INTERNATIONAL MONETARY FUND

CZECH REPUBLIC

Selected Issues

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I. Introduction and Overview

1. **This paper provides background on key issues of the consultation**. The first three chapters present an analysis of various aspects of population aging: its macroeconomic effects; impact on fiscal sustainability; and implications for private savings. The last chapter evaluates the monetary policy implications of capital account volatility—as the relative importance of portfolio flows increases.

2. **Chapter II simulates the macroeconomic effects of population aging in the Czech Republic using an overlapping-generations model**. It finds that aging can significantly weaken the outlook for economic growth and living standards. Although labor market reforms and technological progress can help mitigate the impact on growth, the budget burden of increases in old-age pensions and health care is likely to remain significant.

3. **This provides the backdrop for Chapter III, which evaluates the fiscal implications of aging using a generational-accounting framework**. It finds that the fiscal position is unsustainable in the long run under current policies. Systemic reform of both age- and non-age-related expenditures will be needed to restore sustainability. Fiscal adjustment needs to be implemented early to minimize its magnitude and ensure that a fairer generational balance is achieved in restoring fiscal sustainability.

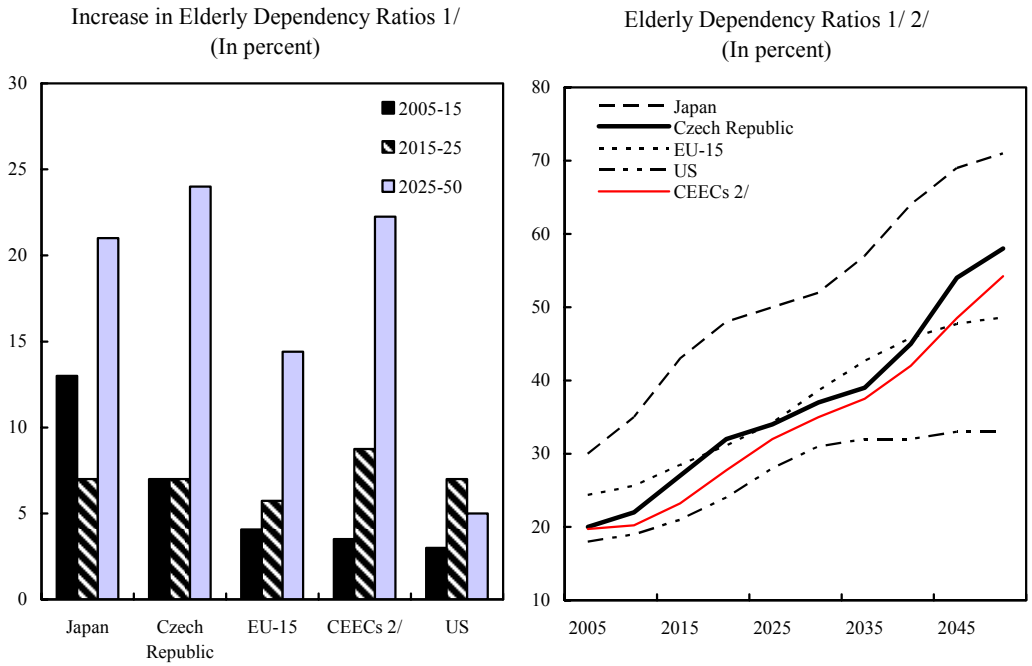
4. **Chapter IV explores household balance sheets in a comparative perspective**.The structure and level of financial assets and liabilities are affected by two main trends in the Czech Republic: convergence to the EU and population aging. Based on behavior observed in financially developed countries, this chapter concludes that households will likely need to shift their wealth from nonfinancial to financial assets. Moreover, the level of financial wealth is expected to increase—in line with overall wealth, and to help deal with the transfer of risks from the public to the private sector as the population ages.

5. **Financial flows in the Czech Republic show an increase in the volatility of direct and portfolio investment**. This trend is expected to continue, especially as the composition of FDI is likely to shift toward intermediate products and services with lower capital intensity than past FDI. Chapter V analyzes the monetary policy implications of this phenomenon based on a two-region version of the IMF's new Global Economic Model. The main conclusion is that monetary policy may need to become more responsive to address the macroeconomic variability arising from more volatile flows. However, the difficulty of forecasting the persistence of capital flows in real time calls for caution in responding actively to capital account shocks.

II. Macroeconomic Effects of Population Aging in the Czech Republic[1]

A. Introduction and Summary

6. **Population aging is set to affect the Czech Republic earlier and to a greater extent than many other advanced countries and regional peers**. Low fertility rates and rising longevity are causing a gradual decline in population growth and a shift in the age structure of the population toward a greater share of the elderly. Although a gradual process, population aging is proceeding faster in the Czech Republic than on average in the EU-15 and Central European countries (Text Figure). By 2050, the elderly will account for a higher share of the population than in the key comparator countries.



Source: United Nations.
1/ The ratio of the population aged 65 and above to the population aged 15-64.
2/ Average for Hungary, Poland, Slovakia, and Slovenia.

7. **Population aging is likely to have significant effects on the Czech economy and public finances**. A decline in the working-age population, which accompanies population aging, is likely to slow growth in real GDP and improvements in living standards. Although reforms to raise labor force participation and productivity growth can help mitigate these adverse effects, they are unlikely to eliminate the need for structural fiscal reforms. The budget is expected to come gradually under pressure from rising expenditures on pensions

[1] Prepared by Natalia Tamirisa and Hamid Faruqee.

and healthcare. Consolidation will be needed to preserve debt sustainability. The earlier it starts, the smaller will be the fiscal adjustment needed to close the fiscal gap.

8. **This chapter simulates the macroeconomic effects of population aging in the Czech Republic in an overlapping generations model**. The analysis is based on a small-open-economy model, sharing many of the features found in the Fund's global macroeconomic simulation model, MULTIMOD, but extended to incorporate demographic projections and life-cycle dynamics (Faruqee, 2002).[2] The chapter also examines a broad policy response to population aging, identifying trade-offs and synergies between fiscal and structural reforms.

B. Theory and Model

9. **The model is a dynamic general equilibrium system with forward-looking behavior and model-consistent expectations**. Consumption-saving behavior is based on Blanchard's (1985) model, where agents are assumed to have finite planning horizons. The production function is of the Cobb-Douglas form with capital and labor. Investment behavior is based on Tobin's q-theory, whereby the desired rate of investment exceeds the steady-state rate as long as the expected marginal product of capital is greater than its replacement cost. On the external side, import volumes depend on the main components of aggregate demand, and exports reflect the foreign import demand functions. Exchange rates and interest rates are linked by the interest parity condition. The real exchange rate equilibrates the goods markets and ensures consistency between flow relationships and consumers' desired rates of asset accumulation. International capital markets are assumed to be perfect, allowing the small open economy to borrow freely at the prevailing world interest rate. Government absorption is exogenous, and an endogenous aggregate tax rate ensures that the ratio of government debt to GDP converges to a target level.

10. **The key channel through which population aging affects the economy in this model is the life-cycle profiles of individuals' earnings** (Faruqee, 2002).[3] These profiles typically have a hump-shaped pattern: earnings rise, as young individuals enter the labor force and start gaining work experience, peak in middle age, and decline as individuals move into retirement. On the supply side, age-earnings profiles reflect changes in relative productivity and labor supply over an individual's working life. Changes in the age structure of the population affect aggregate labor supply through differences in relative productivity and individual labor supply. On the demand side, individuals are assumed to adjust their savings and smooth consumption based on their anticipated path of life-cycle income. Young individuals are net borrowers, because their current income is below their permanent income.

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[2] For more details on MULTIMOD, see Laxton and others (1998).

[3] For an application of the model to the analysis of population aging in other countries, see Faruqee (2002) and Faruqee and Mühleisen (2003).

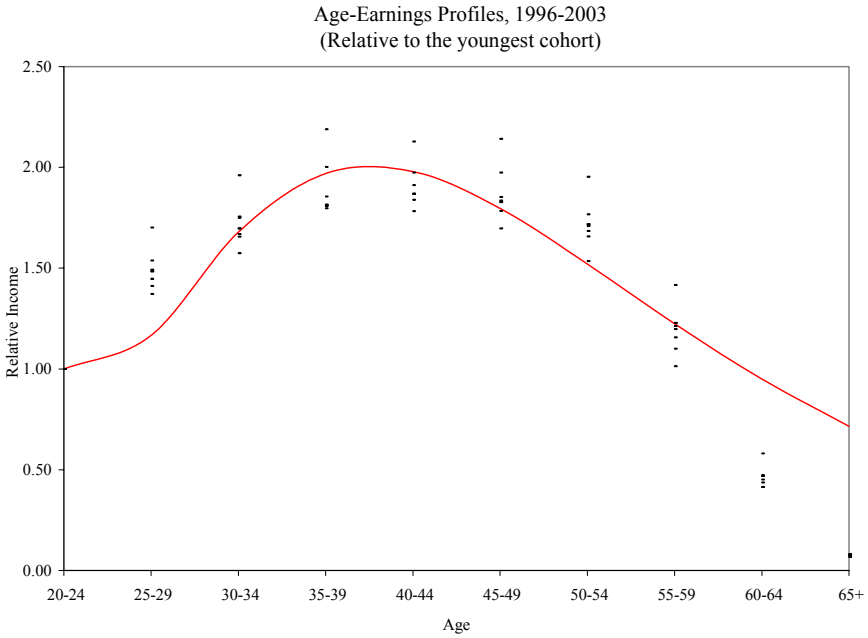
Mature agents, at the peak of their income potential, save in anticipation of retirement. The elderly also save in this model, given uncertainty about the lifetime.[4]

C. Calibration and Experiments

11. **The age-earnings profiles were estimated using the Czech Statistical Office's data on wage-based salaries by age cohort for the period 1996–2003**. The data on labor earnings were adjusted by the labor force participation rates and normalized relative to per capita earnings of the youngest working cohort.[5] The resulting cross-sectional age-earnings profiles were taken to represent the time-series pattern of individuals' relative earnings over their lifetime and were fitted to the following exponential function:

$$ry(s,t) = a_1 e^{-\alpha_1(t-s)} + a_2 e^{-\alpha_2(t-s)} + a_3 e^{-\alpha_3(t-s)}, \qquad (1)$$

where *ry* is relative labor income, *s* and *t* are cohort and time indices, respectively; and the difference $t - s$ is the age of a given cohort. This particular exponential form makes the model tractable and ensures a reasonable fit of the data. The first two terms are intended to



Source: Czech Statistical Office and IMF staff estimates.

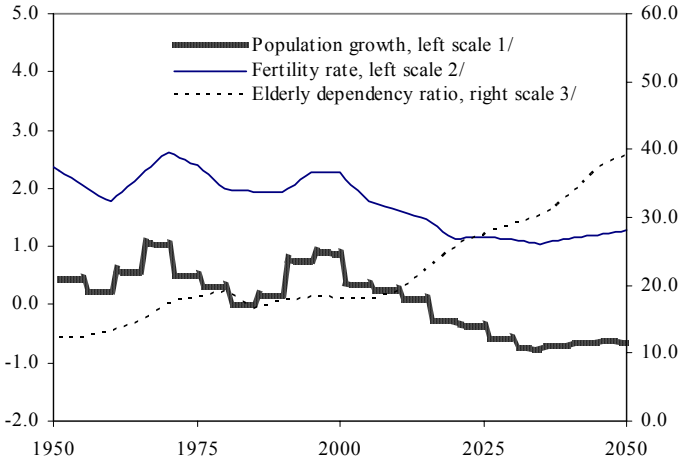
[4] This feature of the model is consistent with household survey data, which typically find positive savings rates for the old-age cohorts.

[5] We take the 20–24 year-olds to be the youngest working cohort. The labor force participation rates for the preceding, 15–19 year-old cohort are significantly below those for other working-age cohorts.

capture the change in an individual's labor supply (for example, the number of hours worked) over the lifetime. The last term reflects productivity gains associated with age and experience.[6] The fitted values are shown by the solid line in the text figure. Using the nonlinear least squares method, the parameter values in equation (1) were estimated to be: α_1=0.09; α_2=0.12; and α_3=0.10; all significant at the 5 percent level. The model assumes that the relative age-earnings profiles—and hence, these parameters—remain stable over time. However, to the extent that healthier individuals would choose to postpone retirement and remain active in the labor force, the current age-earnings profiles would flatten in the future, mitigating the negative impact of population aging on growth. In this study, the potential overestimation bias is alleviated by the fact that the fitted profiles are flatter for the old-age cohorts than the actual profiles based on the historical data.

12. **Demographic projections are based on World Bank data**. The main factor underlying population aging trends is the decline in fertility rates over the last half a century: from 2.69 children per woman in 1950–55 to 1.17 in 2000–05. The World Bank's projections assume that the fertility rate will stabilize around 2015 and then rise gradually to the replacement rate, leading to a stationary population by 2100. Under these projections, the elderly dependency ratio will peak in 2060 and then gradually stabilize by 2090. The assumption that the elderly dependency ratio will stabilize at some point in the future is essential for ensuring the stability of the model. From the policy point of view, however, the choice of the demographic projections is less relevant, since the analysis in this chapter focuses on the period to 2050, and for this period the World Bank projections are broadly similar to those of the authorities

Demographic Projections, 1950-2050
(In percent, in terms of the adult population)



Source: World Bank, United Nations, and IMF staff estimates.
1/ Year-on-year percent change in population aged 20 and above.
2/ Year-on-year percent change in population aged 20-24 years.
3/ The ratio of population aged 65 to the population aged 20-64.

[6] There are restrictions on the coefficients in equation (1), for example, $a_1 + a_2 + a_3 = 1$. These restrictions are intended to generate non-negative hump-shaped profiles, which are normalized to unity for the youngest cohort (for which $s = t$). For more details, see Faruqee (2002).

and the United Nations.[7] The demographic projections assume zero net migration, consistent with the historical data and the baseline assumption that current policies will continue.[8] To ensure compatibility of the demographic data with the theoretical structure of the model, we redefine the key demographic rates with respect to the adult population. The declining fertility rates imply that fewer young workers enter the labor force, and the adult population declines. As the share of the working-age people in the adult population falls, the share of the elderly rises (Text Figure).

13. **The baseline was calibrated to reflect the key relevant features of the Czech economy in a long-run steady state**. Real GDP growth in the Czech Republic is assumed to converge to that in the EU-15, taken to be about 2 percent per year.[9] The population is assumed to remain stationary in the baseline, and hence the long-run per capita GDP growth also equals roughly 2 percent. Consumption is assumed to be inelastic with respect to the interest rate, i.e., the intertemporal elasticity of substitution is small (0.4), while the rate of time preference is taken to be 2½ percent. As regards investment, a fixed equity risk premium is added to yield a reasonable capital-output ratio equal to 3. The long-run real world interest rate is assumed to be 4 percent. The initial level of public debt is about 25 percent. Note that since the model simulates the effects of population aging in *relative* terms—as percent deviations from the baseline—the simulation results are fairly robust to the baseline assumptions.

14. **Simulations focus on the macroeconomic effects of a population aging shock relative to the baseline of a stationary population**. We first consider population aging under current policies, and then assuming that fiscal and structural policies are adjusted to offset the adverse effects of population aging:

- ***Demographic shock***. We assume that the elderly dependency ratio rises relative to the baseline of stationary population in line with demographic projections. By 2050, the elderly dependency ratio increases by about 12½ percent compared to the baseline of a stationary population. This increase reflects a gradual decline in the fertility rate and a rise in longevity (a decline in the mortality rate).

- ***Fiscal consolidation***. First we assume that consolidation is delayed by about 10 years, from 2020 to 2030; during this time, the government finances rising age-

[7] The authorities' analysis of long-term fiscal sustainability is based on the demographic projections prepared at the Charles University (available at www.reformaduchodu.cz).

[8] Net migration flows are relatively small in the Czech Republic: less than ⅛ percent of the population during 2000–04. See the data provided by the Czech Statistical Office at www.czso.cz.

[9] For recent potential growth estimates in the EU, see Chapter I in EC (2004).

related expenditures through borrowing. Next we consider a scenario where the government does not take any special consolidation measures and finances the increase in age-related expenditures exclusively through borrowing.

- ***Labor market reforms and technological change***. Factors related to labor market reforms and technological change are assumed to augment growth in the effective labor supply (i.e., in productivity-adjusted terms) by an average rate of ⅓ percent per year during the next 50 years (thereafter, the effective labor supply is assumed to gradually return to the baseline level). This boost to growth can come from several sources: (i) ⅓ percent growth in the number of workers owing to an increase in the labor force participation rates,[10] (ii) a labor-augmenting technological change raising labor productivity growth by ⅓ percent per year; (iii) ⅓ percent annual growth in the number of hours worked; or a combination of these sources amounting to ⅓ percent increase in annual growth in the effective labor supply during 2005–55. The needed increases in labor productivity and labor supply are significant (amounting to a cumulative increase of 17½ percent in the effective labor supply by 2055), and would require designing comprehensive and consistently effective reform strategies.[11]

D. Simulations

15. **Population aging is estimated to reduce GDP growth in the long run compared to the baseline scenario of a stationary population**. By 2050, the level of real GDP is projected to decline by about 30 percent (relative to the baseline without demographic change); this amounts to an average reduction of more than ½ percentage point per year in trend growth (Figure 1). With the composition of the labor force shifting toward a larger share of the elderly, the productivity-adjusted labor supply falls by more than the number of workers. As a result, real GDP per capita also declines in the long run relative to the baseline, albeit to a lesser extent (i.e., by 15 percent relative to the baseline by 2050 or about ⅓ percent per year on average). Under these estimates, growth of total and per capita GDP will remain positive in absolute terms. Additional age-related expenditures are assumed to be covered through borrowing and increases in direct taxes. Public debt approaches 60 percent of GDP by 2050, and a permanent tax revenue increase of about 6 percent of GDP would be needed to maintain the debt ratio on a sustainable path. The current account deficit start to widen after 2050.

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[10] In the model, the increase in the effective labor supply can also result from immigration, provided immigrants are of the working age and are at least as productive as the resident population.

[11] See *Czech Republic—Selected Issues* (IMF Country Report No. 04/265) for a discussion of labor market reforms.

16. **The transmission dynamics of a population aging shock are characterized by a two-stage process**. The stages reflect the relative strength of the two factors driving population aging: rising longevity and declining fertility rates (Figure 1):

- Initially, until 2015, the effect of rising longevity outweighs that of lower fertility rates, and the adult population and the effective labor supply increase. Output increases by about 3 percent relative to the baseline, as investment and capital-labor ratios increase. Savings rise in line with output and for precautionary reasons, because individuals anticipate continued population aging. The ratio of the current account to GDP narrows by about 2 percent by 2015. Social security expenditures initially rise at a moderate rate; relative to GDP, they are less than 1 percent higher in 2015 than in 2005 relative to the baseline without the demographic change. This increase is fully financed through borrowing. The rate of growth in public debt is moderate until the late 2010s, with debt rising by about 5 percent relative to GDP.

- As the population aging shock continues to unfold, the effect of lower fertility rates starts to dominate. From around 2015, the effective labor supply starts to decline. Interest rates rise, as savings and investment decline with output. In the early 2020s, total and per capita GDP start decline. Growth of social security expenditures and public debt accelerates, requiring the government to start raising taxes around 2020 to close the financing gap and preserve debt sustainability. The current account deficit continues to narrow until about 2030, as investment falls. Thereafter, this trend reverses as the decline in savings starts to outpace the decline in investment.

17. **A delay in fiscal consolidation accelerates the accumulation of public debt and raises the cost of adjustment**. If the government delays consolidation by 10 years, to 2030, the fiscal gap would need to be closed through government borrowing. Public debt reaches the targeted level earlier, by 2030 instead of 2050 (Figure 2). The magnitude of the fiscal adjustment needed to close the gap is larger in this case, reflecting higher debt-servicing costs. If consolidation does not take place at all, the debt ratio reaches 60 percent by 2030, and the fiscal position becomes unsustainable in the long run (Figure 3).

18. **Labor market reforms or boosts to labor-augmenting technological change can help offset the adverse impact of population aging on growth and welfare** (Figure 4). An increase in the effective labor supply by about 17½ percent by 2050 would largely neutralize the welfare implications—as measured by GDP and consumption in the per capita terms—of the increase in the elderly dependency ratio. Labor market reforms and/or a labor-augmenting technological change would also reduce the need for the fiscal adjustment relative to GDP by about 2 percent. Yet, the needed fiscal adjustment would remain significant—about 4 percent of GDP in 2050.

19. **The qualitative conclusions are robust to demographic projections and alternative assumptions on consolidation policies**. The results are quantitatively sensitive to alternative demographic projections, with growth and fiscal effects being proportional to the increase in the elderly dependency ratio. However, for a reasonable range of

demographic projections, such as the United Nation's high and low variants, for example, the simulated effects of aging on growth and public finances remain broadly similar.[12] In addition, the results are somewhat sensitive to the assumption on how the fiscal gap is closed. Our simulations assume that the fiscal gap is closed through an increase in direct taxes. This is the most conservative assumption, as the distortionary effects of a direct tax increase on saving and labor supply are likely to be higher than those for indirect taxation and cuts in social security benefits. Under such alternative assumptions, the estimated impact of population aging on growth would be smaller than in the simulations presented in the paper, but, for reasonable values, remain significant.

E. Conclusion

20. **Aging weakens the outlook for economic growth and living standards and puts pressure on public finances**. It is comforting that the adverse impact on growth can be largely mitigated through what appears to be an achievable increase in labor force participation rates and a labor-augmenting technological change. Yet, even with extensive structural reforms, significant fiscal consolidation will be needed to ensure long-term debt sustainability.[13] The earlier consolidation starts and the deeper are the accompanying structural reforms, the smaller the needed fiscal adjustment will be. To mitigate the macroeconomic effects of population aging, private savings need to adjust in preparation for aging. Such an endogenous response is assumed in the model, but in practice it will be conditional on good foresight on the part of individuals and well-functioning financial markets for long-term savings.[14]

[12] UN (2004).

[13] See Chapter III for a detailed analysis of fiscal policy responses to population aging.

[14] Chapter IV examines the extent of adjustment households need to make in their balance sheets to prepare for population aging.

REFERENCES

Blanchard, O., 1985, "Debt, Deficits, and Finite Horizons," *Journal of Political Economy*, 93, pp. 223–247.

Czech Statistical Office, "*Statistical Yearbook of the Czech Republic*," various years.

European Commission, 2004, "*The EU Economy: 2004 Review*."

Faruqee, H., 2002, "Population Aging and Its Macroeconomic Implications: A Framework for Analysis," *Working Paper* 02/16 (Washington: International Monetary Fund).

Faruqee, H., and M. Mühleisen, 2003, "Population Aging in Japan: Demographic Shock and Fiscal Sustainability," *Japan and the World Economy*, 15, pp. 185–210.

International Monetary Fund, 2004, "How Will Demographic Change Affect the Global Economy," *World Economic Outlook*, September (Washington: International Monetary Fund).

Laxton, D., and others, 1998, "MULTIMOD Mark III: The Core Dynamic and Steady-State Models," *Occasional Paper* 164 (Washington: International Monetary Fund).

United Nations, 2004, "*World Population Prospects: The 2004 Revision Population Database*," available at www.esa.un.org.

Figure 1. Macroeconomic Effects of Population Aging
(Deviations from stationary-population baseline levels)

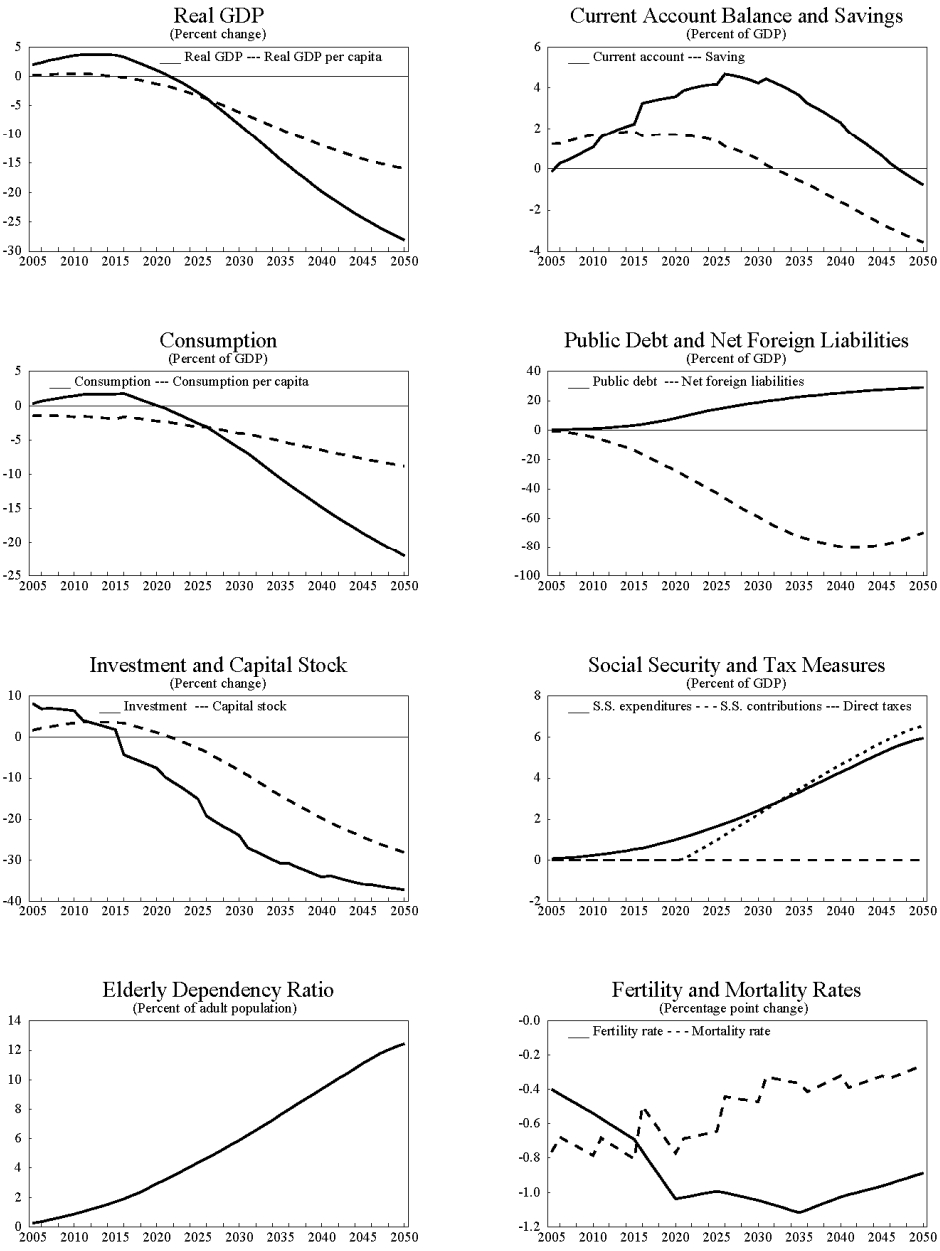


Figure 2. Delayed Fiscal Consolidation
(Deviations from stationary-population baseline levels)

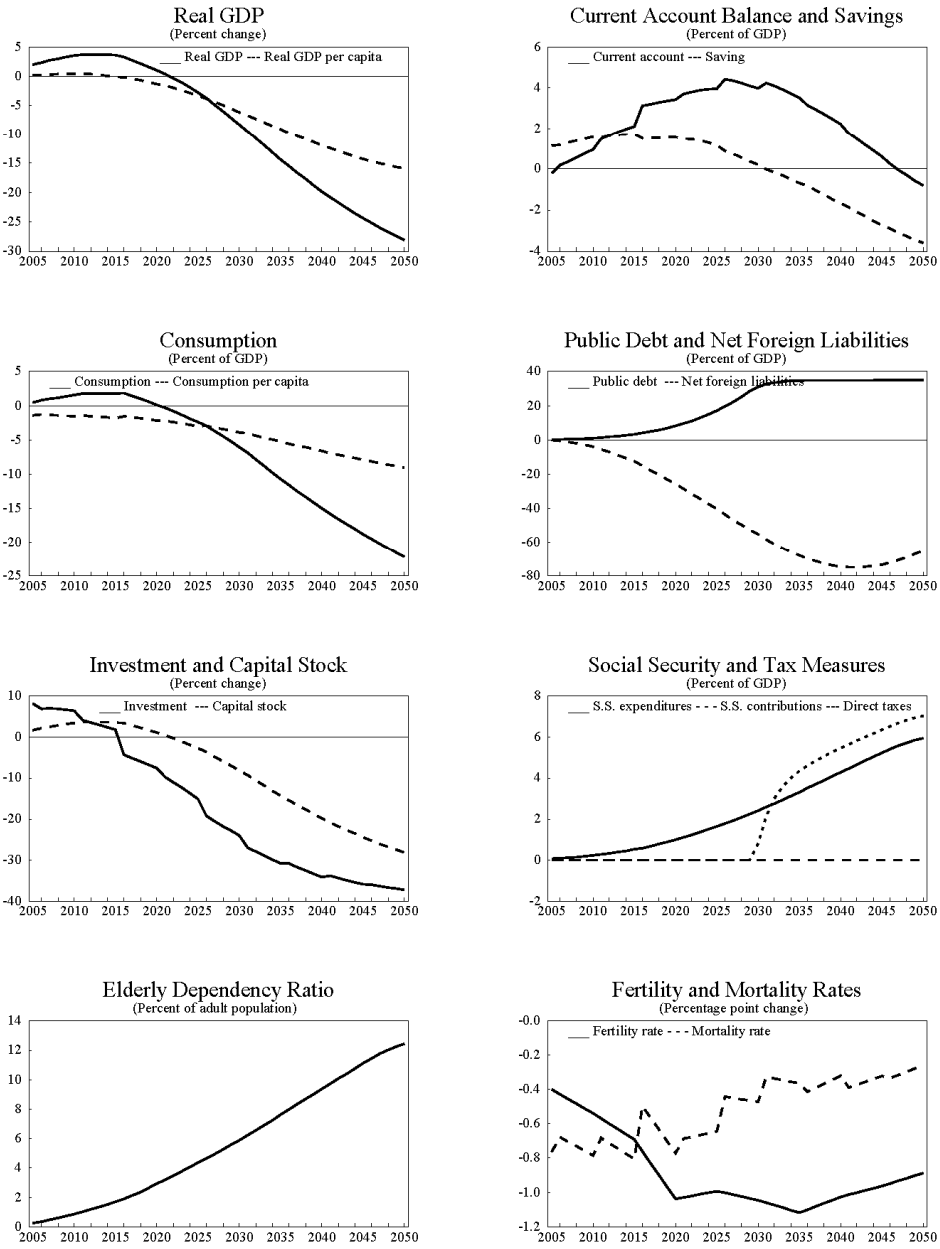


Figure 3. No Consolidation Scenario
(Deviations from stationary-population baseline levels)

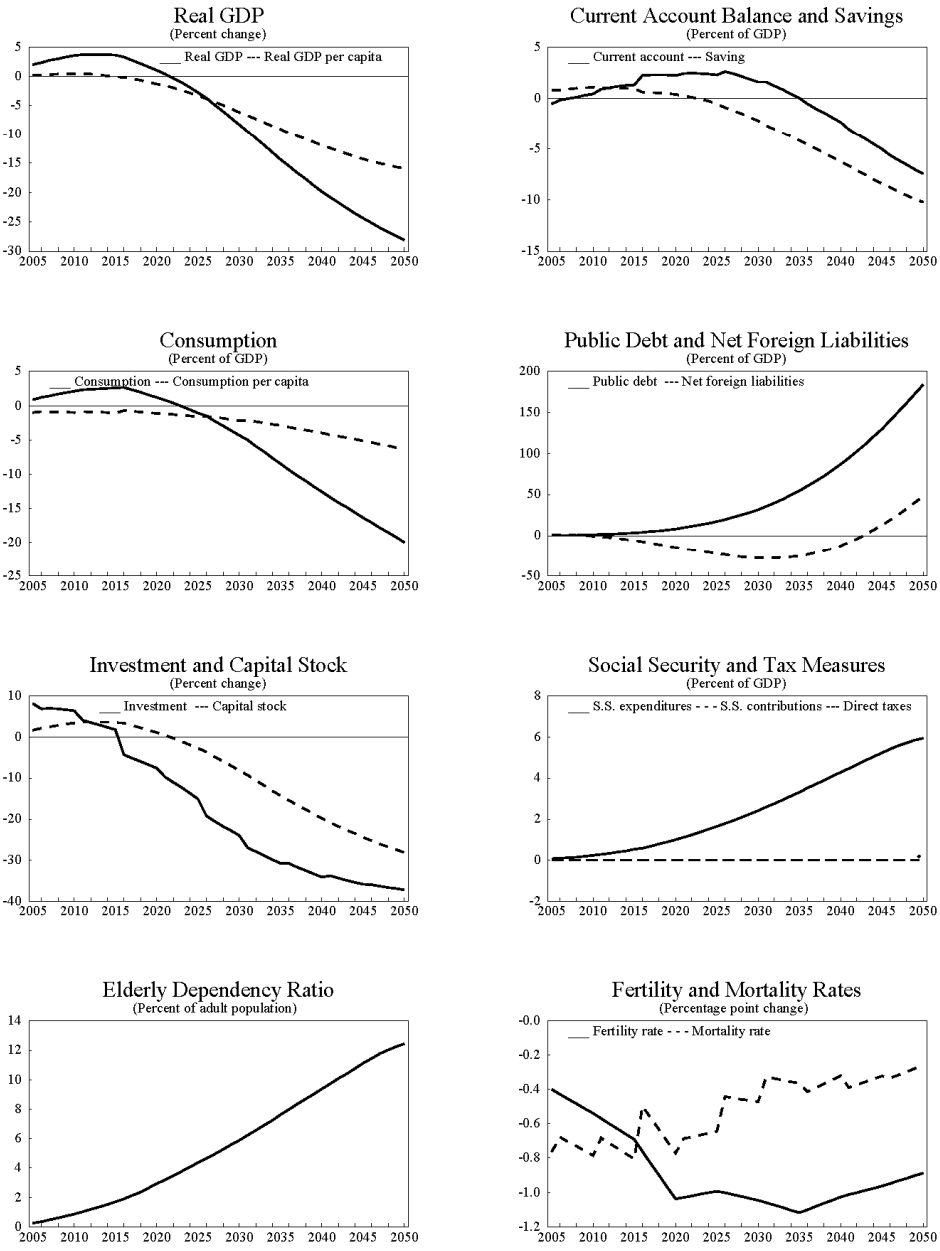
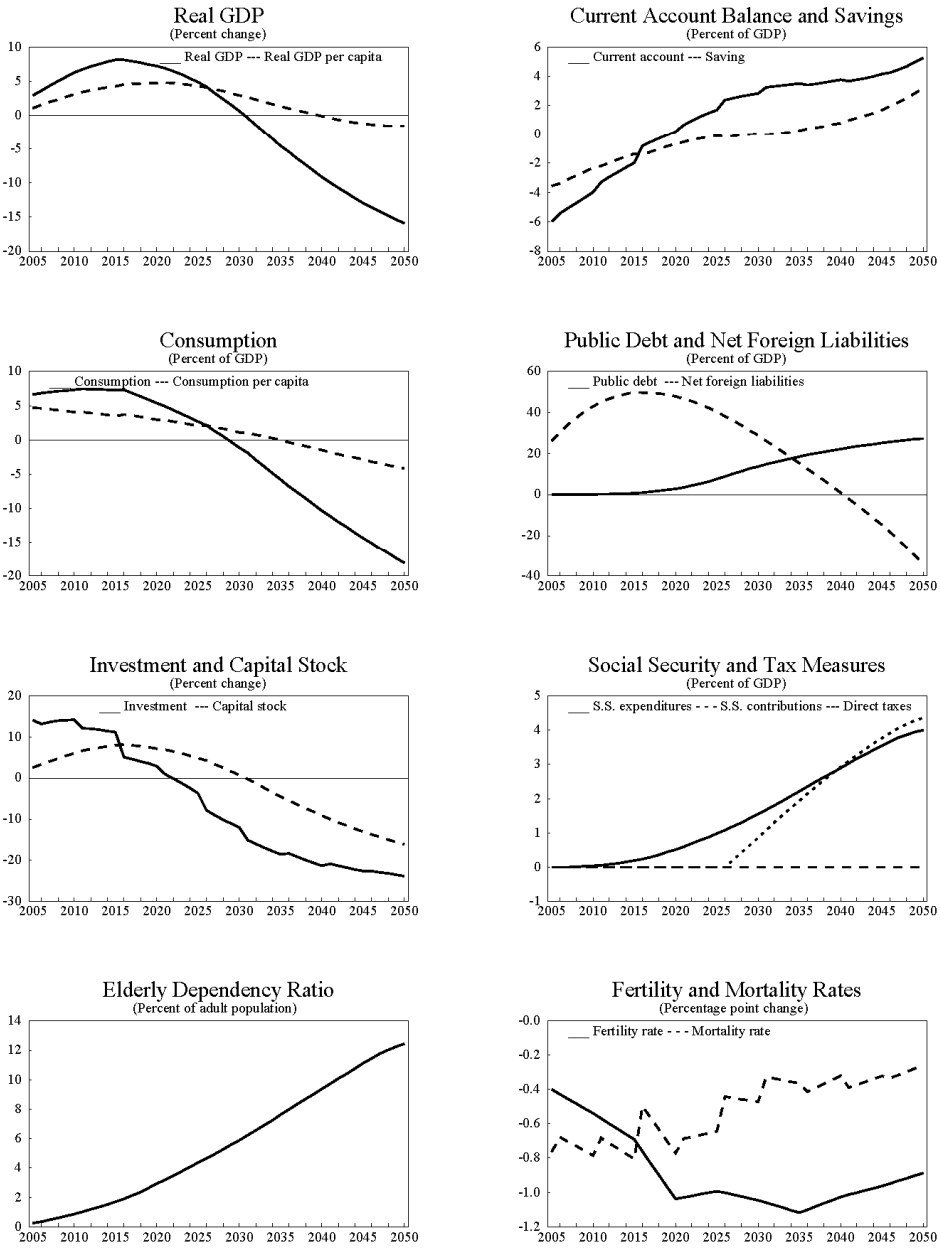


Figure 4. Labor Market Reforms and Labor-Augmenting Technological Change
(Deviations from stationary-population baseline levels)



III. Impact of Aging on Fiscal Sustainability in the Czech Republic[15]

A. Introduction

21. **The Czech Republic is projected to age at one of the fastest rates among the OECD countries**. This demographic trend is expected to put significant pressure on age-related spending over the coming decades. Furthermore, a decline in productivity growth from its current high rates will adversely impact income taxes and social contributions. As a result, the rising deficits are expected to push debt to unsustainable levels. This fiscal outlook is further dimmed by the generous eligibility conditions for public benefits provided by the existing system, which encourages withdrawal from the labor market and dampens growth prospects.

22. **Staff projections show that, in the absence of reforms, the social benefits system will place severe demands on public finances**. Under current policies, the relatively low debt position will quickly worsen, and it is estimated that taxes would need to increase by over 10 percent of GDP, in net present value terms, to meet the fiscal solvency constraint. In order to achieve a target debt-to-GDP ratio of 60 percent in 2050—a less stringent requirement, given rising deficits—taxes would need to increase by around 6 percent of GDP.[16]

23. **This chapter seeks to assess the long-run sustainability of current policies and the impact of reform scenarios**. In addition, it also aims to examine the generational burden of fiscal policies. The chapter is organized as follows: section B provides a background on the current fiscal policies, including the pension and health care system, and the demographic developments. Section C describes the model for the long run projections, the assumptions used, and the results. Section D discusses conclusions and policy implications.

B. Background

Current fiscal situation

24. **The current fiscal position of the Czech Republic is relatively favorable**. General government debt at around 25 percent of GDP, in *Government Finance Statistics* terms, is still low. Near-term fiscal policy is anchored by a medium-term budgetary framework which

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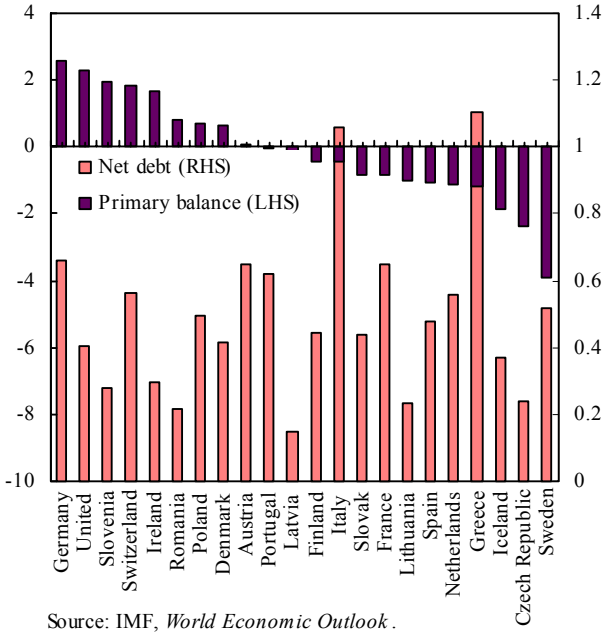
[15] Prepared by Anita Tuladhar. The author would like to thank Roberto Cardarelli, Lawrence Kotlikoff, James Sefton, and Natalia Tamirisa for their kind assistance with the program, and seminar participants at the Czech National Bank and European Department for useful suggestions.

[16] As part of the Convergence Program (Ministry of Finance, 2004), fiscal reform measures have been identified and partially implemented. The authorities estimate that if these reform measures are fully implemented, in order to achieve the target debt of 60 percent by 2050, an additional adjustment of 5 percent of GDP will be needed. Under a more pessimistic scenario, if the reforms are not implemented, a 10 percent adjustment will be required.

targets a general government deficit of 3 percent of GDP in 2008, in line with the Maastricht deficit criterion. Current age-related spending, comprising pensions, health care and education, is at around 20 percent of GDP, which is comparable to other European countries.

25. **Despite this benign outlook, there are underlying vulnerabilities which could lead to a rapid buildup of debt**. A significant share of large outstanding guarantees is considered to be high risk. Privatization revenues, which have been used to finance bank and public enterprise restructuring costs, will soon dry up and the government will need to increasingly rely on market borrowing. With the primary deficit among the highest in the European Union (Figure 1) and a large share of mandatory expenditures, fiscal consolidation and increased budget flexibility is paramount to avoid a rapid increase in debt and create the budgetary room for looming age-related expenditures.

Figure 1. Fiscal Indicators
(In percent of GDP, 2004)



Source: IMF, *World Economic Outlook*.

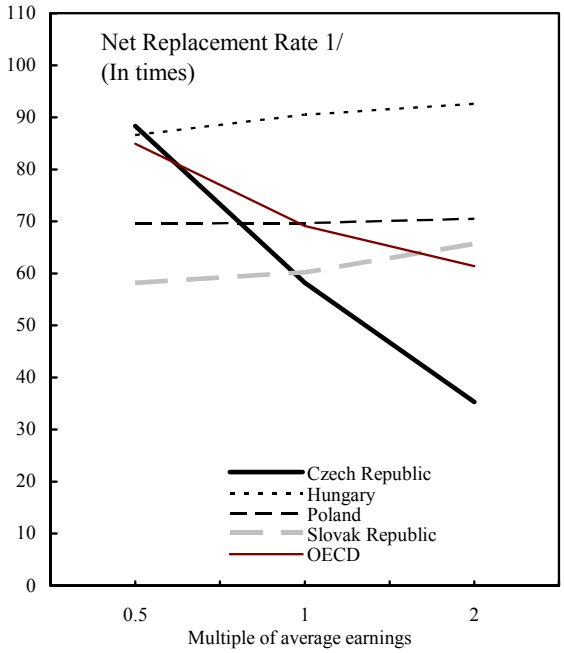
26. **Publicly financed pensions and health care account for the bulk of the age-related expenditures in the Czech Republic**. The pension system consists of a mandatory, pay-as-you-go insurance (1st pillar), and voluntary private supplemental insurance (3rd pillar). But private pensions have had limited success, and with assets of only about 3 percent of GDP, they function largely as a state subsidized savings scheme. The health care insurance system provides universal and near comprehensive coverage with no co-payments and a public price-setting mechanism. Private health insurance is virtually nonexistent.

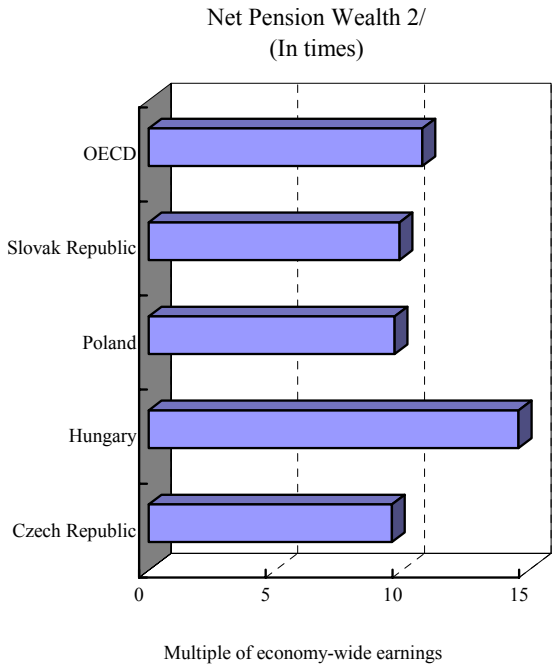
Pensions

27. **The public pension system is a mandatory, defined-benefit, social insurance scheme, which has been successful in achieving high coverage and redistribution at a relatively low cost**. The pay-as-you-go scheme covers old-age, full and partial disability, and survivors' benefits, provided through a combination of flat rate and earnings-related benefits. While the level of benefits is not overly generous, the scheme has achieved high coverage and redistribution, as indicated by the relatively low pension wealth and net replacement rates which decline with wage levels (Figure 2). Pension benefits are indexed, at a minimum, to consumer price inflation and a third of real wage rate growth, while the assessment base for new pensions is indexed to wages. In 2000, pension expenditure was around 11 percent of GDP, of which old-age expenditures comprised almost 8 percent of GDP, close to the OECD average. Following reform measures in 2003, the pension system recorded a modest surplus in 2004 (Kraal, 2005; and MLSA, 2004).

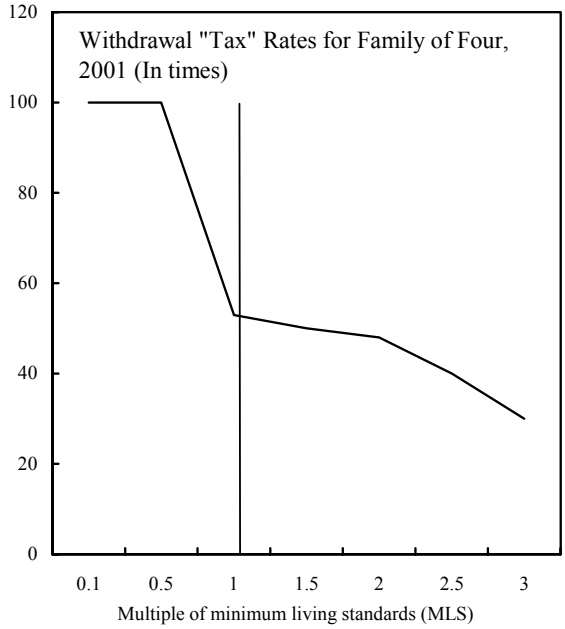
Figure 2. Pension System Indicators

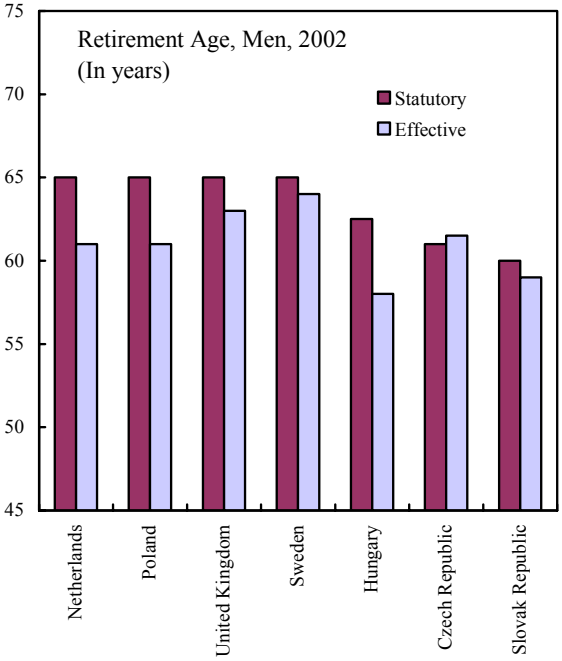
Pension benefits are highly redistributive, and moderate by international comparison...





...but provide incentives to withdraw from the labor market.





Sources: OECD (2004); and OECD (2005).

1/ For mandatory pension program, men.

2/ Present value of pension entitlement.

28. **Despite these achievements, the pension system has drawbacks which will compound the financial pressures arising from population aging**. The statutory retirement age (61 currently, 63 for men by 2013) is already low by comparison to most European and OECD nations. Current policy has encouraged an even earlier exit from the workforce by providing generous eligibility criteria for pension benefits, particularly among low-wage earners. Pension benefits combined with other social benefits have resulted in a net replacement rate of around 100 percent among low-wage earners. Among the current cohort of retirees, around 40 percent have chosen early retirement. This phenomenon partly reflected strong incentives provided by generous early retirement schemes, but disability pensions, providing comparable benefits to old-age pensions, were also one of the main pathways to retirement. With longevity expected to increase in the future, disincentives to work among the elderly would have an adverse impact on pension system viability.

Health care

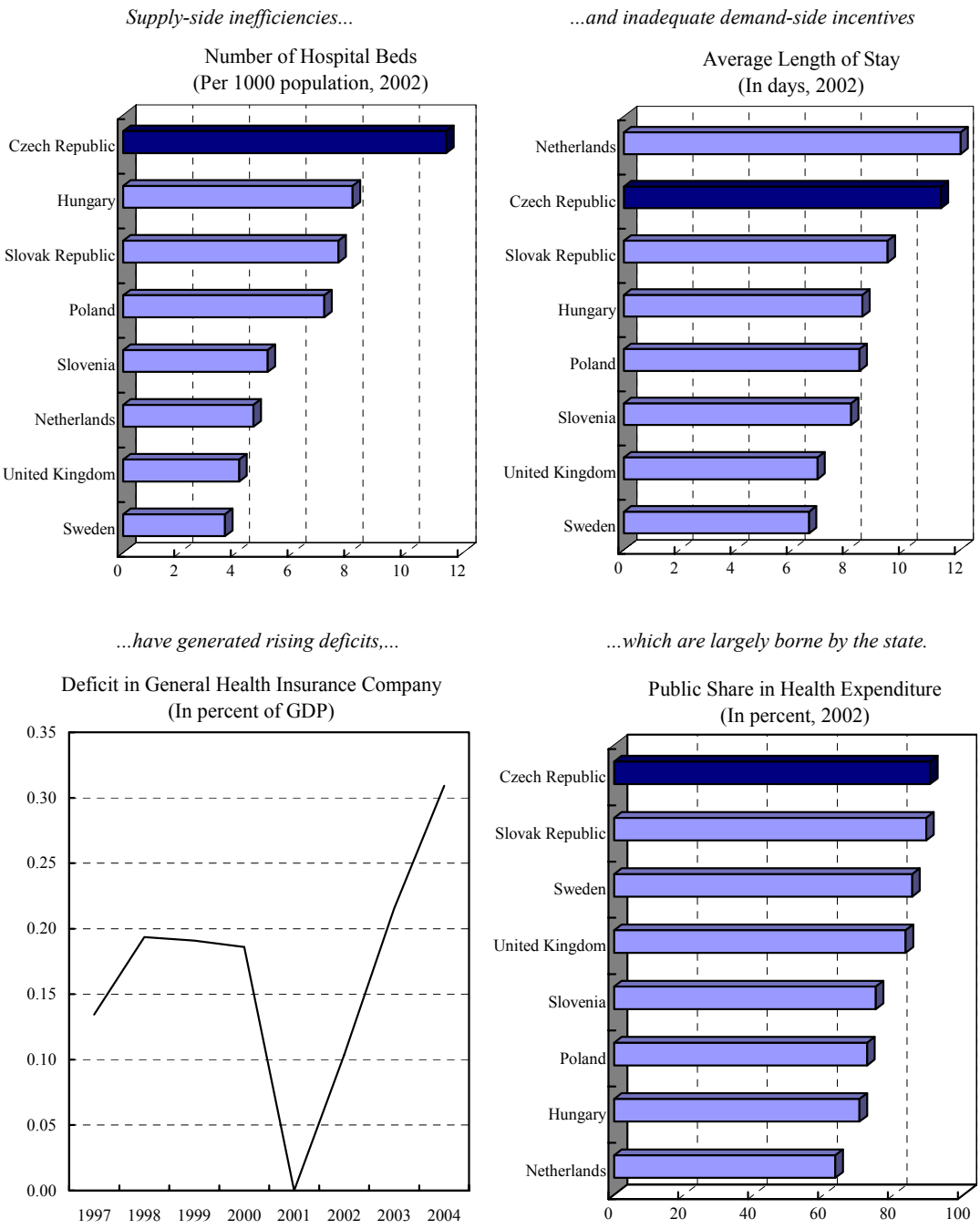
29. **The Czech health care system is a largely public-funded network providing generous access to services**. Individuals, employers, and the state[17] contribute to a mandatory, employment-based insurance system. The public has the choice of the health insurance fund and the provider, which includes a public/private mix of hospitals and physicians. The government supervises, and also has the final authority over the negotiation of contracts between insurance funds and providers, specifying benefits coverage, fee structure and reimbursements. The state also acts as the guarantor of the system (EOHCS, 2000).

30. **The system has been facing financial strains**. Beneficiaries are not required to make co-payments for most services, and reimbursements are provided for specialist care on a fee-for-service basis. These features have created strong demand for services without adequate incentives for rationalization of service delivery and cost containment, resulting in high utilization rates, as reflected in the higher-than-average in-patient admissions per capita and length of hospital stay (Figure 3). Furthermore, the legacy of a planned economy remains, with excess capacity in hospitals and excess supply of number of specialist care providers. Reimbursements to hospitals by the health insurance companies have been insufficient to cover the costs of these services, and the underfunded health insurance companies have mounting deficits, requiring repeated bailouts by the budget.

31. **Although health care expenditures are moderate, costs are rising rapidly and health care services need significant reconfiguration to prepare for the demands of elderly care**. Health care expenditures on a per capita basis is in line with regional and EU standards. But the demand for pharmaceuticals and technology use has been rising rapidly,

[17] The budget covers for the "state insured" comprising unemployed, pensioners, dependents up to the age of 26, students, women on maternity leave, military, prisoners and people on social welfare. They constitute almost 53 percent of the population.

Figure 3. Health Sector Indicators



Sources: National authorities; OECD; and Chawla (2005).

consistent with rising incomes. Combined with escalating prices, this has resulted in a sharp increase in expenditures. A high number of hospital beds are devoted to acute care rather than long-term care, and with shifting demographics, resources would need to be diverted towards long-term elderly care.

32. **Going forward, the already high social security contribution rate puts the onus of the adjustment burden on entitlement reform**. The current social contribution rate for pensions, sickness and employment insurance is 34 percent. With employers paying a large share, the tax wedge is relatively large.[18] Further increases would not be desirable as they would discourage labor force participation and dampen growth. Reforms thus need to focus on benefits to restore sustainability.

Demographic and labor market trends

33. **The demographic shift in the Czech Republic is set to change the fiscal position significantly**. The authorities project the population[19] to decline, starting around 2020, and the elderly dependency ratio to increase from around 20 percent in 2003 to over 50 percent in 2050 (Figure 4). [20] The resulting increased demand on the pension and long-term care benefits combined with a shrinking contribution base will put significant pressure on the budget. In addition, a decline in the labor force and output growth will lower revenues and adversely affect the fiscal balance.

34. **Current labor market trends pose additional challenges**. Labor force participation ratios have been declining, although this is in line with regional trends. Currently, there is a high inactivity rate among the elderly and women (Figure 4), and this tendency will increase the fiscal burden as more people reach retirement age. Increased labor force participation will require a more flexible work environment, including improvements in part-time employment, which is among the lowest in OECD countries.

35. **To meet these challenges, a concerted reform effort is needed to mitigate the fiscal burden while encouraging labor force participation**. Important steps have already been taken. Incentives to claim sickness benefits have been revised by lowering the benefit amount and increasing burden sharing with employers. A generous early retirement scheme has been eliminated. Reform proposals under discussion consider a combination of an

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[18] Income tax plus employee and employer contributions in the Czech Republic was 43.8 percent of labor costs in 2003, compared to the OECD average of 36.5 percent.

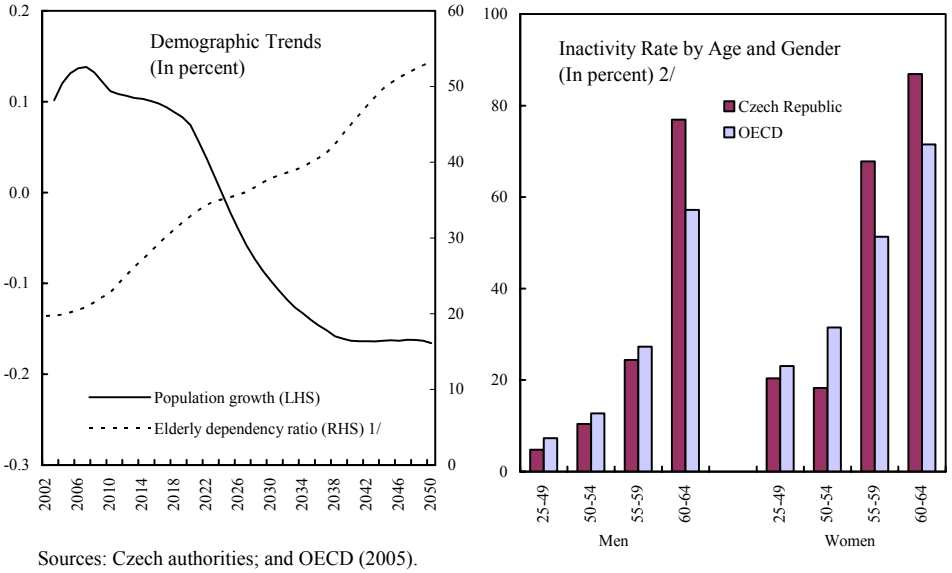
[19] Demographic projections by Charles University, which are used by the Pension Reform Committee, are based on the assumption of life expectancy increasing from 72.8 years to 82 for men and 79.2 years to 86.7 for women, fertility rates increasing from 1.23 births to 1.64, and net migration rate increasing from 22.8 persons (per thousand) to 25.4, between 2005 and 2050.

[20] See Chapter II for a more detailed description of aging trends and cross-country comparisons.

increase in retirement age, changes in pension benefit indexation, and an introduction of a Notionally Defined Contribution System. Other proposals also consider maintaining a minimum flat rate and opt-out provisions to private pensions.

Figure 4. Demographic and Labor Market Indicators

The elderly population, which tends to exit from the labor market early, will rise significantly, leading to a decline in the labor force participation rate.



Sources: Czech authorities; and OECD (2005).

1/ Population aged 65 and over divided by the working-age population aged 15-64.

2/ Population not employed divided by the total population.

C. Fiscal Sustainability: Long-Run Projections

36. **This section assesses the long-run fiscal outlook under current policies and projected demographic trends, and evaluates the possible impact of some reform scenarios**. It provides estimates of the fiscal gap as a measure of the adjustment needed to bring debt to a sustainable path, and the cost of delay in reforms.

Model assumptions

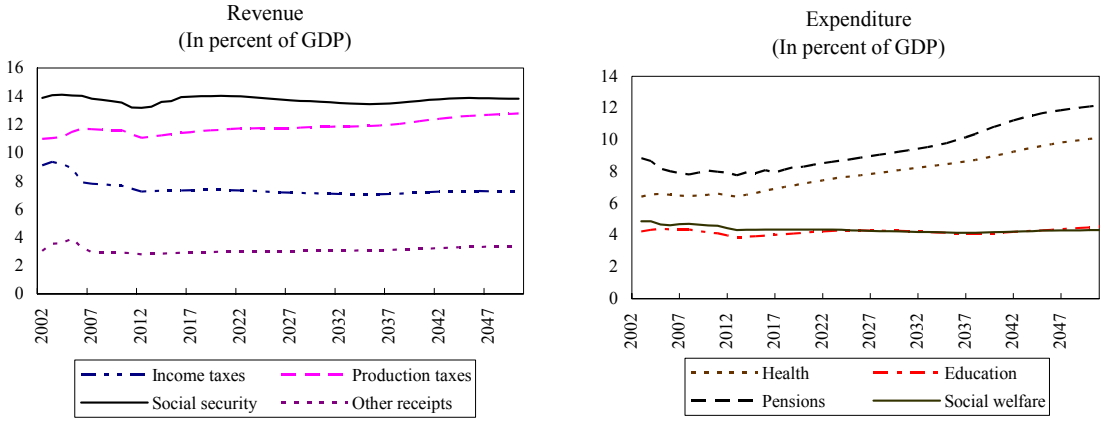
37. **The analysis is based on a generational accounting model** (see appendix for details on model description). This methodology has been frequently used to assess the long-run fiscal sustainability and the generational burden of policies (Cardarelli, Sefton, and Kotlikoff, 2000; Cardarelli and Sartor, 2000; and UK HM Treasury, 2004). The framework uses age and gender profiles that provide the distribution of taxes and transfers across age cohorts, by gender, for a given year. These profiles, used in conjunction with the population data and aggregate taxes and transfers in that year, provide estimates of the average taxes and transfers paid per person. The average per capita taxes and transfers, aside from pensions and health care, are assumed to grow in line with labor productivity. The long-run evolution of the aggregate taxes and transfers is thus projected based on assumptions of productivity growth and population changes (Box 1).

Baseline scenario

38. **In the baseline scenario, age-related expenditures are expected to rise considerably while revenues decline**. On the revenue side, income taxes and social security contributions, assumed to grow on a per capita basis at the same rate as productivity growth, decline. Since this reflects the shrinking working-age population, the decline as a share of GDP is marginal. Production taxes, such as the value-added and trade taxes, also assumed to grow in line with productivity growth, increase as a share of GDP, since consumption by the elderly population is expected to stay high.

39. **On the expenditure side, pensions and health care expenditures are expected to rise by over 7 percent of GDP** (Figure 5). These costs are not offset by the savings from education and social benefits. For existing pensions, the real per capita pension growth is based on the assumption of partial indexation to wages. For new pensions, it is assumed that valorization of the assessment base growth is 55 percent, approximating the net replacement rate for new pensions of an average wage earner. The authorities predict that with current policy—indexation of basic pensions to wage and of pension payments to inflation and one-third of wage growth—total pension expenditure will rise by over 5 percent of GDP by 2050. Health expenditures are expected to grow at a rate slightly above (0.25 percent higher) wage growth, reflecting the high income elasticity of demand and rising costs of pharmaceuticals and advanced medical technologies. This assumption is close to the historical growth rate of health care (around 5 percent in 1999-2003, in real terms, deflated the changes in longevity

Figure 5. Long-Run Projections: Revenue and Expenditure, 2002-50



Source: IMF staff estimates.

Box 1. Long-Run Fiscal Projections: Underlying Data Assumptions

The *demographic projections* produced by the Charles University faculty are used. These projections, till 2065, are based on medium-term growth assumptions described in footnote 3. Longer run projections over the period 2065-2150 were obtained from the pension reform committee's website (www.reformaduchodu.cz).

Labor productivity growth in the Czech Republic has been above 4 percent in recent years. However, this will be difficult to sustain as the economy converges closer to EU levels. Labor productivity growth is assumed to decline to 3 percent by 2010, and in the baseline case, stay at 3 percent over the long run.

Labor force participation is assumed to increase marginally and stabilize at 71.6 percent in the long run. Although much depends on labor market policies, given the downward trend, we use conservative assumptions. The labor force is thus assumed to vary in line with working-age population, which, combined with labor force productivity growth, is used to determine GDP growth rate.

A *discount rate* of 4 percent is assumed. Historically, the average nominal interest rate on public debt has been around 7 percent. We assume a longer run inflation rate of 3 percent. By current standards, this interest rate assumption is on the high side which provides a downward bias to the estimate of fiscal gap.

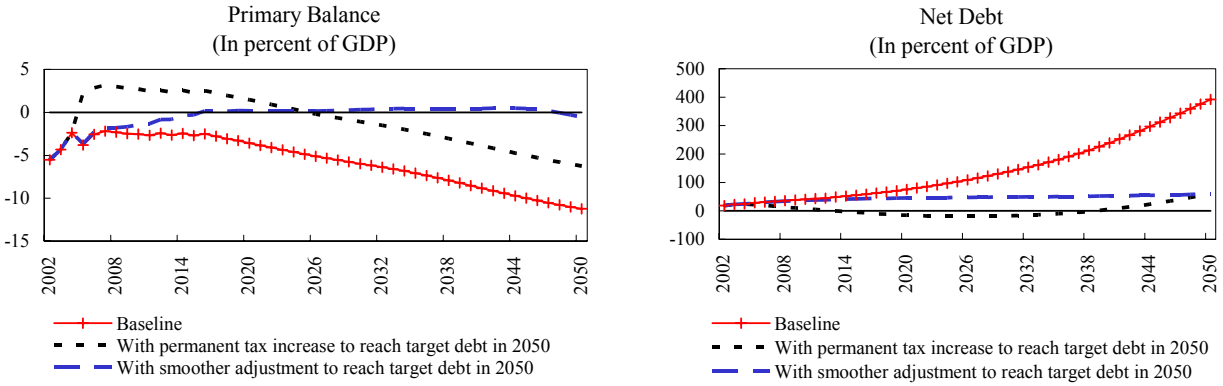
The *relative age and gender profiles* for the income tax revenues and social security taxes were constructed from the data on earnings distribution, labor force participation and population data of the Czech Statistical Office, and average income and social security tax rates. The profiles for expenditures and other revenues were obtained from Dybczak (2004). Although there is uncertainty over the age profiles as behavioral responses of the population could change over time, it is assumed for simplicity that the age profiles remain stable. However, the age profiles are adjusted over time to reflect certain policy changes such as an increase in retirement age.

For *aggregate taxes and transfers*, consolidated general government fiscal data up to 2003, based on a functional classification, were obtained from the Ministry of Finance and the Czech Statistical Office. Since fiscal projections under this classification were not available, aggregate deficit targets based on the Convergence Program targets are used up to 2007, while growth rates for individual categories of fiscal expenditures were based on historical growth rates adjusted for the GDP deflator. Longer-term projections for fiscal aggregates are based on labor productivity growth assumption, as described in the baseline scenario.

and morbidity rates would affect health care costs, international experience suggests that per capita health care expenditure rises much faster than assumed in the baseline scenario. Noncontributory social benefits, also expected to grow in line with wages on a per capita basis, decline marginally.

40. **These trends imply a widening primary deficit and an unsustainable debt position,** which are projected to reach around 11 and 400 percent of GDP, respectively, by 2050. As a share of GDP, expenditures in pensions are expected to increase by around 4 percent and health care by around 3 percent (Figures 5 and 6).

Figure 6. Long-Run Projections: Primary Balance and Net Debt, 2002-50



Source: IMF staff estimates.

Fiscal gap

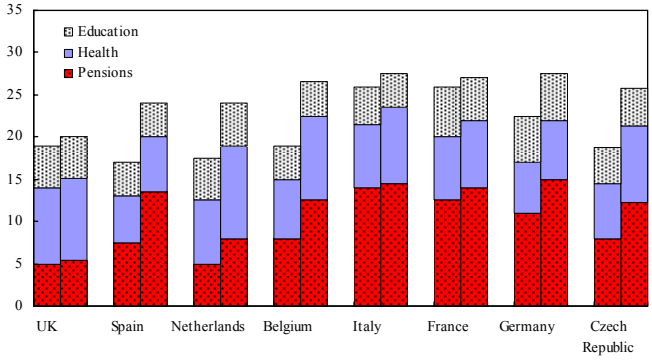
41. **The fiscal gap provides a quantitative measure to assess fiscal sustainability**. Following the literature, two alternative measures of fiscal gap are used. They are based on the following:

- **Intertemporal budget constraint**. This indicates the permanent increase in taxes, as a percent of GDP, needed to meet the intertemporal budget constraint. Based on the deficit path projected in the baseline case and the net general government debt level as the initial condition in 2005, the fiscal gap is estimated at 11.6 percent of GDP in net present value terms.

- **Target debt-to-GDP ratio**. An alternative measure is the permanent increase in taxes as a percent of GDP needed to reach a targeted debt-to-GDP ratio. Using a target of 60 percent by 2050, the adjustment needed to close the fiscal gap is 6.1 percent of GDP (Figure 6). Since a primary deficit persists beyond 2050, the intertemporal fiscal gap will be larger than this measure. While this measure aims for the target debt at a certain horizon, it does not suggest a particular debt path till the target date. An alternative adjustment path, which maintains a fiscal balance or a small surplus from early in the next decade would also reach the same debt target.

42. **These estimates suggest a more unsustainable fiscal position in the Czech Republic than in many other countries with aging societies.** The increase in age-related spending is above average compared with many European countries (Figure 7). When measured in terms of tax revenues and expenditures, fiscal gap estimates are also among the highest relative to some advanced economies (table 1).

Figure 7. Age-Related Spending for 2008 and 2050
(In percent of GDP)



Sources: UK HM Treasury (2004); and IMF staff estimates.

43. **The magnitude of the gap also indicates that a delay in reforms to restore a sustainable fiscal position would be costly.** It is estimated that each year of delay increases the size of adjustment needed to close the intertemporal budget gap by 0.15–0.2 percent of GDP (table 2). If labor productivity growth is assumed to be lower (2.5 percent), the delay in adjustment costs 0.3 percent of GDP every year, which is in line with the authorities' estimates.

Table 1. Intertemporal Fiscal Gap: An International Comparison

	In percent of tax revenues	In percent of expenditures
Czech Republic	34	25
United Kingdom	3	10
United States	11	20
Italy	5	5
Germany	10	14

Sources: Cardarelli and Sartor (2000); and IMF staff estimates.

44. **Inevitably, there is uncertainty surrounding these projections; nevertheless, a sensitivity analysis points to a sizable fiscal gap**. The gap is not closed even under a higher discount rate and adjustment is needed to maintain a debt to GDP ratio of 60 percent in 2020 (table 2). In addition, an increase in the productivity growth rate also does not eliminate the gap, partly because growth in per capita expenditures track labor productivity growth. Below, we simulate the impact of alternative assumptions on per capita revenue and expenditure growth, reflecting alternative reform scenarios and their impact on the fiscal gap.

Table 2. Indicators of the Fiscal Gap
(In percent of GDP)

Intertemporal fiscal gap 1/	
Baseline scenario	11.6
(Productivity growth (3%) and interest rate (4%))	
Higher productivity growth (3.5%)	5.6
Lower productivity growth (2.5%)	15.8
Lower interest rate (3.5%)	18.1
Higher interest rate (4.5%)	9.8
Higher productivity growth (3.5%) and baseline non-age-related spending (3.0%) and health care (3.25%)	-2.5
Tighter non-age-related spending (1.5%)	2.3
Extended retirement age	9.5
Lower pensions indexation	8.8
Tighter health care spending	8.9
Intertemporal fiscal gap with an explicit debt/GDP target 2/	
Net debt/GDP at 60% in 2020	1.1
Net debt/GDP at 60% in 2030	3.1
Net debt/GDP at 60% in 2040	4.7
Net debt/GDP at 60% in 2050	6.1

Source: IMF staff estimates.
1/ Immediate change in taxes needed to meet the intertemporal budget constraint.
2/ Immediate and permanent change in primary deficit needed to maintain a target debt-to-GDP ratio at a target time horizon.

Alternative reform scenarios

45. **Restoring fiscal sustainability will require significant reforms encompassing fiscal adjustment as well as labor market reforms**. Possible reforms, including parametric changes to the pension system, are quantified below (Figures 8 to 11):

- With age-related spending set to escalate, reform needs to focus on increasing labor force participation among the elderly. An **increase in the statutory retirement age**—by 2 years (to 65), phased in over the next 16 years—is considered, given the increasing longevity trends and the need to reduce the number of pensioners. Under this scenario, pension expenditure will moderate but pick up again from around 2020, reaching almost 11 ½ percent of GDP in 2050. This will also increase the number of contributors to the pension system, which, together with the increase in the income taxes, will reduce the fiscal gap to 9.8 percent of GDP.

- Another option to ease the age-related fiscal burden is to **reduce pension benefits by lowering the rate of valorization.** Pension expenditures are assumed to grow at 40 percent of wage growth. This is used as an approximation of an indexation rule that keeps a constant net replacement ratio at 40 percent for new pensions and maintains existing pension benefit growth at 40 percent of wage growth. This has a significant impact on pension expenditure, reducing the intertemporal fiscal gap to 8.8 percent of GDP.

- **Tighter health care spending**, where per capita health expenditure is assumed to grow in line with productivity growth (compared with 0.25 percentage point higher than productivity growth in the baseline case), will also have a large impact in improving fiscal sustainability. Health expenditure is lowered by 1 percent of GDP by 2050, leading to an intertemporal fiscal gap of 8.9 percent.

- A **lower growth rate on non-age-related spending**—of half the productivity growth rate compared to the baseline case—shows that the fiscal gap is narrowed sizably to 2.3 percent, but is still not closed. Indeed, to close the fiscal gap, real spending per capita growth in this category would need to be lowered to 0.5 percent. Since the average real growth rate, over 1999-2003, has been around 5 percent, this implies an adjustment that would likely be infeasible.

- On the other hand, a **higher growth in labor productivity** while maintaining **a tighter growth rate for non-age-related spending** produces a more favorable result. Increasing labor productivity growth from 3 percent to 3.5 percent, while keeping health care spending growth as in the baseline reduces the gap to 5.6 percent. An increase in productivity growth does not reduce the gap more drastically because an increase in the labor productivity growth also affects the overall expenditures. Indeed, if health care is also assumed to grow in line with productivity growth, at 3.5 percent, the fiscal gap remains high at 8.7 percent. But if growth of non-age-related spending per capita is also lowered to around 3 percent, the intertemporal fiscal gap turns into a surplus. The impact of the non-age-related spending, assumed to grow slower than productivity growth, dominates the age-related spending after 2060, which helps to reduce the level of primary deficit over time and ultimately close the fiscal gap. This underscores the importance of combining fiscal adjustment with labor productivity enhancing measures to restore fiscal sustainability.

Figure 8. Alternative Scenarios: Health Care Spending, 2002-50

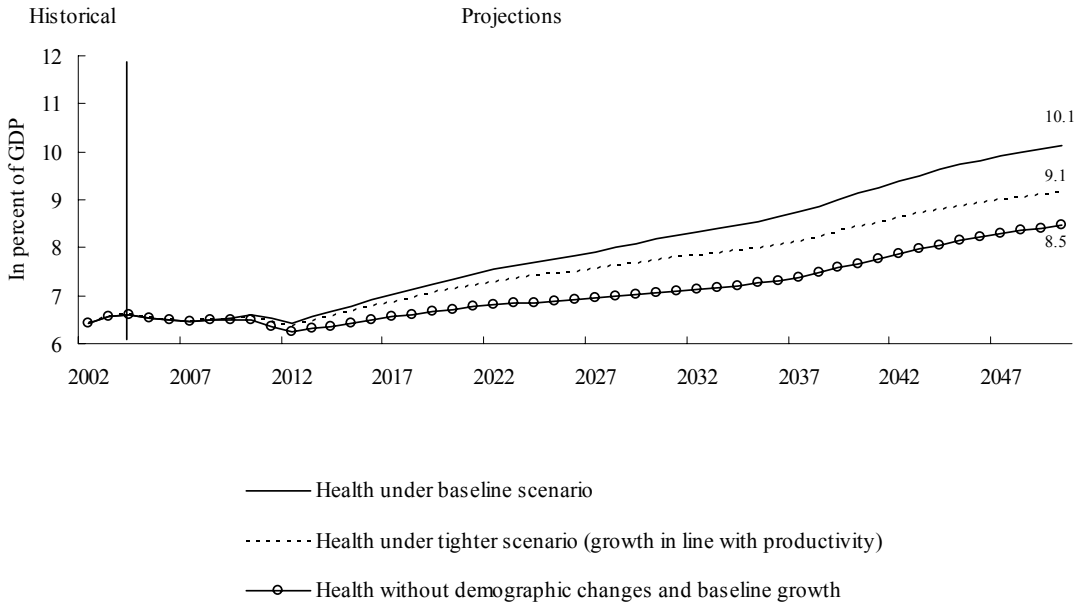
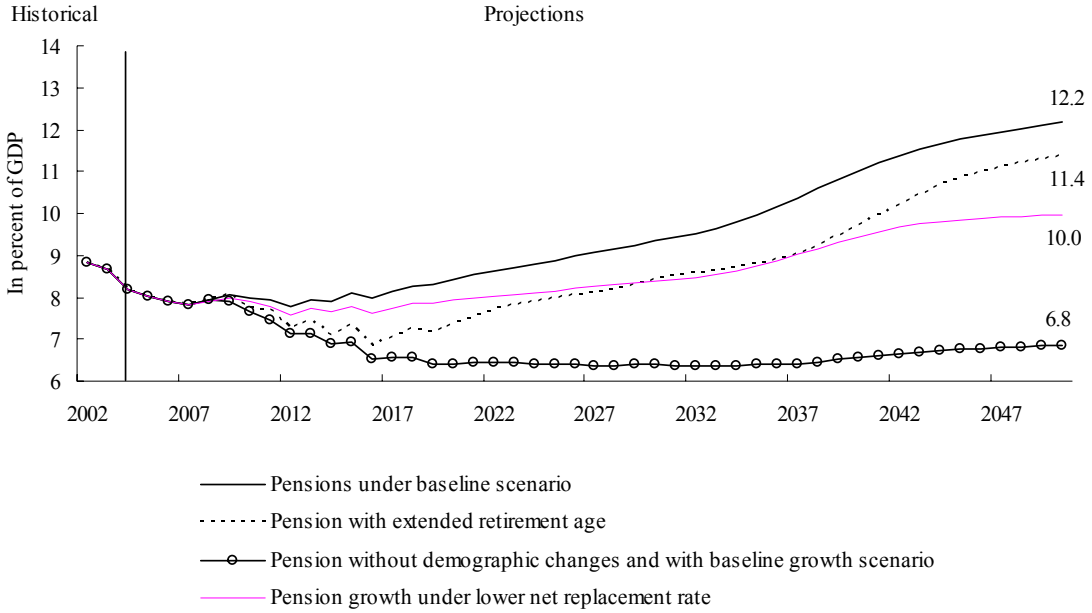
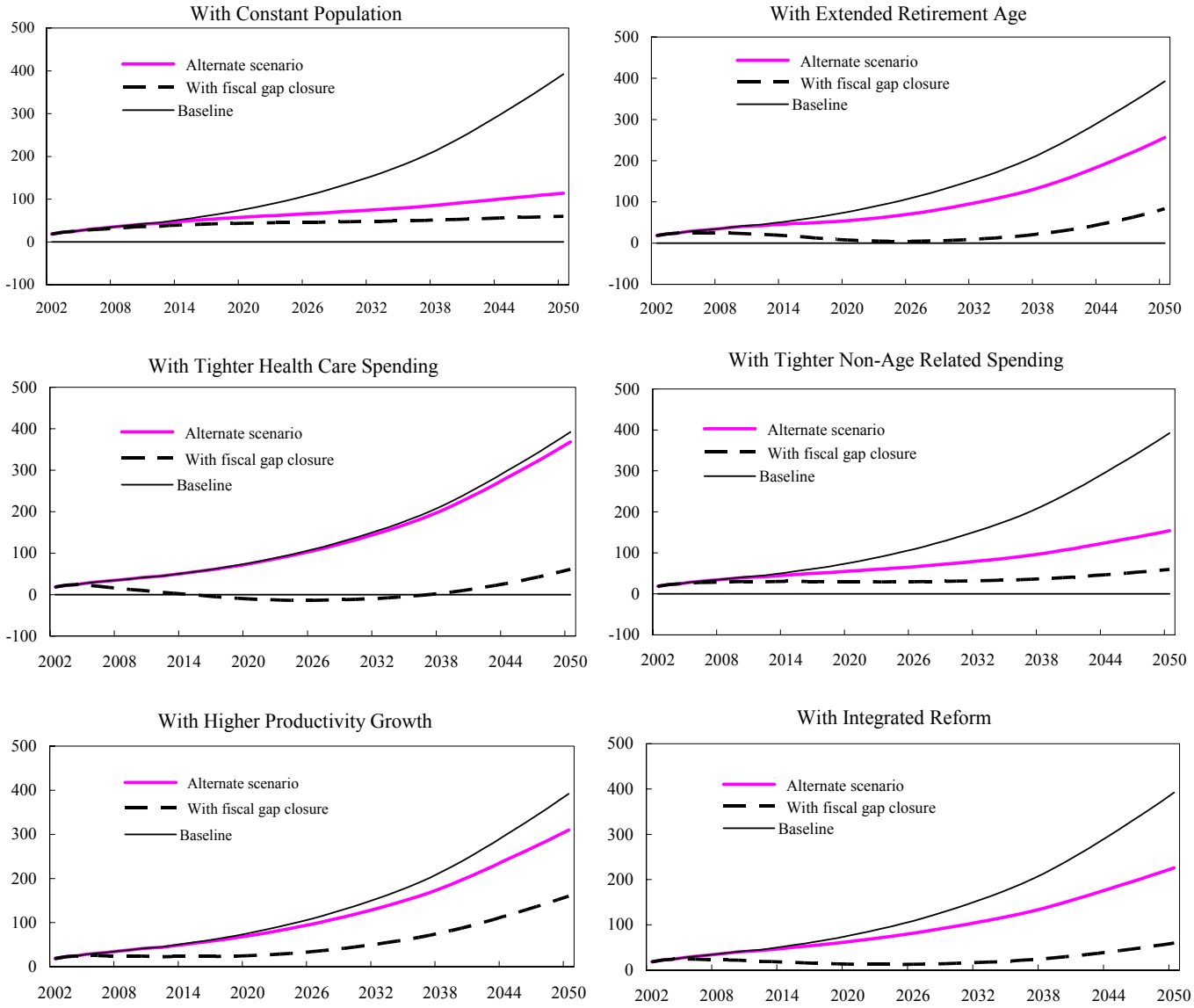


Figure 9: Alternative Scenarios: Pension Expenditure (2002-50)



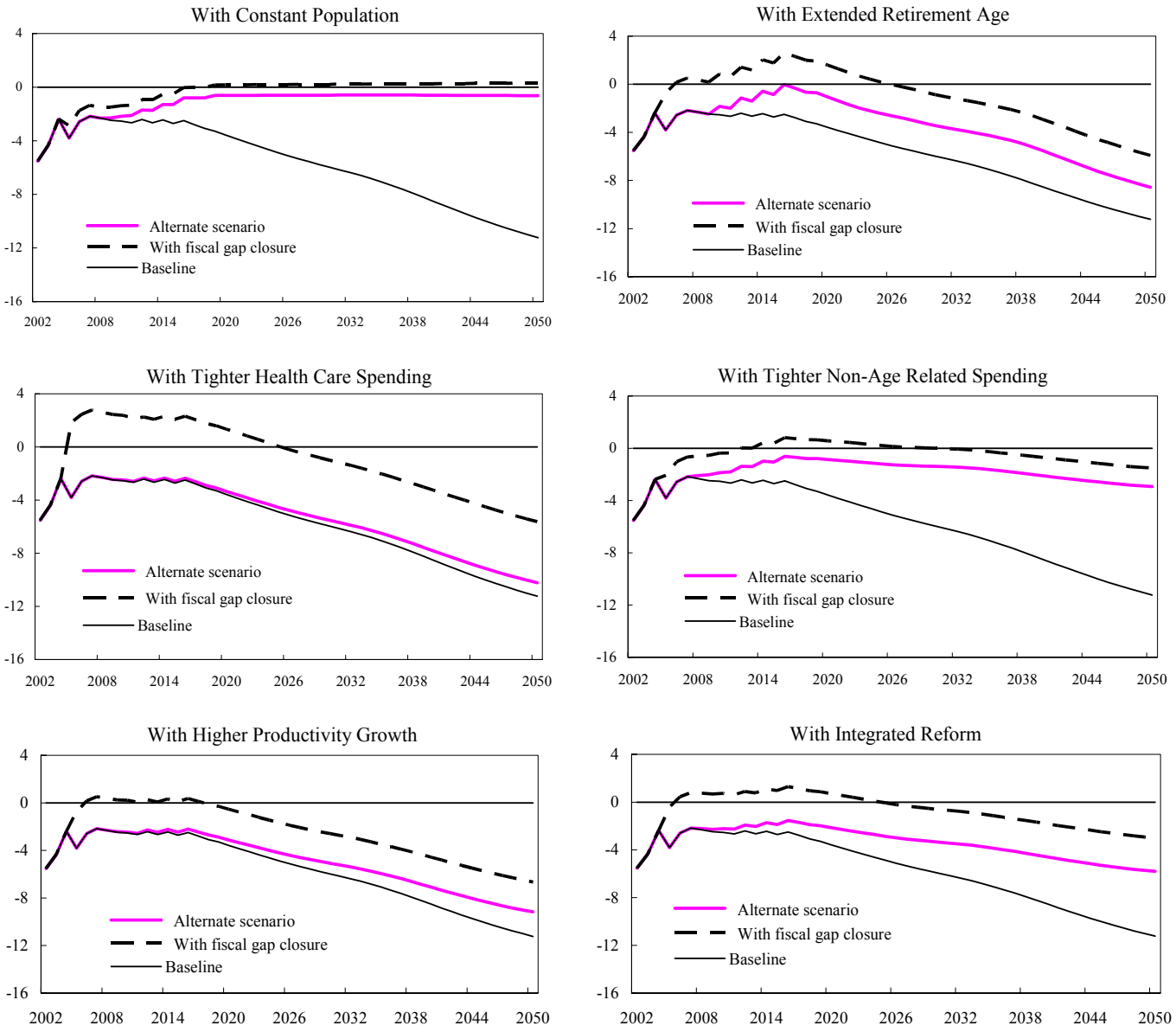
Source: IMF staff estimates.

Figure 10. Alternative Scenarios: Net Debt, 2002-50
(In percent of GDP)



Source: IMF staff estimates.

Figure 11: Alternative Scenarios: Primary Balances, 2002-50
(In percent of GDP)



Source: IMF staff estimates.

46. These results also suggest that, although the fiscal outlook will be considerably more benign following the implementation of reform, the fiscal gap will not be eliminated under any one single measure. Parametric changes in the pension system, such as extending the retirement age and lowering the degree of indexation, buys some time but does not address the longer-run sustainability of the system. Indeed, under the model assumptions, fiscal solvency is not achieved even in the absence of demographic pressures. The high level of the primary deficit implies a fiscal gap of 2 percent of GDP, under the constant population scenario. This calls for a fiscal objective of a balance or a small surplus over the medium term. Thus, **achieving fiscal sustainability would require an integrated approach that combines reforms in both age-related and non-age-related expenditures, as well as labor market reforms**.

Intergenerational equity

47. **An important consideration for fiscal reform is the generational burden**. This is evaluated using the concept of generational accounts, which defines the discounted average remaining lifetime net taxes paid by an individual (see appendix for a technical discussion). The baseline simulation above shows that the intergenerational balance gap is lower than the intertemporal budget gap (table 3). This implies that the net taxes paid by the future generations is lower than that paid by the current generation. A decomposition of the net taxes shows that this can be largely attributed to the higher growth in the health benefits per beneficiary over the longer run. Indeed, under an alternative scenario with tighter health care spending, the net tax burdens of future and current generations are similar, suggesting that the generational burden is more fairly distributed.

48. **Early implementation of reform measures to restore fiscal sustainability is needed to ensure generational fairness**. In the alternative reform scenarios, the generational burden is more fairly distributed than in the baseline case, as shown by the more even net taxes paid by the different generations. However, with reforms that substantially reduce the fiscal gap, such as the scenario with a tighter non-age-related spending where the fiscal gap is lowered to 2.3 percent, much of this adjustment burden falls on future generations. Indeed, as the intergenerational balance gap measure indicates, if future generations pay the same lower net taxes as the current generation, the fiscal gap increases to 3.7 percent. Fiscal adjustment thus needs to be implemented early to ensure that a fairer generational balance can be achieved while restoring fiscal sustainability.

Table 3. Intertemporal Fiscal Gap and Generational Balance Gap: Alternative Policy Scenarios

	Intertemporal Budget Gap as a Percent of GDP	Intergenerational Balance Gap as a Percent of GDP	Net taxes paid by newborns in Thousands of CZK.		
			2002	2022	2042
Baseline scenario	11.6	9.5	-1,476	-1,524	-1,616
Tighter non-age-related spending	2.3	3.7	-473	-106	48
Extended retirement age	9.5	7.3	-1,179	-1,255	-1,381
Lower pensions indexation	8.8	7.3	-1,126	-1,109	-1,170
Tighter health care spending	8.9	8.6	-1,317	-1,300	-1,337

Source: IMF staff estimates.

D. Concluding Remarks

49. This chapter analyzed the long-run impact of population aging on the general government fiscal balance and illustrated some reform scenarios under alternative policy assumptions. The main conclusions are as follows:

- Despite the relatively favorable current fiscal position, longer-run fiscal viability is at risk. Debt is expected to increase to over 400 percent of GDP by 2050, and restoring solvency would require taxes to increase by over 10 percent of GDP in net present value terms. Every two-year delay would raise this adjustment cost by 0.3 percent of GDP. Although projections are subject to considerable uncertainty, alternative reform scenarios suggest that, even under more benign assumptions, the fiscal gap would remain considerable.

- Meeting these challenges would require an immediate focus on reform measures. A broad approach to reform is needed, concentrating on enhancing labor productivity, and restructuring fiscal benefits and other non-age-related spending. A fiscal target aiming for balance or a small surplus over the medium-term would also be needed.

- Given the size of the fiscal gap, restoring sustainability would place a large burden on future generations. Since current policies favor future generations, reform measures would help to restore generational balance, but delays in implementing reforms risk placing an even larger fiscal burden on future generations. Hence, early implementation of reform is needed for intergenerational fairness.

REFERENCES

Cardarelli, Roberto, and Nicola Sartor, 2000, "Generational Accounts for Italy," in *Fiscal Sustainability*, ed. by Banca d'Italia (Perugia, Italy: SADIBA).

Cardarelli, Roberto, James Sefton, and Laurence Kotlikoff, 2000, "Generational Accounting in the UK," *Economic Journal*, Vol. 110 (November), pp. 547–74.

Chawla, Mukesh, 2005, "Why Should We Worry About the Health Sector in the Czech Republic?," (unpublished; Washington: World Bank).

Dybczak, Kamil, 2004, "Generational Accounts in the Czech Republic," (unpublished; Prague: Ministry of Finance).

European Observatory of Health Care Systems, 2000, *Health Care Systems in Transition: Czech Republic* (Copenhagen: Secretariat of the European Observatory on Health Care Systems).

Kraal, J., 2005, "Czech Pension Reform," (unpublished; Prague: Ministry of Labor and Social Affairs).

Ministry of Finance, 2004a, *Convergence Programme of the Czech Republic* (Prague: Ministry of Finance).

Ministry of Labor and Social Affairs, 2004b, *Actuarial Report on Social Insurance* (Prague: Ministry of Labor and Social Affairs).

OECD, 2004, *Ageing and Employment Policies: Czech Republic* (Paris: OECD).

_____, 2005, *Pensions at a Glance: Public Policies Across OECD Countries* (Paris: OECD).

United Kingdom, HM Treasury, 2004, *Long Term Public Finance Report: An Analysis of Fiscal Sustainabilit*y (London: HM Treasury).

NOTE ON GENERATIONAL ACCOUNTING MODEL

Projection methodology

Let X_t denote the aggregate transfer of health care benefits in the base year. This can be expressed as the sum of transfers to different age groups, i, as

$$X_t = \sum_1^{100} X_{i,t} ,$$

where $X_{i,t}$ is the transfer to the age cohort i at time t. This can be calculated using the relative age profile, $R_{i,t}$, which attributes the share of the total transfers to the different age groups.

$$X_{i,t} = R_{i,t} X_t$$

To project forward the age specific transfers, the per capita transfers are calculated:

$$A_{i,t} = \frac{X_{i,t}}{P_{i,t}} ,$$

where $A_{i,t}$ denotes the per capita transfer to an individual of age i at time t, $P_{i,t}$ is the number of individuals in this age cohort. In other words, the aggregate transfers can also be calculated as

$$X_t = \sum_1^{100} A_{i,t} P_{i,t} .$$

The projection for each of the transfers would thus depend upon the growth of the per capita transfers, g, and the population growth within each cohort:

$$X_{t+1} = \sum_1^{100} A_{i,t+1} P_{i,t+1}$$

$$X_{t+1} = \sum_1^{100} A_{i,t} (1+g) P_{i,t+1} .$$

The growth of the per capita transfers, is typically linked to per capita productivity growth to reflect the indexation to wages. If the transfers are only indexed to inflation, however, per capita growth would equal zero. It is also assumed that the relative profile remains constant:

$$R_{i,t} = R_i .$$

Thus, transfers are projected as

$$X_{t+1} = \sum_1^{100} \frac{R_i X_t P_{i,t+1}}{P_{i,t}} (1+g) .$$

Under some of the alternative scenarios, such as extension of retirement age, the relative age profile is allowed to vary for specific variables, such as income taxes, social security contributions, and pensions.

Generational accounts

The generational account of an individual measures the present value at time t of the average remaining lifetime net tax payment. This is defined as

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+100} T_{s,k} \frac{P_{s,k}}{P_{t,k}} (1+r)^{-(s-t)} .$$

Here, $T_{s,k}$ is the projected average net tax payment to the government in the year s by a member of the generation born in the year k, which essentially represents the sum of the per capita transfer (or tax) $A_{k,s}$ of an individual born in the year k across all the government taxes and transfers at time s. The term $\frac{P_{s,k}}{P_{t,k}}$ is the proportion of members of cohort k alive at time t who will also be alive at time s. The net tax payments are discounted using the real discount factor, r. Thus, the generational account captures the *average* present value over all net tax and transfer payments as well as probability of survival.

Intertemporal fiscal gap

The intertemporal fiscal gap, based on a dynamic analysis of fiscal policy, is defined as the imbalance in the intertemporal budget constraint. This constraint simply states that in present value terms, the future net tax payments of current and future generations should cover the government's future purchases of goods and services and the initial net debt. Formally, the intertemporal budget constraint, is expressed as

$$\sum_{s=0}^{\infty} G_{t+s}(1+r)^{t-s} + D_t = \sum_{s=0}^{100} N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{t-s},$$

Where G is the government purchase of goods and services, D, the initial net debt, $N_{t,k}$, the generational account in year t of an individual born in year k. The first term on the right hand side thus represents the net tax payments over the remaining lifetime of currently living generation while the second term is the present value of the net tax payments of future, yet unborn, generations. The intertemporal fiscal gap is calculated as the immediate and permanent adjustment in taxes or expenditures needed to ensure that the above constraint holds:

$$IBG = [\sum_{s=0}^{\infty} G_{t+s}(1+r)^{t-s} + D_t - \sum_{s=0}^{100} N_{t,t-s} P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{t-s}] / GDP .$$

Intergenerational balance gap

The intergenerational balance gap is a hypothetical calculation of the intertemporal budget gap based on the assumption that net tax payments of the future generation is the same as that of the newborn in the currently living generation, adjusted for growth:

$$\sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{t-s} = \sum_{s=1}^{\infty} N_{t,t} (1+g) P_{t,t+s} (1+r)^{t-s} .$$

$$GBG = [\sum_{s=0}^{\infty} G_{t+s}(1+r)^{t-s} + D_t - \sum_{s=0}^{100} N_{t,t-s} P_{t,t-s} - \sum_{s=1}^{\infty} N_{t,t} (1+g) P_{t,t+s} (1+r)^{t-s}] / GDP$$

Thus, *IBG* will be greater than *GBG* if $N_{t,t+s}$ is lower than $N_{t,t}(1+g)$. In other words, if the current policy is favorable to future generations such that the net taxes owed by a member of the future generation is lower than that of a currently newborn, the intertemporal budget gap will be higher than the intergenerational balance gap. For further details on these concepts, see Cardarelli, Sefton, and Kotlikoff (2000).

IV. CZECH REPUBLIC: HOUSEHOLD BALANCE SHEETS IN A COMPARATIVE PERSPECTIVE[21]

A. Introduction

50. **Recent global structural changes in financial markets and pension systems have shifted risks to the household sector**. The tendency to switch from defined-benefit to defined-contribution plans, for example, implies a transfer of the longevity and market risks from the public to the household sector. Changes in the behavior of banks, insurers, and private pension funds also imply that a variety of other risks traditionally managed within the financial sector are flowing directly to the household sector. In emerging markets, such as the Czech Republic, this shift of risks to households is starting to happen, particularly as the public sector cannot continue to bear the full burden of social services and retirement. These developments suggest that the monitoring of household assets and liabilities should be enhanced and integrated into the wider context of financial sector surveillance (see IMF (2005, Chapter III)).

51. **This chapter focuses on recent and expected trends in household wealth in the Czech Republic using a balance sheet approach**. The analysis focuses on the developments in household assets and liabilities observed in the Czech transition process and on the possible implications for financial stability. The paper also identifies, based on the experience of financially developed countries, what are the likely future trends in household balance sheets, and discusses how Czech households will need to adjust their balance sheets in order to cope with the pressures arising from an aging society.

52. **The setting of the chapter is as follows**. Section B introduces the balance sheet approach. Section C discusses some recent trends in household financial wealth in the Czech Republic. Section D presents an estimation of models of structural determinants of household assets and liabilities, using a panel of Group of Seven (G-7) countries. The coefficients derived from these estimations are then applied to the Czech Republic in Section E in order to derive "equilibrium" levels of household assets and liabilities and to asses likely future trends. Section F focuses on how households are expected to adjust their balance sheets in response to aging, while Section G draws some conclusions.

B. The Balance Sheet Approach

53. **The balance sheet approach is a framework that allows us to monitor financial vulnerabilities on the basis of the analysis of stock variables**. This approach was developed in the literature (see Dornbusch (2001) in order to explain some features of emerging-market financial crises that were not adequately captured by traditional models focusing on flow variables (such as Krugman, 1979).

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[21] Prepared by Giovanni Ganelli (EUR).

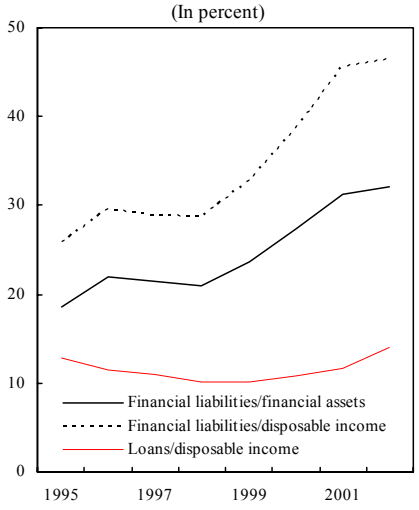
54. **Information on household balance sheets is usually difficult to obtain**. In many countries, detailed data on household wealth are often only partially available and can be obtained only with significant time lags (see Allen and others (2002)). Given the scarcity of household balance sheet data for new European Union (EU) member states, the international comparisons carried out in this paper will be mostly with G-7 and other financially developed countries.

55. **The Czech authorities have made progress in the analysis of household sector balance sheets**. Data on household wealth are compiled by the National Accounts Unit of the Czech Statistical Office. The Czech National Bank is also working on the construction of intersectoral balance sheets with the aim of integrating them into the analysis of financial stability. An analysis of household financial trends was included in the *Financial Stability Report* (Czech National Bank, 2004).

C. Household Balance Sheet Trends in the Czech Transition

56. **In line with other countries in the region, the Czech Republic has experienced a significant increase in credit to households**. The year-on-year rate of growth of total loans to households increased from one-digit Figures in the mid-1990s to around 30 percent in recent years. Figure 1 shows three household aggregate indebtedness indicators for the 1995-2002 period. All indicators show an acceleration in household indebtedness starting from the late-1990s. The steep increase in the ratio of financial liabilities to financial assets indicates a tendency of liabilities to grow faster than assets, and a bias toward nonfinancial assets in total household wealth. The trends highlighted in Figure 1 reflect various economic factors. On the supply side, the sale of the main commercial banks to foreign strategic investors during 1999-2001 implied a more aggressive targeting of the household sector. This trend was reinforced by competition from the fast-developing nonbank industry. On the demand side, the catching-up process and low interest rates have encouraged household borrowing.

Figure 1. Household Sector: Indicators of Financial Soundness, 1995-2002
(In percent)



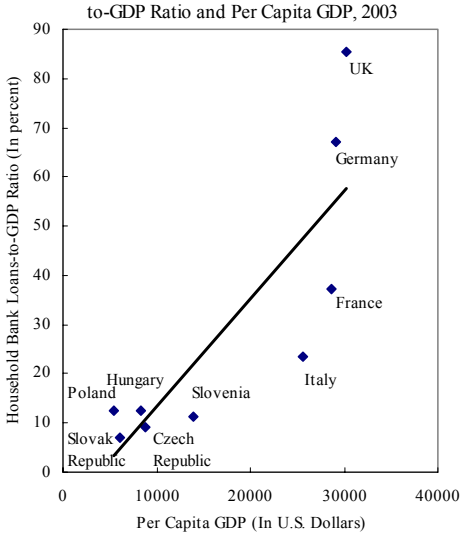
Sources: Czech Statistical Office; and IMF staff estimates.

57. **One issue to be investigated is whether the rapid increase in household liabilities is justified by structural determinants observed in financially developed countries**. The view that credit growth and economic development might go hand in hand is widespread in the literature. Greenwood and Jovanovic (1990), for example, develop a theoretical model in which growth promotes financial intermediation by providing the means to implement costly financial structures. Empirically, King and Levine (1993) find that various measures of the level of financial development are strongly associated with per capita GDP growth. The rapid increase of credit to households in the Czech Republic could, therefore, be a natural consequence of the process of converging to EU standards. In order to test this hypothesis, in

this chapter we analyze the relationship between household liabilities and their economic determinants.

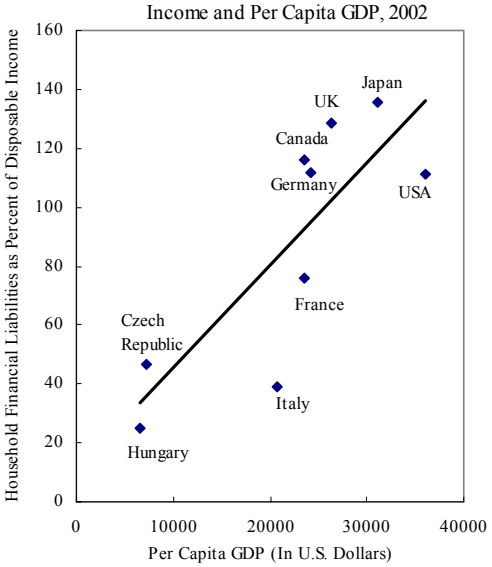
58. **An international comparison with G-7 and other new EU member countries gives mixed evidence on whether household indebtedness in the Czech Republic is in line with its level of economic development**. A simple way to compare credit dynamics in an international setting is to control for the level of development of the economy, proxied by per capita GDP (see Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2003)). Figures 2 to 4 illustrate the relationship between the three indebtedness indicators presented in Figure 1 and per capita GDP for a sample of countries. Using both household bank loans and total household liabilities as ratios to GDP, the position of the Czech Republic is very close to the fitted line. This suggests that the level of indebtedness of households is justified by the level of development. However, a look at the ratio of financial liabilities to financial assets (Figure 4), for which the position of the Czech Republic is well above the fitted line, suggests that household indebtedness could be higher than warranted by the level of per capita GDP.

Figure 2. Selected Countries: Household Bank Loans-to-GDP Ratio and Per Capita GDP, 2003



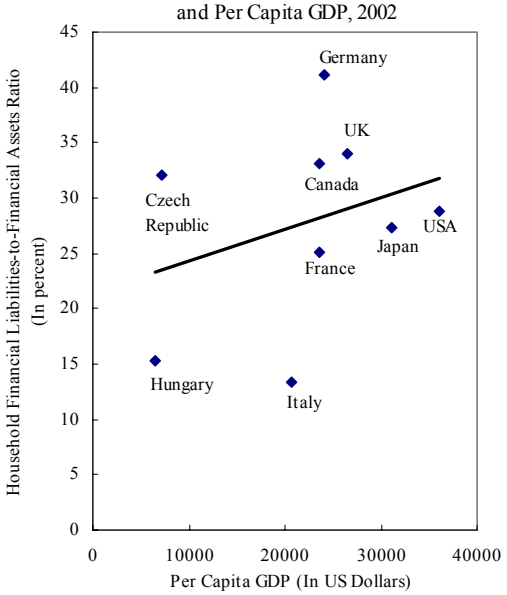
Sources: National Banks of respective countries; IMF, WEO database; and IMF staff estimates.

Figure 3. Selected Countries: Household Financial Liabilities as Percent of Disposable Income and Per Capita GDP, 2002



Sources: Czech Statistical Office; National Bank of Hungary; OECD; IMF, WEO database; and IMF staff estimates.

Figure 4. Selected Countries: Household Financial Liabilities-to-Financial Assets Ratio and Per Capita GDP, 2002



Sources: Czech Statistical Office; National Bank of Hungary; OECD; IMF, WEO database; and IMF staff estimates.

D. Structural Determinants and Likely Future Developments of Household Assets and Liabilities in the Czech Republic

59. **Estimating models of structural determinants of assets and liabilities can provide a more formal analysis of the financial position of households**. Since summarizing economic fundamentals only by per capita GDP gives mixed results, we now turn to a multidimensional analysis. We estimate structural models of determinants of household assets and liabilities using a panel comprising G-7 countries, and then we apply the derived coefficients to the Czech Republic.[22] A similar approach is used by Cottarelli, Dell'Ariccia, and Vladkova-Hollar (2003) in their study of bank credit to the private sector in transition countries. Such a methodology appears appropriate in our case for at least two reasons: (i) given the short length of the time series for household balance sheet data and for the structural determinants for the Czech Republic, it would be difficult to estimate the model directly on Czech data; and (ii) the methodology gives an idea of the "equilibrium" levels of household assets and liabilities in the Czech Republic and allows us to evaluate how far the actual values are from this equilibrium, thus suggesting the likely direction of financial developments.

60. **Household financial assets are assumed to be determined by macroeconomic conditions, the degree of financial market development, old age-related government spending, and demographic factors**. The estimated panel regression includes the ratio of household assets to disposable income as a dependent variable. Among the explanatory variables, per capita GDP and inflation are included as proxies of macroeconomic conditions. The ratio of market capitalization of listed companies to GDP is included as a proxy for financial market development, which is expected to increase the level of assets held by households. Since the more the government is willing to assume pension risks the smaller is the incentive of households to save for this purpose, the ratio of public old age-related spending to GDP is expected to reduce the level of assets. The old-age dependency ratio is also included among the explanatory variables.[23] The standard life cycle theory predicts a reduction of savings for old-age cohorts.[24] This would imply that a reduction of aggregate household assets should follow an increase in the dependency ratio. This effect, however, could be mitigated or even reversed if younger cohorts perceive that the aging process is putting pressure on the fiscal sustainability of the public pension system, and as a result

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[22] See the Appendix for details of the econometric model specification and data sources and description.

[23] The old-age dependency ratio is defined as the ratio of population aged 65 and above to the population aged 15-64.

[24] Modigliani and Blumberg (1954), and Friedman (1957). See also Scholz, Seshadri, and Khitatrakun (2004) for a modern reformulation.

increase their current level of savings for retirement. We therefore have an agnostic a priori expectation about the sign of the coefficient on the dependency ratio in the regression.[25]

61. **The econometric estimation for the G-7 countries panel indicates that financial market development, and the transfer of old age-related spending risk from the public to the household sector, as well as aging itself, tend to increase the level of assets**. The results of the estimation are shown in Table 1. The financial market development variable (market capitalization) has the expected positive sign and is statistically highly significant. Old age-related public spending has the expected negative sign and is also statistically significant. This implies that household assets increase as the public sector withdraws from pension spending. GDP per capita has the expected positive sign and is statistically significant. Inflation is also statistically significant and tends to reduce the level of household assets. The dependency ratio displays a positive sign that is also statistically significant, indicating that population aging tends to increase the level of household assets.

Table 1. Structural Model of Determinants of Household Financial Assets

Random effects panel estimation, G-7 countries, 1992-2000
Dependent variable: household financial assets/disposable income

	Coefficient	Standard Error	*t* -statistics	Prob.
GDP per capita	0.002	0.001	2.689	0.009
Market capitalization/GDP	1.080	0.082	13.105	0.000
Inflation	-5.083	2.316	-2.195	0.032
Old-age related public spending/GDP	-10.826	5.921	-1.828	0.073
Old-age dependency ratio	11.308	2.855	3.961	0.000
Total panel (balanced) observations	63			
R -squared	0.97			

Source: See Appendix.

62. **Household liabilities are assumed to be determined by macroeconomic conditions, by the level of unemployment, and by the degree of credit crowding in from the corporate sector**. In addition to GDP per capita and inflation, explanatory variables include short-term interest rates, a measure of corporate indebtedness, and the unemployment rate. A higher unemployment rate is expected to lower the level of liabilities, since it is more difficult to get credit if unemployed. The corporate indebtedness variable is expected to capture the effect of crowding in: the lower the level of credit demanded by enterprises, the more banks are expected to move toward the household sector. This trend is likely to be reinforced in a low-interest- rate environment, in which the spread between the commercial

[25] Section E focuses in more detail on the impact of aging.

and household sector rates makes bank lending to households more profitable. Low interest rates also capture demand factors, since they encourage household borrowing. We therefore expect negative coefficients on the interest rates and corporate indebtedness variables.

63. **The estimation of a household liabilities model for the G-7 panel confirms the a priori expectations about the effects of the structural determinants**. The results of the estimation are shown in Table 2. In the estimated equation, the ratio of household liabilities to disposable income enters as a dependent variable. The negative signs on the interest rates and on corporate indebtedness variables (both of which are also highly significant) confirm the relevance of the crowding-in assumption, and the presence of significant demand effects of low interest rates. The negative sign on unemployment also confirms the expectation that lower unemployment makes it easier to get credit and therefore raises the level of liabilities. The positive inflation coefficient, although not significant, is consistent with the intuition that higher inflation reduces the real value of liabilities, at least to the extent that these are not fully indexed, and, therefore, stimulates household indebtedness by making it less costly.

Table 2. Structural Model of Determinants of Household Liabilities

Random effects panel estimation, G-7 countries, 1992-2001.
Dependent variable: household liabilities/disposable income

	Coefficient	Standard Error	*t* -statistics	Prob.
GDP per capita	0.001	0.000	2.168	0.034
Interest rates	-1.539	0.567	-2.716	0.009
Inflation	0.859	1.097	0.783	0.437
Corporate indebtedness	-1.019	0.263	-3.879	0.000
Unemployment	-1.844	0.696	-2.648	0.010
Total panel (balanced) observations	70			
R -squared	0.960			

Source: See Appendix.

E. Equilibrium Levels of Household Assets and Liabilities in the Czech Republic

64. **Applying the coefficients derived from the G-7 panel to the Czech Republic suggests that further increases in both household assets and liabilities would be justified**. Table 3 compares the predicted values of some household indebtedness indicators derived from our methodology, with actual values for the Czech Republic for 2001.[26] Table 3

[26] 2001 is the most recent year for which data availability makes this comparison possible.

shows that the equilibrium levels of the various indicators are higher than the actuals, suggesting that the current level of the structural determinants in the Czech Republic would justify further growth of both household assets and household liabilities in the convergence process.

Table 3. Czech Republic: Comparison of Actual and Predicted Variables, 2001
(In percent)

	Actual Value	Predicted Value	Absolute Deviation
	(a)	(b)	(a-b)
Financial assets/disposable income	145.5	216.9	-71.4
Liabilities/disposable income	45.6	93.9	-48.3
Liabilities/financial assets	31.3	43.3	-12.0

Sources: Czech Statistical Office and IMF staff calculations.

65. **Although, based on the estimated model, further increases in both household assets and liabilities would be justified, recent trends show that liabilities have been growing faster than financial assets**. The dynamics of the ratio of liabilities to financial assets presented in Figure 1 also makes this clear. In addition, the year-on-year rates of growth for the 1996-2002 period, shown in Table 4, confirm that liabilities have been growing faster than financial assets in recent years.

Table 4. Czech Republic: Year-on-Year Rates of Growth of Household Financial Assets and Liabilities, 1996-2002

	1996	1997	1998	1999	2000	2001	2002
				(Percent)			
Financial assets growth	8.2	13.6	7.8	4.2	5.7	8.3	5.0
Liabilities growth	28.7	10.6	5.1	17.9	22.1	24.1	7.7

Sources: Czech Statistical Office and IMF staff calculations.

66. **A key priority for preserving household sector financial stability is to ensure that the growth of financial assets will not lag behind the growth of financial liabilities in the convergence process**. Comparing the actual indebtedness indicators with the equilibrium values implied by the model gives no immediate reason for concern regarding the financial sustainability of the household sector in the Czech Republic. However, the fact that liabilities have been growing faster than financial assets in recent years, combined with the results of the empirical estimation showing that the growth of liabilities is in part supply driven, suggest that the risk of an unbalanced dynamics of assets and liabilities cannot be ruled out in the medium term.

F. Dealing with the Impact of Aging

67. **The level and composition of household assets also need to be monitored in relation to the transfer of risks, which will be intensified by an aging population**. Demographic trends are expected to place significant demands on public finances in the Czech Republic. Current public pension and health policy would drive up the deficit and debt to unsustainable levels in the absence of reforms.[27] The increase in the old-age dependency ratio in the Czech Republic is projected to be among the highest in the world in the coming decades. In this context, a substantial degree of transfer of risk from the public to the private sector seems unavoidable, and households will have to bear a significant part of the expected increase in pension and health care spending (from 14 percent of GDP in 2005 to 22 percent in 2050). From the point of view of household budgets, a simple comparison with the United States of the share of some selected items in total consumer expenditure suggests that Czech household spending in the fields of health, education, and private pension plans might increase considerably (see Table 5). It is therefore important that the level and composition of assets be adequate to deal with these potential future liabilities.

Table 5. Selected Countries: Selected Expenditure Items of Average Household
(Percentage of Total Consumer Expenditure)

	Health	Education	Personal Insurance and Pensions
Czech Republic	2.3	0.6	4.5
United States	6.0	2.0	10.8

Sources: Czech Statistical Office; U.S. Bureau of Labor Statistics; and IMF staff calculations.

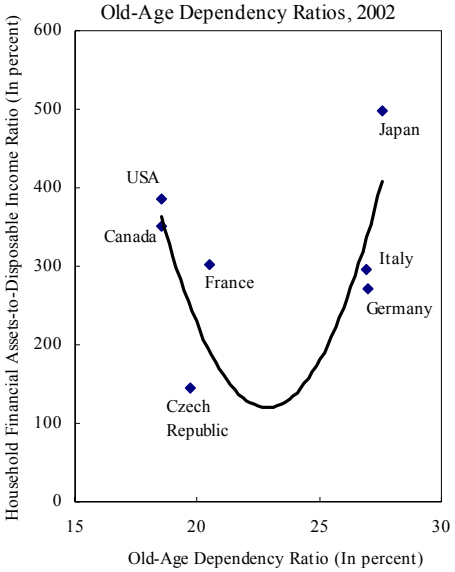
68. **The estimation results of the structural model of asset determinants (Table 1) suggest that Czech households will have to increase their assets in response to aging**. Table 1 shows that households in G-7 countries have increased the ratio of their financial asset holdings to disposable income by about 11 percent, for an additional 1 percent increase in the elderly dependency ratio. This result contrasts with the predictions of the standard life-cycle theory, which were summarized in Section D. Possible explanations are the following: (i) an increase in savings of younger cohorts, who perceive that aging pressure will make the public pension system unsustainable; (ii) an increase in savings of older cohorts for bequest motives; and (iii) an increase in savings of older cohorts reflecting un-met expectations of pension wealth, a fall in the marginal utility of consumption with aging, or uncertainty about the lifetime.[28] The experience of G-7 countries suggests that an increase in financial assets

[27] See Chapter III on *"The Impact of Aging on Fiscal Sustainability in the Czech Republic."*

[28] Points (ii) and (iii) have been put forward in Moreno-Badia (2005) to explain the "retirement savings puzzle" observed in Ireland.

would be an appropriate household strategy to cope with aging in the Czech Republic. This is also confirmed in Figure 5, which displays a U-shaped relationship between household financial assets and the old-age dependency ratio. Figure 5 suggests that, for countries that start aging when the level of household assets holdings is already high, assets might initially decrease but will subsequently rise. Since the Czech Republic is close to the lowest point of the fitted U-shaped curve, this U-shaped dynamics should not apply here, and immediately increasing household assets would seem the more adequate response.[29]

Figure 5. Selected Countries: Household Financial Assets-to-Disposable Income and Old-Age Dependency Ratios, 2002



Sources: OECD; and IMF staff estimates.

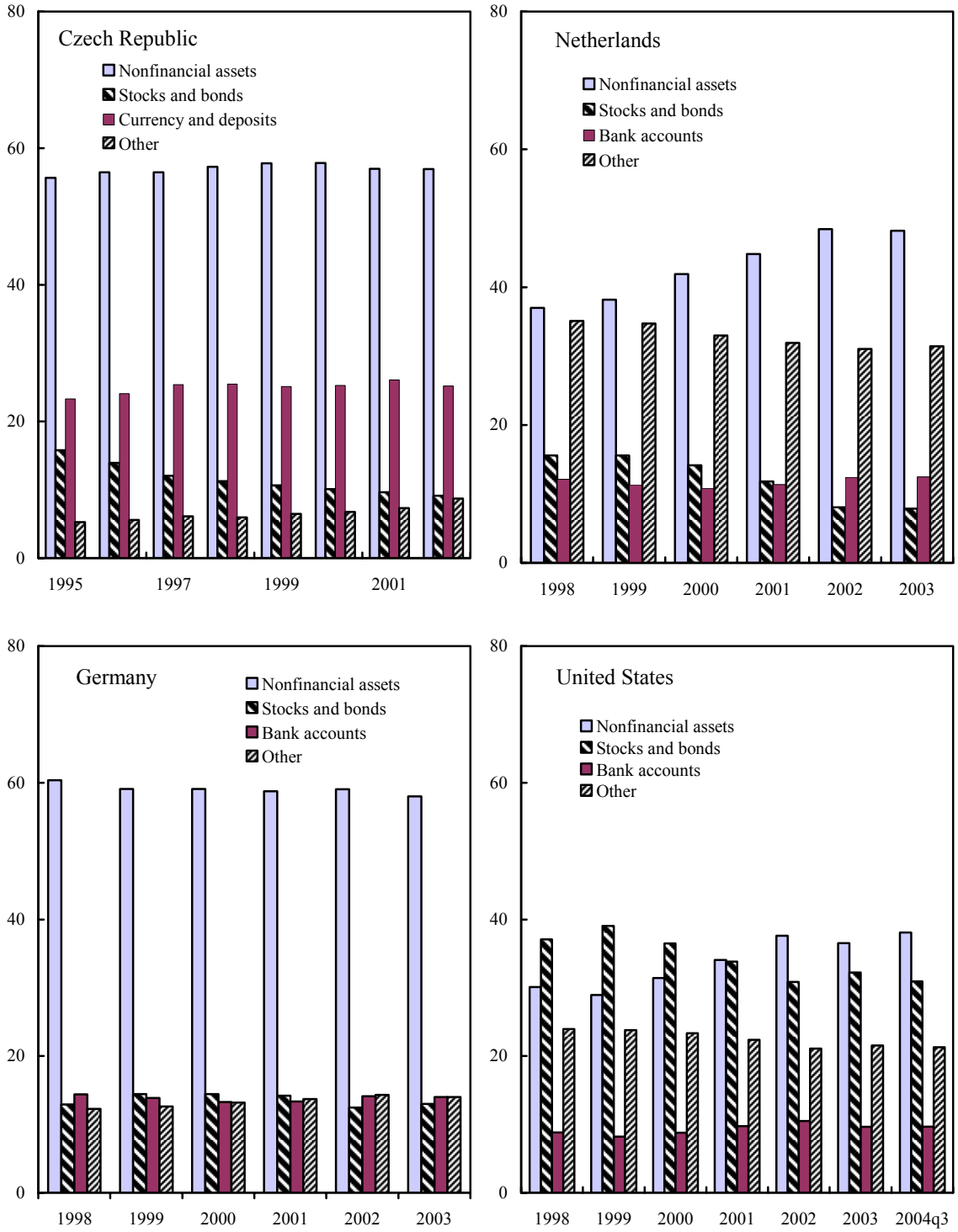
69. **In addition to the level of financial assets, the composition of total assets may also need to change**. Comparison with other industrialized countries suggests that household wealth in the Czech Republic tends to concentrate on relatively low-marketable nonfinancial assets (Figure 6)**.** The large share of nonfinancial wealth in the Czech Republic is second in this sample only to that of Germany, where strong incentives to invest in housing are in place. On the other hand, claims on insurance and pension companies in the Czech Republic (included in the "Other" category) look remarkably small as a percentage of total assets in an international comparison. Housing constitute the bulk of nonfinancial assets. Given the relatively low marketability of housing wealth and the low propensity of households to borrow against it, this asset structure might not be adequate to deal with the expected transfer of financial risks to households.

70. **Household portfolios in the Czech Republic also tend to concentrate on low-volatility assets**. Table 6 shows that the ratio of the volatility of Czech households' net worth to disposable income is lower than in most financially developed countries; the Czech position becomes even more evident when only market-sensitive assets are taken into account.[30] A low volatility can be taken as an indicator of welcome stability in household wealth, even during a period of significant transformations in the financial and real sectors. On the other hand, Table 6 also suggests that Czech households tend to concentrate their wealth in low-return assets, which are probably not adequate to save for retirement and to face the other challenges associated with the transfer of risks from the public sector.

[29] The results shown in Figure 5 do not contradict the estimation reported in Table 1, since in Figure 5 we do not control for the other structural determinants of household assets.

[30] Net worth is defined as total (financial plus nonfinancial) assets minus liabilities.

Figure 6. Selected Countries: Household Sector: Total Assets Composition
(In percent of total assets)



Sources: Czech Statistical Office; and IMF, *Global Financial Stability Report (2005)* .

Table 6. Selected Countries: Household Balance Sheets: Volatility Measures
(In percent) 1/

	Volatility of Net Worth Disposable Income	Volatility of Market-Sensitive Assets/Disposable Income 2/
Czech Republic (1998-2002)	3.8	5.0
United States (1998-2003)	7.0	10.0
United Kingdom(1998-2003)	5.1	7.5
Netherlands (1998-2003)	6.2	7.5
France (1998-2003)	3.8	10.4
Germany (1998-2003)	1.5	2.5
Japan (1998-2003)	2.5	7.1

1/ Volatility defined as standard deviation divided by average.
2/ Non-market-sensitive assets consist mainly of deposits.

Sources: Czech Statistical Office; IMF, *Global Financial Stability Report* (2005); and IMF staff calculations.

71. **Possible explanations for the current composition of assets include demand- and supply-side factors, as well as policy-induced distortions**. Households might not be investing strategically due to a lack of awareness of their future financial responsibilities. An increase in financial education could help stimulate the demand for more strategic investment tools.[31] The lack of supply of more sophisticated saving instruments could also be a determinant of the current assets composition. The supply of instruments such as annuities, long-term bonds and "life cycle" products could be promoted in order to encourage strategic investment. From the policy point of view, government subsidies, tax exemptions for mortgage loans, and saving schemes of building societies might be encouraging investment in nonfinancial and short-term financial assets. Heavy regulation of the private pension industry also discourages the supply of personalized pension plans. Phasing out of these government policies might be needed to stimulate long-term investments, which would be more adequate to finance retirement.

G. Conclusions

72. **The evidence presented in this chapter suggests that both household assets and household liabilities in the Czech Republic will need to rise to be consistent with the**

[31] Recent research shows that financial education usually results in better financial decision-making practices, especially with regard to long-term savings (Helman and Paladino, 2004; and Lusardi, 2004).

structural determinants observed in financially advanced countries and to prepare for aging. The analysis showed that, although there are no immediate sustainability concerns, the financial position of Czech households could become more fragile going forward, especially if the rates of growth of household liabilities continue to significantly outpace those of financial assets. Given the interlinkages among sectors, a weakening of the households' financial position would have an impact on financial stability as a whole. In this context, a system of intersectoral balance sheets, such as the one being developed by the Czech authorities, is an adequate surveillance tool which would allow the monitoring of the household sector financial position to be integrated with financial sector surveillance.

73. **The analysis also showed that the current composition of assets might not be adequate to face the challenges related to the expected transfer of risks and to aging**. Households currently hold a large share of their total assets in nonfinancial assets and low-yield financial assets. This could be in part due to government policies that encourage home ownership over other forms of investment, and create incentives for short-term savings. Demand and supply factors generated by households' lack of awareness of their future financial responsibilities, as well as a lack of supply of more sophisticated investment tools, might also be playing a role in determining the current assets structure.

REFERENCES

Allen, Mark, and others, 2002, "A Balance Sheet Approach to Financial Crisis," IMF Working Paper 02/210 (Washington: IMF).

Czech National Bank, 2004, *Financial Stability Report.* (Prague: Czech National Bank).

Cottarelli Carlo, Giovanni Dell'Ariccia, and Ivanna Vladkova-Hollar, 2003, "Early Birds, Late Risers, and Sleeping Beauties: Bank Credit Growth to the Private Sector in Central and Eastern Europe and the Balkans," IMF Working Paper 03/213 (Washington: IMF).

Dornbusch, Rudiger, 2001, "A Primer on Emerging Market Crises," NBER Working Paper No. 8326 (Cambridge, Massachusetts: National Bureau of Economic Research).

Friedman, Milton, 1957, *A Theory of the Consumption Function* (Princeton, New Jersey: Princeton University Press).

Greenwood, Jeremy, and Boyan Jovanovic, 1990, "Financial Development, Growth, and the Distribution of Income," *Journal of Political Economy*, Vol. 98 (October), pp. 1076–107.

Helman, Ruth, and Variny Paladino, 2004, "Will Americans Ever Become Savers? The 14th Retirement Confidence Survey, 2004," Issue Brief No. 268 (Washington: Employee Benefit Research Institute).

IMF, 2005, *Global Financial Stability Report: Market Developments and Issues,* 2005 (Washington: IMF).

King, Robert G., and Ross Levine, 1993, "Finance and Growth: Schumpeter Might be Right," *Quarterly Journal of Economics*, Vol. 108 (August), pp. 717–37.

Krugman, Paul, 1979, "A Model of Balance-of-Payments Crises," *Journal of Money, Credit and Banking* Vol. 11 (August), pp. 311–25.

Lusardi, Annamaria, 2004, "Saving and the Effectiveness of Financial Education," in *Pension Design and Structure: New Lessons from Behavioral Finance*, ed. by O. Mitchell and S. Utkus (Oxford: Oxford University Press).

Modigliani, Franco, and R. Blumberg, 1954, "Utility Analysis and Consumption Function: An Interpretation of Cross-Section Data," in *Post-Keynesian Economics*, ed. by K.K. Kurihara (New Brunswick, New Jersey: Rutger University Press), pp. 388–436.

Moreno Badia, Marialuz, 2005, "Who Saves in Ireland? The Micro Evidence," in *Ireland: Selected Issues*, IMF Country Report (forthcoming; Washington: IMF).

Scholz, J. K., Ananth Seshadri, and Surachai Khitatrakun, 2004, "Are Americans Saving 'Optimally' for Retirement?" NBER Working Paper No. 10260 (Cambridge, Massachusetts: National Bureau of Economic Research).

ECONOMETRIC MODEL SPECIFICATION AND DATA DESCRIPTION

Econometric models of structural determinants of assets and liabilities were estimated using a balanced panel of the G-7 countries (see Tables 1 and 2 for estimation results). The estimation period was 1992-2000 for the assets model and 1992-2001 for the liabilities model. The choice of the sample was driven by data availability. The estimation technique used is the generalized least squares (GLS) random effects procedure. The equations have the following forms:

$$ASS_{it} = \alpha_0 + \alpha_1 * GDPPC_{it} + \alpha_2 * MC_{it} + \alpha_3 * INFL_{it} + \alpha_4 * GOVOLDAGE_{it} + \alpha_5 * OLDAGE_{it} + \varepsilon_{it}$$

$$LIAB_{it} = \alpha_0 + \alpha_1 * GDPPC_{it} + \alpha_2 * INFL_{it} + \alpha_3 * INT_{it} + \alpha_4 * FLA_{it} + \alpha_5 * UN_{it} + \varepsilon_{it},$$

where the variables are defined as follows:

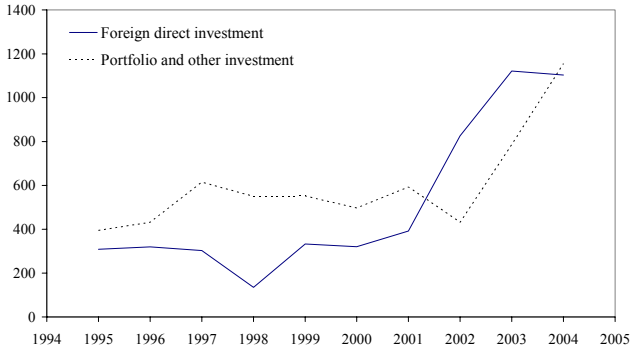
- *ASS* is the ratio of household financial assets to disposable income, available from OECD.
- *LIAB* is the ratio of household liabilities to disposable income, available from OECD.
- *GDPPC* is per capita GDP from the IMF's World Economic Outlook (WEO) database.
- *MC*, the ratio of market capitalization of listed companies to GDP, is used as an index of financial market development, available from the World Bank's World Development Indicators database.
- *INFL* is the consumer price index (CPI)—annual inflation calculated on the basis of CPI data from the WEO database.
- *GOVOLDAGE* is the ratio of old age-related public expenditure to GDP, available from the OECD Social Expenditure Database.
- *OLDAGE* is the old-age dependency ratio, calculated using OECD data on labor force Statistics.
- *INT* are short-term interest rates from IMF, *International Financial Statistics* (*IFS*).
- *FLA*, total liabilities of firms as a percentage of assets, available from the IMF's Corporate Vulnerability Utility database, is used as a proxy for corporate indebtedness.
- *UN* is the OECD standardized rate of unemployment.

V. Monetary Policy Implications of Capital Account Volatility under an Inflation Targeting Regime[32]

A. Introduction and Summary

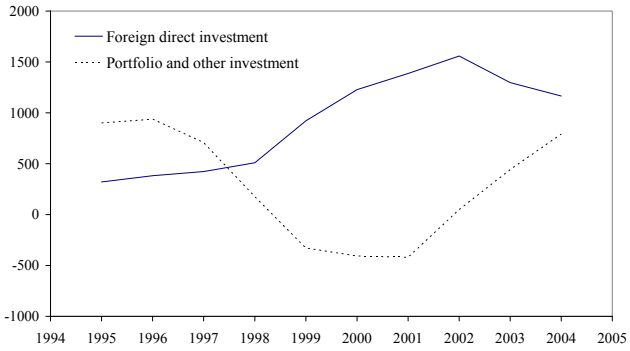
74. **Two trends are evident in the Czech data on financial flows**: (i) an increase in the volatility of direct and portfolio and other investment flows; and (ii) a decline in the magnitude of direct investment flows and an increase in the magnitude of portfolio and other investment flows (Text Figures). While it is difficult to predict whether the volatility of capital flows will continue to increase in the future, there are some reasons to believe that the relative importance of portfolio and other flows might increase over time. Large privatization-related FDI inflows are expected to diminish in importance over the medium term as the country moves up the technology ladder and the marginal product of capital declines. The composition of FDI is likely to shift toward intermediate products and services with lower capital intensity than past FDI.[33] On the other hand, portfolio flows are likely to increase in importance. Increasing trends in investment from funds tracking EU fixed-income securities have already been observed following the Czech Republic's entry in the EU. Moreover, the Czech Republic was also recently included in the Lehman Aggregate Index, which is widely tracked by investors, with expected increases in the liquidity, depth and turnover of asset markets.

Standard Deviation of Quarterly Capital Flows, 1993-2004
(In millions of dollars, three-year rolling averages)



Source: CNB and IMF staff estimates.

Mean of Quarterly Capital Flows, 1993-2004
(In millions of dollars, three-year rolling averages)



Source: CNB and IMF staff estimates.

[32] Prepared by Philippe Karam (INS), Douglas Laxton (RES) and Natalia Tamirisa (EUR). The authors are grateful to Meral Karasulu (WHD) and participants in a EUR seminar for very useful comments.

[33] This change in the composition of FDI is consistent with the authorities' medium-term growth strategy: *Economic Strategy for the Czech Republic*, prepared by the Prime Minister's Office, Prague, Czech Republic, June 2005.

75. **This chapter focuses on the implications of capital account volatility for monetary policy**. To the extent that volatility of key macroeconomic variables increases as capital flows become more volatile, monetary policy will need to become more responsive to capital account shocks to keep inflation on target. The chapter first considers macroeconomic and policy implications of two different types of capital account shocks, namely FDI and portfolio and other investment, with varying degree of persistence. The chapter then examines the implications of a change in the composition of shocks that the Czech economy is exposed to (namely, an increase in the volatility of FDI and portfolio flows, and an increase in the magnitude of portfolio flows and a decline in FDI flows) on the optimally-calibrated monetary policy rules.

76. **The analysis of capital account shocks is based on a two-region version of the IMF's new Global Economic Model (GEM)**. GEM is a dynamic stochastic general equilibrium model developed at the Fund. It has been developed to provide an optimizing intertemporal framework capable of addressing basic policy questions involving international transmission of policy and structural shocks. The model has choice-theoretic foundations building on the new open-economy literature[34] and assumes there is a fundamental role for monetary policy to anchor inflation and inflation expectations by being committed to adjusting the policy rate in response to new information about developments in the economy. Two regions are included in the version of the model used in this chapter—the Czech Republic and the European Union—and it has been calibrated to model the trade linkages between these two economies.

B. A Brief Description of the Model[35]

77. **Each region in GEM includes households, firms, and a government**. Consumption and production are characterized by constant elasticity of substitution utility and production functions. There are two factors of production, labor and capital, which can be moved across sectors to produce a continuum of tradable and nontradable intermediate goods as well as raw and semi-finished materials. Land is a factor of production in fixed supply. A distribution sector drives a wedge between wholesale (producer) prices and retail (consumer) prices that downstream firms producing the final nontradable good must pay. Investment is driven by a Tobin's q-relationship, in which firms respond sluggishly to differences between the discounted value of their marginal products of capital and the replacement value of their capital stock. To simulate realistic investment flows, capital accumulation is subject to adjustment costs of a quadratic functional form. The model assumes imperfect international capital markets where only short-term bonds denominated in foreign currency are traded. Wage contracts and prices of intermediate goods are subject to adjustment costs, i.e., there

[34] See Obstfeld and Rogoff (1995 and 2000) and Lane (2001).

[35] For a detailed description of the structure and properties of the GEM and its calibration to Czech and EU data, see Laxton and Pesenti (2003).

are nominal wage and price rigidities, designed to guarantee that the model exhibits meaningful dynamics and a realistic representation of lags in the monetary transmission mechanism. Government spending falls exclusively on nontradable goods, both final and intermediate, and is financed through tax and seigniorage revenues. The monetary authority in both countries is assumed to set short-term interest rates based on information about inflation and output.

78. **The model has been calibrated to reflect key macroeconomic features of the Czech Republic and the Euro area**. The shares in GDP of consumption, investment, government spending, exports and imports are calibrated to correspond to historical averages in the two economies. The baseline parameters are based on available estimates from the literature, adjusted to reflect specific characteristics of the Czech and the EU economies. The model adequately replicates the lags in the monetary transmission mechanism that are used in both the Czech National Bank's forecasting model and the ECB's area-wide model. Variability in Czech interest rates and inflation corresponds to the recent, post-disinflation period (see Laxton and Pesenti, 2003).

79. **Monetary policy is specified in terms of a (Generalized) Taylor rule**.[36] A simple interest rate reaction function relates interest rates to the deviation of the inflation rate from the targeted level, the deviation of the interest rate from the neutral level, and the lagged level of the output gap:

$$\left(1+i_{t+1}\right)^4-1=\omega_i\left[\left(1+i_t\right)^4-1\right]+\left(1-\omega_i\right)\left[\left(1/\beta^4\right)\left(P_t/P_{t-4}\right)-1\right]+\omega_1\left[P_t/P_{t-4}-\Pi_t\right]+\omega_2\left[ygap\right], \quad (1)$$

where the left-hand side is the annualized interest rate i_{t+1}, i_t is the lagged interest rate with $0<\omega_i<1$, P_t/P_{t-4} is the year-on-year CPI inflation rate, Π_t is the year-on-year inflation target, and *ygap* is the output gap (defined as the deviation of real GDP from the steady-state level implied by the model.) The term with the weight $(1-\omega_i)$ refers to the neutral interest rate. The parameter β is the discount rate and a reciprocal of the steady state real interest rate. In the steady state, the nominal interest rate equals the equilibrium real interest rate plus the rate of inflation.

[36] Taylor (1993). The term "Generalized Taylor (GT) rule" is used here to refer to a Taylor rule with interest rate inertia (ω_i>0). The interest rate rule in the model is similar to the one used in the Czech National Bank's *Quarterly Projection Model* (see CNB, 2003). The main difference is that the CNB rule depends on a model-consistent forecast of year-on-year inflation one year in the future, while the Taylor rule depends on a contemporaneous measure of inflation.

80. **Weights in the interest rate rule function are optimally calibrated to minimize a standard loss function**. In line with a conventional approach in the literature on the evaluation of the monetary policy rules in empirically-based models,[37] we assume a linear loss function, which depends on the unconditional variances of inflation, the output gap, and the first difference of interest rates. Underlying the standard loss function, there is an implicit assumption that minimizing variability in inflation and detrended measures of output is broadly equivalent to maximizing welfare.[38] The loss function is given by:

$$L = \sigma^2\left(P_t \big/ P_{t-4}\right) + L_{ygap}\sigma^2\left(ygap\right) + L_i\sigma^2\left(i_{t+1} - i_t\right), \tag{2}$$

In the baseline loss function L, the weight on inflation variability is 1 and the weights on interest rate variability L_i and the output gap L_{ygap} are ½ each. Alternative weights are considered as part of the robustness analysis. The optimally-calibrated rules imply inertia in the policy rate and a higher weight on inflation vis-à-vis the output gap.

81. **The model encompasses a variety of stochastic shocks.** These include shocks to productivity in all sectors, shocks to aggregate investment (the depreciation rate), consumption (the marginal utility of consumption), government spending, labor effort (the marginal disutility of labor), and a preference shifter that reflects the weight of tradable goods in final good production. Each shock is assumed to follow a stochastic process of the following form:

$$y_t = \left(1 - \Psi\right)\bar{y}_t + \Psi y_{t-1} + \varepsilon_t^y, \tag{3}$$

where y_t is the variable, $\bar{y}_t$ is its steady-state value, Ψ is the persistence parameter, and ε_t^y is a Gaussian disturbance term. The distributions of these shocks are calibrated to reflect the historical variability of key macroeconomic variables in the Czech Republic and the EU: real GDP, consumption, investment, government expenditure, exports, imports, CPI inflation, short-term interest rate, and real effective exchange rate. In addition to the above shocks, a risk premium shock is introduced in the GEM model as an additive component in a financial intermediation (friction) function. In the model, domestic agents face a financial transaction cost when they trade the international foreign-denominated bond. Adjustment cost parameters affect the extent of the intermediation friction, and have an impact on the dynamics of net foreign assets and the current account. The source of uncertainty relating to financial intermediation friction in the model is synonymous with what is known as an

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[37] See Williams (2003) for a survey.

[38] This assumption holds true as long as the monetary policy does not have significant first-order effects on welfare through its impact on the average level of real variables, such as investment, labor effort, and real income (Svensson, 2003a and 2003b).

uncovered-interest rate-parity shock or a risk premium shock in other models. In the absence of shocks to the risk premium, arbitrage implies that the interest rate differential will be equal to the expected change in the value of the Czech koruna.

C. Capital Account Shocks

82. **We assume that positive FDI shocks lead to productivity improvements**. High-quality foreign technology embodied in Czech production leads to persistent productivity improvements with tested and reliable markets of final products. An example of such FDI is large-scale investment in assembly lines for automobiles, TV sets, and computers, which has been attracted to the Czech Republic over the past decade by the high marginal product of capital and educated labor force. Less persistent FDI shocks reflect investment in medium-size production facilities for intermediate components. Markets for such components are characterized by lower entry costs and greater competition and hence greater uncertainty about market demand and productivity improvements.

83. **Portfolio investment shocks are modelled as a decline in the country risk premium**. The decline in the risk premium can reflect a variety of factors: improved country fundamentals, increases in global liquidity or structural shocks such as a regional reallocation of portfolios. We assume that portfolio investment shocks differ by their persistence as in the case of FDI shocks.

84. **The impact of capital account shocks and their implications for monetary policy depend on the response of aggregate demand and supply**. The supply-side effects reflect changes in incentives, such as an increase in the desired capital stock (when productivity and external demand for domestic tradable goods rises), an increased desire to work (when the demand for labor increases leading to higher real wages), or a reallocation of factors between sectors (when productivity in the tradables sector increases). On the demand side, the increase in consumption depends on the extent to which individuals view an increase in real wages and real appreciation as a permanent increase in their future income. This effect in turn depends on the planning horizon of individuals (their level of impatience) and the persistence of the shock. Investment responds to the real interest rate increase reflecting the increased demand for tradable goods resulting from the FDI shock, while net exports respond to the increase in the demand for domestic tradable goods as well as changes in the real exchange rate.

85. **To assess more general implications of capital account volatility for monetary policy, we recalibrate the weights in the interest rate rule to a new combination of shocks compared to the baseline**. In the interest rate equation (1), the weights minimize the variability of inflation, interest rates, and output in line with the loss function (equation (2), given the historical combination of standard demand and supply shocks. In the simulation experiments, weights are re-estimated assuming a new composition of shocks: (i) smaller and less persistent FDI shocks, and (ii) larger and less persistent risk-premium shocks.

D. Simulation Results

86. **FDI inflows lead to supply-side improvements, which tend to offset the inflationary effect of demand expansion**. In the case of a persistent FDI shock, the real exchange rate appreciates by ⅓ of a percent (in percent deviation from a baseline of zero in the figures), reflecting Balassa-Samuelson effects and improved foreign market penetration (after a slow transition start with low real exchange rate appreciation) . Consumers view this real exchange rate appreciation as a positive wealth effect, which will lead to a permanent increase in their future income. Investment and exports surge in response to higher external demand. The current account deficit widens by about ½ of a percent, as savings fall to accommodate increased investment and consumption. With persistent improvements in productive capacity, the supply-side effects dominate demand-side effects, limiting inflationary pressures and the interest rate response (Figure 1). In fact, in our simulations, the inflation rate remains broadly stable in the long run in the case of persistent FDI. With less persistent FDI, the macroeconomic effects are qualitatively similar (Figure 2). However, since FDI productivity improvements are less certain, the demand pressures are more likely to call for raising interest rates. In our simulations, the monetary authorities would need to tighten interest rates slightly, by less than 25 basis points, to keep the inflation rate on target.

87. **Portfolio inflows lead to real exchange rate appreciation and pressures for inflation to fall, requiring an interest rate cut**. A persistent decline in the risk premium in the uncovered interest parity condition leads to significant real appreciation on impact, about 4 percent in our simulations (Figure 3). This appreciation represents a temporary misalignment of the exchange rate, since it is not associated with an improvement in the productive capacity of the economy and raises concerns about the sustainability of the ensuing current account deficit. Real appreciation creates disinflationary pressures, to which the monetary authorities respond by lowering interest rates by over 40 basis points. The less persistent is the decline in the risk premium and the associated portfolio inflows, the smaller is the real appreciation (2½ percent in our simulations), and the smaller is the interest rate cut needed to bring inflation to the targeted level (25 basis points) (Figure 4).

88. **Higher volatility of capital flows reduces the weight on interest-rate smoothing component of the monetary policy rule**. We assume that the composition of shocks hitting the Czech Republic changes, with FDI shocks becoming smaller and less persistent and portfolio shocks becoming larger and less persistent. Smaller and less persistent FDI shocks do not lead to any significant changes in the variability of macroeconomic variables, because such shocks are broadly consistent with the historical composition of shocks and historical macro-variability in the Czech Republic (Table 1). In contrast, larger and less persistent risk-premium shocks increase variability of aggregate demand components, the output gap, and inflation. To minimize macroeconomic variability, it becomes appropriate to assign a somewhat lower weight to the interest rate smoothing component of the monetary policy rule ($\omega_i = 0.91$ compared to $\omega_i = 0.96$ in Table 1). Monetary policy needs to be less constrained by past interest rates to address increasing macroeconomic volatility. This result is robust to

alternative weights on the output gap and interest rate variability in the loss function given by equation (2).

Table 1. Optimal Weights in the Monetary Policy Rule and Measures of Macroeconomic Variability 1/

	Optimal weights			Measures of macro-variability (σ)		
	Interest rates (ω_i)	Inflation rate (ω_1)	Output gap (ω_2)	Inflation rate	Output gap	Interest rates
Baseline	0.96	0.29	0.13	1.73	1.79	0.57
Smaller and less persistent FDI shocks	0.96	0.29	0.13	1.73	1.78	0.57
Larger and less persistent portfolio shocks	0.91	0.28	0.12	1.76	1.95	0.67

Source: IMF staff estimates.

1/ The table reports weights in the Generalized Taylor rule given by equation (1). The weights have been optimally calibrated to minimize the standard loss function given by equation (2). Also reported are measures of macro-variability in the loss function.

E. Conclusion

89. **The main conclusion of this chapter is that an increase in capital account volatility calls for a more responsive monetary policy**. The capital account shocks considered in this chapter were classified as FDI and portfolio investment shocks. Yet conclusions can be generalized beyond this dichotomy:

- Capital account shocks might be associated with supply-side improvements, which would help offset the demand-side effects and dampen inflationary impact of demand expansion. If such supply-side effects are smaller in the case of more volatile capital flows, demand-side effects are more likely to dominate, calling for a greater monetary policy response to keep inflation close to target.

- To the extent that capital account volatility increases the volatility of key macroeconomic variables, monetary policy may need to become more responsive and be somewhat less constrained by past interest rates. However, unless the volatility of capital flows increases significantly, the impact on the optimal monetary policy rule is likely to be relatively small. The difficulty of forecasting the persistence of capital flows in real time also calls for caution in responding actively to capital account shocks.

REFERENCES

Czech National Bank, 2003, "*The Czech National Bank's Forecasting and Policy Analysis System*" (Prague: Czech National Bank).

Juillard, M.; P. Karam, D. Laxton, and P. Pesenti, 2004, "Welfare-Based Monetary Policy Rules in an Estimated DSGE Model of the US Economy," forthcoming, *ECB Working Paper* (Frankfurt: European Central Bank).

Lane, P. R., 2001, "The New Open Economy Macroeconomics: a Survey," *Journal of International Economics,* 54 (2), pp. 235–266.

Laxton, D., and P. Pesenti, 2003, "Monetary Policy Rules for Small, Open, Emerging Economies," *Journal of Monetary Economics*, 50, pp. 1109–1146.

Obstfeld, M., and K. Rogoff, 1995, "Exchange Rate Dynamics Redux," *Journal of Political Economy*, 103, pp. 624–660.

Obstfeld, M., and K. Rogoff, 2000, "New Directions for Stochastic Open Economy Models," *Journal of International Economics*, 50(1), pp. 117–153.

Svensson, L., 2003a, "The Inflation Forecast and the Loss Function," *Essays in Honour of Charles Goodhart*, Volume I: Central Banking, Monetary Theory and Practice, pp. 135–152 (Cheltenham, U.K. and Northampton, Mass.: Edward Elgar).

Svensson, L., 2003b, "What is Wrong with Taylor Rules? Using Judgment in Monetary Policy through Targeting Rules," *Journal of Economic Literature*, 41, pp. 426–477.

Taylor, J., "Discretion Versus Policy Rules in Practice," *Carnegie–Rochester Conference Series on Public Policy*, 39, pp. 195–214.

Williams, J., 2003, "Simple Rules for Monetary Policy," *Federal Reserve Bank of San Francisco Economic Review*, pp. 1–12.

Figure 1. The Czech Republic: Simulated Effects of a Persistent FDI Shock

(Deviation from the baseline; in percent, unless otherwise specified)

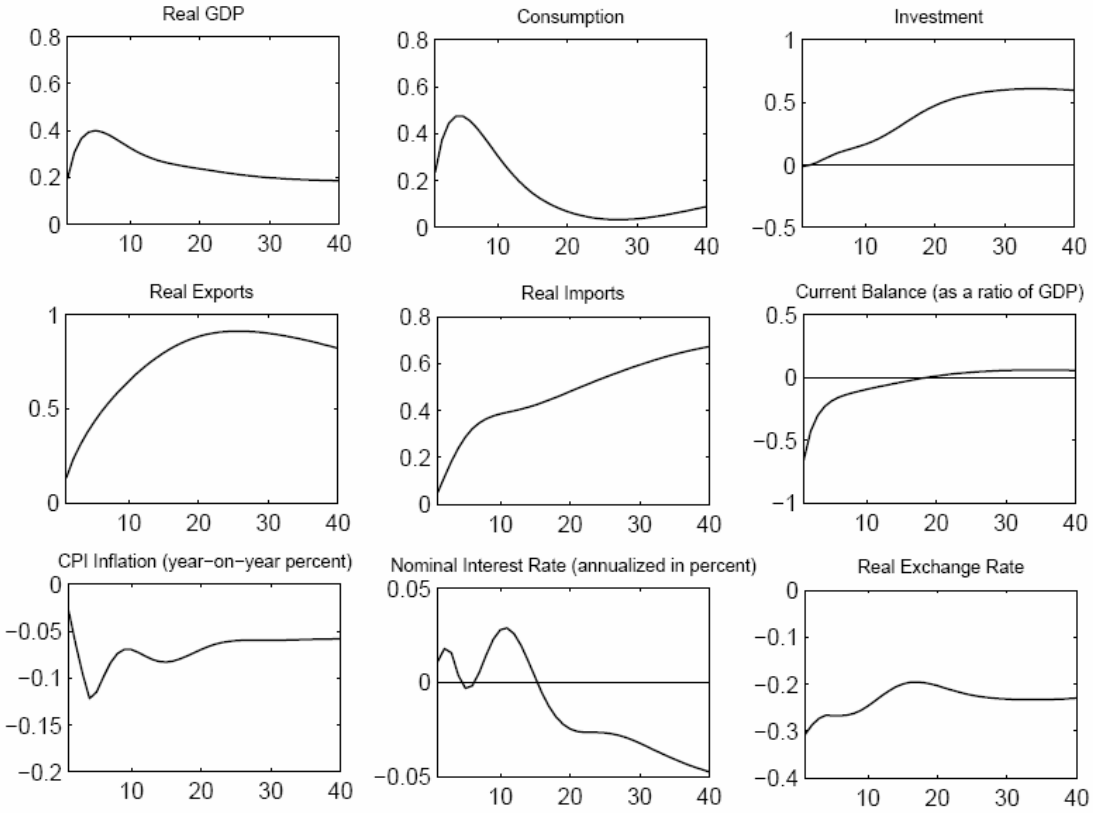

Figure 2. The Czech Republic: Simulated Effects of a Less Persistent FDI Shock

(Deviation from the baseline; in percent, unless otherwise specified)

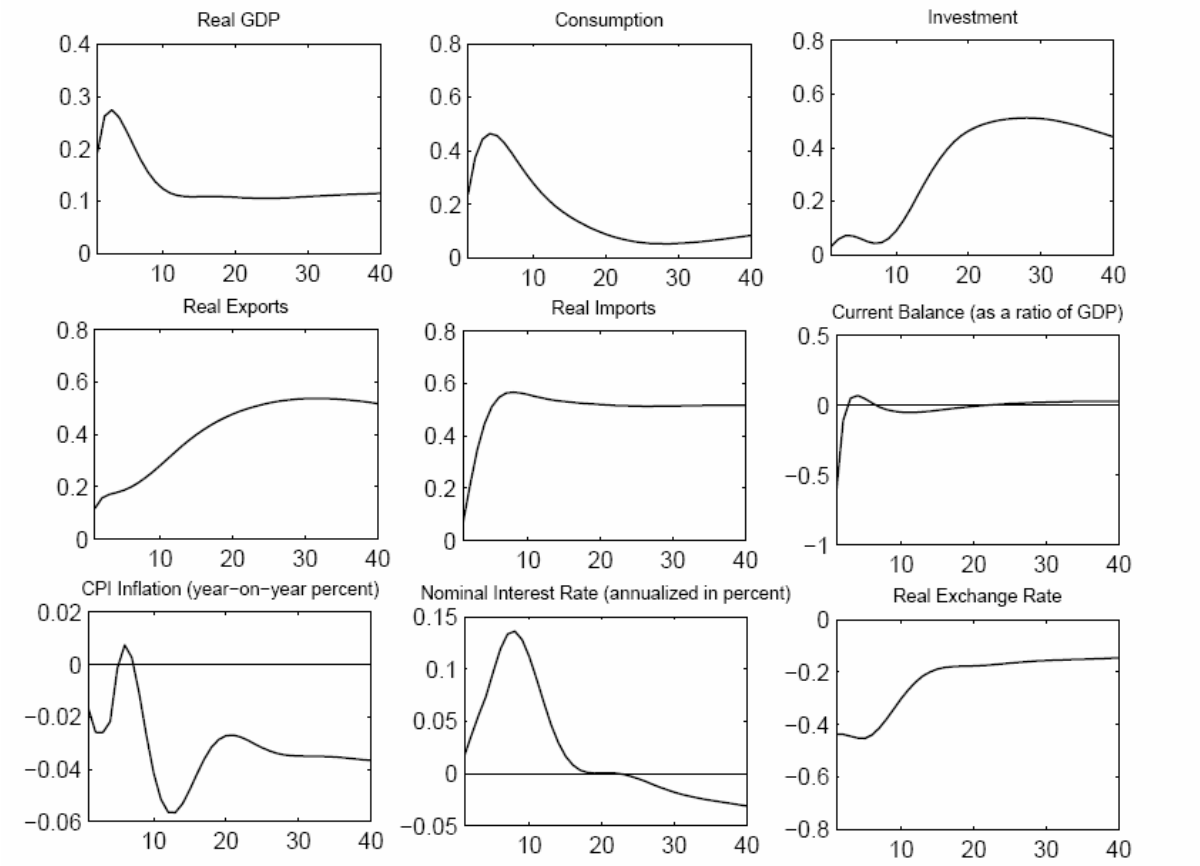

Figure 3. The Czech Republic: Simulated Effects of a Persistent Portfolio Investment Shock

(Deviation from the baseline; in percent, unless otherwise specified)

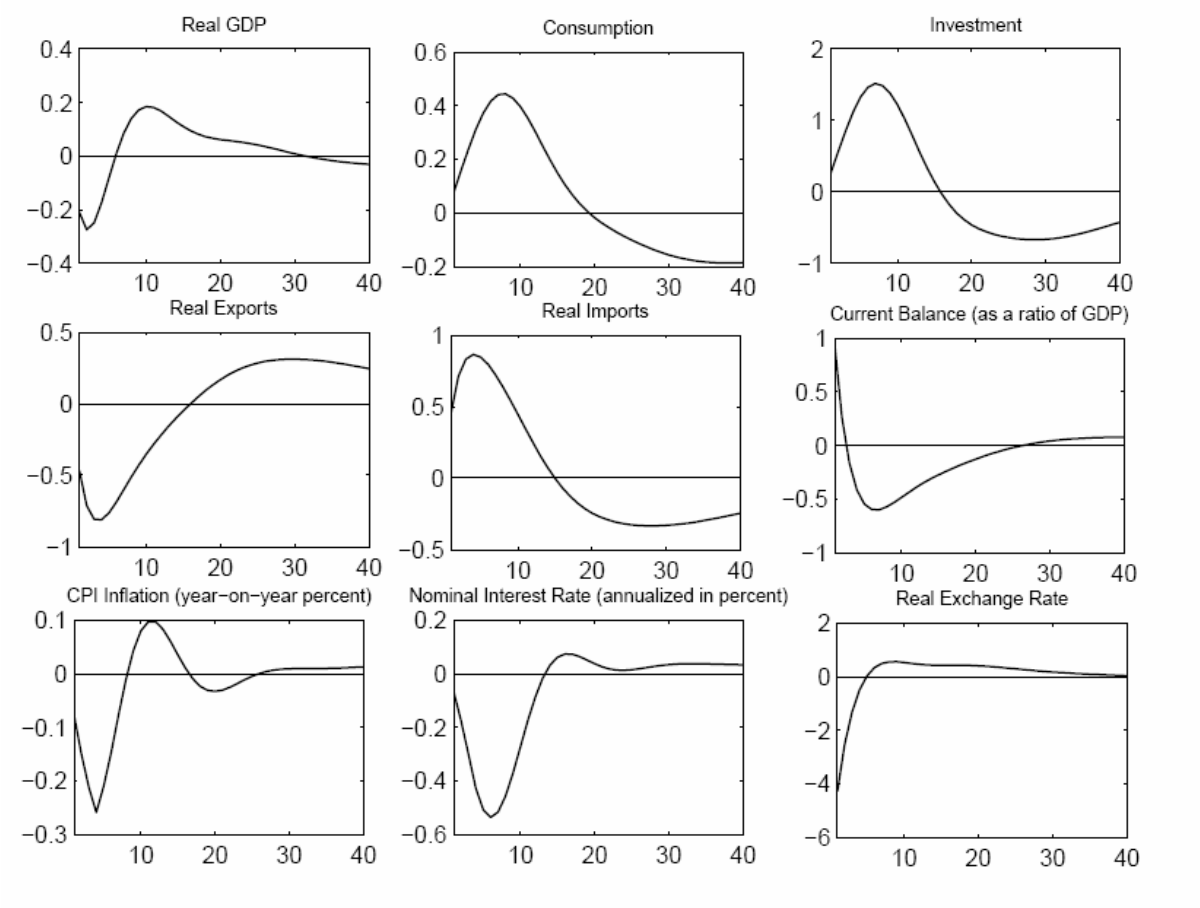

Figure 4. The Czech Republic: Simulated Effects of a Less Persistent Portfolio Investment Shock
(Deviation from the baseline; in percent, unless otherwise specified)