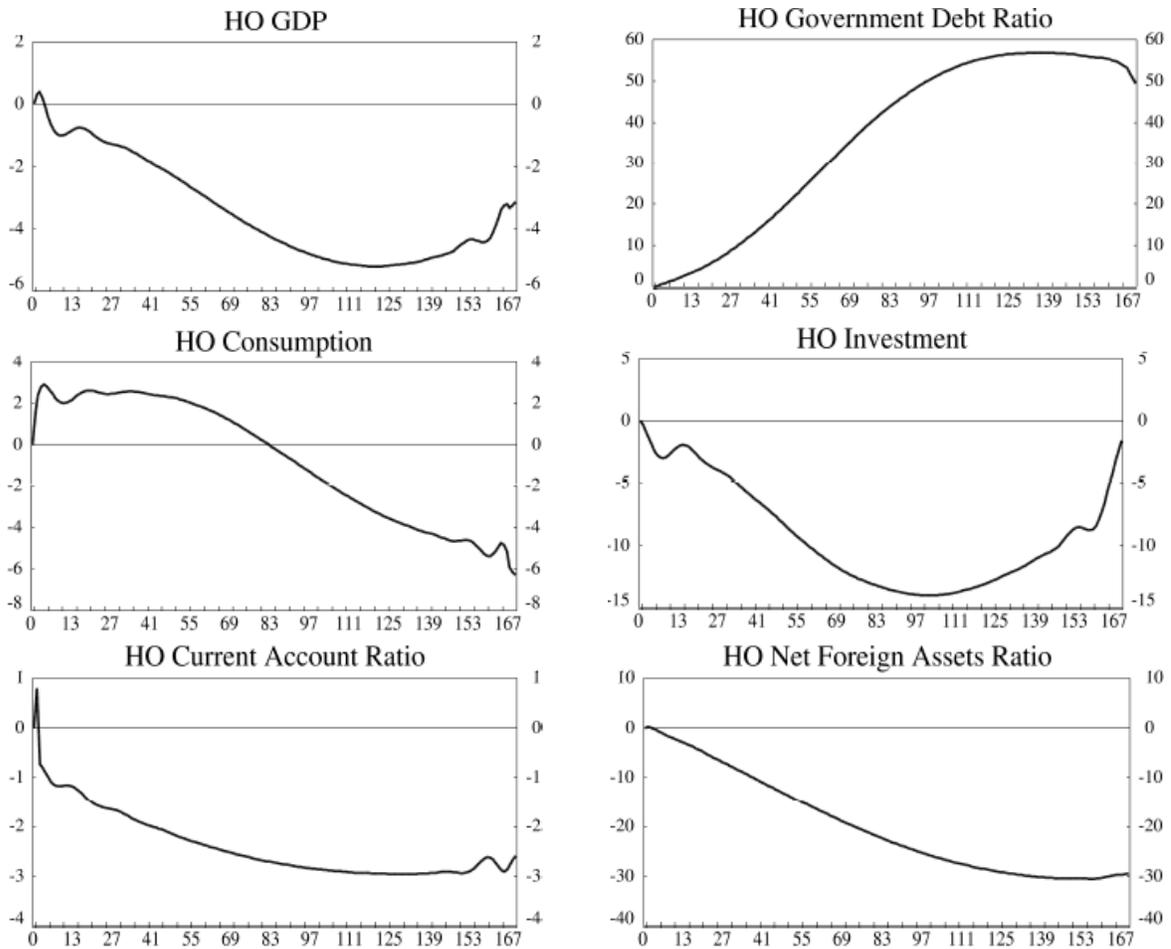
<sup>13</sup> This is the sum of the debt ration in the baseline scenario (5 percent) and the deviation from this baseline under the alternative scenario (55 percent).

<sup>14</sup> This result depends on the assumption of imperfect international capital mobility.

public debt (Figure 4). This leads to a 10 percent lower capital stock in 2050, reducing output by 3 percent and private consumption by 6 percent. The current account deteriorates, and net foreign assets are about 30 percentage points of GDP lower than under the baseline in 2050.

27. **If transfers are fully tax-financed, the economic costs are highest for the profit tax and lowest for the VAT, with the UST in the middle** (Figure 5a).<sup>15</sup> The profit tax reduces capital accumulation, and the UST reduces labor supply, while the VAT is less distortionary than payroll taxes because its base is broader (it also taxes accumulated savings). The profit tax is more distortionary than the UST because its effects are cumulative (the capital stock is permanently lower).

Figure 4. Debt-Financed Increase in Transfers  
(Deviations from Initial Steady State in Percent of GDP, quarterly periods until 2050)

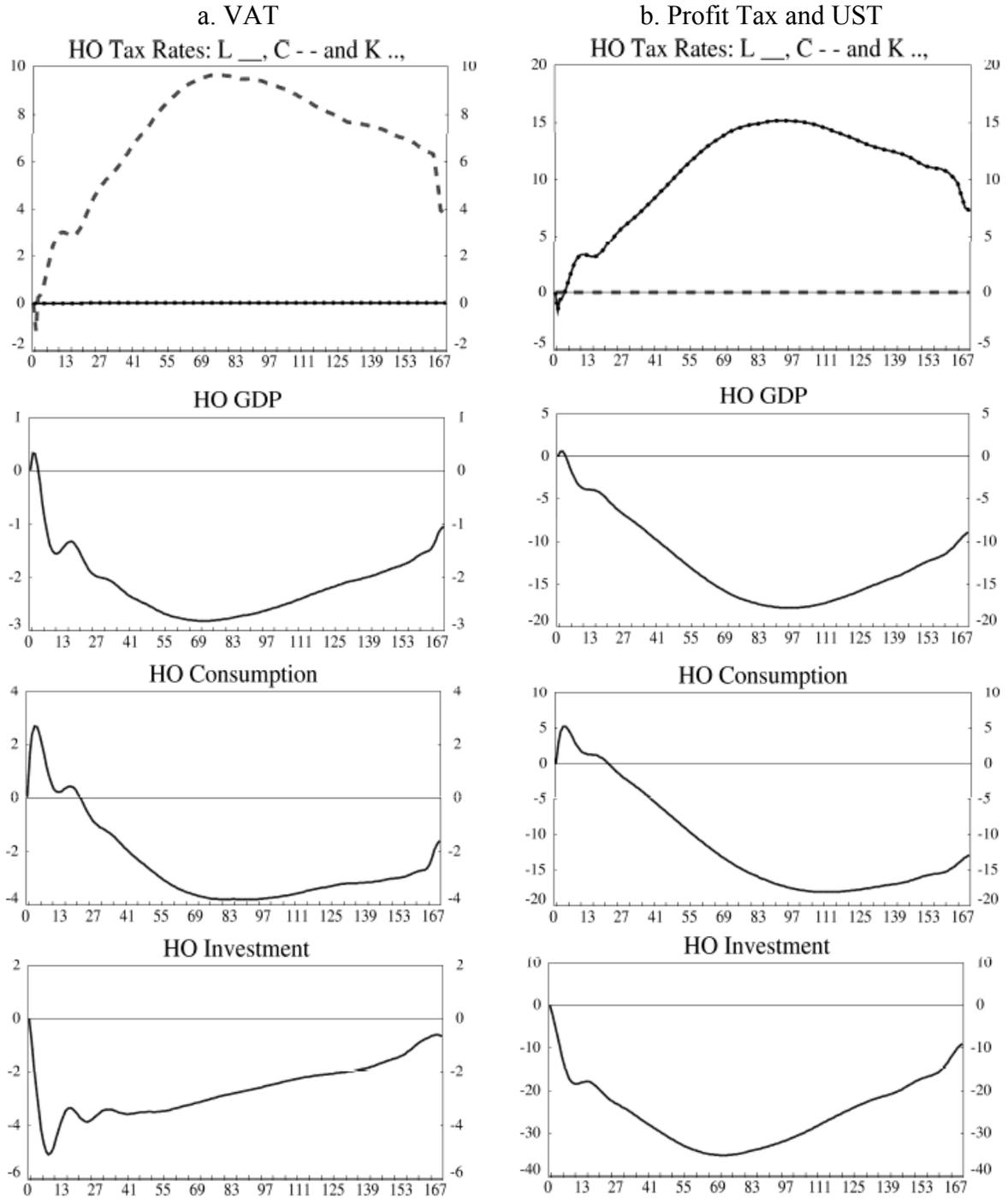


Source: Fund staff estimates.

Notes: Simulations of effects of gradual increase in government transfers in line with pattern shown in Figure 2 with the Global Fiscal and Monetary Model. “HO” is the model’s “home country,” the Russian Federation.

<sup>15</sup> The taxes are here referred to as applicable for Russia, but their definitions in the model are generic.

Figure 5. Tax-Financed Increase in Transfers  
(Deviations from Initial Steady State in Percent of GDP, quarterly periods until 2050)



Source: Fund staff estimates.

Notes: Simulations of effects of gradual increase in government transfers in line with pattern shown in Figure 2 with the Global Fiscal and Monetary Model. "HO" is the model's "home country," the Russian Federation.

28. **Thus, if the gap in the pension system is to be financed with higher tax revenues, increasing the VAT would be the least distortionary option** (Figure 5b).<sup>16</sup> Under this scenario the VAT rate peaks in 2030 at more than 9 percentage points higher than the current effective rate of 12 percent.<sup>17</sup> This could be largely achieved through base broadening to bring the effective VAT rate closer in line with the (higher) statutory rate of 18 percent. If, instead of the VAT, the profit tax and UST are raised in tandem,<sup>18</sup> their larger negative effects and smaller bases imply that both rates would need to reach a peak of 15 points above the baseline around 2030. Output around 2030 would be 20 percent lower than under the baseline, whereas it would be only 3 percent points lower if only the VAT were increased. Moreover, raising the VAT is particularly appropriate in an aging society because its base can be expected to contract less than the base of direct taxes.

29. **Raising the UST, while more consistent with the insurance character of the pension system, is economically less efficient.** In principle, benefits in an insurance-based pension system should be tied to contributions. However, the exceptional circumstances of Russia's economic and demographic transition argue against strict application of this principle, as it would not allow smoothing of the transition cost across generations. It is important to strike a balance between these considerations, including the question as to what extent the gradual decline in the effective UST rate due to the regressive scale should be halted. No such tension exists for the basic pension that is independent of contributions and could be financed from general tax revenue (Holzmann and others, 2004, pp. 10–11).<sup>19</sup> This would make the basic pension a welfare benefit that could be means-tested to save costs.

30. **On the expenditure side, cutting public investment has strong adverse effects on consumption and GDP in the simulations** (Figure 6a). The lower capital stock reduces output by 15 percent relative to the baseline after 40 years. Moreover, as mentioned above, lower capital accumulation has, in contrast to lower labor supply, a permanent effect. The output loss is thus about the same as when the UST and profit tax bear the entire burden, and is much larger than for raising only the VAT. However, this conclusion hinges on the assumed productivity of public investment: halving this parameter also halves the output loss relative to the baseline (to 8 percent), which is much lower than the scenario where the profit tax and UST bear all of the adjustment burden, although is still not lower than for raising the

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<sup>16</sup> Studying the pension reform options for China in a DSGE model, Wang and others (2004) also suggest using the VAT to finance the transition cost.

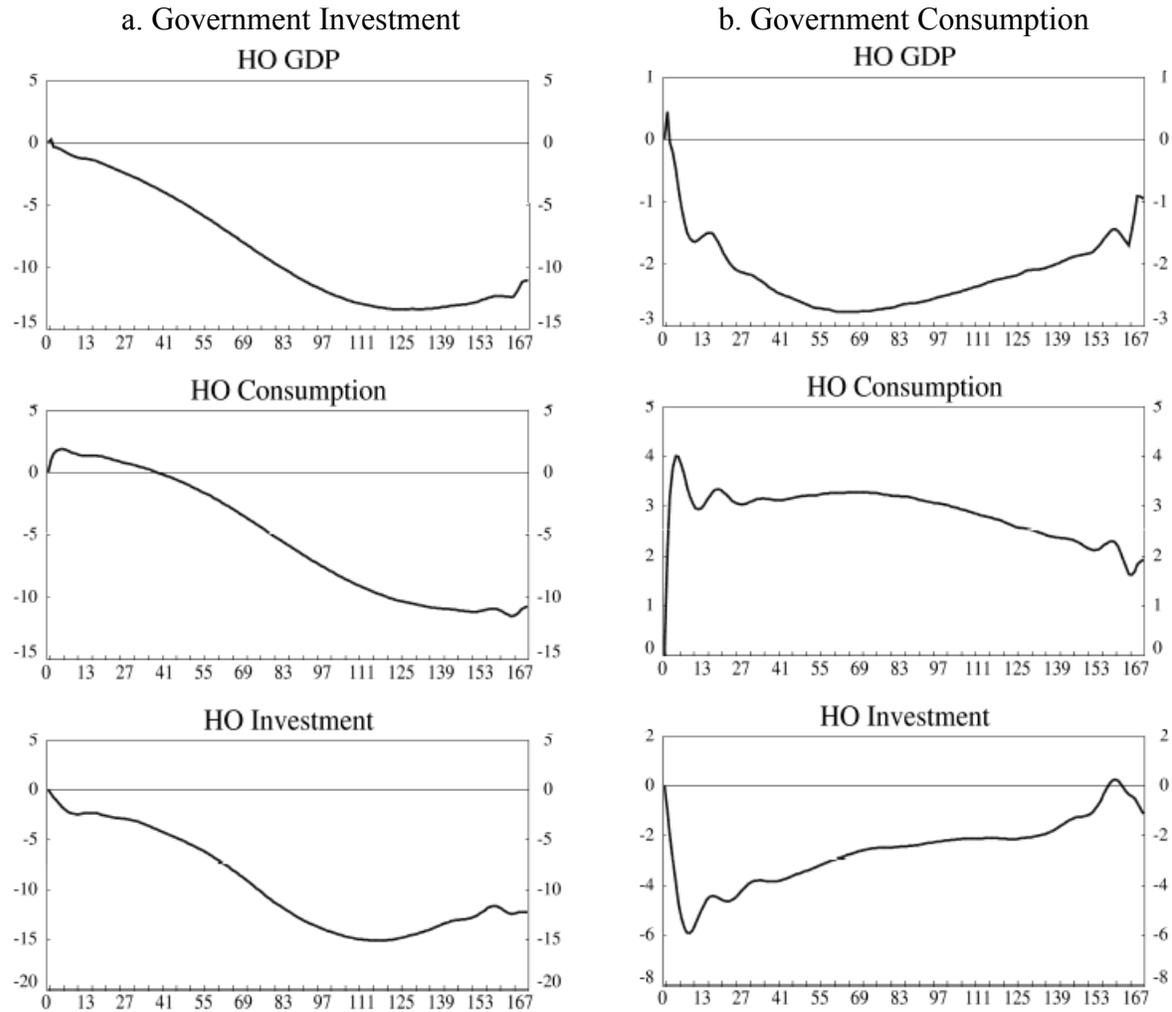
<sup>17</sup> This magnitude is not unusual; see, for example, Botman and Iakova (2006) on Ireland. From a static perspective, an effective rate of 12 percent currently generates 6 percent of GDP in revenue; raising revenue by 4.5 percent of GDP thus requires a rate increase by 9 percentage points.

<sup>18</sup> The revenue requirement is so large that neither the profit tax nor the UST could generate it individually.

<sup>19</sup> See Willmore (2007) for details on universal pensions and Selden and You (1997) for a case study of China.

VAT. Thus, cutting public investment would be preferable to raising the profit tax or UST unless the social rate of return on public investment (i.e., its impact on the economy) is significant.

Figure 6. Expenditure-Financed Increase in Transfers  
(Deviations from Initial Steady State in Percent of GDP, quarterly periods until 2050)



Source: Fund staff estimates.

Notes: Simulations of effects of gradual increase in government transfers in line with pattern shown in Figure 2 with the Global Fiscal and Monetary Model. “HO” is the model’s “home country,” the Russian Federation.

31. **Cutting government consumption is the best financing option from a purely macroeconomic perspective, according to the model simulations (Figure 6b).** While associated with a small output loss similar to the loss associated with a higher VAT rate, replacing government consumption with transfers allows for even higher private consumption than under the baseline. To fully offset higher transfers, government consumption would need to decline gradually by 4 percentage points of GDP by 2030, or

about one quarter relative to the current ratio to GDP. This is feasible, given the long time horizon and the scope for significant efficiency gains.<sup>20</sup> At the same time, however, Russia urgently needs to upgrade its public services and improve public sector wages. Moreover, the magnitude of the effect on private consumption is overstated by the (standard) assumption in the GIMF model that government consumption does not enter the private sector's production function, which is arguably not the case for education spending, for example. Gradual reduction in government consumption will thus require reinforced and continuous efficiency-enhancing reforms in the public sector.

## F. Conclusions

### 32. **Russia's current pension system entails a considerable contingent fiscal liability.**

The projected decline of the replacement rate of the public pension system to 17 percent in 2030 is unlikely to be socially sustainable. Private pensions will only be able to make up for a small part of the shortfall, given the small share of the population that can be realistically expected to save in private pension funds (owing to current income levels, low trust in the financial system, and moral hazard), as well as the timing of the financing gap. The main viable options, therefore, are a higher retirement age and budgetary financing.

33. **A gradual increase in the retirement age would be an important step towards stabilizing the current replacement rate.** Given Russia's shrinking labor force, this policy would be preferred from a macroeconomic point of view. A very gradual increase by 2 months per year for men and 4 months per year for women would raise the retirement age of both men and women to 65 and be sufficient to close the financing gap in the pension system, while maintaining the replacement rate at its current level. However, implementation of this policy may be complicated by the fact that the life expectancy at retirement of Russian men is relatively short at 14 years.

34. **Creating more incentives for working longer voluntarily would also help to strengthen the pension system.** In line with the standard design of a NDC system, pension benefits are best based on the actual life expectancy at retirement. Such a reform would greatly improve the consistency of the NDC system in the long run. Moreover, the deductions for early retirement, as well as premiums for working longer, should be increased.<sup>21</sup> Finally, the lists of hazardous occupations eligible for early retirement should be revisited.

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<sup>20</sup> Staff estimates suggest that current output of public services could be produced with only 2/3 of the actual inputs when comparing Russia to other countries at similar income levels or Russia's regions among themselves (IMF, 2007; Hauner, 2008).

<sup>21</sup> Economic incentives have been shown to affect retirement decisions in similar countries (see Becker and Urzhumova, 1998).

35. **Russia's oil wealth and revenue from privatizations are probably insufficient to finance the entire pension gap.** Given the currently legislated annual oil-wealth consumption and current oil prices (in real terms), the oil wealth is projected to be exhausted around 2025. Additional withdrawals to finance a replacement rate at the current level of 26 percent would deplete the funds by 2020, well before the peak of the gap in 2030. Moreover, such additional withdrawals would further undermine the new budget framework's stated goal to save some of the oil wealth for future generations. Similarly, even if the entire estimated value of state corporations is realized through privatizations, this would only cover half of the financing need for a stable 26 percent replacement rate. However, privatizations would also have positive side effects for the economy at large, through enhanced efficiency and a boost to financial markets.

36. **If the pension gap were to be financed through the budget, the model simulations suggest that fiscal room is best created by lowering government consumption.** At the same time, however, Russia urgently needs to upgrade its public services and improve public sector wages. Gradual reduction in government consumption will thus require substantially reinforced and continuous efficiency-increasing reforms in the public sector; see, for example, IMF (2007) for a discussion of some related reform priorities.

37. **The model simulations suggested that financing of the pension gap through borrowing, lower public investment, or higher taxes would entail a higher cost in terms of foregone GDP.** While debt financing would be unlikely to lead to sustainability concerns even in the extreme case where it fully finances the gap to a 30 percent replacement rate, it would require a legislative amendment to increase the current borrowing limit of 1 percent of GDP per year. Moreover, debt financing, as well as lower public investment or tax increases, entail substantial macroeconomic costs. Through higher interest rates and price distortions, they reduce output, investment, consumption, and net foreign assets relative to the baseline.

38. **The basic pension should ideally be means-tested and financed from general tax revenue.** The basic pension is independent of contributions and thus a social benefit that could be financed from taxes that are less distortionary than the UST, such as the VAT, or lower expenditure in other areas. The cost of the basic pension could be reduced by means-testing. The UST revenue could be limited to the financing of the insurance-based NDC pillar, which would allow sustaining a replacement rate of 26 percent approximately until 2013.

39. **The returns on the mandatory funded pillar are currently too low.** The negative real returns on the lion's share of contributions that is managed by the public sector have been detrimental to both the long-term financing of the pension system and the public's trust in financial markets. They also stand in stark contrast to the highly positive average real returns of private pension funds. Against this background, consideration should be given to outsourcing the management of the mandatory contributions to private asset managers, possibly under a model similar to Sweden's where managers compete for standardized

investment mandates to keep administrative fees low. Given the limited depth of domestic markets, an increase in the current ceiling on investment abroad could also be considered. This may allow for a better risk-return profile, particularly through international diversification.

## APPENDIX: Model and Calibration<sup>22</sup>

### The Model

40. **GIMF is an open economy general equilibrium model developed at the IMF that is equipped for both monetary and fiscal policy analysis** (Kumhof and Laxton, 2007). The model's nominal and real rigidities, monetary policy reaction function, multiple non-Ricardian features, and fiscal policy reaction function yield plausible macroeconomic responses to changes in fiscal and monetary policy. Real rigidities embedded in the model include consumer habits that induce consumption persistence, investment adjustment costs that induce investment persistence, and import adjustment costs. Nominal rigidities include sticky inflation Phillips curves in each sector of the economy.

#### Within the model, Ricardian equivalence fails to hold for four reasons:

- The model features overlapping generations agents with finite lifetimes as in Blanchard (1995). These agents are myopic, in the sense that they perceive debt-financed tax cuts as an increase in their wealth, and attach a low probability to having to pay for them in the future.
- Workers have a life-cycle labor productivity pattern that implies a declining rate of productivity as workers age. This means that workers discount the effects of future payroll tax increases as the latter are likely to occur when they are less productive.
- The model contains liquidity-constrained consumers who do not have access to financial markets and change their consumption one-for-one with after-tax income.
- The model includes payroll and capital income taxes that are distortionary because labor effort and private investment respond to variations in relative tax rates.

41. **GIMF relaxes the conventional assumption that all government spending is wasteful.** Instead, GIMF allows for productive public infrastructure spending that adds to the public capital stock, and enhances the productivity of private factors of production.

**The government determines how the fiscal surplus-to-GDP ratio responds to business cycle fluctuations using a simple fiscal policy rule of the following form:**

$$\frac{fs_t}{gdp_t} = \phi^* + d \left( \frac{\tau_t - \tau_t^*}{gdp_t} \right) \quad (1)$$

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<sup>22</sup> This appendix draws on Leigh (2007).

where  $\frac{fs_t}{gdp_t}$  is the fiscal surplus-to-GDP ratio. If the response parameter  $d = 0$ , the fiscal surplus is kept equal to  $\phi^*$  at all times, regardless of the economy's cyclical position. For example, if  $d = 0$  and the economy experiences a cyclical upswing with actual tax revenue  $\tau_t$  exceeding steady-state tax revenue  $\tau^*_t$ , the fiscal surplus remains unchanged, and the cyclical excess revenue is spent. Such a response corresponds to a “balanced budget” rule and is procyclical. A response of  $d < 0$  would qualify as countercyclical. As the response parameter  $d$  increases, a greater share of the cyclical excess revenue is saved.

**The central bank targets inflation by manipulating the nominal interest rate following a standard inflation forecast-based rule of the following form:**

$$i_t = i_{t-1}^{\mu_i} (r_t^* \bar{\pi}_{t+4})^{1-\mu_i} \left( E_t \frac{\bar{\pi}_{t+4}}{\pi_{t+4}^*} \right)^{(1-\mu_i)\mu_\pi} \quad (2)$$

where the gross policy interest rate is  $i_t$ , the inflation forecasting horizon is 4 quarters, the inflation target  $\pi^*$  is for total 4-quarter gross inflation,  $\bar{\pi}_{t+4} = \pi_{t+1}\pi_{t+2}\pi_{t+3}\pi_{t+4}$ , and  $E_t$  denotes expectations based on information available at time  $t$ .<sup>23</sup> Coefficient  $\mu_i \in [0,1)$  denotes the degree of nominal interest rate inertia. If  $\mu_i = 0$ , Equation (2) implies that when the inflation forecast exceeds the target by 1 percentage point, the nominal interest rate increases by  $1 + \mu_\pi$ . The equilibrium real interest rate  $r_t^*$  is endogenous, and is determined by the global market for loanable funds, as well as a country-specific risk premium.

**The model includes an endogenous country-specific risk premium.** In particular, the risk premium on the interest paid on domestic government debt is denoted  $\rho_t$  and enters the model via an augmented uncovered interest parity (UIP) equation:

$$i_t = i_t^{RW} E_t \varepsilon_{t+1} (1 + \rho_t) \quad (3)$$

where  $i_t^{RW}$  is the (gross) nominal interest rate in the rest of the world, and  $\varepsilon_{t+1}$  denotes future (gross) nominal exchange rate depreciation. The domestic risk premium  $\rho_t$  is assumed to have the following non-linear form:

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<sup>23</sup> The actual rate equals the gross rate minus one.

$$\rho_t = \delta_1 + \frac{\delta_2}{\left((debt / gdp)^{\max} - (debt_t / gdp_t)\right)^{\delta_3}}. \quad (4)$$

If  $\delta_2 = 0$ , then the risk premium always equals the exogenous level  $\delta_1$ , regardless of the level of the debt-to-GDP ratio  $(debt_t / gdp_t)$ . If  $\delta_2 > 0$ , a decline in government debt reduces the risk premium. As the debt-to-GDP ratio rises towards a threshold level  $(debt / gdp)^{\max}$ , the risk premium rises at an increasing rate. The assumption that the risk premium responds more strongly to changes in government indebtedness as the debt-to-GDP ratio increases is broadly consistent with empirical studies that estimate the relationship between the *logarithm* of the risk premium and the debt-to-GDP ratio. The estimates of such studies imply that the *level* of the risk premium, in basis points, increases more at high levels of the debt-to-GDP ratio than at low levels of the debt-to-GDP ratio. The parameter  $\delta_3 > 0$  determines the curvature of the risk premium function.

### Calibration

42. **The model is calibrated to contain two countries, Russia and the rest of the world.** Russia is assumed to comprise 2.5 percent of world GDP, and to have a steady state inflation rate of 4 percent per year, while the inflation rate for the rest of the world is 3 percent per year. In the steady state, the rate of technological progress is assumed to be 2 percent per year, population is assumed to grow at 1 percent per year, and the real interest in the rest of the world is assumed to be 3 percent per year. The structural parameters regarding household preferences and firm technology are set following Kumhof and Laxton (2003). In particular, the parameters that govern the degree of household myopia, a key non-Ricardian feature of the model, are calibrated as follows: households both in Russia and the rest of the world are assumed to have a planning horizon of 15 years, and a decline in lifecycle productivity of 5 percent per year. 40 percent of Russian households are assumed to be liquidity constrained.

43. **Fiscal parameters are calibrated based on 2006 data.** The productivity of public capital is calibrated so that a 10 percent real increase in public investment is associated with a long-run increase in real GDP net of depreciation of 1.4 percent. The depreciation of public capital is set at 5 percent per year. The parameter that governs the fiscal policy response to the business cycle,  $d$ , is set to equal zero, in line with Russia's non-oil deficit ceiling.

44. **The fiscal surplus is assumed to equal the value that stabilizes the debt-to-GDP ratio at the level of 5 percent** (except in the simulation of debt financing). In particular, in the steady state, there is a one-to-one correspondence between the fiscal deficit-to-GDP ratio

and the government debt-to-GDP ratio that depends on the rate of nominal GDP growth, that is,

$$\left(\frac{fdef}{gdp}\right)^* = \frac{NG^*}{1+NG^*} \left(\frac{debt}{gdp}\right)^*, \quad (5)$$

where  $NG^*$  denotes the steady state nominal growth rate, and  $fdef$  denotes the fiscal deficit.

45. **The monetary policy reaction function is calibrated in line with empirical evidence for a number of countries.** The nominal interest rate inertia parameter is  $\mu_i = 0.5$ , and the baseline calibration of the inflation response parameter is  $\mu_\pi = 1.5$ . While particular uncertainty surrounds the validity of these parameters, the results are not sensitive to them.

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## II. FINANCIAL INTEGRATION WITHIN THE CIS<sup>24</sup>

### A. Introduction

46. **This chapter takes stock of the extent of Russia’s financial integration with overseas markets, focusing in particular on the role of Russia within the CIS.** As yet, preliminary analysis suggests that Russia has a somewhat limited impact on other CIS markets. Indeed, data on direct cross-border asset holdings indicate that Russia is a marginal source of funds within the region.

47. **Noting the potential shortcomings of direct capital-flow data, however, the chapter pays particular attention to indirect evidence of financial integration between Russia and the rest of the CIS.** Staff analysis of equity returns indicates that, although Russia is relatively well integrated into global capital markets, Russian developments have little effect on other regional financial markets. Further, in seeking to explain this apparent lack of correlation, the chapter finds that this result is largely to be expected, given the current level of financial development throughout the region—more specifically, the low degree of correlation reflects the small size of non-Russian CIS economies, along with their relatively illiquid, less-developed financial systems. In sum, the results suggest that the risks of spillovers from Russia to other CIS economies, through financial channels, are limited at this point in time.

48. **Looking forward, staff will keep the process of financial integration within the CIS under close review.** Financial development within the CIS is still at a very early stage. Moreover, given Russia’s physical proximity and close cultural links with other CIS countries, and given that Moscow is already a key headquarters location for many transnational corporations operating within the post-Soviet area, Russia’s potential as a regional financial center is substantial. In this context, staff analysis suggests that the degree of integration will likely increase over the medium term as the financial systems of CIS economies grow and develop further.

49. **This chapter is organized as follows.** Section B will outline the problems associated with measures of direct asset holdings, and will suggest the need for a more indirect gauge of intra-CIS financial integration. Section C will provide preliminary analysis of the correlation of CIS equity returns, both within the region and with other developed and emerging markets. Section D will estimate a gravity model to explore the possible reasons for the apparently low correlation of returns between Russia and other CIS countries. Section E will conclude.

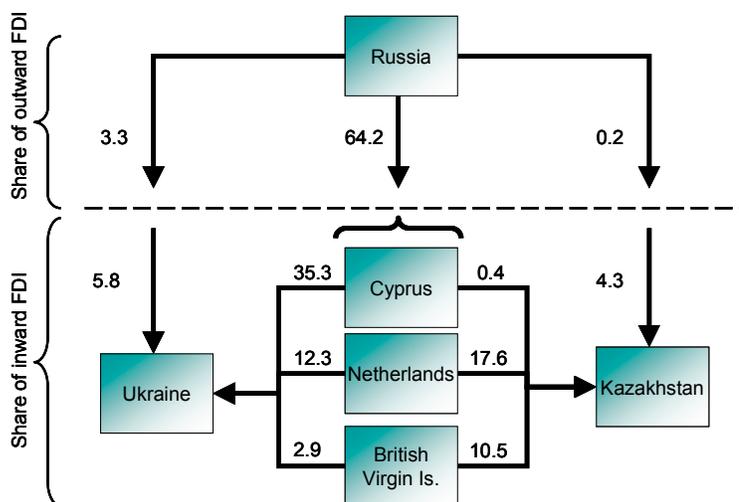
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<sup>24</sup> Prepared by Andrew Tiffin (EUR).

## B. Capital Flows

50. **Measurement of intra-CIS capital flows is problematic, as useful data on direct financial linkages are difficult to obtain.** The locational BIS International Banking Statistics covers bank flows between countries, but as Russia is not within the BIS reporting area, it is impossible to infer anything about the pattern of lending within the region. The IMF's Coordinated Portfolio Investment Survey (CPIS), on the other hand, covers cross-border portfolio flows and *does* have Russia as a reporting country. The most recent survey includes data for 2006, and its results for the CIS region are summarized in Table 1 below. The first feature of note is that Russia appears to be a marginal source of portfolio investment for other CIS countries; accounting for less than 0.4 percent of total inflows. However, closer inspection highlights a key issue. For many CIS countries, a sizable fraction of inflows originate in international financial centers. Taking Kazakhstan, for example, the data suggest that Guernsey is 50 times more important than Russia as a source of portfolio funding. But anecdotal evidence suggests that much of these inflows actually represent Russian funds, which have been channeled via international centers for privacy reasons. The actual importance to the region of Russian portfolio capital, therefore, is unknown.

51. **This problem appears to be even more acute when considering direct investment flows.** FDI is a vital source of foreign funding throughout the CIS. But for these countries, the diversion of funds through international financial centers is widespread. The attached diagram represents the flow of FDI in 2007 between Russia and two key CIS economies: Ukraine and Kazakhstan. As before, the direct flows between Russia and these countries are relatively small. Taking Ukraine, the bilateral flow represents only 3.3 percent of Russia's outward direct investment, and only 5.8 percent Ukraine's inward direct investment. By contrast, three key international centers account for almost 65 percent of total Russian outflows, and those same three centers represent over 50 percent of total Ukrainian inflows. It is impossible to know the exact amount, but it is a widely held view that much of this activity stems from unrecorded Russian investment within the CIS.



Source: National Central Banks, staff calculations.

52. **Consequently, this chapter takes a more indirect approach to measure the role of Russia within the CIS.** For real markets, full integration can be defined as a situation in which goods are able to move freely between two markets. Similarly, integrated financial markets imply that agents can trade financial assets freely within a specified area. However, when the volume of trade in goods—or assets—cannot be measured accurately, it is often preferable to look at more indirect measures. In the goods market, for example, full integration suggests that the law of one price applies, so that goods flow from one market to another until the price of same good is equalized. Analogously, in the case of financial integration, the return of assets with the same risk characteristics should be equalized across markets. Asset returns in integrated markets, therefore, should be closely correlated.

53. **The close co movement of equity returns, in which developments in Russia are mirrored in other CIS markets, would suggest that Russia is an important source of capital within the region.** Moreover, this should be the case regardless of whether assets are traded directly between CIS markets, or are instead traded indirectly via international intermediaries. If the markets are not well integrated, on the other hand, then asset prices and returns should be relatively independent. In this context, the next section will look at the co movement of equity returns between Russia and other financial markets, to gauge whether CIS markets are in fact well integrated with Russia.

### C. Asset Returns: Preliminary Analysis

#### Data

54. **In measuring the co movement of asset returns, this chapter focuses on stock-market behavior across a range of markets.** In order to ensure comparability and consistency, wherever possible we use the daily MSCI indices compiled by Morgan Stanley, as reported on Datastream International. In addition, as we are considering the viewpoint of a standard international investor, we study returns in U.S. dollars.<sup>25</sup> For CIS markets, however, reliable equity indices are relatively rare, and so we are limited to data for Russia, Ukraine, Kazakhstan and Kyrgyzstan. In the case of Kazakhstan and Kyrgyzstan, equity index data is taken from the Kazakhstan Stock Exchange (KASE) and Kyrgyzstan Stock Exchange (KSE) directly. The behavior of the four included CIS stock market indices are illustrated in Figure 1 below.

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<sup>25</sup> This is a standard approach. Large swings in the US\$ exchange rate may yield larger observed correlations, but should have less of an impact on the *relative* strength of bivariate correlations.

Table 1. Total Portfolio Assets, 2006  
(US\$ Million)

Investment from:	Investment in:											Total		
	USA	Japan	UK	Netherlands	Offshore Financial Centers	<i>o/w Bahamas, The</i>	<i>o/w Bermuda</i>	<i>o/w Cayman Islands</i>	<i>o/w Cyprus</i>	<i>o/w Guernsey</i>	<i>o/w Jersey</i>		<i>Russia</i>	Other Countries
Azerbaijan													15	15
Belarus												4	1	5
Georgia	30		41									1	218	291
Kazakhstan	1,288	49	4,853	169	165		37	14	100	14		2	2,332	8,858
Kyrgyz Republic		4	2		1		1					61	2	70
Tajikistan														-
Turkmenistan														-
Ukraine	1,507	188	4,766	1,049	223		10	92	94	27	3		3,063	10,800
Uzbekistan			6										1	7
<i>Russian Federation</i>	48,441	2,957	30,962	5,144	11,018	72	583	4,044	4,161	2,095			60,324	158,847
<b>Total</b>	<b>51,266</b>	<b>3,198</b>	<b>40,630</b>	<b>6,362</b>	<b>11,408</b>	<b>72</b>	<b>585</b>	<b>110</b>	<b>4,151</b>	<b>4,355</b>	<b>2,136</b>	<b>71</b>	<b>65,957</b>	<b>178,892</b>

Note: the data are derived from the creditor side for both assets and liabilities

-- Indicates a zero value or a value less than US\$ 500,000

... Indicates an unavailable datum

Source: Coordinated Portfolio Investment Survey

55. **Equity data is gathered for a range of developed, emerging, and CIS markets, and returns in each market are measured on a weekly basis.** This helps eliminate any spurious correlation resulting from the fact that not all markets are within the same time zone. It also reduces the impact of the relative illiquidity of some of the smaller markets, where it may take a number of days to execute a particular trade. Returns are also defined in continuously compounded terms, so that the return over one period (a week) is defined as:

$$R_t = \ln(P_t) - \ln(P_{t-1})$$

In this context,  $P_t$  is the value of the index at time  $t$ . The correlation matrix for key developed, European, and CIS markets is given below. As can be seen, it appears that most CIS markets are poorly correlated with other markets. The exception, however, is Russia, which seems relatively closely linked with global asset markets.

Correlation Matrix. Weekly Returns, 1999-2007

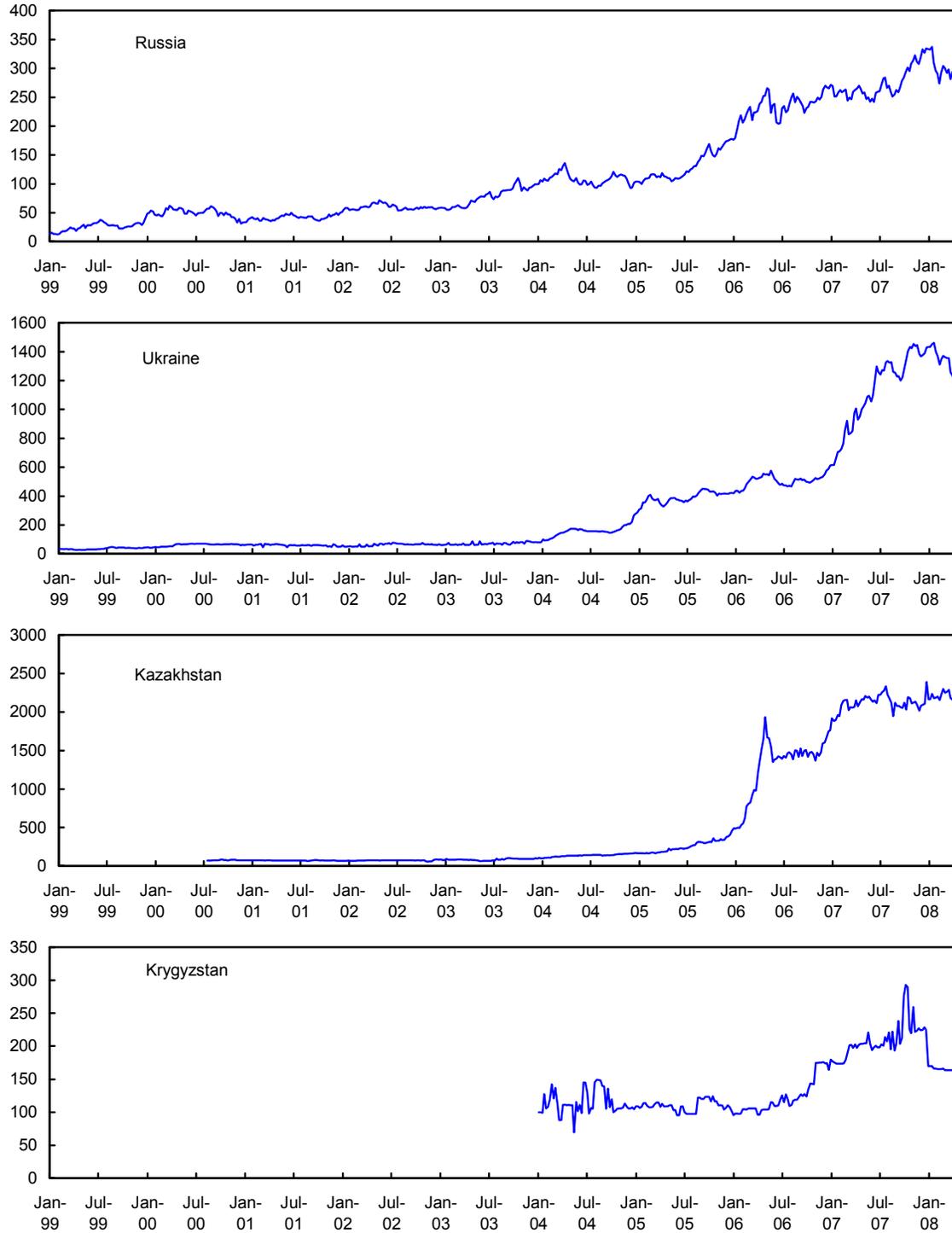
	DEU	JPN	GBR	USA	TUR	CZE	HUN	POL	RUS	UKR	KAZ	KGZ
DEU	1.00											
JPN	0.53	1.00										
GBR	0.85	0.53	1.00									
USA	0.71	0.47	0.70	1.00								
TUR	0.53	0.46	0.54	0.47	1.00							
CZE	0.60	0.54	0.63	0.43	0.58	1.00						
HUN	0.61	0.50	0.62	0.46	0.61	0.66	1.00					
POL	0.69	0.49	0.73	0.52	0.63	0.69	0.76	1.00				
RUS	0.47	0.43	0.54	0.35	0.51	0.56	0.57	0.55	1.00			
UKR	0.10	0.11	0.12	0.07	0.18	0.10	0.19	0.10	0.11	1.00		
KAZ	0.13	0.04	0.14	0.07	0.16	0.07	0.14	0.17	0.15	0.15	1.00	
KGZ	0.09	0.07	0.11	0.05	-0.07	0.05	0.04	0.01	0.07	0.09	0.00	1.00

Source: Datastream, KASE, KSE, staff calculations

### Principal Components Analysis

56. **As a first step, this chapter employs Principal Components Analysis (PCA) to help build a rough picture of stock-market co movements: both within the CIS region, and between CIS and non-CIS countries.** This is a widely used tool in multivariate statistics, and is specifically designed to help uncover underlying patterns within a given, often complex dataset—allowing us to extract the key driving factors that explain stock-return co movements across different markets. The methodology is outlined in more detail in the appendix.

Figure 1. CIS Stock Market Indices, 1999-2008  
(USD Index, 1 Jan 2004 = 100)



Source: Datastream, KASE, KSE, staff calculations

57. **As noted, apart from Russia, CIS markets appear relatively uncorrelated with other developed and emerging markets.** It is still possible, however, that events in Russia may nonetheless be an important driver of market developments in other CIS countries, independent of developments elsewhere—i.e. CIS markets may be relatively integrated with Russia, but not with the global market. If this were the case, then we would expect our analysis to identify Russia and other CIS markets as a single, separately identifiable group.

58. **PCA analysis suggests that, within our sample, there are three main independent factors that explain cross-country co movements in stock market returns.** The attached table illustrates the correlation (the “loading coefficient”) of the factors with each individual market, focusing on

instances where the correlation is greater than 0.5. As seen, the three extracted factors account for a large amount of variance for each of the different stock-return series, ranging from about 50 percent for Japan to almost 90 percent for Kyrgyzstan.<sup>26</sup>

	Loading Coefficients.			Communality
	Factor 1	Factor 2	Factor 3	
Germany	0.860			0.75
Japan	0.697			0.50
United Kingdom	0.874			0.78
USA	0.738			0.57
Turkey	0.728			0.63
Czech Rep.	0.801			0.65
Hungary	0.802			0.69
Poland	0.854			0.76
Russia	0.676			0.50
Ukraine		0.721		0.59
Kazakhstan		0.736		0.57
Kyrgyzstan			0.934	0.88

(blanks represent coefficient < 0.5)

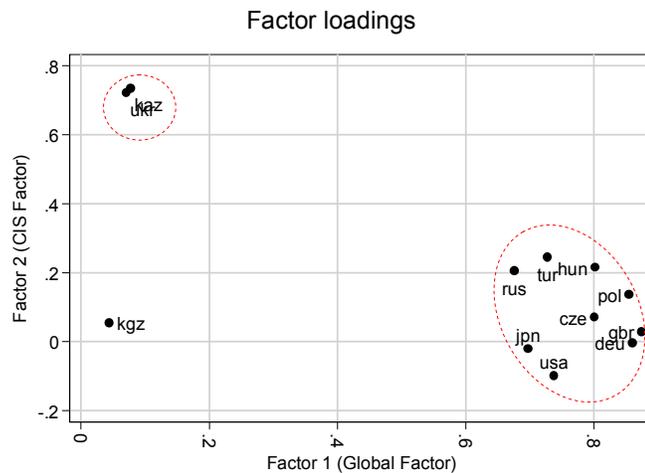
59. **The first factor seems to represent a common *global* trend, which jointly influences**

**both developed and emerging markets together.** Russia falls into this group, and so appears to be driven by the same forces that drive most other active markets around the world. This would suggest that Russia is now effectively integrated within the international financial system.

60. **The second factor might be characterized as a *CIS-specific* trend, which drives both Ukraine and Kazakhstan in tandem, but appears to exclude Russia.** Consequently, while the financial markets of Ukraine and Kazakhstan may be closely related to each other, they appear to be isolated from global market trends, and are also relatively separate from developments within Russia. Kyrgyzstan, it seems, is somewhat secluded—from both Russia and other CIS countries—and is driven by a factor of its own.

<sup>26</sup> For each country series, the total variance explained by all three factors, known as the “communality,” is given by the squared sum of the loading coefficients.

61. **In sum, although Russia is well integrated within international capital markets, global developments that impact Russia do not appear to flow on into other CIS markets.** Moreover, there does not seem to be any significant pattern of regional comovements, in which idiosyncratic developments in Russian impact other CIS markets. Instead, non-Russian CIS markets are relatively separate from developments within Russia. On the one hand, this result is somewhat surprising, given the common language, legal traditions, and historical ties that are shared between CIS countries. On the other hand, however, this result may reflect the fact that, compared to Russia, the economies of other CIS countries are relatively small, with illiquid and underdeveloped financial systems. Financial markets in smaller CIS countries, therefore, may be influenced by a substantially different set of idiosyncratic trends. The remainder of this chapter will model the factors that typically determine the comovement between different countries' financial markets, to see whether they can explain the relatively low degree of correlation between Russia and other CIS countries



#### D. Modeling Financial Linkages: A Gravity Approach

##### Background

62. **In seeking to explain the apparent lack of integration between Russia and other CIS markets, the chapter builds on existing empirical efforts to measure the determinants of cross-country financial integration.** Studies have identified various key factors that determine the degree of integration, such as trade intensity (Chinn and Forbes, 2004), financial development (Dellas and Hess, 2005), and business-cycle synchronicity (Walti, 2004). Generally, these studies find some support for the explanatory power of such factors, but the results and conclusions often differ significantly. Martin and Rey (2004), on the other hand, have proposed a theory of capital flows from which a “gravity” equation emerges. The model’s main result is that gross financial flows should depend inversely on transactions costs—such as the cost of gathering information across borders—and should depend proportionally on market size, as proxied by stock-market capitalization.

63. **Empirical studies that have adopted this gravity-model framework have found that it is generally successful in explaining bilateral financial flows.** The gravity equation has been the workhorse model for trade in goods since the 1960s. At core, the trade version seeks to explain the bilateral flow in goods between countries as a function of their two masses (GDPs) and their geographical distance. Unlike the goods trade, however, where distance is a useful proxy for transportation costs, the trade in financial assets is relatively weightless, so the role of geographical distance is less obvious. Nonetheless, Portes and Rey (2005) demonstrate that the gravity equation performs at least as well in explaining asset trade as it does in explaining goods trade. They further illustrate that geographical distance, in this case, serves as a valuable proxy for informational frictions that serve as a barrier to interaction between economic agents. Similar studies have shown that such informational considerations are also important *within* countries, so that domestic investment decisions are often biased in favor of projects that are relatively familiar, and that these tend to be those that are relatively close (Coval and Moskowitz, 1999). Other studies have confirmed that the gravity effect is also important for international *portfolio* flows (Berkel, 2006), and for *FDI* flows (Talamo, 2007).

64. **Following this approach, the chapter adopts a gravity-model framework to explain co movements in stock prices across countries.** As mentioned above, a lack of suitable data precludes us from modeling capital flows directly. However, for those countries with a viable stock exchange, we can model the impact of these flows indirectly by measuring the extent of correlation between stock-market returns. In this regard, we build on the work of other authors that have also modeled stock-market co movements within a gravity framework (Biene and Candelon, 2005; Flavin and others, 2002).

### **The Model**

65. **The model specification essentially augments the standard gravity equation.** As with the trade model, the variables influencing the degree of stock-market correlation include the standard geographical and historical factors, such as distance, common borders, common language and colonial links, while country size is replaced with stock-market capitalization. Details on data sources and country coverage are provided in the appendix, which also includes a more thorough discussion of the specification and econometric methodology chosen. However, it should be noted that our sample includes indices from 30 stock markets—including from the four CIS countries discussed in the previous section—which implies a total of 435 pairs of countries for each time period. Again, we use standardized weekly returns to eliminate any spurious correlation owing to non-synchronous trading hours, and we then calculate 435 bivariate correlations for each year (1999-2007), generating a potential panel of 3,480 observations.

66. **Given this chapter’s focus on the extent of integration between CIS markets, the model explicitly tests whether the degree of correlation within this subgroup is systematically different from that of other countries.** For each bivariate observation, therefore, the model includes a dummy variable that indicates whether both countries are CIS members. If the coefficient on this dummy were positive, it would suggest that CIS markets tend to be more closely connected to each other, compared to a randomly-selected country pair. In this case, therefore, we might conclude that the impact of Russia on other CIS markets is larger than expected—even after controlling for these markets’ relative size and close cultural links. On the other hand, if the coefficient were negative, it would suggest that the degree of correlation is unexpectedly low; perhaps indicating de facto restrictions on the free flow of capital. The model further allows for the possibility that this CIS effect may have changed over time, so it also includes an interaction term to indicate whether the observation is from the second half of the sample. In addition, given that correlations might be higher for economies that are similar, the model includes a variable that measures the relative disparity between the two countries’ GDP (as represented by the relative share of the smallest partner). Finally, the model allows for possible dynamics by including a time trend and lagged dependent variable.

67. **Thus, the bivariate correlation ( $\sigma_{ij,t}$ ) is modeled as:**

$$\begin{aligned} \sigma_{ij,t} = & \rho\sigma_{ij,t-1} + \alpha_0 + \alpha_1 time + \beta_1 (distance_{ij}) + \beta_2 (size_{i,t} \times size_{j,t}) + \beta_3 (GDPshare_{ij,t}) \\ & + \beta_4 (language_{ij}) + \beta_5 (border_{ij}) + \beta_6 (colony_{ij}) + \beta_7 (CIS_{ij}) + B_7 (CIS_{ij} \times I_{T \geq 2004}) + \mu_{ij} + \varepsilon_{ij,t} \end{aligned}$$

As mentioned, details on the explanatory variables are provided in the appendix, but it should be noted here for clarification that this is a panel-data model, so we allow for possible non-modeled country-pair effects via a fixed-effect term  $\mu_{ij}$ .

## Results

68. **Coefficient values all display the expected sign and are generally significant.** The positive coefficient on the time trend confirms that, worldwide, the degree of integration between markets has increased markedly over time—a coefficient of 0.037 corresponds to trend increase in correlation of about 1½ percent per year. The coefficient on the lagged dependent variable, on the other hand, suggests that the persistence of a shock to cross-country correlation is generally small, but is still statistically significant. As expected, greater distance between markets tends to reduce the degree of co movement, whereas markets with a large joint capitalization tend to move together more closely. Once we control for physical distance, however, it appears that other “informational distance” variables—such as the presence of a common language—have little extra explanatory power.<sup>27</sup> Finally, economies that are closer in size exhibit a higher degree of market correlation.

	Kiviet-corrected LSDV	Two-step system GMM	Corrected two-step system GMM
Dependent Variable: Bivariate Correlation (transform)			
Lagged correlation (transform)	0.273 [16.13]***	0.222 [13.90]***	0.222 [6.21]***
Time	0.060 [6.65]***	0.037 [15.29]***	0.037 [6.93]***
(Log) Distance	---	-0.054 [-3.86]***	-0.054 [-1.81]*
(Log) Joint Market Capitalization	0.049 [3.44]***	0.101 [23.55]***	0.101 [10.83]***
CIS Country	---	0.046 [0.54]	0.046 [0.29]
CIS interaction term	-0.048 [-0.25]	0.004 [0.04]	0.004 [0.02]
Common Language	---	0.011 [0.32]	0.011 [0.18]
Share of Smallest Partner	-0.304 [-0.55]	0.668 [10.38]***	0.668 [5.45]***
Constant	---	0.0464 [0.54]	0.0464 [0.29]
Observations	3307	3307	3307

t-statistics in brackets

\* p<.1, \*\* p<.05, \*\*\* p<.01

69. **Controlling for the above factors, there is little evidence to suggest that CIS countries are systematically more integrated than other country pairs.** The CIS dummy is not significantly different to zero, and does not seem to have changed throughout the sample period. This suggests that the poor correlation between Russia and other CIS countries is broadly what we might expect given their histories, location, and relative size. On the one hand, the fact that CIS countries are relatively close, often share a common border, and enjoy a common language, all suggest that Russian investors should have a relative advantage when investing in other CIS countries (and vice versa). From this point of view, therefore, we would expect that their financial markets would be relatively closely

<sup>27</sup> Other geocultural variables, such as a common-border dummy or an indicator of past colonial ties, are also insignificant, once we control for distance.

integrated. On the other hand, stock markets in Ukraine, Kazakhstan, and Krygyzstan are somewhat undercapitalized and illiquid, so we would expect that developments in the Russian market might not flow easily into other CIS markets. Similarly, compared to Russia, the economies of the other CIS countries are somewhat small, and this disparity in size will further tend to reduce the degree of financial integration.

70. **Despite their cultural and geographical proximity, therefore, the low degree of integration between Russia and other CIS countries is not surprising; and reflects the relatively small and financially underdeveloped nature of non-Russian CIS economies.** It might be argued that formal and informal restraints on capital inflows may also play a role in these CIS countries. However, if that were the case, we would expect that the degree of integration and correlation would be systematically lower than that exhibited throughout the rest of the world—i.e. we would expect the CIS dummy to be significantly negative. With no evidence of this, we can tentatively conclude that there is little to suggest that defacto barriers to inflows are any greater in the CIS than those existing elsewhere.

#### E. Conclusion and Caveats

71. **In light of Russia's clear potential as a regional financial center, this chapter has taken stock of the current level of financial integration between Russia and other countries within the CIS.** At present, although Russia appears to be well integrated with global capital markets, the process of financial development throughout the rest of the region is still at a very early stage. As a result, developments in Russia still have a somewhat limited impact on other CIS markets.

72. **It should be noted, however, that some of the above results may reflect weaknesses in the available data.** Measuring integration in any context is a challenge, and this is especially so in the context of the CIS. As mentioned, data on direct asset holdings is scarce and potentially misleading, and this chapter has therefore turned to more indirect evidence of financial integration—focusing instead on the correlation between equity returns. But even here, reliable equity indices are available for only a few CIS markets. Moreover, cross-border equity flows are only a small part of capital flows within the region. On the latter point, in an ideal world with perfect markets and frictionless arbitrage, capital should be fungible, and so equity-market returns should also be influenced by non-equity capital movements. However, CIS financial markets are far from perfect, and are often fragmented. Thus, it is possible that Russian capital flows, though unmeasured and channeled through international centers, may have a greater role than implied by the minimal co movement of CIS equity returns.

73. **The degree of regional integration, and the potential for financial spillovers between markets within the CIS, will be an ongoing focus of staff analysis.** Currently, staff analysis suggests that the low degree of integration between Russia and other CIS

markets can be explained by the small size and financial underdevelopment of non-Russian CIS economies. As these economies grow and develop further, however, the results suggest that geocultural proximity of CIS countries to one another will result in a greater degree of integration. Looking forward, therefore, we can expect that Russia will have a greater and greater influence on other markets in the region.

## APPENDIX

*Principal Components Analysis*

74. **Principal-component models have been applied across a wide range of empirical investigations.** PCA has been used to analyze global and regional business cycles, including the co movement of consumption, investment and output (Cerqueira, 2006), but an approach closer to this chapter uses the methodology to isolate closely-integrated groups of countries that are driven by a single common factor (Kozluk, 2008; Fernandez-Izquierdo and Lafuente, 2004). We are interested in the extent of financial integration between Russia and other CIS countries, and whether they form a single, separately-identifiable group

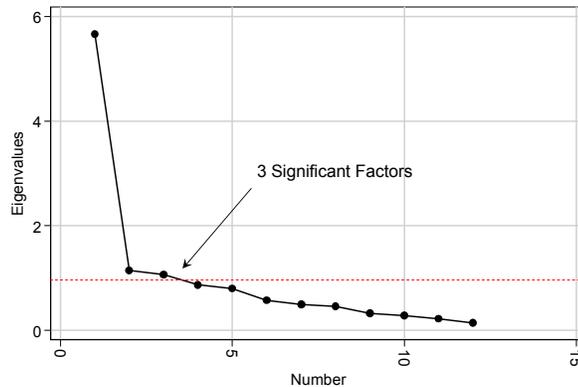
75. **A brief outline is provided below.** With  $i = 1..N$  stock-market indexes and  $t = 1..T$  observations, our dataset can be represented by the  $(N \times T)$  matrix  $\mathbf{X}$ . This matrix can then be decomposed into:  $r = 1..R$  orthogonal common factors, represented by the  $(R \times T)$  matrix  $\mathbf{F}$ ; as well as a  $(N \times R)$  matrix of coefficients  $\mathbf{P}$ ; and a matrix of idiosyncratic components  $\boldsymbol{\varepsilon}$ .

$$\mathbf{X} = \mathbf{P}\mathbf{F} + \boldsymbol{\varepsilon}$$

Every  $i$ th column of  $\mathbf{P}$  represents a series of “loading” coefficients, each one of which captures the impact of factor  $r$  on series  $i$ . The reduced number of factors  $R$  is not known a priori, so we determine this number statistically: the standard approach is to look at the largest eigenvalues of

the covariance matrix  $\mathbf{C}_x = \frac{1}{T-1} \mathbf{X}'\mathbf{X}$

, where the number of factors  $R$  is determined by the number of eigenvalues greater than one.<sup>28</sup> The loading matrix  $\mathbf{P}$ , then, is comprised of the  $R$  eigenvectors associated with these largest eigenvalues. The attached chart illustrates the eigenvalue distribution for our dataset, indicating that there are three key factors that explain the behavior of returns within the sample.



<sup>28</sup> A factor with an associated eigenvalue less than one would have less overall explanatory power than a single stock-market index by itself.

### *The Gravity Model*

76. **The chosen specification augments the standard gravity equation.** Explanatory variables include: (i) *distance*, measured by the direct distance between the two country's capitals; (ii) *cultural and historical factors*, such as common borders, common language and colonial links; (iii) *market size*, measured by the level of stock-market capitalization; and (iv) relative economic size, measured by the share of the smallest partner in the two countries' combined GDP. Geographical and cultural data is sourced from the Feenstra, Markusen, and Rose (FMR) dataset, available at <http://faculty.haas.berkeley.edu/arose/RecRes.htm>. Data on GDP and market capitalization are from the World Bank's WDI database. The sample covers indices from 30 stock markets<sup>29</sup> sourced from Morgan Stanley's US\$ MCSI indices. As with the principal component analysis, the model uses standardized weekly returns to eliminate any spurious correlation owing to non-synchronous trading hours. This dataset allows us to calculate 435 bivariate correlations for each year (1999-2007), generating a potential panel of 3,480 observations.

77. **The specification also takes care to allow for possible dynamics.** Noting the well-established finding that correlations between markets have tended to increase over the recent decade, the model includes a common time trend. And noting also that market volatility and correlation tend to cluster over time, the model allows for serial correlation in the dependent variable. The chapter focuses on whether the degree of correlation between CIS countries is systematically different from that of other countries, and therefore include a dummy variable that indicates whether both countries are CIS members. The model further allows for the possibility that this CIS effect may have changed over time, so also includes an interaction term to indicate whether the observation is from the second half of the sample. In addition, the model considers that correlations might be higher for economies that are similar, and so includes a variable that measures the relative disparity between the two countries' GDP (as represented by the relative share of the smallest partner). Finally, as correlations are bounded in the interval  $[-1, 1]$ , there is a potential for bias when observations take extreme values, so the dependent variable is reshaped according to a Fisher-Z transformation:

$$\sigma_{ij,t} = \log \left( \frac{1 + \text{corr}_{ij,t}}{1 - \text{corr}_{ij,t}} \right)$$

The transformed correlation between country  $i$  and country  $j$ ,  $(\sigma_{ij,t})$ , is thus contained in the new interval  $(-\infty, \infty)$ .

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<sup>29</sup> Sample countries include: Germany; Japan; United Kingdom; United States; Argentina; Brazil; Chile; China; Columbia; Czech Republic; Egypt; Hungary; India; Indonesia; Israel; Jordan; Korea; Malaysia; Mexico; Morocco; Philippines; Poland; Russia; South Africa; Thailand; Turkey; Venezuela; Ukraine; Kazakhstan; and Kyrgyzstan.

78. **In sum, the (transformed) bivariate correlation ( $\sigma_{ij,t}$ ) is modeled as:**

$$\sigma_{ij,t} = \rho\sigma_{ij,t-1} + \alpha_0 + \alpha_1\text{time} + \beta_1(\text{distance}_{ij}) + \beta_2(\text{size}_{i,t} \times \text{size}_{j,t}) + \beta_3(\text{GDPshare}_{ij,t}) \\ + \beta_4(\text{language}_{ij}) + \beta_5(\text{border}_{ij}) + \beta_6(\text{colony}_{ij}) + \beta_7(\text{CIS}_{ij}) + B_7(\text{CIS}_{ij} \times I_{T \geq 2004}) + \mu_{ij} + \varepsilon_{ij,t}$$

As mentioned, this is a panel-data model, so the specification allows for possible non-modeled country-pair effects via a fixed-effect term  $\mu_{ij}$ .

### Econometric Discussion

79. **The inclusion of a lagged dependent variable raises a number of econometric issues.** It is well known that dynamic panel estimators tend to be biased in the presence of fixed effects, as the estimated effect is correlated with the lagged dependent variable by construction, rendering the latter variable endogenous. The extent of the bias is of order  $O(1/T)$ , and so is not necessarily an issue for panel-data models with a long time-series. But our sample is moderately short, with  $T = 9$ , so this bias is a possible concern. Therefore, it is expected that, with a simple pooled-OLS estimator, the coefficient on the lagged dependent variable ( $\rho$ ) will tend to be biased upward. Sweeping away the fixed effect via the least-squares dummy variable (LSDV) estimator, on the other hand, does not get rid of the problem, but instead tends to bias the coefficient downward. Comparing the two estimators, therefore, provides a rough guide as to the plausible range for the unbiased estimate. From the attached table, it appears that the dynamic coefficient lies somewhere between 0.07 and 0.46.

80. **One way of addressing this dynamic-panel bias is to calculate the potential bias directly, and then correct the LSDV estimate.**

This is the approach suggested by Kiviet (1995) and Bruno (2005)<sup>30</sup>, and should provide unbiased estimates for the coefficients for all time-varying variables. Unfortunately, the LSDV estimator also sweeps away any time-invariant variables, such as distance, and so is unable to provide coefficient values

	Pooled OLS	LSDV
Dependent Variable: Bivariate Correlation (transform)		
Lagged correlation (transform)	0.455 [27.60]***	0.0734 [3.79]***
Common Language	0.0168 [0.61]	---
(Log) Distance	-0.0335 [-3.85]***	---
Time	0.0431 [13.28]***	0.0713 [11.93]***
Share of Smallest Partner	0.468 [9.37]***	-0.233 [-0.39]
(Log) Joint Market Capitalization	0.0568 [20.24]***	0.0543 [4.92]***
<i>Other variables not reported</i>		
Constant	-2.585 [-17.40]***	-2.559 [-4.65]***
Observations	3307	3307
t-statistics in brackets		
* p<.1, ** p<.05, *** p<.01		

<sup>30</sup> This methodology calculates the extent of the bias using a consistent, instrumental variables estimator, and then corrects the coefficient values derived from the LSDV estimator. Standard errors are bootstrapped.

for many of our geographical variables of interest. As an alternative, however, rather than purging any fixed effects, the “system-GMM” approach instead estimates the effects by building a series of orthogonal instruments from the entire dataset.<sup>31</sup> This estimator can thus provide coefficient values for time-invariant variables, and so is more useful for our purposes. Nonetheless, this approach often provides results that are implausibly precise,<sup>32</sup> especially for the more consistent two-step estimator, so we augment our analysis by applying the Windmeijer (2005) finite-sample correction to the system-GMM standard errors.

81. **Our preferred specification, therefore, is the two-step system-GMM estimator, with corrected standard errors.** Our results are outlined in main text, and include three separate estimators: Kiviet-corrected LSDV; uncorrected system-GMM; and system-GMM with corrected standard errors. The coefficients from all three approaches are generally comparable, with the Windmeijer correction resulting in a substantial upward revision in standard-error estimates.

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<sup>31</sup> We use the system-GMM estimator outlined in Blundell and Bond (1998), as implemented by the `xtabond2` procedure in Stata.

<sup>32</sup> Efficient GMM tends to underweight variables with high second moments, and also deemphasizes outliers.

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