Becoming Old in an Older Brazil

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Human Development Department
Latin America and the Caribbean Region

Implications of Population Aging on Growth, Poverty, Public Finance and Service Delivery

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Contents

FORWARD

ACKNOWLEDGEMENTS

ABBREVIATIONS

KEY FINDINGS

Chapter 1 Introduction and Overview

1.1 Motivation
1.2 Demographic Change
1.3 The Economic Life Cycle
1.4 The Economic Implications of Demographic Change
1.5 Poverty Across the Life Cycle and the Role of Public Transfers
1.6 Public Expenditures across Generations and Age Groups
1.7 Cross-Cutting Issues and Main Conclusions

Chapter 2 Demographic Change and Labor Market Trends in Brazil

2.1 The Demographic Transition
2.2 Trends in Mortality, Fertility and Migration
2.3 Changes in Population Size and Age Structure
2.4 Dependency Ratio and Demographic Bonus
2.5 Labor Market Trends

Chapter 3 The Old-age Social Protection Programs and the Aging Challenge

3.1 Introduction
3.2 The Social Protection Programs for the Elderly in Brazil
3.3 Challenges doe the Pension System in a Rapidly Aging Population

Chapter 4 Health and Long-Term Care

4.1 Increase In Life Expectancy
4.2 Health
4.3 Long-Term Care

Chapter 5 Education and Productivity

5.1 Introduction
5.2 The Age-Productivity Profile
5.3 Opportunities to Improve Education and on-the-Job-Training
5.4 The Wage-Productivity Gap
5.5 Age, Productivity and Wages: New Evidence from Brazilian Firms
Chapter 6 Public Finance Implications of Population Aging in Brazil: 2005-2050

6.1 Introduction
6.2 The Public Sector: Age Structure and the Generosity of Public Benefits
6.3 Education
6.4 Pensions
6.5 Health
6.6 Assessing Overall Impact
Appendix to Chapter 6

Chapter 7 Financing Brazil’s Aging Population: Implications for Saving and Growth

7.1 Introduction
7.2 Aging, Saving, and Growth: The Empirical Evidence
7.3 Aging and Saving
7.4 Aging, Capital Accumulation, and Demographic Dividends
Appendix to Chapter 7

References
Forward

This report addresses one of the most emblematic and fundamental issues to the development of Brazil, which could define whether the Country will enter a cycle of sustained and inclusive development, or, on the other extreme, if it will fall in a fiscal trap with lack of opportunities for youth.

Population ageing was traditionally not a top concern in a country that is seen as synonymous of youth. But this has been changing drastically in the last few decades. Brazil embarked in a process of development that is taking the country to reach social and demographic indicators similar to those of developed countries, but with systems and institutions inherited from another context.

There was little debate about this transition until now, especially from a broader perspective, that seeks opportunities and challenges from sector inter-relations and indirect impacts. This report seeks to reduce this gap and encourage the debate on demographic aging and public policy options in this relatively new field for Brazil. It will be clear to the reader that this debate can no longer be delayed.

Above all, the current rapid demographic changes in Brazil represent a huge opportunity to boost social and economic development and growth. Brazil is going through a short “demographic bonus”, unique for each nation, when the labor force far outsizes the dependent population. This is an inflection point that will only last until 2020, but with much farther-reaching impacts.

Thus, it is impossible to overstate the importance of the moment. Today’s policy decisions in terms of education, health and social welfare will determine the country’s ability to invest in its youth and provide a good and long life to its elderly, but also support economic growth, government services and the Brazil’s international competitiveness – in short, moving more and more towards becoming a developed country.

The current model, developed after the Constitution of 1988 in a young demographic context, with much poverty, recently-created institutions and high inflation, favors public transfers for the elderly in relation to children. This model was very efficient in reducing the poverty and inequality, but it led to OECD-level costs, although Brazil’s age structure is still relatively young. This resulted in lower investments in youth and much higher average benefits to the elderly (66.5% of the average wage in Brazil vs. 30.4% of the OECD average).

Brazil is moving into a fundamentally different demographic context, however, where the increasingly mature population will place an extra burden on the system. The country may be forced to make difficult choices, with consequences on poverty among vulnerable groups and long-term economic growth.

Brazil needs to take advantage of the current opportunity to prepare for the structural changes that the Country will face in the next decades. For instance, the labor market needs to create enough opportunities for the working-age population in the short term, but Brazil will also have to encourage women and other groups to participate in the economy, to sustain productivity growth. Moreover, it will be necessary to finance the fiscal expenses induced by an older population and stimulate savings and growth. In this way, population aging may lead to a large accumulation of capital and increase in incomes, wealth and well-being throughout life.

However, the institutional changes are difficult to negotiate with society and have long transition periods. International experience shows that, the longer they are delayed, the greater is need for reforms, and the more drastic they will be. However, the report points out that the demographic change itself reveals opportunities of gains and compensations. For example, as fewer students enter the system due to a lower
birth rate, resources are released for other purposes, such as increasing the quality or the reach of early childhood education. Likewise, the gradual process of aging is conducive to gradual multi-year adjustment programs in social security, health and education.

I am certain that this report, a result of over two years of work by the World Bank’s Brazil Human Development Team, led by Michele Gragnolati, will contribute to the debate on these issues and will help Brazil face this new challenge, which by itself attests the long way the country has come in the path to development and poverty eradication.

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Director of World Bank Country Management Unit in Brazil
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The report was written building on the findings of the background papers listed below, most of which were presented at a Workshop on Aging in Brazil organized by the World Bank in Brasilia on April 6 and 7, 2010.

2. Beltrao, Kaizo and Sonoe Sugahara (2010), Demographic Transition in Brazil.
3. Camarano, Ana Amelia (2010), Options for Long-Term Care in Brazil: Formal or Informal Care?
8. Rocha, Romero (2010), Aging, Productivity and Wages: Is an Aging Workforce a Burden to the Firms?
11. Turra, Cassio and Romero Rocha (2010), Public Transfers among Dependent Age Groups in Brazil.
# Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEPS</td>
<td><em>Anuário Estatístico da Previdência Social</em> – Statistical Yearbook of the Social Security</td>
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<td>BEPS</td>
<td><em>Boletim Estatístico da Previdência Social</em> – Social Security Statistical Bulletin</td>
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<td>BPC</td>
<td><em>Benefício de Prestação Continuada</em> – Benefits of Continued Provision</td>
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<td>CELADE</td>
<td><em>Centro Latinoamericano de Demografia</em> – Latin American and Caribbean Center of Demography</td>
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<td>CENSUS</td>
<td>Program for Evaluations and Experiments - individual enumeration, universality within a defined territory, simultaneity and defined periodicity</td>
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<td>CEPAL</td>
<td><em>Comissão Econômica para a América Latina e o Caribe</em> – Economic Commission for Latin America and the Caribbean</td>
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<td>CIAPE</td>
<td><em>Centro Interdisciplinar de Assistência e Pesquisa em Envelhecimento</em> – Interdisciplinary Center of Assistance and Research in Aging</td>
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<td>CVD</td>
<td>Cardiovascular Disease</td>
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<td>DLA</td>
<td>Daily Life Activities</td>
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<td>EC</td>
<td><em>Emenda Constitucional</em> – Constitutional Amendment</td>
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<td>ECA</td>
<td>Europe and Central Asia</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GE</td>
<td>General Equilibrium</td>
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<td>IBGE</td>
<td><em>Instituto Brasileiro de Geografia e Estatística</em> - Brazilian Geographical and Statistical Institute</td>
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<tr>
<td>IHD</td>
<td>Ischemic Heart Disease</td>
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<td>IMF</td>
<td>International Monetary Fund</td>
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<td>INPC</td>
<td><em>Índice Nacional de Preços ao Consumidor</em> – Consumer Prices national Index</td>
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<td>INPS</td>
<td><em>Instituto Nacional de Previdência Social</em> – Brazilian National Institute of Social Security</td>
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<td>INSS</td>
<td><em>Instituto Nacional de Seguridade Social</em> – National Institute of Social Security</td>
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<tr>
<td>IPEA</td>
<td><em>Instituto de Pesquisa Econômica Aplicada</em> – National Institute for Applied Economic Research</td>
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<td>IPUMS</td>
<td>Integrated Public Use Microdata Series</td>
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<td>ISCED</td>
<td>International Standard Classification of Education</td>
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<tr>
<td>LAC</td>
<td>Latin America and Caribbean region</td>
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<td>LCH</td>
<td>Life-Cycle Hypothesis</td>
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<td>LE</td>
<td>Life Expectancy</td>
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<td>LEB</td>
<td>Life Expectancy at Birth</td>
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<td>LOAS</td>
<td><em>Lei Orgânica da Assistência Social</em> – Organic Law of Social Assistance</td>
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<td>LOC</td>
<td>Lenght of Contribution</td>
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<td>LOS</td>
<td>Length of Service</td>
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<td>LTC</td>
<td>Long Term Care</td>
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<td>MDS</td>
<td><em>Ministério do Desenvolvimento Social e Combate à Fome</em> – Ministry of Social Development and Fight Against Hunger</td>
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<td>MPS</td>
<td><em>Ministério da Previdência Social</em> – Ministry of Social Security</td>
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<td>NCD</td>
<td>Non-Communicable Disease</td>
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<td>NTA</td>
<td>National Transfer Accounts</td>
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<td>NVP</td>
<td>Net Present Value</td>
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<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>OLG</td>
<td>Overlapping Generations</td>
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<td>OLS</td>
<td>Ordinary Least Squares</td>
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<td>PAYG</td>
<td>Pay-As-You-Go</td>
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<td>Abbreviation</td>
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<tr>
<td>PC</td>
<td>Period of Contribution</td>
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<td>PE</td>
<td>Partial Equilibrium</td>
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<td>PHC</td>
<td>Primary Health Care</td>
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<td>PLOC</td>
<td>Propostional Length of Contribution</td>
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<td>PNAD</td>
<td>Pesquisa Nacional por Amostragem a Domicílios – Brazilian Household Survey</td>
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<td>POF</td>
<td>Pesquisa de Orçamentos Familiares – Brazilian Familiar Budget Survey</td>
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<td>PPP</td>
<td>Purchasing Power Parity</td>
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<td>PSF</td>
<td>Programa Saúde da Família – Family Health Program</td>
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<td>PVI</td>
<td>Pulmonary Vein Isolation</td>
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<td>RA</td>
<td>Retirement Age</td>
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<td>RGPS</td>
<td>Regime Geral de Previdência Social – General Regime of Social Security</td>
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<tr>
<td>RMV</td>
<td>Renda Mensal Vitalícia – Lifelong Monthly Income</td>
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<td>RPPS</td>
<td>Regime Próprio de Previdência Social – Social Security Own Regimes</td>
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<td>SP</td>
<td>Social Protection</td>
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<td>SSA</td>
<td>Social Security</td>
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<tr>
<td>SUS</td>
<td>Sistema Único de Saúde – Unified Health System</td>
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<tr>
<td>TFR</td>
<td>Total Fertility Rates</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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<tr>
<td>VAR</td>
<td>Vector Auto-Regression</td>
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<td>WB</td>
<td>The World Bank</td>
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<td>WEO</td>
<td>World Economic Outlook</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Key Findings

The Facts

1. Brazil is in the middle of a profound socioeconomic transformation driven by demographic change. Mortality started declining, mostly at young ages, around 1940. Infant mortality decreased from 135 to 20 per thousand live births between 1950 and 2010, and life expectancy at birth increased from about 50 to about 73 years over the same period of time. The change in fertility has been even more spectacular, and with more dramatic implications. The average Brazilian woman had more than six children in the early 1960s and currently has less than two. Over time these changes in mortality and fertility alter the population age structure.

2. Brazil is currently in the so-called demographic bonus that is a period of time in a nation's demographic transition when the proportion of population of working age group is high. This period is characterized by smaller dependency ratio (ratio of dependents to working-age population). The dependency ratio, which has been declining since 1965, will reach its bottom value in 2020 and will increase after that.

3. The speed of population aging in Brazil is going to be significantly faster than what has been experienced by more affluent societies over the last century. For example, it took more than a century for France’s population, aged 65 and above, to increase from 7 to 14 percent of the total population. In contrast, the same demographic change will occur in the next two decades in Brazil (between 2011 and 2031).. The elderly population will more than triple within the next four decades, from less than 20 million in 2010 to approximately 65 million in 2050.

4. The elderly population will increase from about 11% of the working-age population in 2005 to 49% by 2050, while the school-age population will decline from about 50% of the working-age population in 2005 to 29% by 2050. These shifts in population age structure will lead to substantial additional fiscal pressures on publicly financed health care and pensions, along with substantial reductions in fiscal pressures for publicly financed education.

5. Per capita public transfers to the elderly relative to transfers to the children are much larger in Brazil than in any OECD and other LAC country with similar welfare systems. Brazil’s public sector spending in education and pensions (as a percentage of GDP) is similar to OECD countries. However, given Brazil’s much younger population age structure, this results in markedly lower public education investment in youth (9.8% of average wages in Brazil vs. 15.5% in OECD) and markedly higher average public pension benefits (66.5% of average wage in Brazil vs. 30.4% of average wage in OECD). Aggregate public health care expenditures in Brazil are much below the OECD average – and average health benefits are somewhat lower.

6. The increasingly smaller size of school age population provides a unique opportunity to increase per student investment to OECD levels without adding much burden on public finance. An ambitious expansion of educational spending to reach OECD levels of investment per student within a decade would require an increase of education spending of little more than 1 percent of GDP by 2020. After that, the share of GDP devoted to education would gradually decline as the school-aged population drops – while maintaining investment levels per student at those of OECD countries.

7. Heath care expenditures are likely to increase substantially. Indeed, health care is likely to emerge as a major fiscal challenge in the coming decades in Brazil. There are two driving forces behind the
projected increase in health expenditures: the increasing proportion of elderly in the population, and a
growing intensity of formal health care use among the elderly.

8. It is also anticipated that the number of elderly people generating a demand for formal long-term
care will increase because of two factors. First, the dramatic increase in the number of the very old over
the next 30 years will result in a larger number of old frail people at any given point in time; this despite a
reduction in the proportion of frail old people as a result of improvements in health prevention and
postponement and better administration of disabilities. Second, the changing status of women and of
family and social values will continue to impact the availability of family caregivers. Projections for
Brazil estimate that twice as many people will be taken care of by non-family members in 2020, and five
times as many in 2040, compared to 2008.

9. Public transfers in Brazil have been very effective in reducing poverty among the elderly. In
particular, the pension system extends benefit coverage to most of the old age population and provides
protection to the poorest segments of society. Indeed the programs have contributed to reducing poverty
and inequality, particularly in rural areas. However, this has come at a high cost, with sharp increases in
expenditures of the social security system. Without substantial changes, the aging of the population will
put a strain on the current system that will result in some critical trade-offs with consequence for poverty
among other vulnerable groups and for the growth prospects of the country.

10. The current pension system creates negative incentives for labor market participation and social
security contribution behavior. The low age limit and the existence of a length of service without
minimum age eligibility result in a population who retires early. Thus a system that is meant to sustain the
income of individuals that are unable to work ends up doing so for a longer period of time than those
individuals contributed. Moreover, early retirement implies that a portion of the productive labor force is
not being used or that they continue working in the informal sector.

11. The rules of the pension system incentivize informality, especially for low-skilled workers. The
availability of a non-contributory program that transfers a benefit equal to the minimum income in the
contributory program (equivalent to the minimum wage) reduces the incentives for low earners to
contribute. This is damaging as a large proportion of the population does not contribute to the social
security system during the working age, while it will benefit in old age. As the population in Brazil ages,
the need to ensure that a larger part of the population contributes to the system will become more and
more pressing.

12. The pension reforms of 1999 and 2003 were successful in slowing the expansion of pension costs.
Without these reforms, spending in pensions would have risen from 10 percent of GDP in 2005 to an
astounding 37 percent of GDP in 2050, because of the mere increase in the number of eligible pensioners
associated with population aging. The recent set of pension reforms more than halved the projected costs.
However, the problem of affordability of pension expenditures has not yet been solved; with pension
expenditures projected to more than double to 22.4 percent of GDP by 2050. Even under more optimistic
scenarios, increases in pension expenditures dominate the fiscal outlook for Brazil.

13. Given the strong association between people’s economic behavior and the life cycle, changes in
the population age structure have a major impact on economic development. The favorable age
composition that Brazil is currently provides opportunities for higher economic growth through various
channels, which are often referred to as demographic dividends. Labor supply increases as the generations
of children born during periods of high fertility enter the labor force (first demographic dividend). At the
same time, as fertility declines women’s labor force participation is also likely to increase. Savings are
likely to increase too as there are more individuals of working age who are expected to live longer. This
leads to increase in physical capital (second demographic dividend). Investment in human capital may
also increase as lower fertility leads to healthier women and parents have more resources to invest in education.

14. Over the medium-term, however, the expected changes in labor force composition due to the aging of the population will pose challenges to economic growth. After the mid-2020s the growth rate of the 15-59 age group will turn negative and population growth will be driven only by the increase in the number of the elderly. Moreover, at the micro level there may be negative effects on productivity as a larger share of the labor force will be beyond its peak in productivity. The negative economic impact is likely to be amplified by the fact that the same decreasing age profile observed for productivity is not observed for wages in the formal sector, which tend to increase with seniority (and age). This, in turn, is likely to affect firms’ competitiveness, profitability and investment negatively.

15. Targeted training programs can be effective in softening or halting any age-related decline in the ability to learn new skills. Until now, however, all evidence indicates that access to training decreases substantially through one’s working life. In the future, firms will have no choice but to expand their training programs to invest more in older employees and to reorient the programs to meet the needs of those workers.

16. It is the conventional view that aggregate saving will be reduced by population aging. However, this may not necessarily be the case in Brazil. This is because elderly generally save to a high extent out of their gross income, which remains high in Brazil mainly thanks to public transfers. So, when population aging leads to a higher fraction of elderly in the population the average saving rate may increase—or at least not fall. However, households’ saving behavior (and Brazil’s aggregate saving rate) will be affected by how the increasing costs of pension and health expenditures associated with an increasing older population will be financed.

The Policy Implications

17. Brazil needs to seize the current opportunity and prepare for the structural changes it will face over the next decades and beyond. The prospect of population aging in Brazil, as for most middle-income (and even more so for most low-income) countries is a source of concern for two reasons: (i) it may obstruct fiscal sustainability and hinder further economic growth; and (ii) it may put a strain on existing institutions.

18. There is urgency in putting in place the right institutional and policy framework for two main reasons: (i) institutions are slow to change; and (ii) those who will be the elderly in 2050 are already entering the workforce today and the rules of the current system are shaping their choices. Decisions they make over their entire adult life will be framed by the social and economic institutions, actual and expected, that influence economic security in old age. In addition, political realities typically impose a long transition period until a new regulatory framework is fully implemented. The longer a reform is postponed, the greater the need for one, and the more drastic it will have to be.

19. As more resources per student become available, it is important that they be used to improve the effectiveness of the education system. Brazil has made impressive progress in basic education over the past 15 years, but the country is still far from its goal of OECD-level educational quality by 2021. The key to accelerated progress in basic education is a mix of continuity in key areas where substantial progress has been achieved (financing equalization, results measurement and Conditional Cash Transfer programs) and further progress in four areas: (i) building better teachers; (ii) reaching the poorest children with quality early child education; (iii) raising quality in secondary education; and (iv) maximizing the impact of federal policy on basic education. In addition, there is a clear need for reform in tertiary education, which the Ministry of Education has been moving more slowly, but steadily, to address.
20. The organization of the health care system needs to be adjusted to the different demographic and epidemiological profile of the increasing older population in Brazil. The magnitude of the increase of health expenditures associated with an older population will depend crucially on whether longer life spans mean more healthy years or added years of illness and dependency. Prevention and postponement of disease and disability and maintenance of health, independence, and mobility in an aging population will be the major health-related challenges of population aging.

21. Policy alternatives to home care need to be developed to address long-term care demand of an increasingly larger number of elderly who will not be able to be supported by family members. Strengthening the capacity of the Family Health Program may be a possible strategy but it will require additional focus and resources.

22. The pension system should be made more efficient, especially addressing the incentives that lead to retirement at a very young age, excessively high replacement ratios and multiple receipts of benefits. For example, a structural policy response of linking mandatory retirement (or entitlement) ages to increasing life expectancy could be considered. Such a reform has already been implemented in various OECD countries (Denmark, for example). This would boost labor supply and reduce the fiscal costs of aging. This reform should be implemented promptly so younger generations have time to adjust their saving behavior.

23. The government should increase coverage and improve incentive-compatibility of social insurance for old age. Indeed, it faces a big challenge in avoiding the consolidation of a bi-polar social protection system, where poor families are limited to non contributory programs and unable to benefit from more generous formal sector social insurance programs.

24. Economic policies should be directed towards capturing the demographic dividends. For example, the labor market needs to create enough opportunities for the growing working age population in the short-term. To sustain aggregate output growth over the medium and long term, however, Brazil will have to stimulate participation in the economy of groups like women and to support productivity growth. On the one hand, to boost productivity of the existing labor force, it needs to invest on incentives and means for skills upgrading of current workers, for example, through training and retraining of mature workers and lifelong learning programs. On the other hand, to boost the productivity potential of future generations it needs to invest in better public education. In particular, increasing coverage and improving quality of education at early stages is likely to be among the most important determinants of a more productive labor force in the future. And this will make retraining more efficient and more effective at later stages of working age life.

25. Moreover, appropriately, adequately, and timely formulated government policies to finance the population aging-induced fiscal costs are needed to stimulate endogenous increase in savings and, thus, growth. By such means, population aging is likely to lead to substantial capital accumulation and increases in lifetime income, wealth, and welfare. For example, refraining from increasing contributions to social security while, instead, allowing replacement rates to gradually adjust downward when the share of elderly per worker increases would keep pensions from further crowding out private saving—thus promoting capital accumulation and economic growth. Policies to enhance the financial market capacity to turn savings into investments are also key to achieving the demographic dividend from private saving.
Chapter 1
Introduction and Overview

1.1 MOTIVATION

Brazil is in the middle of a profound socioeconomic transformation driven by demographic change. Mortality started declining, mostly at young ages, around 1940. Infant mortality decreased from 135/1,000 to 20/1,000 between 1950 and 2010, and life expectancy at birth increased from about 50 to about 73 years over the same period of time. Even more spectacular, and with more dramatic implications, has been the change in fertility. The average Brazilian woman had more than six children in the early 1960s and currently has less than two. The large birth cohorts generated by the onset of the demographic transition had, and continue to have, dramatic effects on the population age structure. First, the population in working ages started to increase rapidly. Second, the population at older ages then begun to increase; a trend that will become increasingly powerful as time progresses.

Between 1950 and 2010 the Brazilian population grew at an average annual rate of 2.2%. In the same period, the elderly population – 60 years old and over – grew at an average annual rate of 3.4%, that is about 1.5 times as high as for the total population. In the next 40 years the Brazilian population will grow at an annual rate of less than 0.3%, while the elderly population will grow at an annual rate of 3.2%, that is almost 12 times as high. As a result, the elderly population, which represented 4.9% and 10.2% of the total population in 1950 and 2010 respectively, will represent 29.7% of the total population in 2050, that is a proportion very close to the 30% of present day Japan (today’s oldest country) and considerably above the “old continent” of Europe – where the average proportion is currently at 24%. In absolute numbers the elderly population will increase from 2.6 million in 1950 to 19.6 million in 2010 and to 64.0 million in 2050. Moreover, the working age population – between 15 and 59 years – will start declining in 2025 and, after that, population growth in Brazil will be entirely due to increases in the older population (the youth population started declining in the early 1990s).

The prospect of population aging in Brazil, as for most middle-income (and even more so for most low-income) countries is a source of concern for two reasons: (i) it may hinder further economic growth; and (ii) it may put a strain on existing institutions. On the first point, achieving high-income status may be more difficult for countries with large elderly populations. Developed countries, by and large, first became rich and then became old. Brazil and other developing countries at a similar stage of socioeconomic development are becoming older at a much faster rate. Indeed, most of the more developed nations have had decades to adjust to this change in age structure (Figure 1.1). For example, it took more than a century for France’s population, aged 65 and above, to increase from 7 to 14 percent of the total population. In contrast, many less developed countries are experiencing rapid increases in the number and percentage of older people, often within a single generation. The same demographic aging process that unfolded over more than a century in France will occur in two decades in Brazil.
Figure 1.1
The Speed of Population Aging:
Number of Years for Population 65+ to Increase from 7% to 14%

a. Developed Countries

- Spain (1947-1992)
- UK (1930-1975)
- Poland (1966-2013)
- Hungary (1941-1994)
- Canada (1944-2009)
- US (1944-2013)
- Australia (1938-2011)
- Sweden (1890-1975)
- France (1865-1980)

b. Developing Countries

- Singapore (2000-2019)
- Colombia (2017-2037)
- Brazil (2011-2032)
- Thailand (2003-2025)
- Sri Lanka (2004-2027)
- Tunisia (2008-2032)
- Jamaica (2008-2033)
- China (2000-2026)
- Chile (1998-2025)
- Azerbaijan (2000-2041)


Going to the second point, meeting the needs of a large elderly population requires rethinking the economic and social institutions that are needed to realize income security and provide adequate health care and other services for an aging society. Moreover, there is certain urgency in putting in place the right institutional and policy framework. This is for two reasons: (i) institutions are slow to change; and (ii) those who will be the elderly in 2050 are already entering the workforce today and the rules of the current system are shaping their choices. Decisions they make over their entire adult life will be framed by the social and economic institutions, actual and expected, that influence economic security in old age. In addition, political realities typically impose a long transition period until a new regulatory framework is fully implemented. The longer a reform is postponed, the greater the need of one, and the more drastic it will need to be. As a result, the cost of existing programs (relative to GDP) may continue to rise for a number of years along the transition period before the stabilizing effects of a reform are felt.

As we just mentioned, the speed of the demographic transition in Brazil will be significantly faster than what has been experienced by more affluent societies over the last century: the elderly population will triuplicate within the next four decades. Hence the policies and solutions sought by these societies are of limited relevance. The fast pace of aging will impact all aspects of society – from health care and social security provision to urban planning, educational opportunities and the job market. What, for instance, are the implications of population shrinkage in a (still) emerging market economy? Societies such as the German, the Japanese and the Spanish are already struggling with population loss. They, however, have an option to compensate for that through importing labor. There are already today some 240 million legal immigrants in the world who have typically left their poorer home countries in search of opportunities in richer ones. Will this be an option open to Brazil in the future when the low fertility rates have accumulated over a long period and led to an inevitable population decline?

Pro-natal policies and increasing retirement ages may be unavoidable steps. However, the debate about the catastrophic consequences of population growth prevailed for so long that the public at large and many professionals are still under the impression that this remains the central issue. Yet the discussion on the need to boost fertility rates in Brazil is likely to be at forefront of the political agenda soon. Prolonging retirement age to increases the working age population and reducing the pressure on the social security system may be very hard to achieve. Current experiences in Europe are not encouraging. General strikes
erupted in France this year in opposition to the extension of the pensionable age by only two years, to a still early 62 threshold. Additionally, for this option to be feasible it is imperative to ensure that the future cohorts of older people will grow older in good health – and remain healthy for many years beyond the 60 or 65 “old age” landmark.

The crucial bottom line is that Brazil cannot afford simply to emulate the policies adopted by richer countries which have aged over a much longer period of time and within a context of relative wealth and, which, themselves, are still struggling to address the same issues. Solutions will have to be developed from within the Brazilian society. Certainly, the experiences of other countries need to be observed – particularly those of other developing countries also experiencing a fast population aging – but the devised solutions need to be coherent to the country’s individual history, culture, resources and values.

Several articles have analyzed demographic trends and their implications on several dimensions of Brazilian economy, public policy and society. However, no report has yet presented these questions in a more comprehensive and systematic way that captures the broad complexity of issues, from economic growth to poverty, from public financing of social services and transfers to savings, from employment to health and long-term care, and their interrelations. This study aims to fill this gap by providing an overview of past and future demographic dynamics, analyzing their effect on social and economic development in Brazil and discussing public policies to address opportunities and challenges associated with population aging.

This initial chapter introduces the main issues associated with population aging, many of which will be investigated in detail in the following chapters. Section 1.2 describes the demographic transformation that Brazil has been experiencing and highlights its specific features, including a very rapid population aging process in the few decades ahead. Section 1.3 presents the main economic framework behind this work – the life cycle theory according to which individuals’ economic behavior varies according to their age. Section 1.4 introduces the first and second demographic dividends associated with the changing population age structure that accompanies the demographic transition of any country. Section 1.5 explores how poverty is linked to the life cycle in Brazil and what has been the role of public transfers in reducing poverty among different age groups. Section 1.6 investigates how public expenditures vary across age groups and generations and what makes Brazil distinct of comparable OECD and Latin American countries. Section 1.7 presents the main findings of the report. Finally Section 1.8 identifies the main questions that were not investigated in this report and proposes directions for further research.

1.2 DEMOGRAPHIC CHANGE IN BRAZIL

Demographic patterns in Brazil are characterized by five main features: (i) the demographic transition is advanced compared to other Latin American countries but Brazil is still a relatively young country compared to OECD countries; (ii) fertility rates declined very fast; (iii) reduction in mortality has not been as rapid and profound as that of fertility; (iv) population age structure has been changing very rapidly; (v) the current age structure is very favorable and conducive to economic growth.

First, Brazil is at an advanced phase of the demographic transition (compared to other Latin American countries) but not as advanced as in most European and other OECD countries where mortality and, most importantly, fertility decline started much earlier (Figure 1.2a). Although the average number of children Brazilian women have in 2005/2010 (1.9) is smaller than the average number of children of all Latin American countries with the exception of Cuba (1.5), it is still higher than the corresponding number for the average European woman (1.5). Among comparator countries and region, the lowest Total Fertility Rate (TFR) is found in Korea (1.2). At the same time, life expectancy at birth of the average Brazilian person in 2005/2010 is lower than that of the average Latin American person (72.3 and 73.4 years, respectively) and much lower than that observed in Japan, the country where currently people live longer.
(almost 83 years). As expected in such a large and heterogeneous country, demographic indicators in Brazil vary considerably across geographic areas, even though a robust pattern of convergence, which is described more in detail in Chapter 2, has been observed during the past three decades. Figure 1.2b shows that the lowest and highest life expectancies at birth are found in Alagoas and Santa Catarina (68.3 and 73.9 years respectively) and the lowest and highest TFRs are found in Rio de Janeiro and Acre (1.6 and 3.0 children, respectively).

Second, fertility is low and its decline was very fast (Figure 1.3). For example, among comparator countries, with the exception of Korea, Brazil is the country that experienced that fastest transition from a TFR of 3 to a TFR of 2 (19 years). It took almost 60 years for the average European country to experience such change. Such rapid decline in fertility has resulted in very rapid population aging, as is briefly described below and in more detail in Chapter 2.
Figure 1.3
Years Taken to Reduce Fertility and Mortality


Third, reduction in mortality has not been as rapid and profound as that of fertility, and life expectancy at birth is still considerably lower than in other Latin American countries – notably Argentina, Chile, Costa Rica, Cuba and Uruguay – indicating that there is much room for improvement. Furthermore, latest figures (2008) indicate that life expectancy at birth for a female child, 76.7 years, is 7.6 years higher than for a male child (69.1 years). This reflects higher male mortality rates at all ages - particularly those of young adults, due to exceedingly high rates of deaths due to accidents and violence. If such deaths could be even partially prevented, a significant increase in overall life expectancy at birth would be achieved. As mortality at adult ages continues to improve, the proportion of old (and very old) population will increase more and more. An in-depth description of mortality patterns and their implications for health and long-term care is presented in Chapter 4.

Fourth, the population age structure has been changing very rapidly. Each stage in the transition corresponds to a shape in the population distribution: Countries in the early stages of the transition display an age-sex distribution as a large base pyramid with narrow top. As countries advance in the transition process, the base (young population) narrows and the top (elderly population) increases. In the later stages, countries would display a pillar-shaped age-sex distribution. In the extreme cases of negative growth it could eventually lead to an inverted pyramid. The whole movement is called from pyramid-to-pillar and is described in Figure 1.4 for Brazil.
It is clear on examination of these figures that the Brazilian population will experience, as is the case for most of the already aged world, a feminization of aging with many more women than men at older ages. This has important health and long-term care as well as employment policy implications. The longer lives of these women are often marked by poor health and frailty. They are particularly prone to non-fatal but debilitating conditions. Added to this is frequent loneliness – as they more often than not out survive their male partners, ending their lives in widowhood that is commonly accompanied by poverty. At the same time, although there has been a substantial increase in female labor force participation since at least the early 1970s, early retirement is still common among women. This has important consequences on economic production, duration of life after retirement and duration, cost and financing of pension benefits. These questions are investigated in Chapter 2 (labor market) and 4 (health and long-term care).

Changes in the population age structure are well summarized by changes in the aging index, which is the number of people aged 65 and over per 100 youths under age 15 (Figure 1.5). The Brazil aging index experienced only a small increase between 1980 and 2000 (from 10.5 to 18.3). Since then it has increased by, again, a small amount: 8.4. This helps to explain why attention to population aging has only recently started to grow in Brazil. Until then, it was simply not that obvious to the public that the country was aging. However, from now on, much more substantial increases in the aging index are expected: Close to 20 by 2020; 28.5 from then to 2030; some 40 more between 2030 and 2040, eventually reaching 172.7 by
2050; that is, an increase of 146 points within the next 40 years compared to only 16.2 over the previous 30.\footnote{In 2000, only a few countries (Germany, Greece, Italy, Bulgaria, and Japan) had an aging index above 100 (more elderly than youth).}

Fifth, Brazil is currently enjoying a very favorable age structure with the largest share of its population in working ages. This is often referred to as Demographic Bonus. During the demographic transition, not only for Brazil but for all countries, there is a period when the proportion of people of potentially productive age grows steadily in relation to potentially inactive ages. In that period, when the dependency ratio—which relates the number of people in dependent age groups (children under age 15 and persons over age 59, in this study) to that of people in the working-age group (aged 15–59)—drops to record lows, the situation is particularly conducive to development, as there are more possibilities for savings and investment leading to capital accumulation and economic growth, while there is also reduced pressure on education spending. In Brazil, the dependency ratio will reach its bottom value in 2020 and will be increasing after that (see Figure 1.6).

![Figure 1.5 Brazil Aging Index: 1980 - 2050.](image)

Source: IBGE (2008)
1.3 THE ECONOMIC LIFE CYCLE

Changes in the population age distribution matter because individuals vary their economic behavior according to their age. The life-cycle theory helps to understand labor income, consumption and saving patterns of individuals across their life span. The simple idea is that people make choices about how much to spend on the basis of their permanent lifetime rather than current income (Modigliani and Brumberg 1954; Modigliani 1988). Indeed, individuals start consuming at the moment they are born and never cease to do so. However, they start working only later in life and, at some point, may have, or decide, to stop. Indeed, the lifecycle can be divided into three stages: (i) pre-work; (ii) work; (iii) post-work.

During the first and the last stage, individuals consume more than they produce, whereas in the second stage the produce more than they consume. The length of each stage differs across individuals and is affected by many factors beyond biology; economic structure of society, educational opportunity, family needs and expectations, health, etc.. The existence of public programs, the level of wealth, the availability of financial institutions, and cultural expectation are all important drivers of the leisure-work tradeoff. Likewise, the relative level of consumption across the life cycle combines biological needs, living arrangements, public programs for children and for the elderly, fertility rates among the poor and the non-poor, etc. (World Bank 2011).

Private consumption and labor income present a standard relationship in Brazil; consumption is increasing and is relatively smooth over time, while labor income has a steep increase as young adults enter the labor market and much slower reduction as the elderly start exiting it (Figure 1.7). As discussed above, during the first and last stage individuals present a “life-cycle deficit” as their consumption is higher than their labor income. During these periods, consumption is mainly financed by private or public transfers. Indeed, intergenerational transfers play a major role in redistributing resources from people of working ages to children and the elderly. Whereas the elderly generally receive substantial support through social insurance programs, family transfers are the main support for children (Lee, 2003).

Box 1.1 National Transfer Accounts

In all societies intergenerational transfers are large and have an important influence on inequality and growth. The development of each generation of youth depends on the resources that it receives from productive members of society for health, education, and sustenance. The wellbeing of the elderly depends on familial support and a variety
of social programs. The National Transfer Accounts (NTA) system provides a comprehensive approach to measuring all reallocations of income across age and time at the aggregate level. It encompasses reallocations achieved through capital accumulation and transfers, distinguishing those mediated by public institutions from those relying on private institutions (Mason and Lee 2010).

NTA is a system for measuring economic flows across age at the aggregate level in a manner consistent with National Income and Product Accounts. These flows arise primarily because of a fundamental feature of the economic lifecycle; that children and elderly consume more than they produce through their labor. NTA provides estimates of the components of the economic lifecycle and the inter-age flows that inevitably arise. The accounts distinguish the economic form of flows, transfers, asset-based flows, and the institutions that mediate the flows (government and private institutions). Currently, 33 countries from the Americas (10), Europe (9), Asia-Pacific (9), and Africa (5) are participating in the project.²

Average labor income becomes higher than average consumption around age 20, and then around age 62 it returns to being low. These thresholds would be different if privately and publicly funded education and health consumption were included. The withdrawal from the labor market is slow and there is no total exit—labor income remains significant even at age 80-plus. The average 60-year-old earns about two-thirds of what the average adult aged 30–49 earns, and the average 70-year-old earns about 25 percent of what prime-age adults earn.

Figure 1.7
Income and private consumption, Brazil, 2008

The relationship between labor income and consumption differs across countries. Turra et al. (forthcoming) use the estimates produced under the NTA project to compare Brazil with other countries³. Their analysis of consumption includes publicly and privately provided education and health. Figure 1.8 shows the normalized lifecycle deficit; that is the difference between labor income and consumption divided by the average labor income at ages 30-49. There are three interesting features that differentiate Brazil from the other countries under examination: (i) the relatively advanced age at which consumption is lower than income; (ii) the early age at which it returns to being high ⁴, and (iii) the imbalance between the accumulated deficit in the first and last stage and the period of positive production in the second stage.

² Detailed methodology and other information can be found at www.ntaccounts.org.
³ The countries include Austria, Chile, China, Costa Rica, Finland, Germany, Hungary, Japan, India, Uruguay, Slovenia, United States, Taiwan, Sweden, Spain
⁴ In other words, the Brazilian surplus stage lasts about 20 years, starting between ages 30 and 35 and ending between ages 50 and 55. As Mason et al. (2009) point out when describing the lifecycle model, the age profiles
While the international comparison has limitations due to the different years of reference, it is still very informative. The Brazilian surplus stage lasts about 20 years, starting between ages 30 and 35 and ending between ages 50 and 55. The old-age lifecycle deficit turns negative at an early age and is very large. Thus Brazil presents the shortest second stage among all the countries considered and old-age dependency stands out as a long stage of the Brazilian lifecycle. In some countries surpluses start as early as around age 20 (China) and end as late as around 64 (Sweden). Brazil also stands out as the country with the highest levels of deficits in old-age, and very low surpluses.

**Figure 1.8**

Normalized Life Cycle Deficit in Brazil (1996) compared to other NTA countries

It is possible for the shape and location of both labor income and consumption to be unchanged but for the number of people in each stage to differ. The aggregate deficit will thus depend on the number of individuals at each stage. It is very important to keep in mind that the previous analysis does not account for the stock of people in each stage. For example, for a given relationship between labor income and consumption, such as the one in Figure 1.7 the stock of people in each stage may be very different across countries and points in time. And the stock is what determines the total “deficit” faced by the economy. With an aging population we would expect a higher number of individuals in the third stage.

**1.4 THE ECONOMIC IMPLICATIONS OF DEMOGRAPHIC CHANGE**

Changes in age structure tend to have a major impact on economic outcomes because people’s economic behavior changes throughout the lifecycle. As we have seen, Brazil currently has a very favorable age structure with a large share of the population in working ages, that is with a positive life-cycle surplus. However, the dependency ratio will reach its lowest value in 2020 and then will rise rapidly resulting in an increasing number of people at any given point in time living in a “life-cycle deficit” stage with important consequences on public finance (especially for transfers and services for the elderly), economic growth and poverty.

Initially, the falling dependency ratio frees up resources for private and public investment in human and physical capital. The entailing economic growth is called the *first demographic dividend*. Hence, the GDP growth that is generated by the additional workers is the measure for the first dividend. While more imply a gradation of dependency. In Brazil, for example, persons aged 70 and over are economically more dependent than those aged 60–69, and youths aged 10–19 are more dependent than young adults aged 20–29.
workers generate more output, ceteris paribus, the same workers generate more savings. To the extent that saving is converted into domestic investment, more capital (human and physical) will be accumulated. As a result, each worker will have more capital to work with in the future and production will rise on account of that—giving rise to the second demographic dividend. As the aging population in Brazil can expect to live longer, they need to finance a longer period of time in retirement and, thus, saving and capital accumulation might increase even further—enhancing the second demographic dividend.

The first dividend typically lasts for decades, but it is transitory in nature. A rise in the share of the working-age population is likely to lead to an increase in output per capita as the labor force used in production simply grows faster than the population as a whole. The first dividend arises to the extent that the economy is able to create productive jobs for the increasingly larger working age population. It will then turn negative as total population growth outstrips growth in the productive labor force. However, the same demographic forces that produce an end to the first dividend may lead to a second demographic dividend. The second dividend is not, unlike the first dividend, transitory in nature since aging may produce a permanent increase in capital per worker and, thus, per capita income—and is very likely to increase further in proportion to increases in life expectancy. The second dividend arises to the extent that the institutional and policy framework induce individuals, firms, and/or governments to accumulate capital.

The dividends are not automatic but depend on institutions and policies to transform changes in population age structure into economic growth. Thus, the dividend-period is a window of opportunity rather than a guarantee of improved standards of living. In particular, when policies are designed to deal with the economic growth and public finance implications of population aging, it is crucial to consider the effects such policies might have on economic behavior. How exactly might demographic change lead to these two demographic dividends, and what is the implication of alternative policy responses? This question is analyzed in detail for Brazil in Chapter 7.

1.5 POVERTY ACROSS THE LIFE CYCLE AND THE ROLE OF PUBLIC TRANSFERS

Over the last three decades, poverty rates decreased more than fivefold in Brazil. The percentage of the population living in poverty declined from about 53% in 1981 to 9.5% in 2008 (PPP $2 a day). In addition, extreme poverty (PPP $1 a day) decreased by about 4 percentage points between 2000 and 2007, and the proportion of the extreme poor, about 4%, is now significantly lower in Brazil than in many other developing countries.

There have clearly been two distinct periods of poverty decline since the early 1980s: 1980-2000, characterized by moderate reduction; 2001-2008, characterized by a significant acceleration in the pace of poverty reduction. Four factors contributed to poverty alleviation during the first period. First, the non-contributory pension benefits that were established after the promulgation of the new constitution in 1988, providing income to rural and urban retirees who were unable to fulfill the contribution criteria. Second, the set of measures taken by the Brazilian government in the early 1990s, that helped to stabilize the economy and kept inflation under control with positive effects on real wages mainly for the poorer. Third, the demographic changes associated with the first and second demographic transitions that reduced family size and the dependency ratio within the families, alleviating poverty through increases in the relative number of adults. Fourth, the progressive and constant increase in human capital (investments in health

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5 This sub-section draws heavily on Turra and Rocha (2010)
6 Recently, Turra et al. (2009) used counterfactual analysis to show that 95% of the decline in the proportion of the Brazilian population living in extreme poverty, between 1985 and 1995, was due to changes in dependency ratio within the families.
and education) and in female labor force participation rates which helped boosting family income across cohorts.

During the 2000s we saw acceleration in poverty reduction. It is well known that poverty rates in Brazil are highly correlated with income inequality. The richest 10 percent accounts for about 45 percent of the total income (Barros et al. 2006) and thus, policies that improve income distribution have been key to reduce poverty (Barros et al., 2001). Until 2000, despite the increase in GDP per capita (from US$1,800 to US$6,000 in 2000), the persistency of income inequality (the 2000 Gini coefficient of 0.593 was close to the historical average) prevented faster poverty alleviation. But 2001 marked the onset of a new period characterized by a steady decline in income inequality: between 2001 and 2008 the Gini coefficient decreased from 0.593 to 0.544 and the per capita income of the 10% poorest grew by 8 percent, almost three times faster than the national average (Barros et al, 2006).

Cash transfer programs and the minimum wage policy account for a high share of the reduction in poverty and inequality. In 2008 the percentage living in poverty represented only a third of the incidence estimated for 2001. Studies based on counterfactual analysis reveal that 48 percent of the decline in income inequality between 2001 and 2005 was due to the development of cash transfer programs (mainly, the Bolsa Familia program), and to the further expansion of the non-contributory pension system (Barros et al., 2006). Also, the policy of minimum wage increases that favored low-wage workers and beneficiaries of the pension system lowered inequality and reduced poverty levels.

The impressive reduction in poverty has not been homogenous across groups. Following the seminal study from Preston (1984), there is now a myriad of studies in Brazil, including official reports (Brant, 2001), that have stressed the importance of public transfers, particularly social security benefits for poverty alleviation by age groups. Most of these studies use simple counterfactual analysis to compare poverty rates with and without public benefits. For example, Turra et al. (2008) use household data for 2005 to show that poverty incidence among men (women) aged 60 and above in Brazil would have risen from 3.9% (15.6) to 63.5% (83.8%) had they not received pensions. Cotlear and Tornarolli (2010) compared poverty rates with and without pensions for two large age groups - 60 and older, and 15 and younger- across several Latin American countries (see Table 1.1). Brazil, together with Argentina, Chile and Uruguay, are “pro-aging” countries, that is countries with large and generous pension systems that have relatively greater impact on poverty rates among the elderly. In Brazil, the poverty headcount ratio in 2008 declines from 49.3% to 4.2% after pensions are taken into account. However, not surprisingly, the authors found that the effect of pensions on poverty among children in Brazil is much smaller (the poverty headcount ratio in 2008 declines from 38.0% to only 31.0% after pensions are taken into account).
In order to better understand the role of public transfers in reducing poverty among different age groups in Brazil Figures 1.9 to 1.11 compare poverty rates by age for three years, 1981, 1995, and 2008. Poverty rates are estimated with and without public transfers, including contributory and non-contributory retirement benefits and conditional cash transfers from Bolsa Familia. Data from PNAD is used (a national representative household survey from Brazil) to measure the percentage of the population living in poverty according to the World Bank poverty line of $2 dollars a day at 2005 purchasing-power parity (PPP).

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Figure 1.9 shows poverty rates by age in 1981, hence before the 1988 Federal Constitution and the expansion of social welfare programs in Brazil. On average, 53% of the population lived in poverty. The incidence varied little by age, ranging from 65.2% among children under 15 to 47.7% among adults ages 65 and older. Given that conditional cash transfer programs for poor families had not been established in 1981, it is not surprising that the impact of excluding public transfers on poverty levels would be virtually zero among children. On the other hand, about 25% of the population above age 65 did not receive public pensions in 1981 and thus, excluding social security benefits would have just a moderate effect on poverty incidence (20 percentage points, on average).

| Country         | All | 60 + | 65 + | 0–59 | 0–64 | 0–14 | 15–24 | 25–59 | All | 60 + | 65 + | 0–59 | 0–64 | 0–14 | 15–24 | 25–59 |
|-----------------|-----|------|------|------|------|------|-------|-------|-----|------|------|------|------|------|-------|-------|     |
| Argentina       | 11.0| 18.6 | 4.9  | 40.0 | 12.0 | 15.1 | 3.7   | 46.5  | 11.8| 15.4 | 19.2 | 21.9 | 11.6 | 15.1 | 8.0   | 11.1  |
| Bolivia         | 35.0| 38.1 | 26.6 | 48.6 | 35.8 | 37.1 | 25.3  | 52.8  | 35.6| 37.1 | 44.5 | 45.6 | 28.4 | 30.1 | 30.7  | 31.9  |
| Brazil          | 18.2| 29.2 | 4.2  | 49.3 | 19.8 | 26.8 | 3.5   | 54.9  | 19.3| 27.1 | 31.8 | 38.0 | 18.3 | 25.5 | 13.8  | 21.0  |
| Chile           | 5.2 | 9.2  | 2.5  | 18.0 | 5.7  | 7.9  | 2.3   | 20.7  | 5.5 | 8.1  | 8.6  | 10.7 | 5.5  | 8.0  | 4.2   | 6.5   |
| Colombia        | 37.8| 40.6 | 42.2 | 52.0 | 37.3 | 39.2 | 44.3  | 54.2  | 37.3| 39.5 | 46.3 | 47.5 | 36.3 | 38.5 | 31.0  | 33.4  |
| Costa Rica      | 11.6| 15.2 | 17.2 | 39.0 | 11.0 | 12.8 | 18.7  | 44.3  | 11.1| 13.2 | 16.7 | 18.1 | 8.7  | 10.7 | 8.5   | 10.5  |
| Dominican R.    | 18.7| 19.5 | 16.0 | 18.6 | 19.0 | 19.6 | 15.6  | 18.6  | 18.9| 19.6 | 26.8 | 27.4 | 16.6 | 17.5 | 14.0  | 14.6  |
| Ecuador         | 17.6| 19.1 | 16.2 | 23.6 | 17.7 | 18.5 | 17.2  | 26.3  | 17.6| 18.5 | 24.0 | 24.7 | 15.1 | 15.8 | 13.8  | 14.7  |
| El Salvador     | 27.1| 27.9 | 20.3 | 23.9 | 27.8 | 28.4 | 20.7  | 24.6  | 27.5| 28.2 | 35.2 | 35.6 | 24.9 | 25.6 | 22.4  | 23.1  |
| Guatemala       | 33.9| 36.1 | 28.2 | 34.9 | 34.4 | 36.2 | 29.1  | 37.1  | 34.2| 36.0 | 42.4 | 44.0 | 28.4 | 30.1 | 27.6  | 29.8  |
| Honduras        | 36.9| 37.3 | 35.6 | 37.4 | 37.0 | 37.2 | 37.0  | 38.9  | 36.9| 37.2 | 45.7 | 45.8 | 30.1 | 30.4 | 31.3  | 31.6  |
| Mexico          | 13.9| 15.9 | 19.9 | 30.1 | 13.3 | 14.5 | 21.9  | 33.0  | 13.3| 14.8 | 18.2 | 19.1 | 11.8 | 13.0 | 10.2  | 11.8  |
| Nicaragua       | 42.7| 43.2 | 32.5 | 34.5 | 43.5 | 43.9 | 32.5  | 34.8  | 43.2| 43.7 | 53.2 | 53.7 | 38.5 | 38.8 | 36.6  | 37.1  |
| Panama          | 22.3| 27.9 | 16.9 | 36.0 | 22.9 | 26.9 | 18.1  | 39.3  | 22.7| 27.0 | 32.4 | 36.5 | 21.8 | 25.6 | 16.6  | 20.5  |
| Paraguay        | 21.4| 22.1 | 16.9 | 20.4 | 21.8 | 22.2 | 17.2  | 21.2  | 21.7| 22.1 | 29.7 | 30.0 | 18.1 | 18.5 | 16.5  | 17.0  |
| Peru            | 21.0| 22.0 | 19.9 | 23.1 | 21.2 | 21.8 | 20.4  | 24.2  | 21.0| 21.7 | 28.9 | 29.4 | 21.6 | 22.3 | 20.5  | 21.1  |
| Uruguay         | 6.7 | 14.8 | 1.1  | 23.5 | 8.1  | 12.6 | 0.9   | 26.4  | 7.7 | 12.7 | 14.6 | 19.6 | 7.2  | 12.2 | 4.8   | 9.0   |
| Venezuela       | 38.7| 41.4 | 32.9 | 44.6 | 39.1 | 41.2 | 34.1  | 46.9  | 38.9| 41.1 | 49.7 | 51.1 | 36.0 | 38.3 | 32.2  | 34.6  |

Source: Cotlear and Tornarolli (2009)
A more striking picture emerges in 1995 (Figure 1.10). Compared to 1981, the incidence of poverty is much lower among elderly (13.6%) than among children (40.8%). The counterfactual analysis suggests that the main factor in the reduction of poverty among the elderly is the expansion of social security benefits; without public transfers, the incidence of poverty rates would be four times larger. Poverty rates decreased for all ages in 2008 (Figure 1.11). The development and expansion of conditional cash transfer programs for poor families (Bolsa Familia) would have reduced the percentage of children living in poverty by at least five percentage points (Figure 1.11). However, the continuous expansion of social protection to the elderly, particularly through the increase in non-contributory benefits (BPC), magnified relative differences in poverty incidence by age and for every old person in poverty there were still almost 16 children in the same condition in 2008.
Whereas these simple counterfactual analyses are instructive, they can be methodologically flawed if one tries to imply causation. In the case of poverty rates, for example, the simulations ignore the possibility that a slower expansion of social welfare programs could have created incentives for increased labor supply and savings, with positive effects on the percentage living in poverty. In addition, many of the counterfactual analyses provided in the literature are based on data for a synthetic cohort and, therefore, ignore the historical determinants of poverty trends that are related to period and cohort changes. However, the results are confirmed by an Age-Period-Cohort (APC) analysis of poverty trends (Turra and Rocha, 2010).

Among the elderly, period effects have dominated and are probably related to the expansion of social welfare. Indeed, the years of expansion in social security benefits to rural workers (1991-1993) and the years of real minimum wage gains (2006-2008), coincide with two of the largest period effects of poverty alleviation detected in the model by Turra and Rocha (2010). On the other hand, among children, long-term effects that are related to gradual changes in the life histories of the cohorts have played a major role during most of the period of observation, which explains why the decline in poverty has been slower for younger ages. It was only in the 2000s that period effects accelerated the process of poverty alleviation. Period effects for children also coincide with real minimum wage gains, and the development and expansion of the Bolsa Familia program.

Finally, it is important to note that public transfers in Brazil have been very effective in reducing poverty among the elderly. Poverty levels for this group are very low by international standards when, instead, they would be very high in the absence of public transfers. However, the same cannot be said about poverty among children. Although programs like Bolsa Familia have been very successful in reducing child poverty, more investment in education is necessary to help the younger generations escape poverty. The next section discusses intergenerational investments and how, compared to other LAC and OECD countries, Brazil has invested little in education and a lot in pensions.
1.6 PUBLIC EXPENDITURES ACROSS GENERATIONS AND AGE GROUPS

1.6.1 Inter and Intra-Generational Equity

The results discussed in the previous section corroborate the idea that the expansion of the old-age social protection system over the last decades was responsible for the largest single impact in poverty rates in Brazil. Since 1980, socioeconomic conditions have improved significantly for the elderly despite the shift in the population age structure. Therefore, one legitimate question, that was asked for other countries before (e.g. Bommier et al., 2010), is whether the elderly benefited from public transfers at the expense of younger and future generations. According to the theory put forth by Becker and Murphy (1988), there is an optimal timing of creation of public programs to children and the elderly. First, the state taxes the working age population to provide the optimal amount of education for children. Next, to compensate parents for spending resources with the younger generation, the state taxes children once they are grown into productive workers in order to provide parents with pensions at older ages.

In the case of Brazil the rise of public expenditures on education started much later than in nations at similar or higher levels of development. For instance, Bommier et al. (2010) shows that, in the US, public expenditures on education started by the end of the nineteenth century and that the public pension system emerged around the 1930s. The expansion of the Brazilian public pension system occurred after World War II (Queiroz, 2008) and has accelerated over the last 20 years, but the consolidation of primary public education did not occur before most of the elderly population had begun receiving retirement benefits (Rios-Neto, 2005). The first law to establish public education in Brazil dates back to the Nineteenth century. However, the expansion of public education remained at low pace until the end of 1980s, when the new Brazilian constitution allowed greater financial and decision-making autonomy for the municipalities and state governments (Fleury and Fleury, 2001).

This point is illustrated in Figure 1.12, which shows the evolution of public expenditures as a percentage of the GDP. Both the pensions and public education systems have expanded since 1980 and reached high coverage levels (above 85%) in 2000, but expenditures with pensions (around 10% of the GDP) are by far larger than expenditures with public education (around 4% in 2000)\(^7\).

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\(^7\) Public expenditures on education increased to 5.1% of GDP in 2007.
It’s instructive to compare the situation of Brazil with that of other countries. In general terms the reallocation system in Brazil is very similar to that in other countries represented in the NTA project. But the elderly in Brazil receive much higher per capita public transfers than children do. Figure 1.13, which compares the ratio of net per capita public transfers for the elderly (ages 65+) to net per capita public transfers for children (ages 0–15), shows that the ratio in Brazil of 9.96 is more than seven times that in the US, about six and a half times that in Japan, and between 4.5 and 7.5 times larger than the ratios in selected European countries. It is also 2.6 times larger than the ratio in Uruguay and 2.78 times larger than the one in Costa Rica—both Latin American countries with social, economic, and institutional arrangements similar to those in Brazil.

Following the work done by Bommier et al. (2010), Araujo et al. (2010) looked at the consequences of the evolution of the welfare state in Brazil in terms of intergenerational equity. The authors calculated the net present value (NPV) at birth of pensions and public education benefits received minus taxes paid for....
Brazilian generations born between 1923 and 2000. Figure 1.14 presents their estimates. The creation of the social security system in the 1960s led to financial gains for early participants. The current elderly population in Brazil (cohorts born before 1950), received larger benefits than the taxes they paid to the system. The gains decrease for younger cohorts as the taxes paid over the life course become larger than the benefits received. The NPVs are negative for cohorts born between early 1950s and 1970s; these are the generations who have born the costs of the expansion in social security benefits after 1992 and who also paid for the expansion of basic education in the 1990s. Therefore, the results by Araujo et al. (2010) life cycle results show large transfers from younger to older generations in Brazil and corroborate earlier findings based on period data (Turra 2000; Turra et al., forthcoming) in showing that the public sector has been generous to the current generations of elderly in Brazil.

**Figure 1.14**

Net Present Value at birth of expected life time of total transfers (pensions + education) by year of birth (1923-2000), Brazil

In summary, the current generations of adults have borne the fiscal costs to reduce the percentage of current elderly living in poverty, despite having experienced themselves high levels of poverty and having not received optimal levels of public investment during childhood. These estimates therefore, appear to contradict the argument by Becker and Murphy (1988), since adults that are now taxed to allow the expansion of both public pensions and public education did not benefit from public transfers at earlier ages.

1.6.2 Who Benefits from Public Expenditures?\(^8\)

Despite the significant decline in inequality mentioned above, Brazil remains a very unequal country. Figure 1.15 shows an aggregate view of the distribution of social expenditures across income groups and across age groups. The expenditures considered include education, health care, pension benefits and Bolsa Familia. The comparison of income quintiles shows a growing proportion of public expenditures going to each subsequent quintile as income increases. The concentration of public expenditures in the top quintile is particularly striking. They are 3.6 times higher than in the bottom quintile. The shape of the aggregate pattern is driven by the shape of pensions which, at 12 percent of GDP, accounts for a large part of total public expenditures in the social sectors.

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\(^8\) This sub-section section draws heavily from Turra and Holz (2010).
The comparison by age shows a per capita age profile and an aggregate distribution estimated by weighting the per capita profiles by the age distribution. The per capita profiles have a small bulge among children and young adults and then fall to grow steeply at around age 50. The per capita profiles also reflect the weight of pensions; public spending on an individual elderly person is several times higher than public spending on an individual child. When the overall distribution of the population is taken into account the aggregate public expenditures on the elderly and the young remain strongly biased toward the elderly in Brazil despite a still young population age structure.\footnote{In 2005 27.6\% and 8.9\% of the Brazilian population were below 15 years and above 60 years respectively.}

Figure 1.15
Distribution of Total Public Expenditures by Income and Age Groups in Brazil (2006)

This pattern suggests a society where the public sector is responsible for the sustenance of the elderly and where the families remain responsible for the sustenance of children. Other studies for Brazil (Turra 2000; Turra and Rios-Neto 2001; Turra et al., forthcoming) have shown that the consumption of old people depends largely on public health care services and pensions. Is this perhaps a "normal" pattern found in other regions of the world? To answer this question, Turra and Holz (2010) use data from the NTA project to compare the importance of public transfers as a proportion of the consumption of elders and of children; these data are shown in Figures 1.16 through 1.18.\footnote{"Consumption" is defined to include in-kind services in education and health care and private consumption of goods and services purchased by the household.}

The importance of public transfers in financing the consumption of the young and elderly is found to vary widely across countries and regions. Figure 1.16a shows that, in Europe, a full two-thirds of elderly consumption is financed from public transfers. At the other end of the spectrum, public transfers to the elderly are very small in South Korea and Taiwan ("other Asia" in figure 1.16a). Japan is in the middle of the spectrum with about half of the consumption of the elderly financed by public pensions. Data are available for four countries in LAC: Chile, Uruguay, and Costa Rica are in the middle of the spectrum, as is Japan, and Brazil stands out in LAC and in the world, with pension benefits equivalent to over 95 percent of the consumption of the elderly; more than in Europe.
Figure 1.16
Public Transfers as a Percent of Total Consumption

a. Elderly

- US
- Europe
- Japan
- Other Asia
- Brazil
- Chile
- Uruguay
- Costa Rica

b. Children

- US
- Europe
- Japan
- Other Asia
- Brazil
- Chile
- Uruguay
- Costa Rica

Source: Turra and Holz (2010)

Figure 1.16b shows that public transfers also finance a significant fraction of children’s consumption through cash transfers and through in-kind provision of services such as education and health. Public financing for children is highest in Europe and Japan, where it constitutes over half of children’s total consumption. In LAC and Other Asia it is smaller but not insignificant, at about a third of children’s total consumption. In all four LAC countries, public expenditures finance about a third of the consumption of children.

Is the public sector more important to finance consumption of children or of the elderly? There is no global pattern. In the United States and in Asia, public expenditures finance a larger fraction of the consumption of children compared with their importance in the consumption of the elderly. In Europe and the four LAC countries, for which data are available, public expenditures finance a larger fraction of the consumption of the elderly.

Figure 1.17a shows that education is a substantial part of the value of the consumption of children. Here, too, there are significant variations across countries. The cost of education (public and private) as a percent of total consumption of children is highest in Japan (37 percent), followed by Europe (about a third), the United States (a bit over a fourth), and Other Asia, with the four LAC countries trailing behind all these international comparators. Figure 1.17b shows that most of the cost of education is publicly financed in the richer countries. Other Asia has the lowest public financing of education. Within the four LAC countries, Chile and Costa Rica have relatively higher levels, while Brazil and Uruguay have the lowest levels in the sample.
c. Children – Education as Percent of Total Consumption

d. Public Funding of Education as a Percent of Total Cost

Figure 1.17

Source: Turra and Holz (2010)

Figure 1.18 shows familial private transfers as a proportion of the consumption of the elderly. It is usually thought that elderly parents are helped by “upward transfers” (private transfers from their children). The NTA data show that this is only observed in Asia. In Europe, the United States, and LAC the pattern observed is of net “downward transfers”—from the elderly to their children and grandchildren. These downward transfers are particularly large in Brazil and Uruguay. In these two countries it seems that the elderly receive significant transfers from the public pensions and pass some of these funds to their children and grandchildren. However, as was described in the previous section, public transfers to the elderly have a limited impact on poverty among the young. This is the result of living arrangements of Brazilian households. In 2008 only 11.7% of people less than 15 years were living in household with people older than 60. Chapter 4 presents some of the intra-family relationships and financial flows in the context of the discussion of family arrangements for the provision of long-term care to the elderly.

Figure 1.18

Elderly – Private Transfers as Percent of Total Consumption

Source: Turra and Holz (2010)
1.7 CROSS-CUTTING ISSUES AND MAIN CONCLUSIONS

Demographic change is one of the most important forces shaping the outcome of social and economic policy, but it cannot be observed in the short term. In the following chapters, this report analyzes the socioeconomic and macroeconomic impacts of demographic change in Brazil under a longer time perspective. The main findings are presented below.

1.7.1 Economic Growth

The size and composition of the workforce in Brazil is changing as a consequence of the demographic transition. The share of the working age population will increase until 2025. A growing working age population implies more people in the labor force, which, all else equal, should result into more wealth being generated. Brazil is currently experiencing a very favorable population age structure. While the share of the mature labor force (25 to 59) is expected to continue growing until the late 2020s, the share of the junior labor force (15 and 24) has already started declining. As the mature workforce has higher overall economic activity and usually generates most of a country’s wealth, Brazil has a great opportunity to increase growth, savings and government revenues.

Over the medium-term, however, the expected changes in the labor force composition due to the aging of the population will pose challenges to economic growth. After the mid-2020s the growth rate of the 15-59 age group will turn negative. A shrinking labor force means that Brazil will have to rely more on productivity growth than on new entrants in the labor market to sustain aggregate output growth. Negative effects of population aging on productivity are expected at the micro level. These, in turn, may have important effects on the aggregate economy as a larger share of the labor force would be beyond its peak in productivity.11

Brazil needs to seize the current opportunity and prepare for the structural changes it will face over the next decades and beyond. The labor market needs to create enough opportunities for the growing working age population in the short-term. Moreover, to boost the productivity potential of future generations it needs to invest in better public education, as well as on incentives and means for the education and retraining of mature workers. The implications of a demographic change on the share of working age population and productivity are discussed in Chapters 2 and 5 respectively.

The pension system also needs to be modified to address the perverse effects its rules have on the labor market. The low age limit and the existence of a length of service without minimum age eligibility result in a population who retires early. Thus a system that is meant to sustain the income of individuals that are unable to work ends up doing so for a longer period of time than those individuals contributed. Moreover, early retirement implies that a portion of the productive labor force is not being used or that they continue working in the informal sector. The system also incentivizes informality, especially for low-skilled workers. The availability of a non-contributory program, that transfers a benefit equal to the minimum wage, reduces the incentives for low earner to contribute. This is damaging as a large proportion of the population does not contribute to the social security system during the working age, while it will benefit in old age. But as the population in Brazil ages, the need to ensure that a larger part of the population contributes to the system will become more and more pressing. The “inefficiencies” of the old-age social protection system in Brazil are described in Chapter 3.

Economic behavior and macroeconomic outcomes change both systematically and endogenously with aging. The impact of population aging on savings (and consequently on growth) is particularly important

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11 The evidence is mixed. See for example Lindh and Malmberg (1999), Tang and MacLeod (2006) and Feyrer (2007). A review of the main findings is presented in Chapter 5.
and is analyzed in depth in Chapter 7. It is traditionally believed that aging will reduce saving, and thereby growth, because the relative share of “prime” savers in the population will decrease as implied by the life-cycle hypothesis. However, under certain conditions Brazil may not experience a fall in saving and growth. In fact, if government policies are appropriately, adequately, and timely formulated, there is likely to be substantial capital deepening and associated increases in growth, lifetime income, and wealth.

Econometric evidence reveals that an increase in the old-age dependency ratio has led to an increase in the private saving rate—suggesting that aging may lead to higher growth in the future. Ultimately, there is no econometric evidence suggesting that an increasing the old-age dependency ratio will lead to reductions in saving and growth. Brazil is not the only developing country that has experienced such unexpected dynamics—several Latin American and Caribbean countries display similar relationships.

So, under which conditions might saving and growth increase when the population ages; that is under which conditions will the second demographic dividend materialize? Four issues are likely to boost capital accumulation and thus income per capita over the long term in spite, and as an effect, of aging: First, age-specific saving rates in Brazil shows a pattern that does not conform to conventional beliefs regarding life-cycle theory. Saving rates do not fall as people age; in fact, after the age of about 40 saving rates remain virtually unchanged on average. This is not too surprising if intra-household bequests and the relatively high public pensions in Brazil are taken into account. Also, it is not uncommon for developing countries to feature high old-age saving rates. It is therefore likely that the saving rate will increase in the future since the population structure will be composed by a larger fraction of high-saving workers and elderly rather than low-saving young. This depends, of course, upon the future structure of the pension system and whether public pensions remain relatively high.

It should, importantly, be taken into account that high pensions themselves crowd out savings; if people are sure that they will receive high public pensions, why should they save for their retirement? As a result, the implications of high public pensions must be analyzed jointly with the motive for saving to see which effect dominates. This will also be done in Chapter 7 where a further increase in public pensions will lead to lower lifetime income per capita and lower (net) capital accumulation—effectively leading to a smaller second demographic dividend. Consequently, there are two counteracting forces. On the one hand, higher pensions could crowd out saving since there is less incentive to save when retirement consumption is financed by pension. On the other hand, higher pensions could enhance the saving rate because the elderly save a large fraction of their pension. The main finding is that the net effect of higher pensions on the saving rate is negative; i.e. if pensions increase, then the positive effect on the saving rate originating from a higher old age income would not outweigh the negative effect originating from reduced incentives to save for consumption in old age. This economic intuition behind this result is that each worker, of which there are fewer, would need to pay higher taxes in order to finance the constant pensions of more and longer-living retirees. Those workers would therefore save much less, and capital accumulation and growth are likely to suffer.

A second reason why aging might promote saving is if the reduction in poverty and inequality follows their recent downward trends. In that case, more people are likely to display higher savings—in effect increasing the average saving rate. Third, the first demographic dividend of more prime working age savers as a share of the population, combined with higher life expectancy, will probably lead to capital deepening and the potential of a non-negligible second demographic dividend. Fourth, there is also a simple, but important, effect on capital deepening of fewer workers which mechanically leads to an amplifying effect on the second demographic dividend. As a result, any potentially negative consequences of aging can be abated to a large extent through prudent fiscal and structural government policies.

Building on the potentially increasing saving rates in the future, a key driver of growth is the endogenous accumulation of capital. The economic behavior related to consumption and saving over the life-cycle is
directly affected by taxes, transfers and debt dynamics. As a result, the capital accumulation that arises due to saving is importantly affected by policies for taxation, transfers, and the issuance of debt in order to postpone the fiscal burden for future generations. In order to analyze the implications for capital accumulation and growth, it is therefore crucial to take into account the financing-choices for the aging-induced fiscal costs that the government has at its disposal.

Three scenarios for financing the fiscal costs associated with aging are compared in a general equilibrium setting: Tax-Financing, where taxes increase to absorb the costs; Benefit-Financing, where social security benefits fall to accommodate the fiscal pressure; and Debt-Financing, where public debt increases so the government can refrain from changing taxes or benefits. It is found that Debt-Financing is likely to reduce the dividend; Tax-Financing will keep it more or less unchanged; while a policy response of keeping taxes and debt constant and allowing pension to adjust (downwards) is likely to promote the second demographic dividend. As a result, in terms of preferable parametric policy responses, the second demographic dividend will be best promoted by keeping taxes and debt constant while allowing public pensions to adjust downwards.

A sensible policy mix could consider the appropriateness of the generosity of the social security system in connection with a reform of entitlement ages to such transfers. A structural policy response of linking mandatory retirement (or entitlement) ages to increasing life expectancy would boost labor supply and reduce the fiscal costs of aging. The international experience, especially from observing Scandinavian countries, with longevity-indexed mandatory retirement ages is ample and thoroughly analyzed. Effective labor supply is very likely to increase when the statutory retirement age increases, because people will (ideally) stay in the labor force for a longer period of time. Leisure, however, may also increase when the statutory retirement age increases. This is mainly because there will be less need to save since the retirement period will also be proportionally lower. More resources will be available for working-period consumption, and since leisure could be assumed to be a normal good, labor supply at the intensive margin is likely to fall. The effects that such policy-responses have for labor supply therefore ought to be taken into account.

1.7.2 Public Finance and Service Delivery

Impact of population aging becomes readily apparent in long-term projections of public spending on education, health care and pension, which is the product of the average generosity of the benefits received by each individual and the age structure of the population. The share of economic output directed toward education, health care, and pensions through the public sector can be decomposed into two multiplicative components. The demographic factor measures the size of the demand for a specific benefit (education, health and pension) relative to the working-age population. The economic factor measures the average benefit received per beneficiary.

Each sector will face different challenges and opportunities. Projecting all three expenditure paths with a comparable methodology provides insight into the interconnections and tradeoffs available to Brazilian policymakers. Too often, policy reforms of pension, health care, and education systems are debated, analyzed, and implemented in isolation from each other without considering the links among these systems. Such projections are presented in Chapter 6. The shifts in population age structure projected for the next four decades are going to lead to substantial additional fiscal pressures on publicly financed health care and pensions, along with some reduction in fiscal pressures for publicly financed education.

With respect to benefit levels, Brazil’s public sector spending in education and pensions resembles that of OECD countries (as percent of GDP) but its population age structure is much younger. This results in markedly lower public education investment in youth (9.8% of average wages in Brazil vs. 15.5% in OECD) and markedly higher average public pension benefits (66.5% of average wage in Brazil vs. 30.4%
of average wage in OECD.) Aggregate public health care expenditures in Brazil are much below the OECD average – and average health benefits are somewhat lower.

In 2005, total public spending on education, pensions and health care amounted to 17.7% of Brazil’s GDP. Although forecast of both demographic and benefit change have to be interpreted with caveats, a few robust conclusions emerge. The Status quo scenario in which current benefits (for education and pension) and expenditures by age (for health care) are not changed would result into an increase of total social spending of 14.2 percentage points of GDP in 2050. With regard to Education, the increasingly smaller size of school age population provides a unique opportunity to increase per student investment to OECD levels without adding much burden on public finance. An ambitious expansion of educational spending to reach OECD levels of investment per student within a decade would require an increase of education spending as a percent of GDP of less than 1% by 2020. After that, the share of GDP devoted to education would gradually decline in concert with the decline in the school-aged population – while maintaining investment levels per student at those of OECD countries.

One of the key findings is that Health Care expenditures are likely to increase substantially in Brazil. Indeed, health care is likely to emerge as a major fiscal challenge in the coming decades in Brazil. We project an increase of more than 4 percentage points of GDP in 2050. There are two driving forces behind the projected increase in health expenditures: The increasing proportion of elderly in the population, and a growing intensity of formal health care use among the elderly. In terms of Public Pensions, without the recent reforms (1999 and 2003), spending of pensions would have risen from 10 percent of GDP in 2005 to an astounding 37 percent of GDP because of the mere increase in the number of eligible pensioners associated with population aging. Clearly the old support system would have been very difficult to afford. Our stylized model of the recent set of pension reforms reveals that they more than halved the projected costs. However, the problem of affordability of pension expenditures has not yet been solved; with pension expenditures projected to double to 22.4 percent of GDP by 2050. In an alternative scenario, we forecast a series of reforms that gradually would bring Brazil pension benefits in line with those of OECD countries. Even in this optimistic scenario, increases in pension expenditures dominate the fiscal outlook for Brazil.

So what policy actions can be taken to help mitigate the unavoidable tension towards increasing social expenditures that is driven by rapid population aging in Brazil? First, as more resources become available per student in Brazil, it is important that such resources are used to improve the effectiveness of the education system. The United States, Japan, Korea, and European countries used declines in student numbers to shift resources towards quality. In Brazil, some of the resources saved from primary education could support the expansion of “crèche” care and pre-school, which are still far from universal and which research shows are among the best strategies for ensuring that children arrive in primary school ready to learn. It could substantially help finance the expansion of higher quality, full-day schooling at the secondary level. The seven million empty seats in primary school could also finance investments in quality for the 24 million primary students who will remain (World Bank, 2010). Moreover, such an ambitious increase in educational investment would likely have profound implications for both economic growth and inequality in Brazil. Indeed, Lee and Mason (2010) present simulation results which suggest that such investments in human capital can offset the costs of population aging.

Second, it is urgent that the organization of the health care system adapts to the different demographic and epidemiological profile of the increasing older population in Brazil. Despite Brazil’s passage through the advanced stages of the epidemiological transition, its medical schools are still training doctors for the requirements of the 20th century. Students are schooled in child care and reproductive health but are presented with little or nothing about aging-related issues. A doctor graduating in 2010 with an average 40 years of medical practice ahead, will witness a three-fold increase in the elderly population – that is to
63 million people.\textsuperscript{12} As non-communicable diseases emerge as the leading cause of morbidity, disability and mortality, effective programs must be implemented to address their main risk-factors: smoking, physical inactivity, alcohol consumption and unhealthy diet.

The magnitude of the increase of health expenditures associated with an older population will depend crucially on whether longer life spans mean more healthy years or added years of illness and dependency. Prevention and postponement of disease and disability and maintenance of health, independence, and mobility in an aging population will continue to remain the major health-related challenges of population aging. Recently, a life course framework was proposed to design policies addressing the needs of the elderly. This is described in Chapter 4. Central to the life course approach to aging is the notion of functional capacity – that is, that individuals reach the peak of their physical functional capacity early in adulthood and then progressively experience a decline throughout the life course which is a natural result of the aging process. Importantly, however, this is not necessarily a problem. Provided that at, say, age 85 one continues to be independent and capable of performing the activities of daily living, the individual will remain a resource to their family, their community, their society and to the economy. Thus, good policies on aging are those policies that will help individuals to remain above the disability threshold as they age.

It is anticipated that the number of elderly people generating a demand for formal Long-Term Care will increase because of two factors. First, the numbers of the very old in Brazil will dramatically increase over the next 30 years and this will result in larger numbers of old frail people at any given point in time even if a decrease in the proportion of frail old people is expected as a result of improvements in health prevention, postponement and better administration of disabilities. Second, the changing status of women and family and social values will continue to impact on the availability of family care givers. The low birth rates and the complexities of younger peoples’ transition into modern adulthood will compound the scenario. Studies from a wide range of developing countries reveal that older people are becoming less confident about receiving family support. Our projections in Chapter 4 estimate twice as many people being taken care of by non-family members in 2020, and five times as many in 2040, compared to 2008. Strengthening the capacity of the Family Health Program to reach and assist the increasingly larger elderly population at home and in residential institutions seems to be a possible strategy to address the increasing demand for health and long-term care services.

Third, the pension system will have to be strengthened to become more efficient. The pension system extends benefit coverage to most of the old age population and provides protection to the poorest segments of society. Indeed the programs have contributed to reducing poverty and inequality, particularly in rural areas. However, this has come at an extremely high cost, with sharp increases in expenditures. As we will see in Chapter 3, these are to a large extent a consequence of some characteristic of the pension programs that lead to retirement at a very young age, excessively high replacement ratios and multiple receipts of benefits. The survivors’ pension system, meant to ensure that the dependants of the deceased do not fall in poverty, is exceptionally generous and ends up representing an extremely high share of old-age pension expenditures, with benefits being accumulated and being paid to young individuals with a long life expectancy. In light of the aging of the population that is bound to put pressure on social security expenditure it becomes of utmost importance to address these issues promptly. Without substantial changes to the current system, the aging of the population will put a strain in the system that will result in some critical trade-offs with consequence for the growth prospects.

\textsuperscript{12} In whatever specialty they embrace, they will be increasingly confronted with older patients regardless of their level of preparedness. Curriculum reform reflecting Brazil’s rapid aging is critical if the country is to avoid an epidemic of iatrogenic conditions – and the consequent escalating health care costs.
Mindful of the impact of population aging, a number of governments have begun to issue official long-term budget projections: the European Union (European Commission Directorate General for Economic and Financial Affairs, 2006), the United States (U.S. Congressional Budget Office, 2009), Australia (Australia, The Treasury, 2007), and New Zealand (New Zealand, The Treasury, 2006). Chapter 6 presents long-run expenditure forecasts for Brazil – an important first step toward long-run fiscal forecasts.

1.7.3 Poverty and Redistribution

Brazil has made huge progress in reducing poverty and inequality. Public transfers have played a significant role in these achievements. The establishment of a non-contributory program and of a program for rural workers has extended coverage to some of the usually excluded part of the population. Moreover, the fast growth in the minimum benefit guaranteed equal to the minimum wage has resulted in an increase of the income floor for the elderly faster than the growth of the higher retirement benefits, resulting in a reduction in inequality. The pension system is responsible for the almost complete eradication of old-age poverty. However, this has come at a high cost and has resulted in a system with perverse incentives and distortions, as mentioned earlier.

Per capita public transfers to the elderly compared to per capita public transfers to children are much larger in Brazil than in any other LAC and OECD country with similar welfare systems. At the same time, the Brazilian quality of public education has been much worse than in other LAC and OECD countries. Bolsa Família, a federal CCT program has improved children’s social protection, with positive effects on child health and education attainment, but it is insufficient to reduce the gap between human capital outcomes of richer and poorer children and contribute to include the latter groups in the most productive sectors of the economy.

A very important concern relates to the need to maintain horizontal equity by giving equal consideration to the needs of all groups in poverty—the aging, children, persons with disabilities, and working families with low earnings. Grosh and Leite (2009) observe that in many LAC countries the total allocation to non-contributory social assistance programs is under 1 percent of GDP, so they emphasize the need to be very cautious before defining policies that would allocate a similar or greater amount to a subgroup of the poor. This concern leads to recommending that payments to the elderly be administered as part of the general social assistance system. Although social assistance expenditures (mostly on the Beneficio de Prestaçao Continuada and Bolsa Família) are larger in Brazil than in other LAC countries, resources available are not enough to reach all poor groups. In Brazil as well, thus, using an integrated framework to administer all resources for social assistance would allow policy decisions to reflect explicit trade-offs among competing priorities and possible groups of beneficiaries.
Chapter 2
Population Dynamics in Brazil

4.1 THE DEMOGRAPHIC TRANSITION

This chapter provides an overview of past and future demographic dynamics in Brazil. The demographic transition is the process followed by a population moving from an initial state characterized by high fertility, high mortality, and the preponderance of a young population, to a different state characterized by low fertility, low mortality, and the preponderance of an old population. The intermediate stage is characterized by high rates of population growth, due to the gap between the initial fall in mortality and the reduction in fertility.

Brazil followed the typical phases of the demographic transition (see Figure 2.1). During the first (pre-transitional) phase, which lasted until approximately 1930, Brazilian population presented high birth and death rates and consequently low natural growth. However, between 1870 and 1930 an important population increase (above 2.0% per year) took place because of international migration. Around 1940, Brazil starts the second phase of its demographic transition characterized by sustained mortality decline, mostly at young ages, high fertility and an almost absence of international migration. The population growth rate increased during this period and reached a plateau of approximately 3.0% between 1950 and 1960. The decline in infant and child mortality led to a large increase in the number of surviving children and a corresponding rise in the child share of the population.

Brazil entered the third stage of its demographic transition at the end of 1960s when fertility started to decline very quickly and at a much faster pace than mortality. From more than 3.0% per year in 1950, the population growth rate slowed down to 1.6% between 1991 and 2000 and reached 1.4% in 2007. Moreover, the changes in the population age structure associated with the demographic transition and a projected sustained decline in fertility for the next forty years predict an increasingly smaller population growth rate, which eventually will turn negative in 2040-2045. The large birth cohorts generated by the onset of the demographic transition had dramatic effects on the population age structure. First, they increased the share of the population in the working ages and, then, as time proceeds, they will increase the share of population at older ages. Continued decline in death rates reinforces the effects of fertility decline because the gains in survival are increasingly concentrated at older ages.

Figure 2.1
Demographic Transition in Brazil

The crude rates described above do not allow a full understanding of the structural changes in mortality and fertility patterns, since crude rates are heavily dependent on age-structure. In the next section we will discuss both age-specific mortality and fertility behavior and international migration to better understand the forces behind demographic change observed in Brazil over the past 60 years.

### Box 2.1 Source of Demographic Data

Unless otherwise specified the data used for Brazil and comparator countries in this report are from the population projections prepared by the United Nations populations projections are used. Given the uncertainty of future demographic trends, the United Nations usually produces a number of projections based on different assumptions about the future paths of the demographic variables, fertility in particular. This chapter uses the medium-fertility variant, which is normally regarded as the most likely among the variants. Under the medium-fertility variant, total fertility in all countries is assumed to converge eventually toward a level of 1.85 children per woman.

### 4.2 TRENDS IN MORTALITY, FERTILITY AND MIGRATION

#### 2.2.1 Mortality

During the first half of the 20th century, mortality declined slowly in Brazil. During 1950–55, life expectancy at birth was only 50.9 years, and infant mortality was 134.7 per thousand births (see Table 2.1). From then on, life expectancy started increasing first due to the decline in infant mortality—mainly due to improved control over infectious, parasitic, and respiratory diseases—and then as a product of declining mortality across the entire population. As a result, life expectancy in Brazil has increased by 21.4 years, on average, over the last 60 years, reaching 72.3 years in 2005–10.

#### Table 2.1

<table>
<thead>
<tr>
<th>Five-year period</th>
<th>Life expectancy (in years)</th>
<th>Infant mortality (per 1000 births)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both sexes combined</td>
<td>Life expectancy</td>
<td>Men</td>
</tr>
<tr>
<td>1950-1955</td>
<td>50.9</td>
<td></td>
</tr>
<tr>
<td>1970-1975</td>
<td>59.5</td>
<td></td>
</tr>
<tr>
<td>1990-1995</td>
<td>67.2</td>
<td></td>
</tr>
<tr>
<td>2000-2005</td>
<td>71.0</td>
<td></td>
</tr>
<tr>
<td>2005-2010</td>
<td>72.3</td>
<td></td>
</tr>
<tr>
<td>2010-2015</td>
<td>73.5</td>
<td></td>
</tr>
<tr>
<td>2020-2025</td>
<td>75.9</td>
<td></td>
</tr>
<tr>
<td>2045-2050</td>
<td>79.9</td>
<td></td>
</tr>
</tbody>
</table>


---

13 One example of this is that, in the period 2005-2010, Brazil would appear to have similar mortality rates to Bolivia and Haiti if the gross mortality rate is the measurement used. In Brazil, however, life expectancy (which measures mortality without the effect of the age structure) is actually 73.5 years, whereas life expectancy in the Bolivia and Haiti is 60 years and 65 years, respectively.


15 In the case of Brazil, the United Nations population projections are slightly more conservative than those prepared by the Brazilian Geographical and Statistical Institute (IBGE) in 2008 according to which the Total Fertility Rate continues declining until it reaches a value of 1.5 children per woman in 2030 and remains stable at that level after that.
As in almost all societies, male mortality in LAC tends to be higher than female mortality, which is reflected in longer life expectancy for women. This difference has also widened as life expectancy increased over the last half-century, mostly because of the joint effect of reduced mortality from female-specific causes such as those related to reproductive health, and increased mortality from causes that affect mainly men, such as accidents and violence. Between 1950–55 and 2005–10, the difference between female and male life expectancy increased from 3.4 years to 7.3 years. Population projections indicate that this difference should remain during the next decades, although a reduction is expected in the future, following a trend currently observed in developed countries.

The pace of mortality decline observed in Brazil during the second half of the twentieth century has been faster than the equivalent decline observed in most European countries during the twentieth century but has been slower than the equivalent decline observed in many East Asian countries during the same period. For example, it took 50 years (from 1950 to 2000) for life expectancy to increase from 50 to 70 years in Brazil. The same 20-year increase took 60 years in Germany (from 1900 to 1960) but only 27 years (from 1937 to 1964) in Japan and 33 years in Korea (from 1954 to 1987).

Figure 2.2 presents life expectancy at birth for Brazil and a set of comparator regions and countries. In 2010 life expectancy in Brazil was 73.5, i.e. 7.0 years shorter than in Germany and 10.2 years shorter than in Japan. The common behavior is an increasing trend with smaller gains for higher levels. Japan is the uppermost curve from the late 1980s on. Brazil follows a path very similar to Mexico, both countries starting at the same level in the early 1950s distancing themselves from the World average. Mexico though, shows a higher rate of increase than Brazil. The fastest average annual growth rate during the 100-year period is projected for Korea where life expectancy in expected to increase from 47.9 in 1950 to 83.8 in 2050.

Figure 2.2 Brazil and Comparator Countries: Life Expectancy at Birth, 1950-2050

The evolution of mortality has not been uniform across Brazil. Figure 2.3 presents box-plots of life expectancy at birth for the period between 1997 and 2006 for Brazilian states. In 1997 the state with lowest life expectancy (Alagoas) presented a figure of life expectancy of 63.0, around 15% lower than the life expectancy of the state in the best situation, Rio Grande do Sul with 73.3. However, the dispersion of life expectancy at birth for the different states narrows with time. In 2006, differences were less striking.


16 Life expectancy at birth for Brazil and regions and state in Brazil were estimated using the survival children method proposed by Brass (1975), with the Trussel variant and the Brazilian model life-table.
with Alagoas (still the state in the worst situation) with 68.3, a figure 8% below that of the state of Santa Catarina with 73.9 years of life expectancy. Similar patterns are observed when considering infant mortality and child mortality rates as indicators of mortality [figures not shown here].

**Figure 2.3**

**Life Expectancy at Birth in Brazilian States, 1997-2006**

Mortality in heterogeneous not only across geographic areas in the country, but mainly across socioeconomic strata. Figure 2.4 presents child mortality rates for selected moments in time for different per capita family income brackets between 1991 and 2006. The huge gaps observed in the early 1990s are almost reduced to zero in the early 2000s. It is interesting to note how infant mortality for the wealthier group remained at a very low level for the whole period. The estimated gap is larger than the corresponding gap estimated for life expectancy (not shown here) suggesting that social-strata mortality differentials among children are larger than those among adults.

**Figure 2.4**

**Child Mortality Rates – Brazil – Both Sexes Combined – By Per Capita Family Income**

Source: PNAD different years
2.2.2 Fertility

Despite the impressive decline in mortality, the decline in fertility has been the main factor affecting population dynamics in Brazil. Table 2.2 shows fertility trends in Brazil between 1950 and 2050. Over the last six decades, total fertility rate from 6.2 children per woman during 1950–55 to 1.8 children per woman during 2005–10. It is expected to keep decline until 2025 and then stabilize at 1.5.

Despite the TFR started declining in the 1960s, the annual number of births increased from 2.6 million to 4.0 million between 1950–1955 and 1985–1990 because of the concentration of the population in child-bearing ages, and then started decreasing as a consequence of the continuing decline in fertility. According to the most recent projections, a steady decrease in the annual number of births is expected in the future.

Table 2.2

<table>
<thead>
<tr>
<th>Year</th>
<th>Total fertility rate</th>
<th>Annual births (1000s)</th>
<th>Year</th>
<th>Total fertility rate</th>
<th>Annual births (1000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-55</td>
<td>6.15</td>
<td>2,572</td>
<td>2005-10</td>
<td>1.80</td>
<td>3,129</td>
</tr>
<tr>
<td>1955-60</td>
<td>6.15</td>
<td>2,918</td>
<td>2010-15</td>
<td>1.70</td>
<td>2,828</td>
</tr>
<tr>
<td>1960-65</td>
<td>6.15</td>
<td>3,303</td>
<td>2015-20</td>
<td>1.60</td>
<td>2,667</td>
</tr>
<tr>
<td>1970-75</td>
<td>5.38</td>
<td>3,330</td>
<td>2020-25</td>
<td>1.52</td>
<td>2,502</td>
</tr>
<tr>
<td>1975-80</td>
<td>4.72</td>
<td>3,441</td>
<td>2025-30</td>
<td>1.50</td>
<td>2,365</td>
</tr>
<tr>
<td>1980-85</td>
<td>4.31</td>
<td>3,741</td>
<td>2030-35</td>
<td>1.55</td>
<td>2,288</td>
</tr>
<tr>
<td>1985-90</td>
<td>3.80</td>
<td>3,974</td>
<td>2035-40</td>
<td>1.60</td>
<td>2,200</td>
</tr>
<tr>
<td>1990-95</td>
<td>2.60</td>
<td>3,757</td>
<td>2040-45</td>
<td>1.70</td>
<td>2,183</td>
</tr>
<tr>
<td>1995-2000</td>
<td>2.45</td>
<td>3,519</td>
<td>2045-50</td>
<td>1.75</td>
<td>2,114</td>
</tr>
<tr>
<td>2000-05</td>
<td>2.25</td>
<td>3,624</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Figure 2.5 shows trends in total fertility rates for Brazil and a set of comparator countries and regions between 1950 and 2050. The Brazilian TFR presented a sharp decline from 1960 up to 1991, followed by a deceleration during the 1990s and a speeding up of the decline from 2000 on.

Since the age structure of the population is mainly a result of previous levels of fertility, those levels will continue to have an impact even when fertility levels have reached replacement.
Opposite to the pattern observed for mortality, fertility decline in Brazil has been very fast and faster than the decline observed in most European, East Asian and Latin American countries. For example, it took only 17.5 years for Brazil to reduce its TFR from 3 to 2 (between 1988 and 2006) while it took more than 50 years for the average European country (between 1924 and 1977). As in the case of life expectancy, the fastest fertility decline was observed in Korea where the TFR decreased from 3 to 2 in less than 8 years (between 1977 and 1984). The rapidity of fertility change with its consequences on the population age structure is indeed the most important feature of the demographic transition in Brazil.

Table 2.3 presents the age specific fertility rates estimated for the period 1970 to 2010. The bottom part shows the relative distribution of the age specific fertility rates. Fertility decline in Brazil was mainly due to the elimination of higher order births, or at least of births at older ages. Differently from what happened in other countries postponement of first birth was not a strategy used by Brazilian women to control their fertility. Increasingly fertility is concentrated around the second fertile age-group and a decrease of births in the higher age-groups.

---

For countries that started the observation period (1950) with total fertility rate above 3 and ended the projection period (2050) with TFR below 2, dates corresponding to 3 and 2 children of TFR were obtained through linear interpolation. All other cases were obtained through linear extrapolation of the two extreme years.
### Table 2.3
Brazil: TFR and Age-Specific Fertility Rates 1970-2010

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>5.83</td>
<td>0.0753</td>
<td>0.2564</td>
<td>0.2971</td>
<td>0.2466</td>
<td>0.1825</td>
<td>0.0856</td>
<td>0.0225</td>
</tr>
<tr>
<td>1980</td>
<td>4.06</td>
<td>0.0742</td>
<td>0.1983</td>
<td>0.2104</td>
<td>0.1611</td>
<td>0.1089</td>
<td>0.049</td>
<td>0.0101</td>
</tr>
<tr>
<td>1990</td>
<td>2.79</td>
<td>0.0817</td>
<td>0.1569</td>
<td>0.1399</td>
<td>0.0945</td>
<td>0.0551</td>
<td>0.0244</td>
<td>0.0054</td>
</tr>
<tr>
<td>2000</td>
<td>2.39</td>
<td>0.0899</td>
<td>0.1401</td>
<td>0.1161</td>
<td>0.0757</td>
<td>0.0407</td>
<td>0.0133</td>
<td>0.0021</td>
</tr>
<tr>
<td>2010</td>
<td>1.76</td>
<td>0.0822</td>
<td>0.1271</td>
<td>0.0862</td>
<td>0.0377</td>
<td>0.0141</td>
<td>0.0034</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

### Percentage Reduction in Fertility Rate
1970/2010 | 69.8 | -9.2 | 50.4 | 71.0 | 84.7 | 92.3 | 96.0 | 98.0 |

### Relative Distribution of Rates by Age

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TFR</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>15 - 19</td>
<td>6,5</td>
<td>7,6</td>
<td>9,1</td>
<td>11,3</td>
<td>14,6</td>
</tr>
<tr>
<td>20 - 24</td>
<td>22,0</td>
<td>23,0</td>
<td>24,4</td>
<td>27,0</td>
<td>28,1</td>
</tr>
<tr>
<td>25 - 29</td>
<td>25,5</td>
<td>25,7</td>
<td>25,9</td>
<td>25,2</td>
<td>25,1</td>
</tr>
<tr>
<td>30 - 34</td>
<td>21,1</td>
<td>20,6</td>
<td>19,8</td>
<td>19,2</td>
<td>16,9</td>
</tr>
<tr>
<td>35 - 39</td>
<td>15,7</td>
<td>14,7</td>
<td>13,4</td>
<td>11,5</td>
<td>9,9</td>
</tr>
<tr>
<td>40 - 44</td>
<td>7,3</td>
<td>6,8</td>
<td>6,0</td>
<td>4,9</td>
<td>4,4</td>
</tr>
<tr>
<td>45 - 49</td>
<td>1,9</td>
<td>1,6</td>
<td>1,2</td>
<td>0,8</td>
<td>1,0</td>
</tr>
</tbody>
</table>


As in the case of mortality, fertility in Brazilian states shows a pattern of convergence towards a national average. In 2007, Acre, a state in the Northern region, presented the highest TFR among the Brazilian states, 3.0 children per women. On the other extreme, with the lowest TFR (1.7 child per women) was Rio de Janeiro (see Figure 2.7).

### Figure 2.7
TFR in Brazilian States 1950-2007

Source: PNAD different years

The heterogeneity across regions is small when confronted with social strata disparities. Figure 2.8 presents the age specific fertility rates for the same income brackets considered for the mortality analysis: families with income up to ½ a minimum wage, income between ½ and 1 minimum wage, between 1 and 3 minimum wages, 3 and 5 and 5 minimum wages and above. The lower stratum presents a much more concentrated and younger pattern. As income increases the mode shifts to older ages, a pattern similar to what is observed in European and other OECD countries. In 2001/2006 the TFR was still almost as high
as 3.5 children among women in the lowest bracket of income per capita and as low as 1.0 child among women in the highest bracket. However, a clear pattern of convergence is also apparent across socioeconomic groups.

**Figure 2.8**
Age Specific Fertility Rates by Age Group and Per Capita Family Income – Brazil 2001/2006

![Graph showing age specific fertility rates by income per capita](image)

Source: PNAD different years

2.2.3 Migration

2.2.3.2 International Migration

Brazil has been traditionally a country of in-migration. This was especially true around the turn of the previous century when it received many immigrants from Europe and Asia (Beltrão & Sugahara, 2008). The migration process continued after World War II. It was only with the 1991 Census that some evaluation was possible of the out-migration from Brazil to other countries. Carvalho (1996) estimated between 1.0 and 2.5 million individuals above 10 years of age migrated out of Brazil during the eighties. Oliveira (1996, 2008) estimated that around 1.26 million individuals in the 20 to 44 years of age group migrated out in the eighties. Carvalho and Campos (2007) estimated the net migration flow as half a million individuals above 10 years of age leaving the country during the nineties. Considering the size of the country population and the incipient international out-migration process, the impact is estimated to be negligible. Presently IBGE (2008) does not take into account in its projection any international migration.

Figure 2.9 presents the natural and total growth rates for selected regions and countries in 2005/2010. Reinforcing the previous analysis, countries like Mexico present a natural growth rate higher than the total growth due to out-migration, while other countries with in-migration (like the USA) present the opposite pattern. The difference between the natural and total growth rates in Brazil is almost none.
2.2.3.2 Internal Migration

As in the rest of the world, urbanization was a prominent force of industrialization in Brazil, experiencing a sharp spike in the second half of the twentieth century. Unlike the rest of the world, however, urbanization in Brazil has and is still occurring in a much faster pace. The proportion of the population living in urban areas increased from 36.0 percent in 1950 to 81.2 percent in 2000. The initial spurt of urbanization (in the early 60s) in Brazil occurred at a rate that was almost double that of the rest of the world. While the rate of growth has gradually declined, it is predicted that over 90% of the population of Brazil will be urbanized by 2050 as compared to only 70% in the rest of the world (see Figure 2.10).
Although the proportion of elderly living in urban areas in Brazil, as recorded in the different censuses, has always been higher than the overall proportion of people living in rural areas, the difference has basically been reduced to zero in 2000, which indicates a much more even distribution of people by age in both places of residence (Table 2.5).

### Table 2.5

**Brazil: Proportion of Population by Major Age Groups by Place of Residence 1950-2000**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>Total</td>
<td>36.2%</td>
<td>63.8%</td>
<td>52.8%</td>
<td>47.2%</td>
<td>67.7%</td>
<td>32.3%</td>
</tr>
<tr>
<td>0 - 14</td>
<td>30.4%</td>
<td>69.6%</td>
<td>48.9%</td>
<td>51.1%</td>
<td>62.7%</td>
<td>37.3%</td>
</tr>
<tr>
<td>15 - 59</td>
<td>40.0%</td>
<td>60.0%</td>
<td>55.6%</td>
<td>44.4%</td>
<td>70.9%</td>
<td>29.1%</td>
</tr>
<tr>
<td>60 +</td>
<td>43.8%</td>
<td>56.2%</td>
<td>57.4%</td>
<td>42.6%</td>
<td>69.6%</td>
<td>30.4%</td>
</tr>
</tbody>
</table>


### 4.3 CHANGES IN POPULATION SIZE AND AGE STRUCTURE

#### 2.3.1 Population growth and size

Population in Brazil has been growing at declining rates (Figure 2.11). In 1950, the annual population growth rate was almost 4 percent. Currently, the growth rate has dropped to 1.0 percent and is expected to remain positive for the next 30 years even if fertility is already below-replacement level. The tendency for population growth to continue beyond the time that replacement-level fertility is the result of a relatively high concentration of people in the childbearing years and is referred to as Population Momentum. This phenomenon results from the large number of young people associated to former high fertility rates. As these youths grow older and move through reproductive ages, the greater number of births tends to exceed the number of deaths in the older populations for a certain period of time. Only in 2040-2050, the Brazilian population is expected to be growing at a negative rate. However, opposing trends are observed if we look at specific age groups: while the adult population (aged 15–59) is growing at declining rates and the young population (aged 0–14) has already started to decline in absolute numbers, the growth rate of the older population (aged 60 and over) is expected to follow an upward trend until 2020–25 and to remain above 2% (although with declining values) until 2045-2050. After that, the growth rate might begin to fall, although remaining well above the growth rates of the other age groups.
In absolute numbers, the population of Brazil increased 3.5 times over the last half-century—from 54 million in 1950 to 186 million in 2005—and is projected to increase an additional 17 percent over the next 45 years, to reach 218 million in 2050. One more time, considerable variation exists among different age groups. While the young population increased 2.3 times between 1950 and 2005 and is expected to decline by around 37.4 percent between 2005 and 2050, the adult population expanded 4.1 times in the first period and is projected to continue increasing over the second period, but only by 2.9 percent. Yet, the most significant change concerns the older population, which increased by 6.3 times between 1950 and 2005, and will increase by almost 300% between 2005 and 2050. The magnitude of the older population will match that of the youth population for the first time in history around 2027. By 2050, the older population is expected to be twice as large as the youth population (see Figure 2.12 and Table 2.6).

As can be seen in Figure 2.13, the youth population has declined since 1990, while the working-age population is expected to expand up to 2025. After that, population growth in Brazil will be entirely due to increases in the older population.
Table 2.6
Brazil: Population by Major Age Groups, 1950, 2005, And 2050

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>53,974,725</td>
<td>186,109,614</td>
<td>218,512,000</td>
</tr>
<tr>
<td>0–14</td>
<td>2,243,209</td>
<td>51,576,213</td>
<td>32,098,000</td>
</tr>
<tr>
<td>15–59</td>
<td>28,915,548</td>
<td>108,477,473</td>
<td>121,389,000</td>
</tr>
<tr>
<td>60 and over</td>
<td>2,627,168</td>
<td>14,112,862</td>
<td>64,025,000</td>
</tr>
</tbody>
</table>


2.3.2 Age structure

The demographic transition has important effects not only on the growth of the total population but also on its age structure. The connection between life expectancy and age structure is often misunderstood and erroneously believed to be the cause of population aging. However, over most of the transition in life expectancy the greatest gains in years lived occur in the 15-64 age group. If we consider, for example, the increase from life expectancy 40 to life expectancy 60, about 5 of the 20 years gained were at 65 and older, about 2 years were gained in the 0-14 age span, and the remaining 13 years were gained in the 15-64 age span. For those countries with very high life expectancy, however, the greatest gains will be experienced at the end of life. For a life expectancy of 75-80, where most of the developed countries currently fall and Brazil soon will be, the gains at 65+ exceed the gains at 15-64. Population aging due to declining mortality is generally associated with increasing health and improving functional status of the elderly. While such aging puts pressures on pension programs that have rigid retirement ages, that problem is a curable institutional one, not a fundamental societal resource problem, since the ratio of healthy, vigorous years over the life cycle to frail or disabled years has not necessarily changed.

In Brazil, at the moment, it is primarily the decline in birth rates that has produced the main changes in the population age distribution and, more specifically, has led to the increase in the share of the population at older ages. For this reason, population aging due to reduced fertility may well impose important resource costs on the population, regardless of institutional arrangements for old-age support.

The share of the distinct age groups in total population in Brazil has indeed changed considerably over time as they grew at different rates. Although in absolute terms the youth population will continue to grow until 2020, its proportion has been declining since 1965 and is expected to continue declining. Similarly, the share of the adult population is expected to start declining after 2020 even though its magnitude will continue to expand until 2025-2030. Whereas the share of the youth and adult populations are predicted to decrease, the share of the older population is expected to increase steadily over the entire period under consideration (see Figure 2.13).

The process of population aging should speed up considerably in the near future. In fact, between 1950 and 2000, the proportion of population aged 60 and over increased only moderately, from 5.0 percent to 8.1 percent. Over the next 50 years, however, it will rise from 8.1 percent to 29.4 percent, which means, in absolute terms, an increase from around 2.6 million to 64 million in the course of a century (44 million of which between 2010 and 2040).
Figure 2.13
Brazil: Population Distribution by Major Age Groups, 1950-2050


Table 2.7 shows the evolution percentage of the elderly population (60+) in Brazil and selected comparator countries and regions between 1950 and 2050. The figure for Brazil shows an exponential pattern: it doubled between 1950 and 2010 and is expected to triple between 2010 and 2050. It is interesting to note that although the proportion of elderly was lower than that of what currently are the oldest countries in LAC (i.e. Argentina, Chile and Uruguay) in 1950 and 2010, such proportion is projected to be higher in Brazil in 2050. In 2050 Brazil will have a higher proportion of elderly than all European countries in 2010. However, the aging process in Brazil will have been much faster. This is because the rapidity of population aging depends mostly by the rapidity of fertility decline, which, as was noticed earlier, was extremely rapid in Brazil. For example, it has taken 60 years (from 1927 to 1987) for Germany to increase its share of elderly population from 10% to 20%. However, it will take only 27 years for Brazil to experience the same change. Only Korea will be faster than Brazil.

Table 2.7
Elderly Population (60+) as Percentage of Total Population – Selected Countries and Regions – 1950/2050

<table>
<thead>
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<td>8.5</td>
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<td>9.9</td>
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<td>21.3</td>
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<td>15.5</td>
<td>16.1</td>
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<td>6.1</td>
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<td>11.2</td>
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<td>6.8</td>
<td>6.3</td>
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<td>7.8</td>
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<td>11.5</td>
<td>15.5</td>
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<td>5.5</td>
<td>5.5</td>
<td>6.5</td>
<td>7.5</td>
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<td>12.9</td>
<td>17.7</td>
<td>23.9</td>
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<td>7.7</td>
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<td>9.0</td>
<td>10.3</td>
<td>13.2</td>
<td>17.5</td>
<td>22.6</td>
<td>25.5</td>
<td>28.7</td>
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<td>Argentina</td>
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<td>9.0</td>
<td>11.0</td>
<td>12.1</td>
<td>13.2</td>
<td>13.7</td>
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<td>16.4</td>
<td>18.3</td>
<td>21.7</td>
<td>24.9</td>
</tr>
<tr>
<td>Uruguay</td>
<td>11.8</td>
<td>11.9</td>
<td>12.9</td>
<td>14.7</td>
<td>16.5</td>
<td>17.4</td>
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<td>20.1</td>
<td>22.3</td>
<td>25.1</td>
<td>27.4</td>
</tr>
<tr>
<td>Brazil</td>
<td><strong>4.9</strong></td>
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<td><strong>5.7</strong></td>
<td><strong>6.2</strong></td>
<td><strong>6.8</strong></td>
<td><strong>8.1</strong></td>
<td><strong>10.2</strong></td>
<td><strong>14.0</strong></td>
<td><strong>18.9</strong></td>
<td><strong>23.9</strong></td>
<td><strong>29.3</strong></td>
</tr>
</tbody>
</table>


Because of expected rapid improvements of mortality at old ages in Brazil in the next 40 years, an even steeper increase is expected for the share of the oldest elderly (i.e. those aged 80+). While in 2010 only
1.5% of population in Brazil was aged 80 plus, the same figure is expected to increase to 6.5% in 2010, i.e. a level higher than is currently observed in any population in the world, including Japan.

To give an idea of the differential growth rate among total population and alternative definitions of elderly population in absolute values, Figure 2.14 presents the ratio of the estimated figure for 2050 and that counted in 1950. The pattern is the same everywhere: total population presents the smallest ratio, followed by population 60+, 65+ and with the population 80+ with the highest ratio. Brazil presents the highest ratio for all the alternative definitions of elderly population among countries and regions selected.

Figure 2.14
Ratio between Population Estimated for 2050 and that in 1950: Total and Elderly Population – World, Selected Regions and Countries


4.4 DEPENDENCY RATIOS, THE DEMOGRAPHIC BONUS AND THE DEMOGRAPHIC DIVIDENDS

2.4.1 Changes in Dependency Ratios

The dependency ratio—which relates the number of people in dependent age groups (children under age 15 and persons over age 59, in this study) to that of people in the working-age group (aged 15–59)—is a valuable indicator of the potential effects of demographic changes on socioeconomic development. The dependency ratio can also be disaggregated into a child dependency ratio, which relates the number of children to that of people of working age, and the old-age-dependency ratio, which relates the number of older persons to that of people of working age. In general, dependency ratios are expressed in terms of the number of people in dependent age groups for every 100 people of working age.

It is important, however, to understand the limitations of dependency ratios expressed in terms of age ranges. First, in most populations, people do not automatically cease to be economically active at a specific age. In addition, not everyone in the working-age group is economically active, particularly among the female population (despite the increasing participation of women in the labor market). Similarly, as professional training becomes lengthier, a growing number of young adults remain in the education system and outside the labor market longer (thereby extending the period of dependence far beyond adolescence).
Between 1950 and the mid-1960s, the total dependency ratio in Brazil increased due to the relative increase in the child population, until reaching a maximum value of 97 dependents per 100 people of working age. Following the decline in fertility rates in the mid-1960s, the total dependency ratio started a steady decline, which is expected to last until 2020, when the ratio will reach its minimum value of 52 before increasing again, due to the growing proportion of older persons (see Figure 2.15).

![Figure 2.15](image)

**Figure 2.15**
**Brazil: Total, Child and Old Dependency Ratio, 1950-2050**

Whereas during the next 10 years the total dependency ratio is going to decline, it is important to understand that its composition will have changed dramatically, indicating a shrinking pool of new workers and an increasing pool of elderly. In particular, by the 2020s there will be five people in the age group 15-64 for each person of age 60 and older. The proportion today was eight to one in 2000. In 2050 it will be less than two to one.

### 2.4.2 Projection Variations under Low-, Medium- and High-Fertility Variants

The United Nations revises its official population estimates and projections every two years by incorporating all new and relevant evidence regarding the demographic dynamics in each country or area of the world, and formulating detailed assumptions about the future paths of the demographic variables.

However, because future trends cannot be known with certainty, a number of projection variants are produced, most of them differing exclusively in the assumptions made regarding the future path of fertility. For the purpose of this exercise, the medium-fertility variant, usually recommended as the most likely one, is compared with the extreme (and unlikely) cases of the low- and high-fertility variants.\(^{19}\)

Figure 2.16 and Table 2.8 show the dependency ratios for Brazil under the medium, high and low variants. The total dependency ratio is estimated to keep falling modestly until 2020, after which it would start to grow. In the high-fertility variant, the growth would start 5 years earlier (2015) and at a slightly higher level (55 instead of 52), and the variation between different assumptions on fertility would be

---

\(^{19}\) Under the high-fertility variant, fertility is projected to remain 0.5 children above the fertility in the medium variant over most of the projection period. By 2045–2050, fertility in the high variant is therefore half a child higher than that of the medium variant. Under the low-fertility variant, fertility is projected to remain 0.5 children below the fertility in the medium variant over most of the projection period. By 2045–2050, fertility in the low variant is therefore half a child lower than that of the medium variant.
largest between 2025 and 2035. By 2050, however, the differences in total dependency ratio under the three variants are projected to range very little, from 78 to 82 dependents per 100 persons of working age.

**Figure 2.16**
Brazil: Total, Old and Child Dependency Ratios under Different Population Variants, 1950-2050

![Graph showing the total, old, and child dependency ratios under different population variants from 1950 to 2050.](image)


<table>
<thead>
<tr>
<th>Dependency Ratio</th>
<th>1950</th>
<th>2005</th>
<th>2050</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<td>Total dependency</td>
<td>87</td>
<td>57</td>
<td>78</td>
<td>79</td>
<td>82</td>
<td></td>
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<tr>
<td>Child dependency</td>
<td>78</td>
<td>43</td>
<td>17</td>
<td>26</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Old age dependency</td>
<td>9</td>
<td>14</td>
<td>61</td>
<td>53</td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>


The child dependency ratio is estimated to fall under all three variants, dropping from 42 dependents in 2005 to 26 dependents in 2050 under the medium variant. Under the high variant, the drop in child dependency ratio would be more modest, reaching 46 dependents in 2050. Under the low variant the ratio would more than halve in the period, reaching a value of 17 in 2050. The old-age dependency ratio is estimated to more than triple under all three variants. It is expected to be 53 dependents and to range from 46 and 61 under the high variant and the low variant respectively.

### 2.4.3 The Demographic Bonus

As was noticed in the previous section during the demographic transition, not only for Brazil but for all countries, there is a period when the proportion of people of potentially productive age grows steadily in relation to potentially inactive ages. In that period, when the dependency ratio drops to record lows, the situation is particularly conducive to development, as there are more possibilities for savings and investment in economic growth, while there is also reduced pressure on education spending. Various terms have been coined to describe this period, including “demographic bonus” or “demographic window of opportunity”, which refers to the possibility of increasing rates of economic growth per capita and the levels of well-being of the population during this period.
There is no exact measurement of the beginning and ending of the demographic bonus, and its definition in terms of the dependency ratio tends to vary. Following the work of CEPAL (2008) and World Bank (2011) in this study the period corresponding to the demographic bonus has been subdivided into three phases. In the first phase, the dependency ratio declines but is still fairly high (above two-thirds, that is, two persons in dependent-age groups for every three persons in working-age groups). In the second phase, the dependency ratio falls below two-thirds and continues to decrease. In the third and final phase, the dependency ratio begins to rise as the proportion of older people increases, but is still below two-thirds. The two thirds cut-off point was chosen arbitrarily to serve as an illustrative benchmark.

In Brazil the demographic bonus started in 1995 and will last until 2043. However, the most favorable phase of a small and declining dependency ratio will finish in 2020 (Figure 2.17). After that the total dependency ratio will be increasing year after year.

![Figure 2.17
The Demographic Bonus in Brazil](image)

The extent and duration of the different phases of the demographic bonus vary significantly across countries (Figure 2.18). Generally speaking, countries more advanced into the demographic transition have a shorter period of bonus left than countries that are behind in the process. The countries with the fastest fertility decline (e.g. Korea, Brazil, Turkey, Mexico) have a longer bonus than countries with longer (e.g. Germany) or smoother (e.g. Argentina and Uruguay) fertility decline. In Japan, Germany and most European countries the demographic bonus has already expired.
2.5. LABOR MARKET

2.5.1 Size of Labor Force in Working Age

This section explores the consequences of demographic change on the size and share of the working age population. As previously described, after that the total dependency ratio will start to increase as the elderly population continues to grow faster and faster. A growing working age population implies more people in economic activity, which, everything else being equal, would result into more wealth being generated (first dividend). At the same time, as life expectancy at birth continues increasing, the increasingly older population is expected to live longer, which could result into more savings over the life-cycle to finance consumption at old ages (second demographic dividend).

Wong and Carvalho (2006) argue that Brazil is currently experiencing the best moment of the demographic bonus. They divide the potential economically active population (ages 15 to 64) into two groups. First, the mature working population (ages 25 to 64) which is expected to continue increasing until 2035. Secondly, the junior segment of the economically active population (ages 15 to 24), which already started a period of negative growth (see Figure 2.19). A fraction of this junior workforce (those aged 15-19) is usually in the qualification phase, and the other (20-24), although economically active, is usually made of people seeking their first job (who usually have smaller economic activity rates). The mature workforce, in contrast, has higher economic activity rates and usually generates most of countries’ wealth and constitutes the most important group of taxpayers.
Very often, unemployment lessens as the age structure shifts towards older ages. Unemployment rates tend to be higher among younger workers because when individuals enter the labor market for the first time they spend more time searching for the best match for their skills, they are less costly to release, they tend to have less information about labor markets, and their potential employers tend to have less knowledge about their own comparative advantages and preferences than do older workers (see Behrman et al, 2001). The junior workforce increased in absolute terms very rapidly until recently in Brazil (see Figure 5.1), thus demographically speaking, by entering into the labor force it pressured the economy towards the creation of enough employment that otherwise would promote social or economic instability by increasing unemployment and/or replacing older population still at working ages [see Wong and Carvalho (2006)]. These pressures are expected to lessen when the period of negative growth of the junior workforce begins. This is what was observed in Brazil where the unemployment rate decreased from 10.43 in 1999 to 7.1 in 2008.

An increasing share of the working age population could boost the prospects for economic growth due to the reduction in the young dependency ratio. And an increasing mature working age population relative to the junior working age population, as in Brazil, represents another window of opportunity to accelerate growth, improve savings, increase government revenues and, consequently, increase fiscal capacity to finance public policies. However, as will be shown later in this chapter, a large share of Brazilian workers are low-skilled workers, employed in low quality jobs in the informal sector, earning very low wages and contributing little to economic growth. Moreover, to take advantage of the fact that people will live longer, incentives should be aligned with the goal of strengthening the financial sustainability of the social security system. In other words, workers should be encouraged to stay longer in the labor force and to not retire when they are still productive. Having people work longer (in the formal sector) has two benefits: first, they draw a pension for fewer years; second, they keep generating income and contributing to financing the social security system. The next sections discuss these questions.
2.5.2 Labor Force Participation and Retirement Behavior\textsuperscript{20}

This subsection describes the changes in the labor market observed in Brazil in recent years. Pooling together 25 rounds of the PNAD between 1982 and 2007\textsuperscript{21}, it is possible to construct labor market characteristics over the life cycle of different cohorts over time.\textsuperscript{22} The cohort analysis, which is used in this section, is more appropriate as it allows to better understanding the life cycle changes related to labor supply being experienced by successive generations of Brazilians (a similar strategy was used by Scorzafave and Menezes-Filho, 2001, when looking at female labor force participation).

There has been very little change in the age specific labor force participation of men across cohorts. By looking at labor force participation of men between 10-14 and 75-79 years of age, covering cohorts born between 1928-1932 and 1978-1982 we see that the age profile is very stable across cohorts (Figure 2.20a). Participation starts around 25% for children between 10-14, peaks at around 95% for adults between 30 and 50, and then falls abruptly until it reaches 20% for elderly in the age group 75-79. The subtle changes that can be perceived from the figure correspond to modest reductions in participation for younger cohorts throughout the age distribution. In any case, the changes do not seem to be quantitatively relevant (see Wajnman et al, 2004, for a comprehensive discussion of labor force participation of the elderly and its change through time, from a perspective of period analysis).

The case of women is presented in Figure 2.20b and is radically different. As noticed before (see, for example, Wajnman and Rios-Neto, 1999), there has been a sustained increase in the labor force participation of women in Brazil over the last decades. In Figure 5.2b, this can be clearly seen from the shift in the age-specific profile across cohorts. Female labor force participation in the age group 55-59, for example, increased from 29% in the cohort born in 1928-1932 to 43% in the cohort born in 1948-1952. At the same time, in the age group 20-24 it went from 45% in the cohort born in 1958-1962 to 63% in the cohort born in 1978-1982. The vertical shift is of roughly the same order of magnitude across cohorts, apart from the two oldest cohorts in the figure, which seem to be more closely together for the older age groups.

\textsuperscript{20} This section draws heavily on Soares (2010). The paper looks at cohorts born within five-year intervals and documents the age-profile of labor force participation, hours of work, and retirement across six different PNADs: 1982, 1987, 1992, 1997, 2002, and 2007. So, for example, it tracks the history of the cohort born between 1968 and 1972, from when it was aged between 10 and 14 in 1982 until it was aged between 35 and 39 in 2007, and similarly for other cohorts. The exercise is conducted for males and females separately.

\textsuperscript{21} Though the PNAD started in 1976, there were substantial changes in the first years of implementation so it is difficult to create a consistent series starting in the 1970s.

\textsuperscript{22} Wajnman and Rios-Neto (1999) highlight the inherent problems in looking at period profiles to infer changes over the life cycle, which relate to the fact that cohort changes may end up being interpreted as age related changes.
Again, oddly enough, the pattern of changes in average hours worked across cohorts (for individuals employed) is almost diametrically opposite for men and women (Figure 2.21). For men, there has been a consistent reduction in the average hours across cohorts. In the age group 55-59, average weekly hours for individuals born in 1928-1932 were 49, in contrast to 45 for the cohort born in 1948-1952. In the age group 20-24, average weekly hours were 48 in the cohort born in 1958-1962, in contrast to 44 for the cohort born in 1978-1982. For women, on the other hand, there is no clear pattern and the profile is reasonably stable, apart from some changes at early ages. For prime age women, average weekly hours hover around 38 for different cohorts.

In sum, the patterns of labor force participation and hours per week suggest that men have maintained a roughly constant profile of labor supply on the extensive margin (labor force participation), while
reducing it on the in the intensive margin (hours worked). At the same time, women have maintained a roughly constant labor supply on the intensive margin (hours worked), while increasing it on the extensive margin (increased labor force participation). Most of these movements extend throughout the age distribution, so in principle it seems difficult to associate them particularly with retirement decisions.

The results for retirement rates show different pattern, as shown in Figure 2.22. Retirement starts being a relevant phenomenon in the Brazilian labor market as early as age 45-49. By age 55-59, close to 30% of all men are already retired. However, male retirement rates are not monotonic through time. In the 45-49 age group retirement rates increased from 8.6% for the cohort born in 1933-1937 to 9.8% for the cohort born in 1948-1952, and then fell back to 4.8% for the cohort born in 1958-1962. For women, the retirement rate has monotonically increased for recent cohorts, which is intrinsically related to increased eligibility to social security deriving from increased female labor force participation, and also to women smaller time of contribution, as we will see latter.

**Figure 2.22**

Percentage of Retired by Age and Birth Cohort

The non-monotonic pattern in retirement rates is therefore a movement restricted to men at relatively young ages and related particularly to the issue of early retirement in Brazil (considering early retirement as retirement before 60 years old). The profile across younger age groups suggests a process of increasing retirement rates at until the mid 1990s, after when retirement rates started being reduced. Figure 2.23 illustrates that there is a systematic movement of reduction in the incidence of retirement at earlier ages and increase at later ages for urban men between 1982 and 2007. On the other hand, the retirement rates for people of 60 years or more has increased for men and women, being a result of the coverage expansion.
Taken together, the evidence suggests that movements in labor supply across cohorts in Brazil have not been intimately linked to changes in retirement decisions. In relation to women, movements along all margins seem to be driven by the increased labor force participation associated with emancipation of women across various social fronts. In relation to men, even though there has been a reduction in labor supply in the intensive margin (hours), this reduction has been observed throughout the period and across all age groups, even very young ones. Retirement, on its turn, experienced an increase associated with increased access, but at the same time was delayed through the reduction in the incidence of early retirement. In face of these trends, it seems difficult to associate the driving force behind the labor market changes with changes in retirement. This may be related to the peculiarity of the Brazilian system, where official retirement bears no legal implications for withdrawal from the labor force. As Oliveira et al (2004) noticed, the absence of retirement penalties for individuals who continue to work in Brazil weakens the relationship between retirement and labor force participation.

Figure 2.24 presents the age specific labor force participation of retirees for different cohorts and for men and women separately. Looking at retired men born in 1938-1942, labor force participation ranges from 41% at age 50-54 to 38% at age 65-69. Looking at the numbers for the entire population (used to construct Figure 2.20) for this same cohort, male labor force participation is 87% at age 50-54 and 43% at age 65-69. So retirement seems to be associated with exceptionally low labor force participation only at younger ages associated with early retirement, but not so for later ages. Given that the incidence of retirement is lower at these younger ages, the overall relationship between retirement and labor force participation does not seem to be particularly strong. In addition, if anything, the evidence from Figure 5.6a suggests that labor force participation of retired men in age groups up to 65-69 has been increasing for recent cohorts. So, for example, the labor force participation at age 55-59 was 32% for the 1923-1927 cohort and 40% for the 1948-1952, while the labor force participation at age 60-64 was 29% for the 1918-1922 cohort 47% for the 1943-1947.

For women (Figure 2.24b), there has been a consistent increase in the labor force participation of retirees across cohorts. This maps the overall increase in female labor force participation. When compared to overall labor force participation, the differences here are even smaller than those observed for men. Also, the increase in the age specific labor supply of retirees across cohorts has been much more marked for women than men. In the age group 55-59, for example, the labor force participation of retired women increased from 13% in 1923-1927 cohort to 35% in the 1948-1952 cohort.
However, the majority of retired workers are employed in the informal sector, as can be seen in Figure 2.25. Informality is closely linked to age and retirement [see details of informality in Brazil in Box 5.1]. Mesquita and Neto (2010) argue that as employer contribution rates are high and workers already receive social security benefits, there is a strong incentive to evade social security taxes, with the employer paying part of (or all) wages off-books. Among the self-employed it is even easier to do so.

Mesquita and Neto (2010) suggest that social security rules, together with the increase in eligibility for social security benefits deriving from the increase in the labor force participation, are the factors responsible for the increase in early female retirement (i.e. before 60 years). Women can retire five years younger, with a contribution period five years shorter than men’s. The argument behind different retirement rules is that women work both outside and inside the household (as housewives) and suffer discrimination. However, many women are single or have domestic helpers in their households, and as more and more women enter the labor market, discrimination should decrease. Old age retirement should be used as an instrument to compensate for the lack of capacity to work due to old age and it is not an efficient mechanism to compensate for gender discrimination in the work place or at home. The authors argue that a larger proportion of women in the labor market will result in lower retirement age, shorter average contribution period, and longer periods in retirement since women are entitled to retire younger and have longer life expectancy than men. At the same time, it is important that social policies, including retirement legislation, do allow compensating women for shorter contributing period due, for example, to childbearing.
The adverse effect of social security rules on labor market behavior becomes clearer when Brazil is compared to other countries. Although the incidence of early retirement of urban men has decreased in Brazil between 1982 and 2007, if compared with OECD and LAC countries, the Brazilian population still retires much earlier. Table 2.9 shows the minimum age of retirement and the expected duration of retirement for Brazil, OECD and LAC countries. For men, the average minimum age of retirement is 62.1 years in LAC, 63.9 years in OECD countries, while the average age of retirement based on time of contribution in Brazil is 54.4 years. For women the situation is even worse, as the average age of retirement in Brazil based on time of contribution is 51.3 years, while the average minimum age in LAC is 60.4 years and in OECD countries is 62.6 years. When we look at Brazilian urban men retirement based on age we can see that it is 65 years old, not much different from OECD and LAC Countries. The expected duration of retirement based on age in Brazil is 15.9 years against 16.7 years in LAC and 16.0 years in OECD countries. Meanwhile, for women, the expected duration of retirement is slightly higher in Brazil than in the other countries and is still worse for rural workers. But what makes Brazil an outlier is retirement based on time of contribution. This is explained by the fact that in Brazil there is no minimum age requirement for this kind of benefit. For example, on average, a woman in Brazil who retires based on time of contribution receives the pension for 29.2 years, against 20.8 in OECD and 21.1 in LAC countries (Rocha and Caetano, 2008).

The Brazilian pension system has a unique 3 tier arrangement when it comes to eligibility conditions for retirement. There are three regimes: (i) retirement based on a minimum age (53M/48W) and a minimum number of years of contributions (30M/25W); (ii) retirement based on a number of years of contributions (35M/30W) and no minimum age; and (iii) retirement based on age (65M/60W) and a minimum number of years of contributions (15M/15W) [see Worldbank (2009)].
Table 2.9

<table>
<thead>
<tr>
<th>Minimum Age and Expected Duration of Retirement – Brazil and Group of Countries(^a)</th>
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<tr>
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<td>****</td>
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<td>Urban</td>
</tr>
</tbody>
</table>

Source: Rocha and Caetano (2008)

Notes: \(^a\) Number of countries in parentheses

However, when another measure of labor market behavior is used, i.e. the unused labor capacity of older workers, Brazil is not as different of OECD countries. The measure, proposed by Gruber & Wise (1999), is calculated by summing up the proportions of individuals out of the labor force between ages 50 and 69 and dividing it by 19. The measure is interpreted as follows. Suppose the unused capacity measure between ages 50 and 69 in a particular year is 50%. It means that a cohort experiencing the labor force participation rates in that year for their whole life would work only 50% of their potential life time person-working-years.

Table 2.10 shows that the unused labor capacity and the % of males out of the labor force at age 59 vary substantially across the eleven countries pointed by Gruber & Wise (1999). Unused labor capacity for ages 55-65 ranges from 67% to 22% and the percentage of men out of the labor force at age 59 ranges from 58% to 13%, for Belgium and Japan respectively. Brazil compares to the countries on the lower end of the distribution. The unused labor capacity in Brazil is similar to those observed in the United States and Sweden, 37% and 35% respectively. The percentage of males out of the labor force at age 59 in Brazil is higher than that of the US (26%) and very similar to the levels in the United Kingdom (38%), Germany (34%), Spain (36%), and Canada (37%).

Table 2.10

<table>
<thead>
<tr>
<th>Unused Labor Capacity and Men not in the Labor Force, Selected Countries (circa 2000).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>Belgium</td>
</tr>
<tr>
<td>France</td>
</tr>
<tr>
<td>Italy</td>
</tr>
<tr>
<td>Netherlands</td>
</tr>
<tr>
<td>United Kingdom</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>Spain</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>United States</td>
</tr>
<tr>
<td>Sweden</td>
</tr>
<tr>
<td>Japan</td>
</tr>
<tr>
<td><strong>Brazil</strong></td>
</tr>
</tbody>
</table>

Source: Queiroz and Figoli (2010)

In summary, the evidence shows that although Brazilian population has incentives to retire earlier than in LAC and OECD countries, labor force participation at older ages in Brazil is comparable to in those
countries. This happens because most Brazilian workers continue to work after they retire. To better understand the determinants of retirement and labor force participation in Brazil, the next sections look at the profile of health and productivity over the life cycle. The goal is to understand to what extent retirement and labor force participation decisions are driven by a worsening of health at later ages and by reductions in labor market productivity.
Chapter 3
The Old-age Social Protection Programs and the Aging Challenge

3.1 INTRODUCTION

All pension systems –PAYG or pre-funded, public or private, compulsory or voluntary– distribute output of today’s workers to today’s retirees (Barr, 2000). They are a part of a country Social Protection system whose objectives are to allow individuals to smooth consumption, and to prevent old-age poverty by guaranteeing a minimum level of income.

The design of pension systems in order to achieve these objectives varies from country to country. In general pension systems can be characterized by the way in which benefits are calculated and the method used for their financing. When benefits are defined ex-ante according to a formula that links the value of the pension to variables such as covered income and number of contributions, we talk about a Defined Benefits system (henceforth, DB system). Alternatively, when the value of the pension is determined at the moment of retirement according to the accumulated assets that the person has accrued as a result of contributions during their working period and transformed into a stream of benefits that take into account the life expectancy at that point, we talk about a Defined Contributions system (henceforth, DC system). In both cases, benefits can be financed either by current contributions (Pay as You Go-PAYG) or by savings or reserves accumulated before retirement (Funded).

Beyond introducing a savings mechanism\(^{24}\) and redistributing income, the rules of the different programs for the elderly have implications for the rest of the economy. Indeed, savings decisions vary with people’s preferences (i.e. personal discount rate), age, liquidity constraints, type of job, life expectations, among others. Mandatory savings or social security contributions are a mechanism to ensure that part of individuals’ earnings are set aside to finance consumption of the elderly. Benefit formulas affect the willingness to participate in the system or to save privately for retirement. Worker’s decisions in terms of sector of choice (formal/informal) as well as retirement decision are also affected by these rules with consequences on workers’ productivity and overall economic output. Non-contributory pensions are an instrument to prevent poverty in the old age, but eligibility requirements and benefits levels may also affect workers’ decisions.

Brazil’s very generous public pension system has contributed to reducing poverty. The system extends benefit coverage to most of the old age population and provides protection to poorer segments of society. Indeed, as shown in Chapter 1, Brazil has almost completely eradicated poverty among the elderly. Public transfers, including pensions, have played a key role in achieving this.

\(^{24}\) In a PAYG system the contribution rate is known as a payroll tax. In a contributory, earnings-related PAYG pension scheme, it is better to think of it as a contribution rather than as a tax.
These achievements of the old-age social protection system have come at a high cost. Expenditure are very high compared to other middle income countries or to countries with similar age structure (Figure 3.1). Expenditures have increased significantly since 1988 when Brazil was spending 2 percent of GDP. Indeed, as for all components of the Brazilian welfare system, the 1988 constitution has been a defining moment for the pension system as it established a set of measures that expanded social security coverage, included previously excluded workers and changed the determination of social security and assistance thresholds, in addition to introducing the indexation of such benefits to the minimum wage.

Over the next 40 years Brazil’s working population will have to support an increasingly higher number of elderly. The life-cycle model seen in Chapter 1 identifies three phases in the lifetime. During the first and the last, individuals are net consumers, whereas in the second they are net producers of output. Thus the overall consumption in an economy relies crucially on the size and productivity of individuals in the second phase. The smaller the share of working age population the higher the burden: more people in the economy are dependent on their production. Moreover, for a given share of working age population, countries face very different prospects depending on the relative share of children and elderly. As we have seen in Chapter 2, while the dependency ratio in 2050 is predicted to be equal to the level in 1980, its composition will be very different: in 2050 about 30 percent will be 60 and over, compared to less than 10 percent in 1980. This has very important implications for the economy as the lower amount of children will result in a smaller future labor force and hence, all things equal, in lower aggregate output in the future. This is bound to put more pressure on old-age income support and to present some critical trade-offs.

Population aging poses important challenges to the pension system irrespective of how it is financed. In a public PAYG system, contributors receive promises from government that future earmarked taxes (compulsory contributions) will provide them with goods and services in their old age. When there is not enough tax revenue to meet pension promises, pensions have to be financed by debt and may become unsustainable. Contributors to a pre-funded pension system also obtain a claim on future output, but in a different way: they accumulate financial assets (bonds and equity), which are later sold to younger workers. If the supply of financial assets in the market increases, due to large numbers of retirees who
want to sell, all things equal, their price can fall, thus lowering the market value of the pension fund and of the assets accumulated by old people\(^{25}\).

While the generosity of the system is currently affordable for Brazil, demographic changes are bound to make the old-age social protection system increasingly more expensive. The current deficit of the system is about 3 percent of GDP, a third of which comes from the non-contributory rural program\(^{26}\). However, as we will see in Chapter 6, a scenario without further reforms predicts pension expenditures would reach more than 22 percent of GDP by 2050. This implies a growing deficit and an inevitable crowding out of other types of expenditures or an increase in debt.

A reform of the system is unavoidable. In particular, Brazil should move towards a more integrated social protection system, avoiding the dualism between informal workers being attended by social assistance and formal workers having access to social insurance. To be successful a reform should have the following characteristics: (i) ensure a smoother and proportional relationship between contribution and benefits; (ii) ensure horizontal equity and transparency; (iii) increase the participation to social insurance programs; and (iv) promote savings.

This chapter describes how the social protection system for the elderly in Brazil is organized to achieve its goals, and then details what are the main shortcomings of the system that should be addressed to increase its effectiveness and efficiency in light of the upcoming rapid aging of the population. Chapter 6 will present the public finance implications of an increasingly larger share of the population of Brazil in older ages. The focus here is on specific effects of the old-age social protection system on individuals’ economic behavior, and their implications in the context of an increasingly older population.

### 3.2 SOCIAL PROTECTION PROGRAMS FOR THE ELDERLY IN BRAZIL\(^{27}\)

#### 3.2.1 Structure

According to the World Bank multi-pillar taxonomy\(^{28}\) (Table 3.1), the Brazilian pension system would be defined as a system with sizable zero and first pillars, no second pillar, and a third pillar of moderate size (Table 3.2). The main objectives of the zero pillar are redistribution and poverty alleviation. It comprises the minimum pension provided to formal contributors, the rural pension program and the social assistance benefits to the poor elderly. These programs cover a large numbers of workers that move in and out of informality during their working lives, and entail a significant degree of redistribution. The rate of subsidization differs according to the program, with the social assistance program being totally subsidized, the rural program being strongly subsidized (revenues cover about 10 percent of expenditures), and the minimum pensions for urban workers being partially subsidized (workers need to contribute for 12 years to be entitled to the minimum pension).

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\(^{25}\) In a DC system, this decline translates automatically into a reduced real value of the pension benefit, thus contributors bear the risk. In a DB system a crisis can erupt, despite pre-funding, when revenue from sales of bonds and equity is less than required to meet pension promises and once again, the promised benefits may become unsustainable. (Willmore 2003)

\(^{26}\) Technically this is a contributory program. Individuals are supposed provide a proof of past work in the rural sector for a total period of at least 180 months and should be working as a rural worker by the time the benefit is claimed. However, in many cases it is virtually impossible to verify whether the claimant really worked as a rural worker for the required period or just used to live in a dwelling located in a rural area. (Mesquita and Neto 2010). Thus workers are exempt from contributions and the revenues from taxation of agricultural production account for less than 10 percent of expenditure

\(^{27}\) This section is taken from the 2006 World Bank Report "Brazil: Towards a Sustainable and Fair Pension System"

\(^{28}\) World Bank (1994) and Holzman and Hinz (2005)
### Table 3.1
#### Pillars of Old Age Income Security

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Objective</th>
<th>Financing</th>
<th>Program features</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Poverty alleviation &amp; Redistribution</td>
<td>Government</td>
<td>Mandatory, Public managed, Means tested, Minimum benefits</td>
</tr>
<tr>
<td>1</td>
<td>Income replacement &amp; some redistribution</td>
<td>Contribution – PAYG or partially funded</td>
<td>Mandatory, Publicly managed, Defined benefits or notional defined contribution, earning-related benefits</td>
</tr>
<tr>
<td>2</td>
<td>Income smoothing through savings</td>
<td>Tax-preferred private savings or insurance. Fully funded</td>
<td>Mandatory, Privately managed, Defined contribution, Benefits equal contributions plus returns of investment</td>
</tr>
<tr>
<td>3</td>
<td>Income smoothing through enhanced savings</td>
<td>Tax-preferred private savings. Fully funded</td>
<td>Voluntary, Privately managed, Defined benefits or contribution, Benefits equal contributions plus returns of investment</td>
</tr>
</tbody>
</table>

The first pillar comprises the mainstream programs of the General Regime of Social Security (RGPS) and the Social Security Own Regimes (RPPS). These are contributory programs with mandatory participation, managed by the public sector, and operating on a defined benefit basis. The RGPS comprises all private sector workers, who participate in formal social security, self-employed workers, domestic workers, rural workers, and those participating on an elective basis. It is administered by INSS and is compulsory. The RPPS comprises government employees at the federal, state and municipal levels. The programs are administered by the respective governments and are compulsory for government workers (civil and military). The Brazilian pension system does not include a second pillar – a mandatory, fully-funded and privately managed scheme. However, it includes a voluntary third pillar of moderate size involving closed and open pension plans that work under a capitalization system.

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29 They are structured and supported by companies and usually restricted to their group of workers and former workers.
30 Operated by the private sector and open to any person who has been active in the RGPS.
Table 3.2  
Structure of the Brazilian Pension System (World Bank Classification)

<table>
<thead>
<tr>
<th>Zero Pillar</th>
<th>First Pillar</th>
<th>Second Pillar</th>
<th>Third Pillar</th>
</tr>
</thead>
</table>
| Regime for Private Sector Workers  
(RGPS - 7% GDP)  
Contributory PAYG Scheme for Urban Workers  |
| Minimum pension  | Old age pension based on length of contribution (LOC) rule (35/30)  
Old age pension based on age rule (65/60)  
Survivor pension  
Disability-related pension |
| Special Scheme for Rural Workers,  
Partially Funded by Earmarked Rural Taxes  |
| Old age pension based on age rule (60/55)  
Survivor pension  
Disability-related pension |
| Regime for Public Sector Workers  
(RPPS - 2% of GDP)  
Scheme for Public Sector Workers at the Federal, State, and Municipal Levels of Government  |
| Minimum pension  | Old age pension based on length of contribution (35/30) and age rule (65/60)  
Survivor pension  
Disability-related pension |
| Social Assistance (0.4 % of GDP)  
Non-Contributory Benefits to the Poor (RMV, BPC)  |
| Old age pension based on means test and age rule (65)  
Disability pension based on means test |

Closed Occupational Pension Plans, Managed by Single and Multi-Employer Pension Funds  
None  
Open Pension Plans, Managed by Insurance Companies
3.2.2 Instruments to Achieve the Objectives

3.2.2.1 Poverty reduction – redistribution (Zero pillar)

As we have seen in Chapter 1, poverty among the elderly in Brazil has almost been eradicated and social spending has played a significant role in reducing poverty and inequality over the last 10 years. The main programs for poverty prevention in old-age are: (i) a means-tested benefit targeted to the elderly poor population; (ii) a rural program; and (iii) a minimum pension guarantee and benefit top-up to workers who have contributed for a specified number of years. These benefits are received primarily by low income workers, both rural and urban, who move in and out of informality during their working lives.

*Means tested benefit.*

The benefit targeted to the elderly poor is known as *Benefício de Prestação Continuada* (LOAS-BPC or BPC). It was established by law in 1993 and implemented in January 1996 in substitution to a previous problem targeted to the elderly, the *Renda Mensal Vitalícia* (RMV). It is a temporary social benefit for the disabled and the elderly above 65 with family income per capita of less than 25% of minimum wage. After qualifying for the program, the individual is entitled to receive a monthly transfer equal to the minimum wage for as long as she/he qualifies for it. Legislation requires a revision of eligibility every two years.

LOAS-BPC is a well targeted program that has increased in importance since 2003 and it now covers about 7 percent of the elderly population. The value of the benefit has increased faster than the average value of benefits for retirement and survivors’ pension: 93 percent compared to 49 percent between 2003 and 2009 (table 3.3). This results from having the benefit linked to the minimum wage, which experienced substantial growth over the last decade.

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31 The origin of the Brazilian social assistance pension program dates back to the early 1970s. The Military Regime had created a social assistance pension program in 1974-75, the Renda Mensal Vitalícia (RMV – “Lifelong Monthly Income”), which was a basic flat-rate pension owed to those invalid or aged 70 and more, who were not able to provide for themselves or be provided for by their family. Individuals were required to document at least 12 months of contribution to social security throughout their working lives, which meant that only persons who had previously worked entered the beneficiary group.
Table 3.3
Beneficiaries as % of elderly (60+) and average value of benefits 2003-09 /a

<table>
<thead>
<tr>
<th></th>
<th>Quantity (% elderly)</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Retirement</td>
<td>72.57</td>
<td>71.52</td>
<td>71.75</td>
<td>70.48</td>
<td>69.55</td>
<td>68.70</td>
<td>69.23</td>
</tr>
<tr>
<td></td>
<td>Survivor Pension</td>
<td>32.70</td>
<td>32.09</td>
<td>31.79</td>
<td>31.03</td>
<td>30.52</td>
<td>29.82</td>
<td>29.90</td>
</tr>
<tr>
<td></td>
<td>LOAS e RMV (Elderly)</td>
<td>5.22</td>
<td>6.31</td>
<td>6.72</td>
<td>6.92</td>
<td>3.07</td>
<td>3.25</td>
<td>3.03</td>
</tr>
<tr>
<td>Brazil</td>
<td>Average Value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retirement</td>
<td>462.37</td>
<td>498.80</td>
<td>520.26</td>
<td>559.76</td>
<td>588.10</td>
<td>634.67</td>
<td>683.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.00)</td>
<td>(1.08)</td>
<td>(1.13)</td>
<td>(1.21)</td>
<td>(1.27)</td>
<td>(1.37)</td>
<td>(1.49)</td>
</tr>
<tr>
<td></td>
<td>Survivor Pension</td>
<td>366.59</td>
<td>401.25</td>
<td>422.42</td>
<td>464.18</td>
<td>492.32</td>
<td>536.67</td>
<td>582.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.00)</td>
<td>(1.09)</td>
<td>(1.15)</td>
<td>(1.27)</td>
<td>(1.34)</td>
<td>(1.46)</td>
<td>(1.59)</td>
</tr>
<tr>
<td></td>
<td>LOAS e RMV (Elderly)</td>
<td>240.99</td>
<td>260.99</td>
<td>301.14</td>
<td>351.05</td>
<td>381.12</td>
<td>414.63</td>
<td>465.71</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.00)</td>
<td>(1.08)</td>
<td>(1.25)</td>
<td>(1.46)</td>
<td>(1.58)</td>
<td>(1.72)</td>
<td>(1.93)</td>
</tr>
</tbody>
</table>

Source: Statistical Yearbook of the Social Security (AEPs) – Historical Volume and Pnad/IBGE, several years

/a The fact that the aggregated percentage exceeds 100% is due to the possibility of benefits accumulation provided by legislation

Expenditure increased faster than the number of beneficiaries. The number of elderly beneficiaries went from about 0.5 million in 1996 to over 1.5 million in 2009, while expenditure increased five times faster going from 56 to 750 million over the same period. There are three reasons behind these increases: (i) the reduction in the minimum age requirement from 70 to 65; (ii) the exclusion of BPC benefits received by other family members in the calculation of familial per capita income (MDS, 2008); and (iii) the increase in the minimum wage (Figure 3.2). However, the total amount of expenditure for BPC is still rather small compared to rest of the pension system: about 1 percent of GDP if considering both elderly and disabled beneficiaries, about 0.6 percent for elderly only.

Figure 3.2
Number of beneficiaries and Expenditure for LOAS-BPC elderly (,000) a/

![Graph showing number of beneficiaries and expenditure over time]

a/ beneficiaries on the left axis and the expenditure on the right

Source: Giambiagi and Tafner (2010)

Rural program

32 The minimum age requirement was reduced twice, in 1998 to 67 and in 2004 to 65.
The 1988 Constitution established the guidelines for Social Security reform that reduced the existing differences in the treatment of rural workers. It decreased the minimum retirement age for both men and women, increased the benefit floor to one minimum wage, and extended access to the length of service (now length of contribution) benefits. These changes resulted in a substantial inflow of rural retirees in the system and an increase in spending. From 1990 to 1993 the number of rural pension beneficiaries almost doubled, mainly due to the lower eligibility requirement (Figure 3.3). This program has contributed substantially to extending coverage to a large segment of the population and to poverty reduction. Though formally a social security benefit, old-age pension to rural workers is really a social assistance program as rural workers are basically exempt from contributions (Mesquita and Neto 2010). It is partly financed by taxes on agriculture sales but it is strongly subsidized (revenues cover about 10 percent of expenditures). The cost of this program is about 1 percent of GDP.

![Figure 3.3](image)

Source: Queiroz and Figoli (2010)

**Minimum pension**

The Brazilian system also includes a minimum pension guaranteed equal to the minimum wage that is provided to members of the RGPS and the RPPS. The rate of subsidization varies. In the case of rural workers it is almost totally subsidized while for urban workers it is partially subsidized, since workers need to contribute for 12 years to be entitled to it. This minimum benefit is indexed to the minimum wage whereas benefits above the minimum are indexed to consumer prices. A large share of beneficiaries receives exactly a minimum wage (almost two-thirds of retirement and survivor’s pension are equal exactly to the minimum wage (Table 3.3)). Indeed, more than half of all individuals whose income is equal to the minimum wage are not in the labor force (Figure 3.4).

The existence of the minimum pension has certainly contributed to lifting many elderly out of poverty, especially in rural areas. The nominal values increased more than seven-fold between 1994 and 2010, and the real value increased three times during the same period (Table 3.4). The real value of pensions above the minimum wage increased by 25 percent between 1995 and 2010 (Giambiagi and Tafner 2010), whereas the value of the minimum wage increased by 120 percent. Inevitably, it has also contributed to increasing pension expenditures. Since the minimum wage has increased substantially over the last 15 years and faster than inflation it has contributed to reducing inequality among the elderly since the benefits above the minimum grew less.
Table 3.4
Nominal and Real Minimum Wage (1994-2010) and Retirement and Survivor Pension benefits of one minimum wage as % of total

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal Value</th>
<th>Minimum Wage deflated by INPC</th>
<th>Accumulated real variation /a</th>
<th>Quantity (%)</th>
<th>Value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>70</td>
<td>70,00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>100</td>
<td>81,54</td>
<td>22,63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>112</td>
<td>96,40</td>
<td>16,18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>120</td>
<td>104,30</td>
<td>15,05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>130</td>
<td>108,61</td>
<td>19,69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>136</td>
<td>112,83</td>
<td>20,54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>151</td>
<td>118,86</td>
<td>27,04</td>
<td>63,0</td>
<td>33,0</td>
</tr>
<tr>
<td>2001</td>
<td>180</td>
<td>126,30</td>
<td>42,52</td>
<td>63,9</td>
<td>35,4</td>
</tr>
<tr>
<td>2002</td>
<td>200</td>
<td>138,58</td>
<td>44,33</td>
<td>63,0</td>
<td>34,9</td>
</tr>
<tr>
<td>2003</td>
<td>240</td>
<td>164,27</td>
<td>46,10</td>
<td>62,3</td>
<td>34,4</td>
</tr>
<tr>
<td>2004</td>
<td>260</td>
<td>175,87</td>
<td>47,84</td>
<td>61,9</td>
<td>34,2</td>
</tr>
<tr>
<td>2005</td>
<td>300</td>
<td>187,50</td>
<td>60,00</td>
<td>62,9</td>
<td>36,3</td>
</tr>
<tr>
<td>2006</td>
<td>350</td>
<td>193,52</td>
<td>80,86</td>
<td>63,9</td>
<td>39,0</td>
</tr>
<tr>
<td>2007</td>
<td>380</td>
<td>199,90</td>
<td>90,09</td>
<td>64,3</td>
<td>40,1</td>
</tr>
<tr>
<td>2008</td>
<td>415</td>
<td>209,84</td>
<td>97,77</td>
<td>64,3</td>
<td>40,7</td>
</tr>
<tr>
<td>2009</td>
<td>465</td>
<td>222,26</td>
<td>109,22</td>
<td>64,5</td>
<td>41,1</td>
</tr>
<tr>
<td>2010 /b</td>
<td>510</td>
<td>229,93</td>
<td>121,81</td>
<td>64,8</td>
<td>41,3</td>
</tr>
</tbody>
</table>


/a It compares the adjustment noted with the accumulated INPC variation between preceding adjustment and the immediately previous month.

/b For 2010 it was employed the Jan-Mar average.

Figure 3.4
Distribution of minimum wage earners as % of total

Source: Giambiagi and Tafner (2010)

The expenditure on transfers equal to the minimum wage has more than doubled over the past 10 years (Figure 3.5). LOAS-BPC, which starting in 2004 includes RMV, grew from 0.08 percent in 1997 to 0.6 percent in 2009. INSS expenditures, which include the rural pensions and the minimum pension to urban workers, more than doubles over this time period going from 1.17 percent of GDP to 2.74 percent.
There is a consensus among researchers that in Brazil that pension transfers, especially the rural pension program, have been a key factor explaining the substantial decline in poverty rates. They also help to explain why Brazil has one of the lowest poverty ratios in the old age population in Latin America. At the same time, researchers have concluded that Brazil’s redistributive pension programs are not as cost-effective as they could be and that poverty would decline further if resources were reallocated to better targeted programs. The proportion of old people in poor families is small, which implies that non-contributory pensions may not be the best way to reduce general poverty since most of these pension benefits are not shared within families.  

3.2.2.2 Consumption smoothing (First pillar)

Description of the programs

The two mandatory regimes, the RGPS and the RPPS offer the full range of pension benefits, including old age, survivor and disability pensions as well as short-run sickness benefits. The RGPS is the central component of Brazil’s pension system and is administered by the INSS. It has over 40 million contributors who are private sector workers, self-employed workers, domestic workers, rural workers, and those participating on an elective basis. The RPPS comprises government employees at the federal, state and municipal levels. It is administered by the respective governments and is compulsory for government workers (civil and military). It has about 5 million contributors. The total contribution rate charged on participating workers is 31 percent of gross wages, of which 11 percent paid by the employee and 20 percent by the employer. There are also complementary regimes that are elective and destined to those who want benefits complementary to those obtained in one of the regimes described above. The complementary pension system still plays a modest role, covering only about 5 percent of the labor force and providing additional benefits primarily to higher income workers.

RGPS has eight times as many beneficiaries as RPPS but its expenditures are only 3.5 times higher (7.2 vs 2.0 percent of GDP). However, RPPS expenditures doubled between 1992 and 1994 and then have remained roughly constant ever since, while RGPS expenditures increased from 2.5 percent of GDP in 1988 to 7.2 in 2009 (Figure 3.6).

33 See World Bank (2007a).
The deficit of the two systems was very similar in 2009: RPPS showed a deficit of -1.7 percent of GDP, RGPS of -1.4 percent. The total deficit was -3.1 percent (Figure 3.7). Hence the amount of transfers from the Treasury to the two systems is similar in dollar amounts, even though per capita it’s much higher for the RPPS. However, the trend is different. As we have seen, expenditure in the RPPS has remained roughly constant since the mid 90s. For the RGPS the deficit has gone from 0 in 1997 (expenditure and revenues from contributions were both equal to 5 percent of GDP) to the current -1.4 percent. Union transfers have increased substantially to finance the increase in expenditures (Table 3.5).
### Table 3.5
**INSS Cash Flow (%GDP), 1997-2009**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>REVENUES</td>
<td>6.2</td>
<td>6.2</td>
<td>6.5</td>
<td>6.5</td>
<td>6.8</td>
<td>7.1</td>
<td>7.2</td>
<td>7.9</td>
<td>8.0</td>
<td>8.5</td>
<td>8.1</td>
<td>8.1</td>
<td>8.7</td>
</tr>
<tr>
<td>OWN REVENUES</td>
<td>5.8</td>
<td>5.2</td>
<td>5.0</td>
<td>5.1</td>
<td>5.2</td>
<td>5.3</td>
<td>4.9</td>
<td>5.3</td>
<td>5.9</td>
<td>5.6</td>
<td>5.8</td>
<td>5.9</td>
<td>6.5</td>
</tr>
<tr>
<td>SS Contribution</td>
<td>5.0</td>
<td>4.9</td>
<td>4.7</td>
<td>4.7</td>
<td>4.8</td>
<td>4.9</td>
<td>4.8</td>
<td>4.9</td>
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<td>5.2</td>
<td>5.4</td>
<td>5.6</td>
<td>5.8</td>
</tr>
<tr>
<td>SIMPLES</td>
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<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
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<tr>
<td>Delayed Credits</td>
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<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Other</td>
<td>0.7</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>-0.1</td>
<td>0.1</td>
<td>0.5</td>
<td>0.0</td>
<td>0.2</td>
<td>-0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>UINON TRANSFER</td>
<td>0.4</td>
<td>1.0</td>
<td>1.5</td>
<td>1.3</td>
<td>1.6</td>
<td>1.7</td>
<td>2.3</td>
<td>2.5</td>
<td>2.1</td>
<td>2.9</td>
<td>2.3</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>COFINS</td>
<td>0.3</td>
<td>0.1</td>
<td>0.5</td>
<td>0.6</td>
<td>1.1</td>
<td>1.1</td>
<td>1.4</td>
<td>1.9</td>
<td>1.6</td>
<td>2.3</td>
<td>1.7</td>
<td>1.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Profit Contribution</td>
<td>0.0</td>
<td>0.4</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>CPMF</td>
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<td>0.0</td>
<td>0.3</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Other Transfer</td>
<td>0.2</td>
<td>0.5</td>
<td>0.6</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>OTHER REVENUES</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Source: Statistical Yearbook of the Social Security (AEPS), and Ipeadata

**Coverage**

Coverage has to be considered from two perspectives: in the contribution phase, as individuals work, and in the benefit phase, as they retire. Looking at Census data\(^34\) from 1960 to 2000, we see how there was a substantial increase in the percentage of individuals contributing to social security in 1980 but there has not been a substantial change after that (Figure 3.8). In the year 2000 more than half of the working age population was not contributing to social security.

\(^{34}\) Data from the 2010 census are not available as the report is being finalized.
In the benefit phase, Brazil has achieved practically universal coverage of the old age population\(^\text{35}\). The number of beneficiaries increased dramatically since 1960. While only about 20 percent of individuals above 65 were receiving some type of public pension in 1960, this percentage was above 85 percent in 2000. Big jumps were observed after the centralization of the program under the supervision of the federal government (1970s) and following the changes in the Constitution of 1988 (Figure 3.9).

Compared to the average for the rest of LAC, Brazil presents a higher coverage in both the benefit and in contribution phases\(^\text{36}\). (Table 3.5 and 3.6) In Brazil 44.7 percent of the labor force contributes

\(^{35}\) Taking retirement and survivor pension benefits into account approximately 96% of all persons 70 and over have social security protection. A residual of only 4% in this age group has no social protection. Amongst them more than 70% are not poor and almost 15% is still working.

\(^{36}\) Notice that these data come from household survey and hence may differ from the ones obtained from the census.
to social security, compared to an average of 30.1 in the rest of LAC. This percentage is higher for men than for women; in urban than in rural areas; and for the richer quintiles.

Table 3.5
Coverage of in the contribution phase (contributors/labor force %)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>30.1</td>
<td>30.9</td>
<td>28.9</td>
<td>34.4</td>
<td>16.7</td>
</tr>
<tr>
<td>Brazil</td>
<td>44.7</td>
<td>46.3</td>
<td>42.4</td>
<td>49.9</td>
<td>17.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>12.5</td>
<td>21.1</td>
<td>29.4</td>
<td>38.1</td>
<td>49.2</td>
</tr>
<tr>
<td>Brazil</td>
<td>17.0</td>
<td>35.7</td>
<td>46.1</td>
<td>57.2</td>
<td>67.2</td>
</tr>
</tbody>
</table>

Notes: (1) The average for Latin America excludes Brazil; Source: Rofman and Lucchetti (2006)

In the benefit case, the differences are much bigger. In Brazil 86.7 percent of the population over 65 receives benefits, compared to an average of 34.9 in the rest of LAC (Table 3.6). Indeed, while for the rest of LAC the level of coverage is similar in the two phases, Brazil stands out as coverage in the benefit phase is twice as high as in the contribution phase.

Table 3.6
Coverage in the benefit phase (beneficiaries/population 65+)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>34.9</td>
<td>40.7</td>
<td>29.9</td>
<td>40.4</td>
<td>18.1</td>
</tr>
<tr>
<td>Brazil</td>
<td>86.7</td>
<td>89.9</td>
<td>84.2</td>
<td>85.6</td>
<td>92.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>14.4</td>
<td>22.7</td>
<td>31.4</td>
<td>39.6</td>
<td>50.1</td>
</tr>
<tr>
<td>Brazil</td>
<td>78.8</td>
<td>90.5</td>
<td>90.9</td>
<td>86.7</td>
<td>86.5</td>
</tr>
</tbody>
</table>

Notes: (1) The average for Latin America excludes Brazil; Source: Rofman and Lucchetti (2006) household surveys.

To get a better understanding of the actual imbalance in coverage in the phases, we can look at the so-called system dependency ratio (beneficiaries to contributors) and at the old age dependency ratios (old age population to the working age population). The latter is frequently used as a benchmark that mature pension systems should try to achieve.

Indeed, the ratio of beneficiaries to contributors for both the RGPS and RPPS are high. Mature pension systems in the OECD have system dependency ratios that are twice as high as the old age dependency ratio (Table 3.7). The situation in Latin America and Central Europe looks worse, as indicated by a system dependency ratio that is almost three times higher than the benchmark. However, these differences are even larger in Brazil, except for the urban RGPS. The low level of the old age dependency ratio and the very large difference between the system and the old age dependency ratios are consistent with the high coverage rate in the benefits phase and the low rate in the contribution phase. In 2008, last available figures from the Brazilian Social Security Administration show that on average there were about 40 million workers contributing to the system and 23 million beneficiaries. (Queiroz and Figoli 2010)
Table 3.7

System and Old Age Dependency Ratios (in %), Brazil and Selected Country Groups

<table>
<thead>
<tr>
<th></th>
<th>System Dependency Ratio (Pensioners/Contributors) (in %)</th>
<th>Old Age Dependency Ratio (Pop. 65+/Pop. 15-64) (in %)</th>
<th>Difference Between the two Indicators, (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD (10)</td>
<td>50.3</td>
<td>24.6</td>
<td>204</td>
</tr>
<tr>
<td>Latin America (9)</td>
<td>30.2</td>
<td>11.0</td>
<td>275</td>
</tr>
<tr>
<td>Central Europe (8)</td>
<td>62.0</td>
<td>21.3</td>
<td>291</td>
</tr>
<tr>
<td>Overall Average (27)</td>
<td>47.1</td>
<td>19.1</td>
<td>246</td>
</tr>
<tr>
<td>Brazil</td>
<td>53.8</td>
<td>8.1</td>
<td>664</td>
</tr>
<tr>
<td>RGPS</td>
<td>53.4</td>
<td>8.1</td>
<td>659</td>
</tr>
<tr>
<td>Urban RGPS</td>
<td>38.0</td>
<td>8.1</td>
<td>469</td>
</tr>
<tr>
<td>RPPS</td>
<td>57.0</td>
<td>8.1</td>
<td>704</td>
</tr>
<tr>
<td>Memo: Brazil excluding social. assis.</td>
<td>48.4</td>
<td>8.1</td>
<td>598</td>
</tr>
</tbody>
</table>

Sources: World Bank (2006)

3.3 CHALLENGES FOR THE PENSION SYSTEM IN A RAPIDLY AGING POPULATION

A well designed pension system attempts to strike a balance between the level of protection it provides, the ability of the system to provide those benefits (sustainability) and the incentives that its rules imply for productive work and retirement decisions. Given the great variety of pension arrangements that are available for countries to implement, the World Bank has devised a conceptual framework for the analysis of pension systems and pension reforms (Box 3.1). This conceptual framework facilitates assessing the ability of any pension system to comply with its objectives. When applying this framework to the case of Brazil, a handful of topics strike out. Given the characteristics of the system that have been discussed in the previous section, Brazil provides adequate benefits in the form of generous social insurance for an expanding formal sector and social assistance for the informal sector. These benefits are also predictable, since they are clearly defined in the regulation and even in the Constitution. However, the generosity of benefits imply that the system is not likely to be affordable in the long run (especially in the context of rapid aging process), which raises issues of sustainability and robustness of the system to face shocks. In addition, given that the contributory system needs public subsidies to pay for the benefits it promises, the redistribution of public spending is not as progressive as it would be if all public subsidies were targeted to the poor or uncovered portion of the population.

While the social insurance systems is well integrated (World Bank 2010), Brazil’s programs for the old-age have been designed with limited consideration for the impact that the different programs can have on the performance of others. Indeed, the rules of social insurance programs are likely to be contributing to the growth in informality, and thus on the potential population eligible for social assistance. In the same vein, the rules of the non-contributory programs may exacerbate this problem, for example as they pay high benefits. As in many other countries, there is little coordination in the design of different types of social insurance programs and among social insurance and social assistance programs. The existing rules of social insurance and social assistance programs in Brazil are likely to distort households’ labor supply and savings decisions. They provide incentives to employees to reduce labor supply, avoid formal work and reduce savings (World Bank 2010). As the aging population puts pressure on the system, it becomes more and more urgent to clarify the design of redistribution arrangements within the social insurance system and ensure the compatibility with the design of social assistance programs.

---

This section draws heavily on Mesquita and Neto (2010)
The next subsections discuss in greater detail three issues that should be addressed in order to improve the efficiency, coverage, equity and affordability of the old-age social protection system, which will be faced with increasing pressure by the aging population. First we look at early retirement and its implications with an aging population; then we discuss informality; and lastly the level of benefits and their implications in terms of cost and incentives.

### Box 3.1. The World Bank Pensions Conceptual Framework

The World Bank has developed over the years a conceptual framework based on its experience with analytical and operational work in the area of pension reform. The Bank’s experience suggests there are no universal solutions or a single model that can be applied to all settings, which is one of the reasons why a series of principles to guide the analysis are useful. The conceptual framework starts with an assessment of the initial conditions when considering any reform to the pension system. It then adopts the multi-pillar typology when considering potential modalities for pension systems. The design of the system is then evaluated against primary and secondary evaluation criteria that allow responding to country specific conditions, needs and objectives. The primary evaluation criteria proposed in the framework are the following:

- **Adequacy**: Capacity of the system to provide benefits sufficient to prevent old age poverty for the elderly and consistent with a consumption smoothing objective for the vast majority of the population.
- **Affordability**: A system that is within the financial capacity of the society, does not unduly displace other necessities or result in untenable fiscal consequences.
- **Sustainability**: A system that is financially sound and can be maintained over a foreseeable horizon.
- **Equitability**: A system that provides progressive income redistribution consistent with social preferences and similar entitlements to participants across generations and income groups.
- **Predictability**: A system that provides benefits that are not subject to the discretion of policymakers or administrators and protects the retiree from inflation and, as much as possible, from longevity risks.
- **Robustness**: A system that has the capacity to withstand major shocks (economic, demographic, political, etc.).

The conceptual framework also reminds to consider the trade-offs among these criteria in order to achieve a balanced approach to pension analysis. Given that all pension systems are effectively claims against future economic output, it is important that the design of the system is consistent with economic growth to the extent possible. Given this, the conceptual framework proposes as secondary evaluation criteria the following elements: (i) minimization of labor market distortions; (ii) contribution to savings mobilization; and (iii) contribution to financial market development. These criteria serve to formulate guiding principles for the design of pension systems.

*Source: World Bank (2008)*

### 3.3.1 Early Retirement

Pension systems can affect labor supply by influencing retirement decisions. There are various factors that ultimately influence retirement decisions, including minimum and mandatory retirement ages and vesting periods. However, benefit formulas play an important role as well by affecting the value of the pension at different retirement ages. For example, minimum pension guarantees that are large relative to earnings can encourage early retirement or reduce contribution densities (see Robalino et al. 2008).

---

38 As we have seen, in Brazil individuals can retire based on two rules: (i) Length of Contribution (LoC) and (ii) Age. Under the LoC rule pensions are awarded to men with 35 years and women with 30 years of contributions with no retirement age restrictions. Teachers have to contribute only 30 year (25 for women). Under the Age rule, urban contributors can retire at the age of 65 and 60 for men and women and rural population at ages 60 and 55. Contribution vesting is being gradually increased from 12 to 15 years by 2011. For rural workers this contribution requirement is waived with a proof of rural residency, making this a strongly redistributive program. (World Bank 2006). Indeed the majority of workers retire with the aging pension rather than completing the vesting period for the Length of Contribution (World Bank 2009) despite the fact that the age pension is considerably lower than the pension by length of contribution.

Delaying retirement imposes both costs and benefits, public and private. The private costs mainly consist of delaying “leisure.” The private benefits include maintaining higher earnings while working and also the potential for a larger pension eventually. Hence, depending on how their pensions grow as a result of their additional contributions, individuals have more or less of an incentive to delay retirement (World Bank 2010). There are also public benefits to delaying retirement that have to do with the sustainability of the system: workers contribute longer to the pension system as well as to the labor force, and consequently they will benefit for a shorter period of time, reducing the wedge between benefits and contributions.

Brazilian workers retire as soon as possible, once they reach the vesting period for contributions or the minimum retirement age\(^{40}\). The median retirement age\(^{41}\) for males has declined from 69 years in 1960 to 63 years in 2000 (Queiroz and Figoli (2010)), which corresponds to an average decline of 1.5 year per decade (Table 3.8). As we have seen in Chapter 2, the trend toward early retirement is a common feature of the labor market in developed nations, with OECD showing a steady decline in average retirement age from 1950 to 1995 (Sveinbjorn & Scarpetta (1998)).

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazil</th>
<th>USA</th>
<th>Italy</th>
<th>Germany</th>
<th>Japan</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>69</td>
<td>66</td>
<td>65</td>
<td>65</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>1970</td>
<td>65</td>
<td>65</td>
<td>63</td>
<td>65</td>
<td>68</td>
<td>64</td>
</tr>
<tr>
<td>1980</td>
<td>65</td>
<td>64</td>
<td>62</td>
<td>62</td>
<td>67</td>
<td>61</td>
</tr>
<tr>
<td>1990</td>
<td>65</td>
<td>63</td>
<td>61</td>
<td>60</td>
<td>67</td>
<td>59</td>
</tr>
<tr>
<td>2000</td>
<td>63</td>
<td>63</td>
<td>61</td>
<td>61</td>
<td>67</td>
<td>59</td>
</tr>
</tbody>
</table>

Source: Queiroz and Figoli (2010)

Brazil is one of the few countries in the world that maintains a large retirement program based entirely on years of contribution, and that has resulted in excessively long periods of retirement. Among retirees by LoC a large percentage of both men and women (73.1 and 78.2 percent respectively) did so with the minimum number of years of contributions necessary, 35 for men and 30 for women (Table 3.9 and 3.10). This results in very low average age for retirement by LoC, 54 for men and 51 for women and results in long expected duration of retirement (23 years for men and 29 years for women). On average women who retire under LoC benefit almost for as many years as they contributed.

<table>
<thead>
<tr>
<th>Time of contribution (years)</th>
<th>Percentage</th>
<th>Accumulated %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 35</td>
<td>73.1</td>
<td>73.1</td>
</tr>
<tr>
<td>36</td>
<td>11.0</td>
<td>84.1</td>
</tr>
<tr>
<td>37</td>
<td>6.3</td>
<td>90.4</td>
</tr>
<tr>
<td>38</td>
<td>3.9</td>
<td>94.3</td>
</tr>
<tr>
<td>39</td>
<td>2.3</td>
<td>96.6</td>
</tr>
<tr>
<td>40 or more</td>
<td>3.4</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Giambiagi and Tafner (2010)

\(^{40}\) There is strong evidence that the rural social pension scheme reduced the labor supply in preretirement ages and induced retirement at early ages. When given the opportunity of earning a benefit that guarantees their subsistence, withdrawal of the labor force is found to be the preferred decision for about 40% of benefit receivers, despite the benefits coming with no strings attached (there are neither means test nor requirement to retire) (de Carvalho 2008).

\(^{41}\) The median retirement age is the youngest age at which less than 50% of the population is in the labor force (Burtless & Quinn, 2001)
Concerned with early retirement and with the need to control spending, the government initiated a pension reform in 1998-1999 (Box 3.2). The 1999 reform was centered in a new benefit formula called the *Fator Previdenciário*\(^{42}\), that links benefits more closely with contributions and the expected duration of the payout phase. The *fator* is a factor that adjusts the value of the benefits and depends on the contribution period and life expectancy at retirement. All else equal, the higher the life expectancy the lower will be the value of the benefit.

The formula implies a 40 percent decline in replacement ratios for workers who do not increase the period of contribution, while rewarding workers who delay retirement and continue contributing. It is a way to encourage workers who reach eligibility to remain in the labor force. The formula has some desirable properties such as benefits that are linked to contributions and that depend on life expectancy, but the link between contributions and benefits is obscured by suppressing the value of contributions paid early in the career and overvaluing those made just prior to retirement. The formula also introduces substantial redistribution by favoring teachers, women, and older retirees with longer contribution histories. The formula was introduced with the expectation that most workers would voluntarily delay retirement in order to obtain a higher replacement ratio. However, despite creating an automatic actuarial adjustment, the design of the “fator previdenciário” generates a pattern of evolution of social security wealth (SSW) that does not give strong incentives to delayed retirement. Soares (2010) calculates the SSW for a man 53 years of age with 30 years of contributions (not eligible for time of work pension) before and after the introduction of the “fator previdenciário” (Figure 3.10). As it can be seen, before the reform the SSW increases very timidly up to age 57 and then starts to decrease. After the reform, SSW increases more rapidly up to age 58 and then decreases much more slowly than before the reform. Therefore, incentives to postpone retirement were improved, but it is still the case that postponing retirement beyond age 60 results in diminishing pension wealth.

---

\(^{42}\) The formula for the *Fator previdenciario* is:

\[
Benefit = Fator \cdot WageBase
\]

\[
Fator = \frac{0.31PC}{LE} \left(1 + \frac{0.31PC + RA}{100}\right)
\]

*PC* is the period of contribution (*women and male teachers get a five years bonus. The bonuses for female teachers add up to 10 years*). *LE* is life expectancy at the age of retirement, *RA* is the retirement age, and *Wage Base* is an average of 80% if highest wages since 1994.
Box 3.2 Pension reforms

The increase in pension expenditures and deficits in the 1990s contributed to an overall increase in fiscal deficits and the public debt, leading to a crisis at the end of the decade. The crisis prompted the Government to initiate a program of fiscal reforms, including pension reforms. The first important step was taken in December 1998 through Constitutional Amendment No. 20, which removed the generous benefit formula from the Constitutional text, and opened the way for further reforms. It also introduced a benefit ceiling in the RGPS, eliminated most special regimes, and introduced a minimum age of retirement in the RPPS (60 for men and 55 women, respectively) with a period of transition, as well as a minimum vesting period of 10 years in the RPPS. The second important step took place in November 1999, involving a reform to the RGPS. This reform was centered in a new benefit formula called the *Fator Previdenciário* that links benefits more closely with contributions and the expected duration of the payout phase. The third step took place in 2003, through Constitutional Amendment No. 41, and involved a reform to the RPPS. This reform aimed at reducing the growing expenditures with civil servant pensions, especially at the level of states and municipalities, and reducing inequalities. The reform entailed a harmonization of the RPPS and RGPS rules and comprised several measures, including a new benefit formula and indexation rules for new civil servants, stricter retirement conditions for existing workers, a reduction on survivor pensions above the RGPS contribution threshold, and the imposition of a special contribution tax of 11 percent on all pensioners.

*Source: World Bank (2006)*

**Implications**

Early retirement is not a problem per se, but it becomes one when benefits for retirees are not commensurate to contributions. It is particularly undesirable in a country with an aging population, as it worsens the system dependency ratio, and hence the financing of the system. Demographic changes lead to a rising burden of dependency, and as we will see in Chapter 6, pose serious problems for public finances through pressure for expenditure on pensions, health, and other social services. Early retirement implies that individuals who could still contribute to the system start receiving benefits at a relatively young age. While we have seen that in Brazil often retiree continue to work, they do so in the informal sector and thus stop contributing to the system. Moreover, the increase in life expectancy will result in longer average duration of retirement. Thus Brazil will have more retirees being so for a longer period of time.
With an aging population and a higher dependency ratio, Brazil will need to improve incentives to work and contribute for longer periods of time. The activity rate of older workers is a key factor. Indeed, many countries are considering or raising the retirement age. This enables a system to both collect contributions over a longer period of time and to pay benefits for a shorter period of time (ISSA 2010).

It is important though to avoid changes that may worsen the incentives of workers to contribute, like increasing the vesting period to qualify for LoC. Rather than mandating longer contribution periods, the rules should reward such choices, for example with benefit premia for years in excess of the minimum.

The decision to retire early may be irrespective of whether the benefit formulas are actuarially fair. This has been demonstrated in several population and affiliate surveys that collected information in countries like Chile, where actuarially fair benefits dominate the pension landscape, but early retirement is widespread. The World Bank 2010 report recommends that when aging starts reducing the size of the working age population, governments consider subsidizing delayed retirement by implicitly increasing the implicit rate of return on contributions.  

3.3.2 Informality

While it has been progressively moving towards a more formalized workforce, Brazil still has a large share of the labor force in the informal sector. In 2009, out of the 84.4 million in the economically active population, only 56.6 contributed and were protected by social security. Recent studies have argued that informality is not always the result of exclusion from the formal sector as some workers, after assessing the expected costs and benefits, deliberately choose informal work. Thus workers may choose the informal sector and the design of the pension system is likely to affect this decision and contribution densities. In general by remaining in the informal sector, both employers and low-paid workers gain from not having to pay taxes nor contribute to social security, but obviously workers lose access to its benefits. In the case of Brazil however, some of the costs of being informal are reduced by the existence of the non-contributory pensions program BPC.

In Brazil a worker who has never contributed to social security can receive a pension equivalent to one minimum wage, which is also the benefit floor for contributory pensions. This is likely to create distortions in the decisions whether to contribute or not during the years in the labor force. This incentive to avoid contribution is particularly strong for workers whose wage is close to the minimum wage, as their pension will be equal to the minimum wage in any event, and hence contributing implies a cost without any benefit. Thus unskilled/low wage earners are less likely to see benefits in formalizing, at least in terms of old age pension.

Camargo and Reis (2007) find evidence that the LOAS-BPC has reduced the probability of contributing for the low-skilled young self-employed, who are more likely to be affected by it. They compare formalization decision before and after the implementation of the LOAS-BPC between two groups: (i) young self-employed individuals with low education, who are likely to have been in the labor market for a short-period of time and with low expectations of a carrier and salary increases over time, and (ii) self-employed with more education and thus better a career expectations and older self-employed. They find that more educated workers did not alter their contribution, as they are more likely to participate in the contributory pension, being formal. The probability to contribute to social security is much lower for the young least educated, who are more likely to benefit from the non-contributory program. Excluding workers “com carteira” the percentage of workers contributing to social security has decreased from 1992 to 2004 (Table 3.11)

---

Table 3.11
Workers contributing to Social Security as % 1992-2004 (selected years)

<table>
<thead>
<tr>
<th>Type of work</th>
<th>1992</th>
<th>1996</th>
<th>1999</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal (Com carteira)</td>
<td>98.54</td>
<td>96.59</td>
<td>100.00</td>
<td>99.99</td>
</tr>
<tr>
<td>Informal (Sem carteira)</td>
<td>8.42</td>
<td>9.87</td>
<td>9.16</td>
<td>10.16</td>
</tr>
<tr>
<td>Employer</td>
<td>73.28</td>
<td>70.62</td>
<td>64.72</td>
<td>58.44</td>
</tr>
<tr>
<td>Self-employed</td>
<td>26.89</td>
<td>24.86</td>
<td>19.95</td>
<td>14.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>De 0 a 3</td>
<td>40.93</td>
<td>36.94</td>
<td>33.91</td>
<td>26.61</td>
</tr>
<tr>
<td>De 4 a 7</td>
<td>56.13</td>
<td>51.02</td>
<td>47.47</td>
<td>40.45</td>
</tr>
<tr>
<td>De 8 a 10</td>
<td>66.40</td>
<td>59.90</td>
<td>57.29</td>
<td>51.39</td>
</tr>
<tr>
<td>Com 11+</td>
<td>80.46</td>
<td>75.07</td>
<td>75.24</td>
<td>72.65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>52.24</td>
<td>49.39</td>
<td>49.26</td>
<td>45.71</td>
</tr>
<tr>
<td>25-29</td>
<td>62.43</td>
<td>58.04</td>
<td>58.28</td>
<td>55.07</td>
</tr>
<tr>
<td>30-39</td>
<td>64.81</td>
<td>60.41</td>
<td>59.50</td>
<td>55.39</td>
</tr>
<tr>
<td>40-49</td>
<td>64.57</td>
<td>61.52</td>
<td>59.69</td>
<td>54.80</td>
</tr>
<tr>
<td>50+</td>
<td>55.49</td>
<td>51.34</td>
<td>49.64</td>
<td>44.73</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector of activity</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>80.29</td>
<td>75.88</td>
<td>74.02</td>
<td>68.77</td>
</tr>
<tr>
<td>Services</td>
<td>58.59</td>
<td>55.93</td>
<td>55.84</td>
<td>54.82</td>
</tr>
<tr>
<td>Commerce</td>
<td>56.81</td>
<td>53.78</td>
<td>51.96</td>
<td>50.82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>63.15</td>
<td>58.48</td>
<td>56.51</td>
<td>51.81</td>
</tr>
<tr>
<td>Women</td>
<td>56.30</td>
<td>54.49</td>
<td>55.23</td>
<td>51.43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salary</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 MW</td>
<td>17.47</td>
<td>9.26</td>
<td>6.23</td>
<td>4.31</td>
</tr>
<tr>
<td>1 MW</td>
<td>66.73</td>
<td>45.50</td>
<td>49.21</td>
<td>55.65</td>
</tr>
<tr>
<td>Btw 1 &amp; 2 MWs</td>
<td>63.92</td>
<td>47.16</td>
<td>49.24</td>
<td>60.17</td>
</tr>
<tr>
<td>2 MWs</td>
<td>77.86</td>
<td>64.93</td>
<td>65.53</td>
<td>72.78</td>
</tr>
<tr>
<td>Btw 2 &amp; 3 MWs</td>
<td>74.89</td>
<td>61.83</td>
<td>62.94</td>
<td>72.88</td>
</tr>
<tr>
<td>3 MWs</td>
<td>84.45</td>
<td>69.77</td>
<td>73.51</td>
<td>77.03</td>
</tr>
<tr>
<td>More than 3 MWs</td>
<td>83.03</td>
<td>72.26</td>
<td>75.37</td>
<td>74.77</td>
</tr>
<tr>
<td>Total</td>
<td>60.50</td>
<td>56.88</td>
<td>55.99</td>
<td>51.65</td>
</tr>
</tbody>
</table>

Source: Camargo and Reis (2007)

Low-skilled workers (receiving less than two minimum wages) once retired are likely to receive a pension equivalent to one minimum wage, irrespective of whether they retire by LoC, Age or because they receive BPC. However, to qualify for LoC they will have to have 35 years of contributions, compared to 12 to qualify under the Age rule and zero for BPC. This obviously encourages benefit arbitrage and contribution evasion. Indeed, the minimum guarantee can also create incentives for workers to participate only until they have complied with vesting requirements and to evade thereafter (Holzman).

In the case of Brazil, there is also evidence showing that generous pension transfers can considerably reduce the labor supply of adult workers. Carvalho Filho (2008) finds that as a result of the 1991 reform of the rural pension, there was an increase of 25.4 percentage points in the number of rural workers aged 60 to 64 receiving pension benefits. Also, the proportion of rural workers aged 60 to 64 who “did not work in the week of reference” increased by 12.56 percentage points, more than for urban workers of the same age during the period immediately before and after the reform. In addition, “total hours of work in all jobs” for rural workers of the “affected age” decreased relative to urban workers by 5.80 hours per week during the period immediately before and after the reform (World Bank 2010).
Implications

In Brazil as in the other LAC countries, social protection systems need to be effective in an environment where informality is the norm for a large proportion of the workforce. Increasing the coverage of social insurance to a larger share of the labor force is a necessary condition for the sustainability and effectiveness of high-quality safety net programs. Indeed, with an aging population it is particularly important to design ways to include informal workers in the contributory social insurance system in order to finance the increased expenditure and avoid increasing the tax wedge on workers already in the formal sector.

The Government should consider opening up contributory social insurance to the population as a whole (rather than just to workers with formal employment contracts) and ensuring that any subsidies are transparent, equitable, and consistent with promoting work and savings. This will open the way to expanding the coverage of contributory social insurance and limiting the proportion of the workforce that needs to be assisted by non-contributory safety net programs (World Bank 2010). The expansion of coverage of contributory social insurance to workers in the informal sector would allow the system to increase its revenues and to boost savings.

3.3.3 Redistribution

Public pension systems usually redistribute income both within and between generations. Within-generation distribution can happen if the system in question has progressive contribution or benefit rules. If some or all benefits are financed from sources other than contributions (such as general revenue taxes), then the distributive effect of the system will depend on the distributive effects of these taxes. Between-generation redistribution is more common in pay-as-you-go systems. Depending on the system’s design, new cohorts of plan members may receive lower rates of return on their contributions than older cohorts. When pension liabilities cannot be financed out of future contributions (as in insolvent pay-as-you-go systems), this implies a redistribution of resources from future generations (including low-income workers outside the pension system) to the current generation (including high-income workers). (World Bank 2010).

The de-facto redistribution is as important as the stated risk pooling (insurance) function. However, this redistribution is often implicit and non-transparent and can be regressive. Within the insured populations, there are wide variations in the ratio of contributions paid to benefits received. The result is that, depending on earnings levels and on their behavioral responses to the incentives within the system, some plan members systematically receive more than they put in (an implicit subsidy), while others systematically receive less (an implicit tax). (World Bank 2010)

In Brazil there is a large difference in the Net Present Value\(^{45}\) (NPV) of pension benefits across workers (Table 3.12). Turra and Rocha (2010) repeated the methodology applied by Pereira et al (forthcoming) to construct an age-time matrix of benefits and taxes for each subgroup in the birth cohort, including cohort members retired under the age rule (urban and rural), members retired under LoC and public servants retirees (Federal servants). These subgroups closely resemble socio-economic groups since age benefits – particularly rural pension benefits - are significantly more prevalent among low skilled individuals. All subgroups experienced positive NPVs and thus, all have benefited from positive transfers made by the younger generations, regardless of their socio-economic groups. However, there are large differentials in life cycle gains, which is equivalent to say that the relationship between contributions and benefit varies a lot. For example, the NPV for civil servants is about six times larger than the that of private workers

\(^{45}\) It is the difference between the present discounted sum of all benefits and the present discounted value of all social security taxes paid.
retired under the age rule. Moreover, the difference between the two groups is higher in terms of NPV than in terms of the average retirement benefit. This suggests that public servants contribute relatively less than private workers. On the other hand, the NPV for retirement by LoC is relatively lower than the others: workers who retire by LoC have been paying social security contributions for a substantial amount of time, which is not the case for the retirement by age.

<table>
<thead>
<tr>
<th>Table 3.12</th>
<th>Net Present Value by Type of Retiree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Retirement benefit in 2000 (mean value)</td>
<td>Not present value at birth</td>
</tr>
<tr>
<td>Retirement by age (urban)</td>
<td>5,848</td>
</tr>
<tr>
<td>Retirement by age (rural)</td>
<td>1,780</td>
</tr>
<tr>
<td>Retirement by contribution</td>
<td>7,854</td>
</tr>
<tr>
<td>Retirement (public servants, central government)</td>
<td>21,739</td>
</tr>
</tbody>
</table>

Source: Turra and Rocha (2010)

The survivor pension is a program that entails a high degree of redistribution, and may give perverse incentives. Survivors’ benefits in Brazil represent a high share of total pension benefit. In 2009 Brazil spent R$101.605 billion (3.2% GDP) for survivor benefits. This is equivalent to 25% of total social security expenditure (Table 3.13) and it’s 3.5 times higher than the average expenditure in OECD countries for this type of pension. This program has been very expensive by international comparison because the rules fail to adjust benefits to the number and needs of dependents and also fail to prevent abuse of the system.

<table>
<thead>
<tr>
<th>Table 3.13</th>
<th>Percentage of retirees by types of pension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Value (R$ million)</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td>Total</td>
<td>22,736,409</td>
</tr>
<tr>
<td>Retirement</td>
<td>15,076,295</td>
</tr>
<tr>
<td>By age</td>
<td>7,856,916</td>
</tr>
<tr>
<td>Disability</td>
<td>2,902,600</td>
</tr>
<tr>
<td>Time of contribution</td>
<td>4,316,779</td>
</tr>
<tr>
<td>Survivor pension</td>
<td>6,457,846</td>
</tr>
<tr>
<td>Auxílio</td>
<td>1,130,431</td>
</tr>
<tr>
<td>Sickness</td>
<td>1,078,270</td>
</tr>
<tr>
<td>Reclusao</td>
<td>25,516</td>
</tr>
<tr>
<td>Accident</td>
<td>26,645</td>
</tr>
<tr>
<td>Maternity</td>
<td>71,166</td>
</tr>
<tr>
<td>Other</td>
<td>671</td>
</tr>
</tbody>
</table>

Source: Giambiagi and Tafner (2010)

Survivo pension expenditures in Brazil are much larger than those in most other countries. As summarized in Figure 3.11, other countries spend on average 0.8 percent of GDP with survivor pensions, or less than 10 percent of total expenditures. Although the RPPS contributes to this outcome, the RGPS alone spends more on survivor pensions than other countries.
Survivor benefits are equivalent to the full value of the retirement pension paid or payable to the deceased and can be accumulated with retirement benefit. For example, in the case of a couple in which both spouses are retired, in the event of the passing of one of them, the survivor is eligible to survivors benefit. Mesquita and Neto (2010) point out two inconsistencies. One is that the per capita income of the dependents actually rises with the passing of the retired person. The other is that the benefit was intended to support the deceased’s dependents and, if they already receive a retirement benefit, it seems unnecessary to accumulate survivors benefit. Forty-four percent of beneficiaries of the survivor pension also have some other income, through work and or a retirement benefit (Figure 3.12).
Implications

While the generosity of the system is currently affordable for Brazil, given the favorable age structure, the demographic changes will have direct consequences for the old-age social protection system. The system needs to address the issue of the relationship between contributions and benefits. Indeed, it should ensure a smooth one, such that more contributions correspond to higher retirement benefits. The current rule that establishes equivalence between the minimum wage, the minimum pension and the value of the non-contributory program clearly works against such an ideal relationship.

Given the duality of the Brazilian labor market, the old-age social protection system is characterized by horizontal inequity. As we have discussed in the previous section, a low skilled individual who has been earning a minimum wage in the formal sector throughout his career will receive the same pension as a similarly low skilled individual who has worked in the informal sector. However, the former contributed to the social security during his working life whereas the second did not. Brazil can be praised for the existence of a non-contributory pension and of a minimum pension that allow protection of individuals from the risk of old-age indigence. However, the same system should also reward those workers who contributed to pay for it for example by ensuring that the non-contributory benefit is lower than the benefit received by workers who have a positive history of contributions.

If the value of benefits continues increasing at the pace observed over the last decade, pension expenditure will increase even faster as there will be an ever increasing number of elderly. While the expansion of coverage and the generous level of benefits have contributed to reducing poverty and inequality, going ahead the government will have to think about trade-offs. Anchoring the minimum pension to the minimum wage and its evolution may not be the most effective mechanisms for poverty reduction. Indeed, we have seen that poverty has been significantly reduced for the elderly, thus increasing the real value of their benefits can be a regressive policy.

3.3.5. Conclusions

The liabilities of a DB system consist of the current benefits paid to the retired population plus all the future benefits promised to be paid to all participants in the system. The generosity of the Brazilian pension system (both urban, rural and public sector) coupled with the rapid aging process that the country will experience imply that the value of these liabilities will continue to increase in the near future. On the other hand, in a PAYG system the assets that back the liabilities are composed by all the contributions paid into the system by participants, current and future. The aging process implies that while the labor age population increases the value of this asset will also increase, but in due course, more people will exit than enter the labor force and the value of this asset will decrease.

The main challenge that affects the pension system in Brazil, given its design, is that the value of the PAYG asset is not aligned with the value of its liabilities. As we will see in chapter 6, pension expenditures are projected to reach 22% of GDP by 2050. That the system cannot sustain its benefit level with its own contributions imply that it will increasingly rely on government expenditure to cover this gap. This raises the policy question about whether backing the solvency of the pension system for formal and public sector employees is a priority for public sector expenditure in the face of the multiplicity of needs in the country. Furthermore, increasing reliance in government transfers to pay for contributory pensions give raise to distributive concerns about public spending, since participants in these pension systems are not the neediest part of the population.

Brazil’s very generous public pension system has contributed to reducing poverty. The system extends benefit coverage to most of the old age population and provides protection to poorer segments of society.
Indeed, as shown in Chapter 1, Brazil has almost completely eradicated poverty among the elderly. Public transfers, including pensions, have played a key role in achieving this.

However, these achievements of the old-age social protection system have come at a high cost. The system is characterized by a high level of subsidization. Many programs pay benefits with no proportionality to contributions. While the system has one non-contributory means-targeted program, LOAS-BPC, which is managed by the Ministry of Social Development but paid out by the INSS, many of the benefits paid under RGPS and RPPS are in fact highly subsidized. Indeed, many of the active benefits don’t keep any proportionality to past contributions. For example, the old-age pension to rural workers though formally a social security benefit, is highly subsidized. The constitutional provision that the minimum wage is the lowest value for any retirement or survivors’ benefits clearly implies a high level of subsidization. Moreover, the fact that the benefit of the non-contributory program is also equal to the minimum wage creates perverse incentives.

The rapid aging process that will occur in Brazil in the next 40 years creates important challenges for the pension system in the country. Old-age income protection for the old faces the task of improving its sustainability, provide more adequate incentives for longer productive careers and improve its equity, while maintaining adequate benefits that ensure consumption smoothing and protect individuals and their families from old age poverty. The good news is that the system presents the basic components to achieve its objectives successfully. The multi-pillar design of the system allows responding to the needs of different segments of the population. A more balanced reliance on noncontributory schemes vs. public contributory schemes vis a vis complementary voluntary pensions may improve the financial sustainability of the system as a whole, provide incentives that are compatible with the aging process and safeguard the adequacy of the benefits provided by the system. A more equilibrated scheme also would mean effectively sharing the risks that affect the pension system among all stakeholders: government, employers and individuals.

The aging population makes it more compelling to expand contributory social insurance coverage and to assess the affordability and incentive-compatibility of non-contributory programs. Vesting periods should be eliminated or substantially reduced and the Government should consider opening up contributory social insurance to the population as a whole (rather than just to workers with formal employment contracts) and ensuring that any subsidies are transparent, equitable, and consistent with promoting work and savings. The affordability of non-contributory programs will depend on how the level of the transfers and eligibility conditions evolve over time.

It will be important to improve the management of implicit and explicit subsidies within the contributory system and those outside the contributory system. Because public resources are limited, it makes sense to focus the redistributive power of the pension system on those individuals who need it the most. This would imply ensuring that benefits from the contributory programs are defined on the basis of past contributions, ending any implicit subsidies and instead use limited public resources to supplement the benefits of workers with limited or no savings capacity. Resources that finance non-contributory pensions carry an opportunity cost; because they are reallocated from other expenditures that may have higher social rates of return (such as pre-natal care, early childhood development, and basic infrastructure). Assessing the extent of this opportunity cost is a very difficult and probably elusive task, but countries facing tight fiscal constraints and the continuing need to improve their basic human development indicators are unlikely to be able to make efficient allocations to finance non contributory programs.
4.1 INCREASE IN LIFE EXPECTANCY

The increases in life expectancy at birth (LEB) observed over the last few decades in Brazil have impressive. Compared to 1980, there has been an addition of some ten years to the life of a child born in 2008. Within those 28 years the median age of the Brazilian population increased from 20.2 (1980) to 28.8 (2008); projections indicate that it will reach 35.8 in 2025 and 46.2 in 2050. That means that by the time a child born in 1980 reaches 70 years of age the median age of the Brazilian population will have more than doubled – an absolute increase of 26 years.

Recent estimates indicate that in a few years from now, LEB in Brazil will reach the symbolic threshold of 75 years. By 2050 it is expected that LEB will be higher than 81 years – that is, above the LEB enjoyed by the majority of the developed (aged) countries today. Furthermore, latest figures (2008) indicate that LEB for a female child, 76.7 years, stands at 7.6 years higher than for a male child – at 69.1 years. This is well above the differential that prevails for most of the world and reflects higher male mortality rates at all ages - particularly those for young adults, due to exceedingly high rates of external deaths from both accidents and violence. If such deaths could be even partially prevented, a significant increase in overall LEB would be achieved.

However substantial are the recent increases in Brazil, LEB is still considerably lower than in other Latin American countries – notably Argentina, Chile, Costa Rica, Cuba and Uruguay – indicating that there is much room for improvement. (Figure 4.1)

![Figure 4.1](image)

Not only have Brazilians enjoyed substantial LEB increases but once they reach “old age” they also expect a much higher life expectancy than in the very recent past. For instance, life expectancy at the age of 60 (LE60) in 1980 was 15.4 for men and 17.8 for women; respective figures in 2005 were 19.1 and 22.6. At the age of 75, life expectancy (LE75) increased in the same 25-year period (1980-2005) 3.4 years for men and 3.0 years for women – that is, an increase of just over one year per decade when considering both sexes together. It is interesting to note that life expectancies for men at older ages in Brazil compare favorably with those presented by much more developed countries. For instance, in 2005 a Brazilian male
at age 75 expected to live a further 10.9 years which was the same as in Canada. The figures for Denmark, Sweden and Switzerland were respectively 9.8, 10.6 and 11.2. This suggests that older men in developed countries have accumulated more risk factors for non-communicable diseases (such as smoking, sedentary life styles, excessive alcohol consumption, over-rich diets), while their Brazilian counterparts belong to cohorts which were spared such excesses. For women, the “protection” conferred by less affluent life styles is not as clear. For Brazilian females LE75 in 2005 was 12.4 – for the same four countries previously selected, the figures were 13.3, 11.8, 12.7 and 13.7. At the same time, in the decade previous to 2008 the very old, 80+, experienced a 10% increase in life expectancy: LE80 in 1998 was 8.72 (8.31 for men, 9.05 for women); respective figures in 2008 were 9.51; 8.94 and; 9.93.

Figure 4.2 shows that the only population sub-group that has remained stable within the period 1990-2010 is the youngest one (0-19). All the remaining sub-groups (20-39; 40-59 and; 60+) have experienced substantial increases – the fastest one being the oldest subgroup. Within the latter, the very old (80+) increased faster than the age-group 60-79. From 1990 to 2010 the 60+ almost doubled but the 80+ almost tripled.

Figure 4.2
Brazilian population 1990-2007 (thousand)

The very old, with their disproportionately higher demands on health and social services, are expected to experience exponential increases within the next four decades. There are today some 1,082,138 men and 1,570,922 women aged 80 and over. In 2050 the projected respective numbers are 5,175,376 and 8,573,332. It is clear on examination of these figures that the Brazilian population will experience, as is the case for most of the already aged world, a feminization of aging. This has important health and long-term care policy implications. The longer lives of these women are often marked by poor health and frailty. They are particularly prone to non-fatal but debilitating conditions. Added to this is frequent loneliness – as they more often than not out survive their male partners, ending their lives in widowhood that is commonly accompanied by poverty.

This chapter investigates the implications of longer life expectancy and a larger share of old population on the provision of two very important services for the elderly, health care and long-term care.
4.2 HEALTH

4.2.1 From Acute to Chronic Care

Brazil is firmly progressing into the epidemiological transition, that is the shift in health and disease patterns that brings death rates down from very high level in which people die young, primarily from communicable disease, to low levels with death concentrated among the elderly, who die from degenerative diseases. In Brazil, the epidemiological transition has not followed the model experienced by most developed countries. There is coexistence of old and new health problems, where despite the predominance of the chronic and degenerative diseases, the communicable ones still play an important role. In this chapter we focus on non-communicable diseases, which are the main source of mortality and morbidity of the elderly in all countries.

The leading causes of death in the country are now cardiovascular diseases (CVDs) (30%), cancer (15%) and ‘external causes of death’ (12%). Regional differences reflect disparities in socioeconomic levels. For instance, data from the Ministry of Health indicate that for the population aged 20 – 74 there has been a decrease in the cardiovascular disease mortality rates of around 1.4% a year for the period 1990-2006. These declines however, have been pronounced in the south and the southeast while the northeast has seen an increase. Similar observations can be made in relation to mortality rates for specific CVDs for the oldest age group, 60 – 79, as can be seen below.46

Table 4.1 shows the mortality rates for the age group 60-79 for all CVDs for the country as a whole and desegregated by region. For both males and females there has been a decline in mortality rates for CVD pronounced in both the south and the southeast regions while the northeast region reveals an increase. Furthermore, CVD mortality rates in 1990 were around 2.5 times higher in the southern regions compared to the northeast but that relative difference had been reduced to only about 20% by 2007. This shows that the southern regions share the trend apparent in the developed world since the 1970s of decreasing mortality rates in CVDs at all ages, including older age. This is not the case in the northeast – a region still at an earlier stage of the epidemiological transition.

<table>
<thead>
<tr>
<th></th>
<th>Females 60-79</th>
<th></th>
<th>Males 60-79</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>998.8 730.8</td>
<td>1406.6 1102.3</td>
<td>1406.6 1102.3</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>638.8 564.8</td>
<td>796.9 828.8</td>
<td>796.9 828.8</td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>515.3 710.2</td>
<td>689.1 1005.7</td>
<td>689.1 1005.7</td>
<td></td>
</tr>
<tr>
<td>Southeast</td>
<td>1242.8 742.4</td>
<td>1825.4 1159.9</td>
<td>1825.4 1159.9</td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>1224.5 773.1</td>
<td>1763.1 1168.8</td>
<td>1763.1 1168.8</td>
<td></td>
</tr>
<tr>
<td>Center-West</td>
<td>918.0 741.5</td>
<td>1187.4 1139.4</td>
<td>1187.4 1139.4</td>
<td></td>
</tr>
</tbody>
</table>

Ministry of Health (2009)

Table 4.2 shows mortality rates data for cerebrovascular diseases. An average decrease of around 3.6% per year has been observed for the country as a whole – however, in the northeast, a small but significant increase was again registered. This decrease of 3.6% per year was larger than that experienced by ischemic heart disease (IHD) for the same years – which was of the order of 1.9%, with once again the northeast region experiencing an increase rather than a decrease.

46 No data is presented for age group 80+. This reflects the common practice of either total omission, or the lumping together of all individuals aged 60 in one group.
Table 4.2
Adjusted mortality rates for cerebrovascular disease;
Brazil and regions 1990-2007

<table>
<thead>
<tr>
<th></th>
<th>Females 60-79</th>
<th></th>
<th>Males 60-79</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>348.2</td>
<td>234.6</td>
<td>481.4</td>
<td>339.7</td>
</tr>
<tr>
<td>North</td>
<td>249.1</td>
<td>229.7</td>
<td>291.8</td>
<td>308.1</td>
</tr>
<tr>
<td>Northeast</td>
<td>211.7</td>
<td>253.2</td>
<td>264.1</td>
<td>346.3</td>
</tr>
<tr>
<td>Southeast</td>
<td>404.1</td>
<td>218.7</td>
<td>587.7</td>
<td>331.9</td>
</tr>
<tr>
<td>South</td>
<td>455.9</td>
<td>259.1</td>
<td>648.5</td>
<td>373.2</td>
</tr>
<tr>
<td>Center-West</td>
<td>301.9</td>
<td>217.1</td>
<td>418.2</td>
<td>312.1</td>
</tr>
</tbody>
</table>

Ministry of Health (2009)

Table 4.3 illustrates mortality rates for ischemic heart disease. Of particular interest to note, is that while the rates in 1990 for the southeast region were substantially higher than for the northeast, the declines (particularly among women) in the former have been very rapid while the increases in the latter have been considerable.

Table 4.3
Adjusted mortality rates for ischemic heart disease;
Brazil and regions 1990-2007

<table>
<thead>
<tr>
<th></th>
<th>Females 60-79</th>
<th></th>
<th>Males 60-79</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>274.3</td>
<td>216.7</td>
<td>457.2</td>
<td>382.1</td>
</tr>
<tr>
<td>North</td>
<td>138.1</td>
<td>140.5</td>
<td>216.2</td>
<td>239.1</td>
</tr>
<tr>
<td>Northeast</td>
<td>106.3</td>
<td>199.4</td>
<td>175.4</td>
<td>315.0</td>
</tr>
<tr>
<td>Southeast</td>
<td>359.8</td>
<td>225.8</td>
<td>625.3</td>
<td>415.1</td>
</tr>
<tr>
<td>South</td>
<td>370.4</td>
<td>244.5</td>
<td>612.7</td>
<td>444.0</td>
</tr>
<tr>
<td>Center-West</td>
<td>180.0</td>
<td>200.8</td>
<td>291.0</td>
<td>375.0</td>
</tr>
</tbody>
</table>

Ministry of Health (2009)

Another non-communicable disease of great importance which shares some of the risk factors for CVD (namely unhealthy diet and a sedentary life style) and which itself can lead to an increased risk for CVD, is diabetes. Table 4.4 shows the adjusted mortality rates for diabetes for women and men above age 60. As a whole, substantial increases, particularly for men can be observed.

Table 4.4
Adjusted mortality rates for diabetes;
Brazil and regions 1990-2007

<table>
<thead>
<tr>
<th></th>
<th>Females above 60</th>
<th></th>
<th>Males above 60</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>144.3</td>
<td>221.3</td>
<td>97.6</td>
<td>184.5</td>
</tr>
<tr>
<td>North</td>
<td>64.2</td>
<td>200.7</td>
<td>45.4</td>
<td>136.7</td>
</tr>
<tr>
<td>Northeast</td>
<td>100.8</td>
<td>280.9</td>
<td>72.0</td>
<td>224.6</td>
</tr>
<tr>
<td>Southeast</td>
<td>183.6</td>
<td>198.4</td>
<td>125.7</td>
<td>174.8</td>
</tr>
<tr>
<td>South</td>
<td>131.8</td>
<td>206.2</td>
<td>90.3</td>
<td>174.5</td>
</tr>
<tr>
<td>Center-West</td>
<td>115.4</td>
<td>205.3</td>
<td>67.3</td>
<td>159.4</td>
</tr>
</tbody>
</table>

Ministry of Health (2009)

The data summarized in these four tables show that NCDs are still very common causes of death for older people in Brazil. There have been recent declines, however, which can be attributed to a variety of factors.
such as: i) changes in life style (more recent cohorts of older people have greater health-concern and higher levels of health literacy; ii) early detection and increased access to appropriate treatment for secondary risk factors (high cholesterol and hypertension) and; iii) effective medical interventions, such as new drugs, pacemakers and open heart surgery, that were previously unavailable. It is important to restate that it can be misleading to interpret national figures. In a country as vast as Brazil regional differences are substantial. The stages of the demographic/epidemiological transition can be markedly varied. Thus, while the wealthier southeast and south regions are already showing the same patterns of more affluent societies – decreasing rates of mortality and morbidity for CVD – the less affluent northeast still presents a trend in the opposite direction.

Regarding cancers (for all ages), the ones that present the highest incidence in Brazil (2006) are: for men, prostate; lung; stomach; colon and esophagus and for women: breast, cervix; colon; lung and stomach. Mortality rates are on the increase for all of them except for stomach cancer. These trends are opposite of those prevailing for other non-communicable diseases. They reflect the high prevalence of cigarette smoking among the cohorts now reaching the ages when the disease is manifested (and more recent higher smoking rates among females). It should also be noted that breast cancer rates are expected to increase in a reflection of the reproductive experiences of younger women – such as the postponement of the first full term pregnancy and the shorter cumulative breast feeding experience. More positively, the rate of stomach cancer is expected to continue to decline reflecting improved food hygiene and preservation. Also anticipated are declines for cervical cancer as screening with papanicolau smear tests become more widespread and the vaccine for PVI in young teenagers becomes more widely available. The recorded incidence of prostate cancer is expected to increase as more men reach very old age and the disease is more accurately diagnosed.

When considering the age group 60+, all-cancer mortality rates have experienced a 25% increase within the period 1980-2005 – from 484.1 to 606.6 per 100,000. The increase for the most frequently lethal male cancer, lung, was from 54.9 to 82.8 per 100,000 (50.7%) while for females, breast cancer, from 38.9 to 56.7 per 100,000 (45.8%). Regarding the latter, 52% of women aged 60+ had never been submitted to a mammography - 64% if they were users of the SUS, 23% if they were users of private services. Only 31% of SUS users had been submitted to a mammography over the previous 2 years compared to 67.5% of those who had access to private services (PNAD 2003).

Data obtained from a telephone survey (Vigitel) in all capitals of 26 states and the district of the country’s capital (Brasilia) show a high prevalence of the risk factors associated with the main non-communicable diseases among older interviewees. While only 8.5% were current smokers, 67.5% consumed fresh vegetables and fruits only irregularly; 20.6% reported eating meat with excessive fat; 87.5% reported a sedentary life-style and 62.4% were overweight. Of those who self-declared as hypertensive (55.5%), the vast majority reported concomitance of two or more other relative risks for NCD and 48% three or more (Kalache, 2010).

As previously noted, a cause of death of enormous significance in Brazil (128,388 deaths in 2006) is that produced by “external causes”. In contrast to most countries, homicides lead the ranking with road accidents featuring second. Rates are much higher for men than for women in all age groups – an overall relative risk (RR) of 5.4 in 2006. In young age groups the RR is even larger. There is almost 16 times the probability of a young man aged 20-24 being murdered than that of a young woman. With road accidents it is 4.7 times as much. The rate is 4 times higher for suicide. These sex differentials persist well into old age. Among those aged 75+ the risk for a male to be murdered is 5.1 times higher than for a female of the same age. In 2006 the mortality rate for homicide (all ages) was 26/100,000 while for road accident the rate was 19.4/100,000. These disturbing statistics show that there is an urgent need to implement multi-sectorial interventions. These unacceptably high mortality rates attributable to “external causes “are a
major contributing factor for a relatively low life expectancy at birth and at all ages. This is particularly the case for males (in comparison, for instance, to other Latin American countries).

Falls are especially important in older age, both in terms of mortality and as a cause of admission to hospital. Out of the total number of admissions to hospital (662,652) in 2006, no less than 42.5% (281,324) were attributed to a fall – at a huge human and economic cost. Admission rates increased to 15.1/10,000 in 2006 from 13.9/10000 in 1998. Rates were considerably higher for women than for men: 10.1 and 20.3 per 10,000 in 2006. When these rates are compared with those of road accidents - 2.2 and 7.2 respectively - the significance of falls stands out as a public health concern. Hospital admissions prompted by a fall were three times higher among males aged 10-39 compared to females of same age. In older age however (75+), the opposite is observed: women being 30% more likely to be admitted to a hospital as the result of a fall. This reflects the higher incidence for women of suffering serious consequences from a fall. In part this is related to osteoporosis but it is also influenced by the fact that older women are more likely to be widowed and living alone. It is more usual for a man of the same age to benefit from a family caregiver at home.

An extremely common feature of the health scenario in older age is that older people often present with multiple pathologies. Typically, an older person presents hypertension in association with diabetes, high cholesterol levels, osteoporosis, and respiratory conditions, among others. The presentation of these diseases may differ from that at younger ages. The multiple pathologies often provoke simultaneous use of many drugs which can produce a host of unanticipated cross-over effects. Frequently, older people get confused with so much simultaneous drugs use. It often leads to intoxication. These problems are best confronted by improved training in old age care for future cohorts of health care professionals. As elsewhere, there is indeed a dramatic shortage of geriatricians in Brazil. This need for specialists, however, can be mitigated by the training of all medical doctors in old age care. More geriatricians are required (in part because they are the trainers of future doctors) but even more pressing is this need for all future doctors to be familiar with old age care. Gastroenterologists, neurologists, cardiologists and family medicine specialists alike will increasingly be dealing with older people in their practices. Despite Brazil’s passage through the advanced stages of the epidemiological transition, its medical schools are still training doctors for the requirements of the 20th century. Students are schooled in child care and reproductive health but are presented with little or nothing about aging-related issues. A doctor graduating in 2010 with an average 40 years of medical practice ahead of her/him will witness a three-fold increase in the elderly population – that is to say, 63 million people. In whatever specialty they embrace, they will be increasingly confronted with older patients regardless of their level of preparedness. Curriculum reform reflecting Brazil’s rapid aging is critical if the country is to avoid an epidemic of iatrogenic conditions – and the consequent escalating health care costs.

Despite the fact that in 2006 the proportion of older people in Brazil was about 10%, some 26% of hospital costs were consumed by them. Given the rapid population aging that the country is experiencing, it is clear that without vigorous policies to stem hospital admissions by this age group, the cost will escalate dramatically. Figure 4.3 shows the coverage of influenza vaccination for the population aged 60+ in Brazil since the beginning of this campaign in 1999 until 2007. This has been a particularly successful public health intervention with coverage rates ranging from 73 to 87% (consistently very close or well above the 75% coverage target). In more recent years (not shown in the figures) the uptake has declined but nevertheless it still remains around the 75% mark. This particular public health intervention is an example of the kind of policy that can result in a prevention of diseases and their complications. Not only can it postpone death and suffering but it can also lead to substantial savings related to hospital admissions and the treatment of serious respiratory conditions triggered by an episode of older age influenza.
One of the most poignant illustrations that the epidemiological/demographic transition has reached an advanced stage is when an increasing proportion of all deaths occur in older ages. Already now, in Brazil, over 60% of all deaths occur after the age of 60 – only 11% happen before the age of 20. Further increases are foreseen. Studies throughout the world have shown that the bulk of health care costs occur within the very last years of life. Brazil must focus greater attention to medical care in older age if for no other reason than because of the savings to be gained. Furthermore, the older an individual is at the time of death, the lower are the costs associated with the care in the preceding year. A death at an age of say 40 or 50 years, costs relatively much more than a death from the same cause at age 80 or 90. Keeping people healthy well into their old age not only extends life and productivity but also helps to contain health care costs.

Equally important is to invest in health promotion and disease prevention throughout the entire life course. Better health in older age depends not only on medical interventions targeting older people. It is also the combined result of assisting individuals to grow older in better health (discussed in coming sections of this chapter). It is particularly important to focus on the four main risk factors for non-communicable diseases: smoking; physical inactivity; alcohol consumption and unhealthy diet. Current data show a substantial decrease in smoking rates in Brazil – it is now lower than in more health-concerned countries such as Canada. These decreases were possible due to a combination of multi-sectorial policies: health education (illustrating the harm); fiscal (tax increases do directly discourage individuals to smoke); legal (banning smoking from public spaces and prohibiting advertisements and sponsorship of sports and cultural events).

Much more concentration however is needed in relation to the other three major risk factors for NCD. Some community based interventions targeting sedentary life-styles (“Agita Brazil” for example) have been successful. There have been campaigns from both the public and the private sectors but much more is required if the exceedingly high rates of physical inactivity are to be brought down. Typically a sedentary person is a female, of low socio-economic-educational level, rural or semi-urban with a decreasing level of physical activity as she ages. Equally worrying are the trends related to unhealthy diets. There exists a general preference for high fat/sugar/carbohydrate and salty foods – the so-called “white” diet. Finally, the social acceptability of the high consumption of alcohol not only manifests itself through diseases but also in violence and road accidents. In very broad terms, the affluent/well educated
classes have learned healthier behaviors but the lower socio-economic classes continue to be burdened with problems related to excess weight, smoking and sedentary life-styles.

Although the epidemiological shift from acute to chronic care has already occurred in Brazil, health care is still focused on acute care. It signals a need for a reorientation toward chronic care. This requires a difficult but unavoidable change of paradigm. Treating hypertension or diabetes as if they were acute respiratory infections or gastroenteritis will simply not work. Doctors are typically only mindful of their patients when they pass in front of their radar screen. Most of the time the patient is outside of that radar screen. In fact, the greater part of the care is away from the health premises altogether which serves to illustrate the crucial importance of home and community care. Additionally, as individuals age, the value of self-care increases. One of the reasons that men die earlier than women is their notorious resistance to embrace this self-care.

The emergence of chronic diseases implies a continuum of care that has to start with health promotion, primordial prevention and primary/secondary/tertiary prevention. Hypertension provides a good example. It is a condition that can mostly be prevented in the first instance. The opportunities to prevent it however, are often missed. Once it has become established, proper treatment and follow-up can effectively prevent cardiovascular complications. Missed opportunities to deal appropriately with them are then translated into major CVD for which proper diagnosis and treatment will be required to prevent the onset of a major medical problem such as stroke. This then requires prompt acute treatment. When that does not happen, disabilities occur which require rehabilitation. If this is not forthcoming at an early stage, the chances of a recovery with no or minimal loss of functional capacity decreases. As the Brazilian population ages, the focus on a continuum of care (particularly from the public sector) will have to be considerably sharpened.

Box 4.1 Strategy to Address Chronic Diseases in Brazil

Chronic, non communicable diseases (NCDs) account for a large and growing share of Brazil’s burden of disease. For the last quarter century, NCDs have been the main cause of the burden of disease for both young and older adults, as well as for the rich and the poor, including the indigenous population. About 66 percent of the disease burden in Brazil is due to NCDs, compared to 24 percent from communicable diseases and 10 percent from injuries. Cardiovascular disease is the most important cause of years of life lost, with cancer, chronic respiratory disease and diabetes as other significant contributors. Among indigenous people, the prevalence of diabetes increased from 16.3/100,000 in 1990 to 24/100,000 in 2006. Neuro-psychiatric disorders such as depression predominate the years lost to disability.

In 2005, a World Bank Report provided an overview of the changing NCD burden in Brazil and its root causes, as well as the costs and potential effectiveness of alternative policy interventions. According to the study, seven modifiable risk factors accounted for an estimated 53 percent of all deaths, and 30 percent of all disability-adjusted life years lost (DALYs) in Brazil. These included blood pressure, overweight, alcohol use, tobacco use, high cholesterol, low fruit and vegetable intake, and physical inactivity. The upward trend in chronic diseases is a consequence of urbanization, changing lifestyles, globalization, and improvements in health care, and it is preventable, often at a low cost. An effective response requires broad educational and community interventions, as well as changes in economic policy, food supply, and transportation policy and urban design.

The study found that, taken together, the financial and economic costs of chronic diseases – the added costs to the health care bill and the economic costs due to lost productivity - represented about 10 percent of Brazil’s GDP. However, most of the public health budget is still allocated to the control of communicable diseases, as many of these diseases persist among the poorest groups of the population. The public health system and budget also focus on treatment of disease rather than on health promotion and disease prevention, and addressing the social determinants of health. On current trends, chronic diseases will overwhelm the health system and cause considerable

Closely the equity gap, while addressing the increased burden of chronic diseases was - and continues to be - the principal challenge facing the Brazilian health system. Brazil has made significant progress on adoption of cost-effective and evidence-based interventions to tackle chronic non-communicable diseases and injuries since the NCD study was published. The Ministry of Health (MoH), in coordination with State and Municipal Health Secretariats (SES and SMS, respectively), and other ministries (Ministries of Cities, Transport, Education and others), has led the development of a public health system with a growing focus on health surveillance and promotion, environmental health, and prevention of chronic diseases and injuries, with noticeable results - for example, smoking prevalence decreased in Brazil from 35 percent in 1989 to 16 percent in 2006. According to the results of the VIGITEL telephone survey, conducted in 27 capital cities, 22 percent of non smokers were former smokers. Another example is given by Projeto GUIA, an ongoing evaluation of physical activity programs in 286 municipalities, including the program Academia da Cidade, which has preliminary good results. Two scientific evaluations in the city of Recife in 2006-2007 found that exposure to Academia da Cidade was associated with two-to eleven-fold increase in leisure-time physical activity. Another evaluation in 2006-2007 shows that Academia da Cidade increased participation in leisure-time physical activity predominantly amongst older and poorer women in the more than 20 sites of the city of Recife. In some ways yet to be explained, Academia da Cidade broke a barrier for poor and older women regarding leisure-time physical activity.

Through the Secretariat of Surveillance (SVS), the MoH has implemented several activities aimed at identifying risk factors for chronic diseases, promoting health and evaluating the program’s impact, as follows:

- **Non-communicable disease, injury and risk factor surveillance.** Several routine information systems have been established which provide data mortality and morbidity by chronic diseases and injuries, risk factors, and health knowledge, attitudes and practices, and environmental health. National databases are generated by DATASUS in cooperation with the CENEPI, as follows:
  - SIM: Mortality Information System. Provides information on cause, date, place and municipality of occurrence of death, as well as demographic and other information on the deceased. Data is collected from death certificates in all states and municipalities.
  - VIGITEL (Surveillance of Risk Factors for Chronic Diseases by Telephone Survey) monitors the frequency and distribution of risk factors for NCDs in all capitals of the 26 Brazilian states and in the Federal District, through telephone interviews conducted in random samples of adults living in households served by fixed phone lines in each city. Surveys covering 54,000 persons were carried out in 2006, 2007 and 2008, and results were published on the web.
  - In addition to VIGITEL, a Global Adult Tobacco Survey carried out in 2008 aimed to monitor tobacco use and evaluate efforts to reduce its use.
  - VIVA monitors injuries caused by violence and accidents, and functions at the federal, state and municipal level in 900 municipalities.
  - PENSE is a school-based health survey. IBGE carried out a survey of students’ health in 26 state capitals and the Federal District in 2009. The survey will be carried out every other year for students in grade 9 of all schools in Brazil.
  - SIASI is the Indigenous Health Information System, which will also include information about chronic diseases among the indigenous population.

- **Health Promotion and Disease Prevention.**
  - A national plan for NCD risk factor surveillance and prevention has been under implementation in states and capital cities since 2005.
  - A National Network for Health Promotion has been financing over 500 federal entities.
  - A network of 16 municipalities in large urban areas, corresponding to about 19 percent of the population,

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has been developing surveillance and prevention of injuries and deaths from traffic accidents.

- A network to promote health and prevent violence counts with 254 units in 21 SES, 215 SMS, 16 education and research institutions and two NGOs.
- The School Health Program co-sponsored by the MOH and the Ministry of Education aims at strengthening students health responses in 701 priority municipalities.
- Since 2006, SVS has also promoted several media campaigns aiming at adoption of behaviors that lead to healthier lives, such as reduction of smoking, increasing physical activity, traffic safety, and preventing and controlling hypertension and diabetes.
- One of the most successful prevention policies for NCDs in Brazil has been the Tobacco Control Program. The program developed surveillance and monitoring initiatives, built institutional capacity and decentralized tobacco control initiatives to states and municipalities.
- Academia da Cidade is a community-oriented program to promote physical exercise in poor neighborhood. It comprehensively uses individually targeted behavior change, environmental change and policy changes.

Despite significant progress, important challenges remain to be tackled by the Brazilian health system. The challenges are paradigmatic of middle-income countries, in which the rising volume and changing composition of demand for health care will exert considerable upward pressure on both public and household spending. Over the next generation, an aging population and the growth of chronic diseases will steadily increase demand for high-complexity, high-cost health services. At the same time, rising incomes and the proliferation of new drugs and technologies will feed increased expectations for high-quality and responsive care. If it hopes to build human capital at a cost sustainable to the economy, Brazil will need to carefully manage the double burden of coping with these advanced challenges while completing its unfinished agenda of reducing childhood and infectious diseases among the poor.

Addressing the social determinants of health, while further improving health surveillance, health and environmental promotion, and disease prevention, is the most cost-effective strategy that has been followed by the country to tackle the double challenge - for example, by targeting poor neighborhoods, as the program Academia da Cidade has been doing in several cities in Brazil, and adopting healthy policies, not only in the health sector, but also in other sectors with an impact on health (such as the increase in tobacco prices and taxes). Since 1998, the World Bank has been assisting Brazil, through the VIGISUS Project, to develop activities in the areas of health and environmental health promotion, prevention of NCDs and injuries, and indigenous health that will be mainstreamed in the third phase, starting in 2011. Some of the results expected from this last phase of the project include: (i) 50 percent priority SMS with notification of violence; (ii) 60 percent National Health Promotion Network projects monitored; (iii) 25 of the 34 Indigenous Health Districts with NCD epidemiological profile (diabetes and hypertension) identified; and (iv) 16 percent prevalence of physical exercise countrywide.

1. The project will support strengthening SVS, SES and SMS management, operational and technical capacity; and engage on national and international technical cooperation aimed at exchanging experiences and strengthening the national capacity on strategies related to (i) NCDs and health promotion; (ii) surveillance, prevention, monitoring physical activity; and (iii) surveillance, prevention, monitoring of violence and accidents. Research and population surveys on risk factors for chronic non-communicable diseases in the general population and specific populations (VIVA, VIGITEL, PENSE), and surveillance on domestic violence, sexual and/other violence will continue to be supported, including in the SUS. "Healthy Cities" projects will also be financed. Among other activities, the Indigenous Health component will include the development, implementation, monitoring and evaluation of a NCD strategy and information system; and the provision of support to the Indigenous Health Districts on implementation of NCD surveillance.

50 The WHO Healthy Cities project is a global movement that engages local governments in health development, and promotes comprehensive and systematic policy and planning for health emphasizing: (i) the need to address inequality in health and urban poverty; (ii) the needs of vulnerable groups; (iii) participatory governance; and (iv) addressing the social, economic and environmental determinants of health.
4.2.2 Aging, Health Care Utilization and Health Care Cost

There are widespread concerns that the rapidly aging population in Brazil will have significantly larger and more expensive health care requirements. On the one hand, diseases affect different age groups in a distinct way. On the other hand, treatment costs depend on the type of disease. In consequence, changes in the country’s demographic structure change the cost of the health system and, consequently, public expenditures. In this section some of the empirical relations between demographic change, health care utilization and health care cost are discussed. A more formal modeling of the public finance implications of population aging for the health sector is presented in Chapter 6.

Table 4.5 presents hospitalization through SUS by disease according to the age group. The majority of patients hospitalized by infectious, parasitary and respiratory diseases are children. Young people are the majority among those hospitalized for external causes (accidents and violence), genitourinary diseases, pregnancy, and mental problems. Neoplasms and diseases of the digestive system affect mainly the middle-aged group. Elderly people are the first to be affected by diseases of the circulatory system.

![Table 4.5](#)

<table>
<thead>
<tr>
<th>Disease group</th>
<th>&lt; 10 years</th>
<th>10 to 19</th>
<th>20 to 39</th>
<th>40 to 59</th>
<th>60 or more</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious and parasitic diseases</td>
<td>37.84%</td>
<td>9.83%</td>
<td>18.65%</td>
<td>16.09%</td>
<td>17.59%</td>
<td>100%</td>
</tr>
<tr>
<td>Neoplasm</td>
<td>5.39%</td>
<td>5.61%</td>
<td>19.90%</td>
<td>37.13%</td>
<td>31.97%</td>
<td>100%</td>
</tr>
<tr>
<td>Mental and behavioral disorders</td>
<td>0.20%</td>
<td>4.71%</td>
<td>48.74%</td>
<td>40.11%</td>
<td>6.24%</td>
<td>100%</td>
</tr>
<tr>
<td>Diseases of the circulatory system</td>
<td>0.67%</td>
<td>1.28%</td>
<td>10.42%</td>
<td>32.35%</td>
<td>55.28%</td>
<td>100%</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>45.06%</td>
<td>6.46%</td>
<td>10.11%</td>
<td>12.60%</td>
<td>25.77%</td>
<td>100%</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>11.44%</td>
<td>7.42%</td>
<td>26.79%</td>
<td>30.65%</td>
<td>23.70%</td>
<td>100%</td>
</tr>
<tr>
<td>Diseases of the genitourinary system</td>
<td>8.66%</td>
<td>9.52%</td>
<td>37.24%</td>
<td>26.79%</td>
<td>17.79%</td>
<td>100%</td>
</tr>
<tr>
<td>Pregnancy, childbirth and puerperium</td>
<td>0.00%</td>
<td>24.69%</td>
<td>72.85%</td>
<td>2.39%</td>
<td>0.06%</td>
<td>100%</td>
</tr>
<tr>
<td>External causes</td>
<td>11.57%</td>
<td>15.06%</td>
<td>35.88%</td>
<td>22.45%</td>
<td>15.04%</td>
<td>100%</td>
</tr>
<tr>
<td>Other causes</td>
<td>26.31%</td>
<td>7.74%</td>
<td>22.37%</td>
<td>21.26%</td>
<td>22.33%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>15.98%</td>
<td>11.23%</td>
<td>33.17%</td>
<td>19.31%</td>
<td>20.31%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Ministry of Health.

Table 4.6 also shows that changes related to the number of hospitalizations by disease follow variation in the demographic structure in the course of the period. From 1995 to 2007, the proportion of the young population (up to 14 years old) dropped 18 percent, while the 60+ years old grew by 25.3 percent.
### Table 4.6
Demography and proportion of hospitalization (%) per year according to disease group

<table>
<thead>
<tr>
<th>Diseases</th>
<th>1995</th>
<th>1997</th>
<th>1999</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious and parasitic diseases</td>
<td>8.79</td>
<td>7.96</td>
<td>7.61</td>
<td>8.04</td>
<td>9.17</td>
<td>8.68</td>
<td>8.08</td>
</tr>
<tr>
<td>Neoplasm</td>
<td>3.17</td>
<td>2.97</td>
<td>2.98</td>
<td>3.32</td>
<td>4.91</td>
<td>5.26</td>
<td>5.65</td>
</tr>
<tr>
<td>Mental and behavioral disorders</td>
<td>3.47</td>
<td>3.57</td>
<td>3.55</td>
<td>3.31</td>
<td>2.94</td>
<td>2.67</td>
<td>2.56</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>16.09</td>
<td>17.32</td>
<td>16.48</td>
<td>15.61</td>
<td>15.01</td>
<td>13.70</td>
<td>13.68</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>7.02</td>
<td>7.08</td>
<td>8.35</td>
<td>8.73</td>
<td>8.17</td>
<td>8.53</td>
<td>8.79</td>
</tr>
<tr>
<td>Diseases of the genitourinary system</td>
<td>7.29</td>
<td>6.43</td>
<td>6.79</td>
<td>6.70</td>
<td>6.60</td>
<td>6.57</td>
<td>6.73</td>
</tr>
<tr>
<td>External causes</td>
<td>5.82</td>
<td>5.90</td>
<td>5.68</td>
<td>5.93</td>
<td>6.30</td>
<td>6.90</td>
<td>7.35</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Age Structure of Population

<table>
<thead>
<tr>
<th></th>
<th>0 to 14</th>
<th>15 to 59</th>
<th>60 or +</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>32.8%</td>
<td>60.8%</td>
<td>6.4%</td>
</tr>
<tr>
<td>2001</td>
<td>31.5%</td>
<td>61.7%</td>
<td>6.8%</td>
</tr>
<tr>
<td>2002</td>
<td>30.3%</td>
<td>62.4%</td>
<td>7.3%</td>
</tr>
<tr>
<td>2003</td>
<td>29.3%</td>
<td>63.0%</td>
<td>7.7%</td>
</tr>
<tr>
<td>2004</td>
<td>28.4%</td>
<td>63.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>2005</td>
<td>27.6%</td>
<td>63.9%</td>
<td>8.9%</td>
</tr>
<tr>
<td>2006</td>
<td>26.9%</td>
<td>64.2%</td>
<td>8.9%</td>
</tr>
<tr>
<td>2007</td>
<td>26.9%</td>
<td>64.2%</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Source: Ministry of Health.

Between 2000 and 2007 there have been a proportional increase in more expensive treatments, typical of adults and old people, and a reduction in the percentage of cheaper hospitalizations, characteristic of youths and children. Between 1995 and 2007, the proportion of hospitalizations by infectious and parasitary diseases and by diseases of the respiratory system fell by 8 percent and 15 percent, respectively. There was also a decrease in genitourinary diseases, pregnancies, and mental problems by 7.7 percent, 15 percent and 26 percent respectively. However, there was an increase in the proportion of neoplasms and diseases of the circulatory and digestive system by 78 percent; 2.5 percent; and 25 percent.

The cost of hospitalization by patient for each type of disease is displayed on Table 4.7. On average, pediatric and obstetric treatments, which affect mostly children and youths, cost about twice less than a tuberculosis treatment, which are more characteristic of the middle-aged and the elderly. Long-term treatments, needed for circulatory diseases and neoplasms are even more expensive. As noticed above, the middle-aged and the elderly people are affected by these diseases in larger numbers.

### Table 4.7
Cost per Hospitalization according to Type of Treatment between 2000 and 2007 (Jan/2010 R$)

<table>
<thead>
<tr>
<th>Medical specialties</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Practice</td>
<td>653.74</td>
<td>596.63</td>
<td>541.53</td>
<td>470.62</td>
<td>500.32</td>
<td>503.98</td>
<td>496.98</td>
<td>515.06</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>714.64</td>
<td>653.30</td>
<td>602.79</td>
<td>538.65</td>
<td>576.92</td>
<td>595.70</td>
<td>582.38</td>
<td>635.59</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>520.26</td>
<td>499.16</td>
<td>446.11</td>
<td>397.15</td>
<td>441.76</td>
<td>444.15</td>
<td>467.24</td>
<td>489.03</td>
</tr>
<tr>
<td>Surgical clinic</td>
<td>1414.89</td>
<td>1432.67</td>
<td>1339.81</td>
<td>1206.14</td>
<td>1195.95</td>
<td>1200.60</td>
<td>1179.15</td>
<td>1189.68</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>2469.80</td>
<td>2500.37</td>
<td>2879.76</td>
<td>2056.88</td>
<td>2303.74</td>
<td>2062.65</td>
<td>1843.07</td>
<td>2007.86</td>
</tr>
<tr>
<td>Psychiatry - hospital - day</td>
<td>1183.42</td>
<td>1150.90</td>
<td>1138.36</td>
<td>956.98</td>
<td>846.20</td>
<td>777.33</td>
<td>755.78</td>
<td>747.79</td>
</tr>
<tr>
<td>Long term care (Chronic)</td>
<td>9023.52</td>
<td>10294.91</td>
<td>15746.16</td>
<td>13922.40</td>
<td>14024.34</td>
<td>10510.38</td>
<td>8538.42</td>
<td>11218.23</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>2033.63</td>
<td>1614.40</td>
<td>1520.80</td>
<td>1303.31</td>
<td>1205.98</td>
<td>1101.54</td>
<td>1102.69</td>
<td>1035.26</td>
</tr>
<tr>
<td>Phthisiology</td>
<td>1681.36</td>
<td>1520.34</td>
<td>1372.17</td>
<td>1129.27</td>
<td>1081.74</td>
<td>1068.23</td>
<td>1057.95</td>
<td>1054.61</td>
</tr>
</tbody>
</table>

Source: Ministry of Health.

There is, therefore, a real potential for medical and health costs to rise as population ages in Brazil, although the magnitude will depend crucially on whether longer life spans mean more healthy years or
added years of illness and dependency.\textsuperscript{51} Indeed, there is increasing evidence that older people already are healthier than their counterparts of a few decades ago and have healthier lifestyles relative to previous generations, with the result that the threshold for frailty and disability is being pushed later into old age.\textsuperscript{52}

A large number of studies—primarily concentrated in countries of Western Europe and in Japan—document the impact of aging on health and health expenditures and confirm the high level of use of health services in old age, particularly ambulatory services, medication, hospital admissions, and surgery. The general finding in most assessments, however, is that health expenditure per episode is typically higher for the elderly, though use will level off and even declines for the very old. Yet many studies also show that aging is not a significant factor affecting health expenditures if proximity to death is taken into account, because a large proportion of lifetime expenditures on health take place in the two years preceding death, irrespective of the individual’s age at that time. Furthermore, broader economic trends and technological innovation have a greater influence on total health care expenditures over time than does aging.\textsuperscript{53}

4.2.3 The Life-Course Approach Related to Aging and Health

A life course perspective on aging must recognize that older people are not one homogeneous group and that individual diversity tends to increase with age. In this respect, there is much more variety among older personalities than there is amongst the young. They have had more time and opportunities to accumulate and consolidate differences. Central to the life course approach to aging is the notion of functional capacity— that is, that individuals reach the peak of their physical functional capacity early in adulthood and then progressively experience a decline throughout the life course which is a natural result of the aging process. Importantly, however, this is not necessarily a problem. Provided that, at say age 85, one continues to be independent and capable of performing the activities of daily living, he/she will remain a resource to their family, their community, their society and to the economy. Thus, good policies on aging are those policies that will help individuals to remain above the disability threshold as they age. This is shown in Figure 4.4. Throughout the early stages of growth and development, physical capacities such as cardiac output, muscular strength and ventilatory capability gradually increase. They reach a peak early in adulthood and eventually start declining. It should come as no surprise that an individual’s functional capacity at age, say 85, is on the whole lower than it used to be at age 25. The rate of decline however, is largely determined by factors related to lifestyle—smoking, alcohol consumption, levels of physical activity and diet— as well as external and environmental factors. Overlaying all of these are socio-economic factors. It is crucial to recognize that this inevitable decline can be influenced and may even be reversed or retarded at any age through both individual and public policy measures.

\textsuperscript{51} A discussion on “expansion” and “compression” of morbidity is presented in Section 4.3.

\textsuperscript{52} Prevention and postponement of disease and disability and maintenance of health, independence, and mobility in an aging population will continue to remain the major health-related challenges of population aging. In addition to these health issues, living longer will also present individual and societal challenges related to quality of life in old age, including independence, social interaction, and community involvement. Some of these questions will be discussed in the sections devoted to long-term care in Chapter 6.

\textsuperscript{53} Howse (2005) concludes that technological innovation and productivity have made a substantially larger contribution to increases in health care spending over the past few decades than population aging has. Johansson (1997) reviews overall expenditure developments in Sweden and shows that cost factors in the general economy play a more important role in the increase of health expenditures than does growth in the number of elderly people. The same conclusion is drawn by Castles (2000), using data for the Organization for Economic Cooperation and Development (OECD) countries for the period from 1965 to 1995. This analysis finds no statistically significant relationship between aging and aggregate health care expenditure and concludes that total health expenditure in a country is almost entirely explained by its level of real gross domestic product (GDP) per capita. Similarly, Richardson and Robertson (1999) conclude from OECD data for 1975, 1985, and 1995 that health expenditures per capita are not driven mechanistically by demographic factors.
An approach to help individuals to remain independent for as long as possible well into old age is to lower the disability threshold by making alterations to the environment in which they live. Good policies in this respect put the emphasis firmly on enablement rather than disablement – and that, in itself, is a positive shift of paradigm in an aging world. It should be noted that rethinking an urban space with older people in mind benefits the entire community. Interventions aimed at the societal rather than the individual level can produce a very big impact and are often much more cost-effective. A key message to be extracted from the life course perspective is that there is never a “too late” for interventions aimed at maintaining or improving the functional capacity. While it is true to say that “the earlier the better”, there are nevertheless always gains.

For example, the best strategy to prevent osteoporosis in older age is to focus on nutrition and physical activity of the female child up to late adolescence by which time the full bone mass will have been formed. If such a strategy is put in place at the community level (appropriate/healthy school meals; calcium supplements if indicated; provision of exercise facilities throughout childhood and adolescence), there will be a much larger gain compared to one to one interventions.
The life course approach to aging is also important in terms of fostering intergenerational solidarity. Both the old and the young have a lot to gain. Fostering intergenerational close ties also have important repercussions for health in older age. These are difficult to measure as they deal with personal, subjective personality attributes by promoting self-esteem, optimism and self-efficacy. All of them are crucial for quality of life at any time but are even more so in older age. As empirical evidence shows, they are also related to longevity – probably permeated through a sense of being useful and contributing to society.

4.2.4 The WHO Active Aging Policy Framework

As a response to worldwide aging, the World Health Organization (WHO) produced a document in 2002 ("Active Aging- a Policy Framework") which has greatly influenced policies on aging in both developed and developing countries. Active Aging is defined as “the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age”. Thus, the concept of active aging advanced by WHO is based on three pillars: health, as a universal value, individuals around the world aspire to grow older in good health in order to ensure full participation in their societies; failing that they need the security of being protected. At an international conference on active aging in Seville (June 2010) a fourth pillar was added to the definition – the life-long learning and training of new skills throughout the life course so that knowledge and abilities do not become obsolete as individuals age.

The word active\textsuperscript{55} refers to continuing participation in social, economic, cultural, spiritual and civic affairs and not only the ability to be physically active or to participate in the labour force. Retired older people, those who are ill or who live with disabilities can remain active contributors to their families, peers, communities and nations. Active aging aims to extend healthy life expectancy and quality of life for all people as they age, including those who are frail, disabled and in need of care. Quality of life is a notion of critical importance within the context of aging. It expresses an individual’s perception of his or her position in life in the context of the culture and value system within which they live. It is an assessment that relates to their goals, expectations, standards and concerns. It is a broad ranging concept.

\textsuperscript{55} The term ‘active aging’ is meant to convey a more inclusive message than ‘healthy aging’. The semantic change is a recognition of the factors in addition to health care that affect how individuals and populations age. It allows scope for people to realize their potential for social as well as mental and physical well-being – reflecting therefore the WHO definition of ‘health’. In an active aging framework, policies and programmes that promote social connections and mental health are as important as those that improve physical health status.
incorporating in a complex way a person’s physical health, psychological state, level of independence, social relationships, personal beliefs and interaction to salient features in the environment.

An active aging approach to policy and program development has the potential to address many of the challenges of both individual and population aging. At a time when health, labor market, employment, education, recreation and social policies support active aging, there will potentially be: i) fewer premature deaths and fewer disabilities associated with NCD in older age, ii) improved quality of life as individuals grow older, iii) increased active participation of older people in the social, cultural, economic and political aspects of society, in both paid and unpaid roles and in domestic, family and community life, as well as, iv) lower costs related to medical treatment and care services. People who remain healthy as they age face fewer impediments to continue working. The latter is particularly important when considering the association of population aging with an increasing pressure to raise retirement ages – something that can already be witnessed throughout the developed world.

4.2.4.1 The Age-Friendly Cities Global Project

It is ultimately only through policies that are truly inter-sectorial that the full potential of the active aging paradigm will be realized. This was successfully achieved through the launching of the Age Friendly Cities Global Network in 2007. Aging and urbanization are indeed the two major demographic trends of the 21st century (see Chapter 2 for a brief description of the urbanization process in Brazil, which has been very rapid and has increased the proportion of people living in urban areas from 36.2% in 1950 to 81.2% in 2000). In 2005 the World Health Organization launched the “Age Friendly Cities” initiative. The starting point was Copacabana – the district in Rio more commonly known for its beach culture, youthfulness and joy of life. The reality of the area however, is more complex. Copacabana was urbanized at the beginning of the last century. The process reached its peak in the 1940s, 1950s and early 1960s when tens of thousands of young people flocked into this relatively small physical area. The survivors of these cohorts are still living there. They have “aged in place”. They are loyal to the district in part because of its physical beauty but also because it provides a walking distance concentration of all the services that in the end make their lives easier – shops, restaurants, banks, pharmacies and public transport.

Through a process of worldwide consultations in 35 cities – from Moscow, Tokyo, Melbourne and New Delhi to Nairobi, London, Mexico City and Rio de Janeiro – eight key features of an age-friendly city were identified and checklists for each of the key areas were developed. A guide, which incorporates these checklists, was prepared to help cities at all stages of development to see themselves through the lenses of older people in order to discovery where and how they can become more age-friendly. It is a tool for a city’s self-assessment and it is a map to chart progress.

In Brazil the project has taken particularly deep root in the State of Sao Paulo. A strategy has been devised by the Secretary of Health Aging Unit so that each of the 17 administrative regions of the State would have at least one city leading the process – that is, following the steps required for joining the WHO Global Network. From this ‘head’ city the project would cascade to other cities eventually making Sao Paulo the first “age friendly State” worldwide. Due to the size and complexity of Sao Paulo City, several local districts (“bairros”) are involved in the project.

4.2.4.2 The Age-Friendly Primary Health Care Approach

Increased longevity is unquestionably a success for public health and the result of social and economic development. However, it does bring major challenges to the health sector – particularly when population aging is as rapid as that being recently experienced by Brazil. Simply copying policies and programs from already aged societies will not work. They aged over many more decades - if not longer - and were by and
large wealthy countries by the time they had become old. Yet, they are still struggling to adequately respond to their aging.\textsuperscript{56}

As discussed in previous sections of this chapter, with aging comes an increased risk of developing non-communicable (NCD) chronic diseases and loss of functional capacity. Older people with disabilities need help to get through their daily tasks. Such help is most often provided by family members already stretched for time and resources. In order to prepare for unprecedented numbers of older people it is of utmost importance that health systems in these countries are better prepared to address the consequences of these demographic changes. This requires the adoption of a life course approach, as previously discussed. For instance, hypertension can mostly be prevented – yet more than half of the Brazilian elderly population is hypertensive. Once the condition is firmly established, it needs effective treatment – which often is not provided. In the absence of effective treatment complications emerge, with increased risk of neurological and cardiovascular diseases – for instance, a stroke. Prompt acute care can sharply decrease the risk of serious loss of functional capacity – but in its presence, rehabilitation should be provided as early as possible. Primary Health Care (PHC) plays a fundamental role in this chain that can be referred as the continuum of care in the community. Every single time it fails – consequently leading to institutional care – patients suffer and costs increase.

Most preventive health care and screening for early disease detection and NCD management should ideally take place in PHC settings at the community level. These PHC centers, to which people can self refer, also provide the bulk of ongoing management and care. PHC centers are on the frontline of health care and are therefore familiar to older people and their families. They are ideally positioned to provide the regular and extended contacts and on-going care that older persons need to prevent or delay disabilities resulting from chronic health conditions.

Brazilian health policies have experienced great advances with the implementation of the SUS. This granted universal access to health services as established by the 1988 Constitution. In 1994, the Ministry of Health launched the Family Health Program (PSF).\textsuperscript{57} This is a new strategy of health assistance, provided by a multiprofessional health staff offered to a certain number of families in small communities. They should be registered at the local health administration and are visited by the program’s staff. Residential institutions and nursing homes should also receive this visit. One of the main goals is to contribute to change the health care delivery system from curative care to preventive care.

For the first time, the 2008 PNAD collected information about the households which were registered in the PSF, which are about 27.1 million or 47.7% of the total of Brazilian households. Considering only the households where one can find at least one elder, this proportion is almost the same, 48.8%. As expected and shown in Table 4.8, coverage of the PSF is quite different across the five major regions. The highest coverage is found in the Northeast (67.3%) and the lowest in the Southeast (36.0%). When the presence of at least one elder with difficulties for the daily life activities (DLA) is considered, coverage increases to 52.6%. Regional differences present a similar pattern.

\textsuperscript{56} For instance, in 2003, France experienced a heat wave. As a result, the country’s health system, one of the most sophisticated in the world, failed miserably the elderly population. Thousands of older people died of heat, many of them in complete isolation – the alarm was raised by funerary parlours puzzled by the high demand, not by health or social care workers. And yet countries such as France first became rich and then grew old while developing countries are aging faster before being wealthy. What France and other European countries needed to have in place to protect their older citizens in face of the heat wave was a stronger PHC sector. That might have provided the community-based care to many isolated, frail elderly people.

\textsuperscript{57} Programa Saúde da Família.
Table 4.8
Proportion of Households Registered in the Family Health Program, Brazil 2008

<table>
<thead>
<tr>
<th>Region</th>
<th>Total</th>
<th>With Elderly Living in</th>
<th>With Frail Elders Living in</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>51.7</td>
<td>55.4</td>
<td>53.5</td>
</tr>
<tr>
<td>Northeast</td>
<td>64.8</td>
<td>67.3</td>
<td>68.4</td>
</tr>
<tr>
<td>Southeast</td>
<td>35.9</td>
<td>36.0</td>
<td>38.9</td>
</tr>
<tr>
<td>South</td>
<td>50.3</td>
<td>52.2</td>
<td>58.1</td>
</tr>
<tr>
<td>West</td>
<td>49.1</td>
<td>53.9</td>
<td>57.5</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>47.7</td>
<td>48.8</td>
<td>52.6</td>
</tr>
</tbody>
</table>

Source: PNAD 2008

In 2007/2008 IPEA carried out a census of all Brazilian institutions that provide long-term housing and services for the elderly (IPEA 2007, 2008a, 2008b, 2008c). Of the 3,549 institutions surveyed 1,576 were found to receive regular or sporadic visit of the staff of the PSF. This represents 47.8% of total Brazilian institutions, which points to a low coverage of the program. The proportion varies according to the institutions’ legal status and across Brazilian regions as can be seen in Table 4.9. For instance, even among public institutions coverage is below 70%. only a quarter of the for-profit institutions receive some visit of the PSF. When regions are considered, the highest coverage is found in the West region (69.9%), especially among public institutions, and the lowest in the South (38.0%), mainly among for-profit institutions.

Table 4.9
Number and Proportion of Institutions that Receive the Visit of the Family Health Program, Brazil 2007-2008

<table>
<thead>
<tr>
<th>Region</th>
<th>Public</th>
<th>Charity</th>
<th>Private</th>
<th>Total</th>
<th>Public</th>
<th>Charity</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>9</td>
<td>13</td>
<td>0</td>
<td>22</td>
<td>52.9</td>
<td>41.9</td>
<td>0.0</td>
<td>44.9</td>
</tr>
<tr>
<td>Northeast</td>
<td>9</td>
<td>150</td>
<td>2</td>
<td>161</td>
<td>50.0</td>
<td>61.2</td>
<td>5.3</td>
<td>53.5</td>
</tr>
<tr>
<td>Southeast</td>
<td>41</td>
<td>810</td>
<td>122</td>
<td>973</td>
<td>63.1</td>
<td>59.4</td>
<td>20.2</td>
<td>47.8</td>
</tr>
<tr>
<td>South</td>
<td>27</td>
<td>162</td>
<td>59</td>
<td>248</td>
<td>58.7</td>
<td>47.1</td>
<td>21.6</td>
<td>37.4</td>
</tr>
<tr>
<td>West</td>
<td>61</td>
<td>108</td>
<td>3</td>
<td>172</td>
<td>84.7</td>
<td>65.9</td>
<td>25.0</td>
<td>69.4</td>
</tr>
<tr>
<td>Total</td>
<td>147</td>
<td>1,243</td>
<td>186</td>
<td>1,576</td>
<td>67.4</td>
<td>57.9</td>
<td>20.0</td>
<td>47.8</td>
</tr>
</tbody>
</table>

Source: IPEA/SEDH/MDS/CNPq.

4.3 LONG TERM CARE

4.3.1 The Situation in Brazil

Long-term care (LTC) is a variety of services which help meet both the medical and non-medical need of people with a chronic illness or disability who cannot care for themselves for long periods of time. It is common for long-term care to provide custodial and non-skilled care, such as assisting with normal daily tasks like dressing, bathing, and using the bathroom. Increasingly, long term care involves providing a level of medical care that requires the expertise of skilled practitioners to address the often multiple chronic conditions associated with older populations. Long-term care can be provided at home, in the community, in assisted living or in nursing homes. Homecare may be formal or informal. Formal care is offered by specialized professionals and informal care is provided by family members, friends, neighbors etc. Long-term care may be needed by people of any age, even though it is a common need for senior citizens.

In this chapter people aged 60 and over who reported having difficulties with daily life activities (DLAs) are treated as the demand of long-term care. These elderly are also referred to as “frail”. Figure 4.6 shows that the proportion of the Brazilian population who reported experiencing some difficulties in performing
DLAs increases with age and is higher among women than among men. Also, this proportion decreased between 1998 and 2008. Nevertheless, in 2008 3.2 million persons were still found in need of long-term care, 2.0 million (63.0%) of them being females. This represents an increase of 1.0 million individuals in ten years and is in part due to the aging of the Brazilian population.

Figure 4.6
Proportion of the Brazilian Population who Reported to Experience Difficulties for Daily Life Activities by Sex and Age

Moreover, among the elderly in 2008 88.0% reported experiencing at least one of the 12 chronic diseases investigated by the PNAD. This proportion was 85.5% for men and 89.5% for females. The most important disease was blood pressure, which affected 58.9% and 66.6% of male and female elders respectively. Blood pressure, arthritis or rheumatism, back problems, heart diseases and diabetes were also very important (Camarano, 2010).

Approximately 85% of those with DLA difficulties received at least one old-age benefit in all three years considered (1998, 2003 and 2008). This proportion increases with age and is higher among men (see Figure 4.7). At the age of 80 and over, 93.4% and 88.0% of males and females received some old-age benefit in 2008. Few changes were observed between 1998 and 2008. The most important one is the decline in the proportion of people aged 60 to 64 years receiving an old-age benefit among both males and females, which suggests some postponement of the age of retirement (see Chapter 3 for a description of recent changes observed in retirement age in Brazil).

Source: IBGE/1998 and 2008 PNAD.

This includes contributory benefits, such as a retirement and survival pensions, as well as non contributory ones such as the Beneficio de Prestação Continuada (BPC).
As a consequence, almost 90% of these individuals’ income came from social security in the three years considered. This proportion is higher among women (89.9% in 2008) than among men (75.9% in 2008), due to the importance of survival pensions for women and the low proportion of labor income. The contribution of donations from other family members is quite low: it is higher among women and declined from 3.6% to 0.9% from 2003 to 2008. Individuals who need help for daily life activities and receive old-age benefits contribute to their family budget. To have a benefit may help them to receive support from other members of the family, that is, it stimulates a kind of two-way intergenerational cooperation. For example, women with DLA difficulties who lived with relatives in 2003 contributed to about a third of total household income (Camarano, 2006).

4.3.2 Informal and Formal Care in the World and in Brazil

The global picture of long term care is very complex. What is common is that no country can claim to have yet satisfactorily resolved all the issues. The rich world, with a much longer period to prepare and greater resources at its disposal, is still struggling to define the best delivery and financing systems of LTC. While developed countries did incorporate LTC into their research and policy agendas (Batista et al, 2008; Pasinato & Kornis, 2009; Brodsky et al, 2003; Howse 2007) and LTC has been absorbed into the social protection system in most of these countries, its scope and financing are still a subject of debate. Batista et al (2008) and Pasinato & Kornis (2010) group the developed country experience into three models. Esping-Andersen and Batista et al. added a fourth.

- **Social Democratic**: As exemplified mostly by Scandinavian countries where LTC has been a State obligation since the 1950’s. Funded by local taxes and transfers from the national government, here is found the largest supply of publicly-funded universal care services. There is no requirement of previous contribution or proof of poverty. Services are comprised of both formal homecare and institutional care. (Denmark, Sweden).

- **Conservative**: Within this model the supply of service is reduced and cash benefits (subsidies/ social insurance) are prioritized. Care is largely provided by charitable institutions with funding derived from both private and public sources in varying degrees. (France, Germany, Japan).
Liberal: This model is characterized by a low offer of both public and private social services. The main focus is on poverty reduction with contributory and non-contributory benefits of low value. LTC for the poor is funded from general taxation with private insurance catering for the non-poor. The general orientation is to retain the elderly in their households. (USA).

Mediterranean: Also characterized by a low offer of both public and private social services, this model places LTC firmly in the hands of the family. Institutional care of any kind is extremely minimal within this model. (Italy, Greece, Portugal).

Whether by design or default, it is informal care of the elderly that predominates throughout the world. According to Jacobzone et al (2000) it accounts for an estimated 80% of the LTC within the OECD countries.

In Brazil, as in most developing countries, the extent of government involvement is low. Elder care receives little importance in the policy agendas and legislation has clearly bestowed the main responsibility on the family (1988 Federal Constitution; 1994 National Policy for the Elder; 2003 Elders’ Bill of Rights). This family care occurs with little support from the State. Public home care programmes are scarce. Furthermore, there exists strong prejudice against institutional care in Brazil and government legislation has compounded this bias (Camarano 2008). The 2003 Elders’ Bill of Rights stresses that institutional care is regarded only as an option upon evidence of lack of family, poverty or abandonment (Art. 37; Para. 1). There is no consensus in Brazil on what defines a residential institution but an historical view persists – that they are places of exclusion or “elder deposits” (Novaes 2003). Sheltering the needy elderly has traditionally been left to Christian philanthropy and residence was the consequence of poverty. It remains a fact that the majority of Brazilian institutions are charities (IPEA 2007, 2008a, 2008b, 2008c).

4.3.3 Family Changes and the Provision of Informal Long Term Care

In Brazil as elsewhere, historical social and family values and practices have determined that care is a female responsibility. Not only do women make up the larger proportion of the older population and are the most in need of care, but they are also overwhelmingly the principal caregivers (Lloyd Sherlock 2004). The availability of women to perform this function is subject to broader social considerations. Factors such as increased female education, a larger role for women in the labor market, changing patterns of nuptiality/family breakdown, migration and the reduced pool of children to draw from in the first instance, are inevitably creating new paradigms. In addition, a general lack of recognition and outside support for caregivers through sensible public policies further weakens the role. Failures to put in place networks and vocational training programs are missed opportunities for both the caregivers and the society at large.

Table 4.10 suggests that the main potential source of support of the aged males is the spouse and for the females, the children. In 2008, while the large majority of males, 76.9%, live with their spouses, with or without children, the comparable proportion of females is only 43.2%. On the other hand, 48.0% of the women live with children, whether or not in the presence of spouses. The comparable proportion for men is similar, 45.6%. The presence of relatives or domestic servants in households with frail elders who do not have spouses or children is found in 12.8% of households where the frail elder is male and in 27.3% in the case of female frail elders. Summarizing, the data suggest that frail women are less likely than men to get family support.
Table 4.10
Proportion Distribution of Elders with Difficulties for Daily according to Family Composition by Sex, Brazil 1998, 2003 and 2008

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Couples without children</td>
<td>23.7</td>
<td>12.2</td>
<td>16.6</td>
<td>26.5</td>
<td>12.5</td>
<td>17.8</td>
<td>28.2</td>
<td>14.4</td>
<td>19.5</td>
</tr>
<tr>
<td>Couples without children and others</td>
<td>7.2</td>
<td>6.7</td>
<td>6.9</td>
<td>7.7</td>
<td>6.2</td>
<td>6.8</td>
<td>7.9</td>
<td>6.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Couples with children</td>
<td>23.8</td>
<td>9.0</td>
<td>14.7</td>
<td>20.5</td>
<td>7.4</td>
<td>12.3</td>
<td>20.9</td>
<td>7.0</td>
<td>12.1</td>
</tr>
<tr>
<td>Couples with children and others</td>
<td>24.5</td>
<td>19.7</td>
<td>21.5</td>
<td>20.7</td>
<td>18.9</td>
<td>19.6</td>
<td>20.0</td>
<td>15.4</td>
<td>17.1</td>
</tr>
<tr>
<td>Women Alone</td>
<td>0.0</td>
<td>13.6</td>
<td>8.4</td>
<td>0.0</td>
<td>15.2</td>
<td>9.5</td>
<td>0.0</td>
<td>15.5</td>
<td>9.8</td>
</tr>
<tr>
<td>Women Alone and others</td>
<td>1.4</td>
<td>12.0</td>
<td>7.9</td>
<td>2.5</td>
<td>11.4</td>
<td>8.0</td>
<td>2.3</td>
<td>11.7</td>
<td>8.2</td>
</tr>
<tr>
<td>Mother with children</td>
<td>0.1</td>
<td>11.0</td>
<td>6.8</td>
<td>0.3</td>
<td>10.1</td>
<td>6.4</td>
<td>0.3</td>
<td>11.7</td>
<td>7.5</td>
</tr>
<tr>
<td>Mother with children and others</td>
<td>2.1</td>
<td>12.5</td>
<td>8.5</td>
<td>2.7</td>
<td>14.7</td>
<td>10.2</td>
<td>2.9</td>
<td>13.9</td>
<td>9.8</td>
</tr>
<tr>
<td>Men Alone</td>
<td>8.4</td>
<td>0.0</td>
<td>3.2</td>
<td>10.0</td>
<td>0.0</td>
<td>3.7</td>
<td>10.3</td>
<td>0.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Men Alone and others</td>
<td>2.4</td>
<td>2.6</td>
<td>2.5</td>
<td>3.0</td>
<td>3.3</td>
<td>3.2</td>
<td>2.5</td>
<td>3.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Father with Children</td>
<td>3.3</td>
<td>0.1</td>
<td>1.3</td>
<td>3.7</td>
<td>0.0</td>
<td>1.4</td>
<td>2.6</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Father with Children and others</td>
<td>3.2</td>
<td>0.7</td>
<td>1.7</td>
<td>2.4</td>
<td>0.4</td>
<td>1.2</td>
<td>2.1</td>
<td>0.4</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


Table 4.10 also shows that the proportion of frail elders who resides with spouses or children decreased between 1998 and 2008. This reduction was much higher among males if the presence of children is considered and much higher among females if the presence of spouses is considered. On the other hand, the proportion of males and females who live on their own increased. As a result, in 2008 10.3% of men and 15.5% of women with DLA difficulties declared living alone. An additional 2.5% of the frail men and 11.7% of the frail women declared living alone with other non-family members. This reveals a reduction in female capacity to take care of their members, which was already pointed out in previous studies by Camarano, Pasinato and Lemos (2007) and Camarano (2008). In turn, this generates pressure on the government to offer formal care services (either institutions- or home-based).

Figure 4.11 shows the position in the household of elders who experience DLA difficulties. All indicators vary dramatically by sex. While 72.1% of the males headed their households, only 44.4% of the women did so, 26.0% being spouses. On the other hand, while 28.8% of the female elders lived in the households of their children, son-in-laws or other relatives, the comparable proportion for male elders was 14.3%, which indicates a higher dependence upon the family. It is likely that they left their own home to look for support. Fragile elders who live by themselves or with relatives are the group of persons most exposed to family violence and/or most likely to live in residential institutions or nursing homes.59

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59 See for instance: Branch and Jette, 1982; Breeze et al., 1999; Gaugler et al., 2007; Grundy and Jitlal, 2007; Nihtilä and Martikainen, 2008; Wolinsky et al., 1992).
Figure 4.8
Distribution of Elders with Difficulties for their Daily Life Activities according to their Household Position by Sex, Brazil 2008

Source: PNAD 2008

It is important to understand the relationship of the elderly with the younger household members in Brazil since the latter currently experience difficulties in their transition to adulthood, especially in finding employment and independent housing arrangements. For instance, the average number of members in households with frail elders in the position of heads or spouses is 2.8, (see Table 4.8). These families are therefore composed of elders and non-elders. In fact, in 42.2% them, one may find adult children (i.e. a person aged 21 and over) living there. Of such adult children, 37.6% do not work and do not study. They probably count on parental income for their living and provide some help in exchange. As a matter of fact, in these household the contribution of the frail elders to household income was 54.6% in 2008 and the comparable contribution for children was 19.9%. This means that frail elders do need help but also provide help, at least in financial terms.

Table 4.11
Some Characteristics of Households with Frail Elders as Household Heads in Brazil, 2008

<table>
<thead>
<tr>
<th>Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Number of Members</td>
<td>2.8</td>
</tr>
<tr>
<td>% of Households with Children aged 21 and over living in</td>
<td>42.2</td>
</tr>
<tr>
<td>% Children living in who work</td>
<td>59.7</td>
</tr>
<tr>
<td>% Children living in who study</td>
<td>7.6</td>
</tr>
<tr>
<td>% Children living in who not work and not study</td>
<td>37.6</td>
</tr>
<tr>
<td>Contribution of frail elders to family income</td>
<td>54.6</td>
</tr>
<tr>
<td>Contribution of adult children to family income</td>
<td>19.9</td>
</tr>
</tbody>
</table>

Source: IBGE/2008 PNAD.

Also frail elders who live in the households of their children, in-laws or other relatives contribute to family income as seen in Figure 4.9. Male elders contribute to their family budget with about 30% and females with a quarter. It was already suggested that they live with their children in order to be helped but provide help as well. In fact, one may say that it is a system of two-way intergenerational transfer.

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60 For details see: Camarano, Mello and Kanso (2006), among others.
mediated by the old-age social protection policy. To have a benefit or some income may help the frail elder to receive family care.

Figure 4.9
Contribution to Family Income from Elders with Difficulties for their Daily Life Activities according to their Position in the Household by Sex, Brazil 2008

Source: PNAD 2008

4.3.4 Brazilian Long Term Care Institutions

In Brazil there is no consensus about what residential institutions should provide to the elderly they host. They are sometimes seen as social assistance institutions and sometimes as health institutions. As its origin comes from the asylums (which traditionally used to receive persons abandoned and/or unwanted by society such as elders, people with mental diseases, orphans, beggars, etc.) one of the most important reasons for looking for an institution is poverty and lack of housing. According to Groisman (1999), institutions are not directed to clinic or therapeutic practices, although residents receive not only housing, feeding and clothing, but also health services and medicines. Nevertheless, population aging and the increase of the survival of people with reduction of the physical, cognitive and mental capacities increasingly require that institutions offer something more than just shelter or residence.

There are few LTC institutions in Brazil. They accommodate less than 1% (96,969 individuals) of the elderly population in 3,549 sites. Unsurprisingly given that the bulk of the elderly population resides there, they are concentrated in the Southeast (34.4% in Sao Paulo) and in the larger cities. 72% of Brazilian municipalities have no institutions at all. This rises to 90% in the North region. The majority of those that do exist are charities (65.2%). The private sector accounts for 28.2% and the public sector accounts for only 6% (IPEA 2007, 2008a, 2008b, 2008c).

Among residents, 57.3% are females. Most residents, 36.3%, are aged 80 years and over and only 11.9% are aged less than 60. The age/sex composition of these residents is presented in Figure 4.10 and compared to the age/sex distribution of the overall elder population in the country. It is observed that the proportion of the elderly population diminishes with age and that of residents increases. This behavior is more marked among women, which confirms finding of the literature that associates old age with frailty.
The main source of revenue for all the institutions is fees paid by the residents or their relatives. The Elders` Bill of Rights stipulates that up to 70% of the older person`s social benefits can be paid into an institution. Some tax exemptions are available to charities and there are often contributions from government/university staff as well as voluntary personnel. The small public sector also receives additional government help in the form of medical provision, specialized staff and medical services. As in most developing countries, the offer of institutional care is small in Brazil. Furthermore, the direct contribution of the government toward these institutions is also small. Moreover, the institutions that do exist tend to be small\(^{61}\) and are operating at full capacity (Camarano, 2010)\(^{62}\).

### 4.3.5 Projections

In Brazil an increase is expected of the demand for formal long-term care due to the aging of the elderly population and the reduction in the supply of family caregivers. This is the result of fertility reduction, mortality decline at advanced ages, changes in nuptiality and in family arrangements and the steep increase in women`s participation in the labor market. Migration of young adults, which weakens intergenerational ties and support mechanisms is another important factor to take into account.

Demographic change is not the only factor that explains increase in the demand for long-term care and the pressures on public expenditures. According to Jacobzone, Camboias and Robine (2000), there seems to be no relationship between public expenses for long-term care as a share of GDP and the proportion of the very old population. The key variables to understand such relationship are the health conditions of the elderly population and the arrangements for their care. The author analyzed OECD countries and found that the potential effects of population aging may be partly offset by a relative improvement in the functional health of the old population, which may even be accompanied by a decrease in the demand for formal long-term care. The authors also showed that although morbidity has increased among older persons in France and in the United States, general conditions of life have improved.

\(^{61}\) On average, 28.3 people live in each institution and each bedroom hosts 2.2 people.

\(^{62}\) About 90% of the beds in all institutions are occupied.
One of the main policy implications of the study, however, is that it would not be prudent for policymakers to count on future reductions in the prevalence of severe disability among the elderly to offset the increasing demand for long-term care originating from population aging. Even though disability prevalence rates have declined to some extent in some countries, population aging usually leads to increasing numbers of people at older ages with some disability that requires long-term care (Lafortune and Balestat, 2007).

In other words, the proportion of elderly persons which will demand long-term care may decrease as a result of improvements in health prevention, postponement of the incapacities and their better management. Nevertheless, the rapid increase in the numbers of the very old population is likely to produce an increase in the number of those demanding long term care. At the same time, concerns with the reduction of the commitments of the younger generation to older persons may be exaggerated. The decline in the supply of care by close relatives such as children, nephews, siblings may be at least partially compensated for by the supply of stepchildren and higher survival rates of the spouses.

The next sections present four scenarios for long-term care demand and supply in 2020, 2030 and 2040 in Brazil. Besides considering the increase in the numbers of the very old population that cannot perform daily life activities by themselves, it also considers changes in the family capacity to take care of them. It is certain that the numbers of the very old population in Brazil will dramatically increase in the next thirty years, but there is no certainty regarding their health conditions. Also, there is no certainty about family arrangements for long term care. Two scenarios are built for health and family care arrangements each.63

4.3.5.1 Demand of Long-Term Care

Many population projections have already pointed to a sharp increase in the numbers of the elderly population.64 This section considers Camarano and Kanso’s (2009) projection. It points to an annual growth rate of 5.5% for this age group between 2010 and 2040. This means 13.7 million individuals aged 80 and over in 2040, 60.5% composed of females. It also means 10.9 million more very old people than in 2010. Considering the whole group aged 60 and above, one may expect to find 55.8 million in 2040. See Figure 4.11, which shows not only an increase in the elderly population but also a change in its age composition.

---

63 This method has already been used in some OECD projections. See, for instance, Lafortune and Balestat, 2007.
64 See, for instance, IBGE (2008), Camarano and Kanso (2009).
Regarding health conditions, the first scenario assumes that the proportions of frail elders\textsuperscript{65} will remain constant at the same level as those observed in 2008, and the second scenario that such proportions will decline yearly at the same pace as that observed for Great Britain during 1995-2002 where a decline was observed in the proportion of persons aged 65 and over who reported to have difficulties for performing at least one of the basic daily life activities of 2.6\% and 1.6\% for males and females respectively. For the purpose of projections these proportions are disaggregated by age and sex. This will allow analyzing the impact of the demographic factors on the one hand and of functional health on the other. Both scenarios assume that the impact of other exogenous remains constant.

Table 4.12 presents the results. If no more improvements in the health conditions of the elderly occur until 2020, one may expect approximately 4.5 million frail elders in 2020, which represent 1.3 million more than those observed in 2008. Among them, 62.7\% would be female elders. Also in this scenario, in 2040 10.2 million elders will need long-term care. This figure is 3.4 times higher than that of 2010.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline
 & \textbf{Population 60+} & & \textbf{Frail elders} & & \\
 & Male & Female & Total & Scenario 1 & Male & Female & Total & Scenario 2 & Male & Female & Total \\
\hline
\textbf{2010} & 8,753 & 10,992 & 19,745 & 1,139 & 1,883 & 3,021 & 1,071 & 1,798 & 2,870 \\
\textbf{2020} & 12,683 & 16,169 & 28,852 & 1,675 & 2,817 & 4,492 & 1,114 & 2,085 & 3,199 \\
\textbf{2030} & 17,813 & 23,086 & 40,899 & 2,502 & 4,260 & 6,762 & 1,494 & 2,746 & 4,240 \\
\textbf{2040} & 24,251 & 31,532 & 55,783 & 3,743 & 6,435 & 10,178 & 2,059 & 3,620 & 5,679 \\
\hline
\end{tabular}
\caption{Some Scenarios for Elder Population and Frail Elders (000s)}
\end{table}

Source: Camarano (2010).

On the other hand, if the proportion of frail old people decreases as a result of various improvements, probably about 3.0 million elders will need long-term care in 2020, a figure slightly lower than that observed in 2008. Also, females predominate in this group. It is clear in the second scenario that improvements in health conditions may compensate for demographic growth till 2020. Moreover, demanders of LTC will increase after this year in spite of the improvements in health conditions. The

\textsuperscript{65} It is considered the proportion of persons who cannot perform by themselves their daily life activities such as going to the bathroom, eating and bathing, as defined by the PNAD.
figure projected for 2040 will be twice as large as that for 2010. Comparing the results for the two scenarios, improvements in health conditions, as hypothesized, may “save” about 500 thousand demanders of LTC in 2020 and about 4.5 million in 2040. These results stress the importance of greater policy efforts to prevent or postpone as much as possible health and disability problems among elderly people.

4.3.5.2 Offer of Female Caregivers

We assume that potential caregivers are females aged 20-69 years who report experiencing no difficulty in carrying out daily life activities and who do not participate in the labor market. They are spouses, daughters or other relatives living in the same household as the elderly demanding care. Single individuals are more likely to be a caregiver than married ones. It is recognized that there are family caregivers who do not live in the same household as the elder, but PNAD data do not allow identification of these individuals.

Figure 4.12 shows the proportion of potential female caregivers by age group in 1998, 2003 and 2008. Such proportion decreased for all age groups. Overall, it decreased from 37.0% to 27.4% between 1998 and 2008. At the same time, the female activity rate increased from 53.8% to 60.5% during the same period. The ratio among potential caregivers to observed demanders declined from 7.9 to 5.2 between 1998 and 2008. This means an increase in the potential demand of formal long-term care.

Two scenarios for the projections of future caregivers are presented. The first one keeps the proportion of potential caregivers constant at the same level as those observed in 2008 for each age group. The second one assumes a decrease in such proportion until 2020 taking into account the annual variation observed between 1998 and 2008. After 2020 until 2040, 50% of that variation is assumed.

4.3.5.2 Conclusions

The combination of the two scenarios of potential demanders and of potential caregivers result in four scenarios for the potential demand and family arrangements for long-term care. Table 4.13 shows the ratios among potential caregivers and potential care demanders projected for 2020 and 2040. The value of such ratio was 5.2 in 2008. In most of the cases, a decrease is expected in the supply of informal care. The
only exception is for 2020, when it is assumed that the proportion of frail elders will diminish and that of caregivers will be kept constant.

Table 4.13
Projection of the Ratio Caregiver to Frail Elder, Brazil

<table>
<thead>
<tr>
<th></th>
<th>Caregiver 1</th>
<th>Caregiver 2</th>
<th>Caregiver 1</th>
<th>Caregiver 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frail 1</td>
<td>4.3</td>
<td>2.5</td>
<td>2.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Frail 2</td>
<td>6.0</td>
<td>3.5</td>
<td>3.7</td>
<td>1.0</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Camarano (2010).

The results of the four scenarios in terms of care arrangements for frail elders are presented in Table 4.14. The expected number of frail elders is disaggregated in two groups: those who can expect to be taken care of by their families and those who would need formal care. Considering that in 2008 about 500,000 persons, i.e. 16.1% of the frail elders, were not taken care of by a family caregiver because they were living in institutions or living by themselves, three of the four scenarios point to an increase in the demand for non-family care.66

Table 4.14
Expected Number of Frail Elders by Family Care Arrangements (000s), Brazil

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>2020</th>
<th>2040</th>
<th>2020</th>
<th>2040</th>
<th>2020</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>With</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Family</td>
<td></td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Without</td>
<td></td>
<td>Without</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3,693</td>
<td>800</td>
<td>6,762</td>
<td>4,016</td>
<td>6,162</td>
<td>10,178</td>
</tr>
<tr>
<td>2</td>
<td>3,693</td>
<td>493</td>
<td>4,240</td>
<td>4,016</td>
<td>1,663</td>
<td>5,679</td>
</tr>
<tr>
<td>3</td>
<td>2,142</td>
<td>2,350</td>
<td>6,762</td>
<td>1,128</td>
<td>9,050</td>
<td>10,178</td>
</tr>
<tr>
<td>4</td>
<td>2,142</td>
<td>1,057</td>
<td>4,240</td>
<td>1,128</td>
<td>4,551</td>
<td>5,679</td>
</tr>
<tr>
<td>2008</td>
<td>2,741</td>
<td>528</td>
<td>3,269</td>
<td>2,741</td>
<td>528</td>
<td>3,269</td>
</tr>
</tbody>
</table>

Residents in Institutions 2008 | 97
Living Alone 2008 | 431

Source: Camarano (2010).

Scenario 4 seems to be the most plausible as it assumes a decrease in the proportion of frail old people as a result of improvements in health prevention and postponement and better management of disabilities given the development of new assistive technologies. Even so, one may expect an increase in the demand for formal care due to family changes and population aging. In 2020 twice as many people and in 2040 five times as many people as in 2008 would be taken care of by non-family members. Assuming Considering the same type of arrangements elders had in 2008 remain the same, Brazilian residential institutions would have to double their capacity by 2020 and increase it by eight times by 2040 to meet this increased demand. PNAD data do not provide information on what kind of arrangements are in place for people living alone. Probably, they rely on support from a domestic helper or a formal caregiver whose demand will also increase (see Table 4.15).

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66 Almost 40% of the institutional residents are non-frail persons who need shelter. This demand is not being considered here.
### Table 4.15
#### Expected Number of Frail Elders Not Cared by Families (000s), Brazil

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>2020</th>
<th></th>
<th></th>
<th>2040</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Living Alone</td>
<td>Institutions</td>
<td>Total</td>
<td>Living Alone</td>
<td>Institutions</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>653</td>
<td>147</td>
<td>800</td>
<td>5,030</td>
<td>1,132</td>
<td>6,162</td>
</tr>
<tr>
<td>2</td>
<td>-403</td>
<td>-91</td>
<td>-493</td>
<td>1,358</td>
<td>306</td>
<td>1,663</td>
</tr>
<tr>
<td>3</td>
<td>1,918</td>
<td>432</td>
<td>2,350</td>
<td>7,387</td>
<td>1,663</td>
<td>9,050</td>
</tr>
<tr>
<td>4</td>
<td>863</td>
<td>194</td>
<td>1,057</td>
<td>3,715</td>
<td>836</td>
<td>4,551</td>
</tr>
<tr>
<td>2008</td>
<td>431</td>
<td>97</td>
<td>528</td>
<td>431</td>
<td>97</td>
<td>528</td>
</tr>
</tbody>
</table>

Source: Camarano (2010).

These scenarios should not be seen as forecasts, but as an instrument for highlighting the importance of dynamic factors in projecting future social needs. Although population aging is a demographic process, it is also a dynamic process that affects and is affected by public policies. Future developments in the prevalence of severe disability among elderly people are difficult to predict because a number of factors may be affecting either positively or negatively old-age disability rates in the future. On the positive side, further improvements in the socioeconomic status of new generations of elderly people, including rising levels of education and rising income and better living conditions can be expected to play a positive role in improving the health and functional status of the elderly. The gradual reduction in some health risk factors to health such as smoking can also play a positive role. On the negative side, the rising prevalence of certain chronic conditions such as arthritis and diabetes and of important risk factors, such as hypertension and obesity, can be expected to reduce functional capacity among the elderly, unless greater efforts are made to address them (Lafortune and Balestat, 2007).
Chapter 5  
Productivity and Education  

5.1. INTRODUCTION  

The overall economic output of a country is, everything else equal, determined by its labor force participation and associated productivity. A first, positive consequence of the demographic transition is a larger share of the working age population, which has larger participation rates and, therefore, provides an opportunity for accelerating economic growth and increasing public revenues. However, as the demographic transition progresses, the share of the working age population eventually starts declining, labor force participation rate becomes smaller and more fiscal pressure is generated mainly to support health and social security expenditures. The larger the old dependency ratio grows the more labor market behavior at older ages becomes an important factor to determine the overall size of the working population.

Usually, labor force participation has an intimate relationship with retirement. Chapter 2, however, showed that these two measures are only weakly related in Brazil. While early retirement\(^6\) is common, individuals continue working for quite a long time after that, mainly in the informal sector thus without contributing to the social security system.

One of the reasons for this early retirement pattern could be the fact that older workers tend to have more health problems and may be less productive than younger ones. If older workers are less productive than young ones, firms could substitute them for younger workers, providing them the opportunity to retire early, get the pension benefit, and sometimes, rehiring them with an informal contract. In the first study addressing the relationship between productivity and age, Lehman (1953) revealed a creative age curve showing productivity starting to increase in creative occupations such as the sciences, arts and athletics at around 20, reaching a peak in the period from the late thirties to the mid-forties, and beginning to decline thereafter. Subsequent studies have supported this thesis, although they have stressed also that the effect of aging on productivity depends on the occupation [see Skirbekk (2003) for an overview of these studies]. In occupations that are more dependent on cognitive abilities, such as the scientific ones, the young usually have an advantage. But in managerial occupations, where experience is a more important factor for job performance, older workers tend to perform at least as well as the younger counterparts.

The impact of population aging on productivity at the macro level is not clear. It is known that productivity is enhanced, among other things, by improvements in knowledge and is closely related to innovation, such as new working methods and new technologies. Because innovation is intimately related to creativity, and creativity is often higher among the younger members of society, a higher share of older workers would have a negative effect on productivity growth [see UN (2007)]. However, the human capital theory predicts that demographic changes as the ones that Brazil has been experiencing tend to result into families investing more on their children’s human capital, which could contribute to balance the negative aggregate impact of an older, less creative population on productivity. Furthermore, a smaller share of young age population would make public investments on education and early training collectively cheaper, which, in turn, would make old age re-training more efficient to improve labor force productivity.

Another possible problem resulted from the demographic transition is the imbalance between labor force productivity and labor force costs. If, for some reason, firms pay seniority wages even with a declining age-productivity profile this may be a source of major difficulties in terms of competitiveness,

\(^6\)Retirement here is defined as receiving a pension. Early retirement refers to retirement before age 60.
profitability, investment and all related variables. Although the neoclassical theory predicts that firms pay the marginal productivity of each worker as a wage, we will see in section 5.4 that there are incentive contract and legislation reasons for this pattern does not be observed.

This chapter presents a discussion of how the labor market productivity in Brazil would change as a result of the demographic transition and how this change, in turn, would affect economic growth and public finance. It focuses on issues related to the age-productivity profile, opportunities to improve education and training investments, and the wage productivity gap. In a nutshell, the consequences of population aging are the following: (i) the working age population is becoming smaller; and (ii) the share of the most productive individuals within the labor force is also becoming smaller. Hence, if the overall production/output is to be maintained, some measures/interventions are needed to increase labor force participation and/or productivity.

The rest of this chapter is divided as following: Section 5.2 discusses the effect of age on labor force productivity, and consequently on productivity growth; Section 5.3 shows how improvements on education and on-the-job training could reverse the trend of declining age-productivity effects and describes Brazil’s situation in these areas; Section 5.4 presents a discussion about differences between age-productivity and age-wage profiles; and, finally, Section 5.5 presents evidence about the effect of aging labor force on firm’s productivity among Brazilian industrial firms.

5.2 THE AGE – PRODUCTIVITY PROFILE

A large body of evidence supports the idea that cognitive abilities decline from some stage of in adulthood. On the basis of 91 studies, which investigate how mental abilities develop over the life cycle, Verhaegen and Salthouse (1997) conclude that the cognitive abilities (reasoning, speed and episodic memory) decline significantly before 50 years of age and more thereafter. Maximum levels are instead achieved in the 20s and the 30s.

However, not all kind of abilities are supposed to decline with age. These psychometric studies mentioned in previous paragraph divide the abilities between fluid abilities and crystallized abilities. Fluid abilities concern the performance and speed of solving tasks related to new material, and they include perceptual speed and reasoning. They are strongly reduced at older ages. Crystallized abilities, such as verbal meaning and word fluency, even improve with accumulated knowledge and remain at a high functional level until a late age in life. Hence, one should not expect to see the declining part of the age-productivity profile to set in equally for all tasks and jobs.

Several empirical studies have supported these ideas. Most research has shown that older workers are at a disadvantage (compared to younger workers) in professions that use a lot of cognitive abilities (such as memory, speed, etc), but have an advantage in professions that require verbal abilities, capacity to communicate or managerial experience. Moreover, older workers seem to be less productive in sectors that are most innovative, as they have more difficulty to make adjustments in such rapidly changing environments than younger workers [see Daveri and Maliranta (2007)].

Further, even if we believe that individual productivity decline with age, it is not a certainty that productivity will decline in aggregated terms. Blanchet (1992) pointed out that it is one thing to observe productivity problems for aging workers, but this is not sufficient to prove the plausible changes in the proportion of old workers will turn this individual problem into significant macroeconomic one. According to him, there is a limit to the total effect of demographic on productivity in aggregated levels, which would not be at all negligible over the short run, but given that changes are expected to occur over a very long time span, they will be easily overwhelmed by all other potential sources of productivity growth.
The literature analyzing the effect of demographic on productivity in aggregated levels is divided by papers that use firm’s level and papers that use macroeconomic data. The first group usually reaches the conclusion that productivity of firms decline with the raise of the proportion of older workers (see section 5.4). The second group analyzes this effect based on growth theory and uses cross-country data with controversial finds. Feyrer (2007) finds that the share of workforce above 50 years old is negatively correlated with productivity and growth. Using Canadian provincial data, Tang and MacLeod (2006) also show that the share of old workers is negatively correlated with productivity and growth. However, using the same methodology, Lindh and Malmberg (1999) find evidence that a higher share of population between 50 and 64 is related to higher growth.

Finally, even taking into account the literature that uses firm estimations and finds negative effect of aging on productivity it is important to note that the relative demand for work tasks involving certain cognitive abilities could shift in different ways over time. If the demand for interactive skills, which are abilities that are relatively stable over the life cycle, increases more than demand for mathematical aptitude, which declines substantially by age, the value of labor market experience would increase and the effect of aging on productivity could be smaller than expected or even reversed. Also, in many countries including Brazil population has become more educated, which makes training more efficient to avoid human capital depreciation at older ages, as discussed in the next section.

Brazil has not much evidence about age – productivity profile. Most papers provide information about life cycle wage profile, but as we will see in the next sections, not always this is the same as the age – productivity profile. One way to analyze the outcome of older workers in labor market is to present the share of employed workers in the formal sector by age (see Figure 5.1). The share of older workers in the formal sector is much smaller than the share of younger workers, with a peak in the 40-44 age group. It will be shown in section 5.4 that the same thing doesn’t happen with wages.

![Figure 5.1: Percentage of Formal Workers, by Age and Birth Cohort](source)

This could be a sign that the productivity of older workers is smaller in average than the productivity of younger ones, although is necessary more robust evidence, which will be provided in section 5.5. Informal sector is much less productive than formal sector, as it has less access to credit market and less comparative advantage to compete for more skilled workers (see the box 5.1 about informality in Brazil).
Box 5.1 Informality in Brazil

Informality in the labor market is a big problem in Brazil. Although the share of informal workers has decreased recently (from 52.1% to 48.4% between 2002 and 2007), it remains very high. Informal workers do not contribute to social security system, receive much lower wages and do not have either protection against health problems and unemployment or access to old-age social security benefits when retired. In Brazil employers are required to withhold 11% of the employee's wages for Social Security and a certain percentage as Income Tax (according to the applicable tax bracket). The employer is required to contribute an additional 20% of the total payroll value to the Social Security system. Depending on the company's main activity, the employer must also contribute to federally-funded insurance and educational programs. There is also a required deposit of 8% of the employee's wages into a bank account that can be withdrawn only when the employee is fired, or under certain other extraordinary circumstances (called a "Security Fund for Duration of Employment"). All these contributions amount to a total tax burden of almost 40% of the payroll for the employer and 15% of the employee's wages, which generates a lot of incentives for firms to keep wages off-book, especially because the official supervision is weak. High payroll taxes can also provide incentives for informality by reducing the net earnings gap between the formal and informal sectors or self-employment. The point to make here is that for workers who have the choice between working in the formal vs. informal sector or self-employment, other things being equal, reducing net earnings in the formal sector makes it less attractive. Employees are then more likely to collude with employers and avoid registering with the social security, choose jobs that do not enroll workers, or become self-employed. Low labor productivity in small production units might also "force" evasion if the value of output per worker is below the minimum official cost of labor (minimum wage plus social charges). Simulations using matching models suggest, for instance, that pay-roll taxes would reduce incentives to create vacancies in the formal sector thus forcing workers, particularly middle and low productivity workers, into the informal sector [see World Bank (2009)]. Melo and Santos (2009) show that improvement in workers education composition explains a huge part of the decrease in informality between 2002 and 2007. As Brazilian worker’s average education is expected to continue to increase, the formalization process is expected to continue. However, it is also necessary to improve it institutional and policy framework to reduce incentives for informality and strengthen the enforcement process.

5.3 OPPORTUNITIES TO IMPROVE EDUCATION AND ON-THE-JOB-TRAINING

This section will look at the consequences of population aging on the opportunities to improve labor force skills, dividing the analysis in two types of skill formation: formal basic education and on-the-job training.

5.3.1 Formal Basic Education

One of the consequences of population aging is that the share of population in school age will decrease very much. Blanchet (1992) calculates the optimal adjustment of educational policies as a response to changes in the demographic structure. According to him, aging the population resulting from lower population growth makes more attractive a relative increase in schooling and on-the-job training. This mainly takes the form of a longer stay in the educational system before entry to the labor market (the age at first entry is raised by about 4 years, which is not a marginal change). This can be explained by cost considerations. Schooling is more costly from a collective point of view in an economy where young age groups are relatively important. This collective cost is reduced when population grows more slowly, so that lengthening the initial phase of capital accumulation is possible.

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68 Although Brazil has a free universal health system, companies offer a health insurance, linked to the social security system, which provides better health assistance in the private sector.

69 Of course, this depends also on the calculations of the benefits they would receive for being in the formal sector.

70 This is an issue that is being analyzed in the case of Brazil. There is evidence for other countries, however, showing that a sizable share of firms in the manufacturing sector have productivity levels below the official cost of labor [see World Bank (2007a), and (2009)].
As explained in Chapter 2, the young dependency ratio has been decreasing in Brazil since 1965 and will continue to do so in the foreseeable future. This will make it possible to increase investment per student without increasing the amount of resources for education as a share of GDP. Moreover, the size of the junior workforce (15-24) has also already started to decrease, which makes it easier to finance policies to better qualify this segment, and consequently, makes it easier for them to find a first job. Figure 5.2 shows the unemployment rates in Brazil by age group. Unemployment rates at 15-17 and 18-24 ages are much higher than unemployment rates at 24-49 ages and above 50 years old, showing the importance of policies that help young workers to find their first job and acquire experience.

![Figure 5.2](image)

Source: Rocha (2010)

Aging population has impact on education investment not only from a collective reduced cost point of view, but also by changing individual education choices. The human capital theory predicts that in societies with higher life expectancy at birth, coeteris paribus, families have incentives to invest more in education. This is because as people live longer, they take advantage of the returns to education for a longer period of time. The consequence of investing more in education, given a limited budget, is to have fewer children. At the same time, lower infant mortality usually requires families to have fewer children in order to reach the total number of desired surviving children. This, in turn, also implies fewer and more educated children. The relationship between health, fertility and education has been well documented by Becker, Murphy, Tamura (1990), Bleakley and Lange (2009), Bobonis et al. (2006), Kalemli-Ozcan (2002), Lleras-Muney and Jayachandran (2009), Lorentzen et al. (2007), Meltzer (1992), Miguel and Kremer (2004), and Soares (2005).

As the Brazilian population enjoys an increasingly longer life expectancy at birth, lower infant mortality and reduced fertility, investments on human capital are expected to increase. The next generations should therefore be more educated and productive than the previous ones. However, the real benefit of a population with more years of education can be realized only through a system that provides good quality education. Indeed, most (if not all) of the potential benefits associated with a generation that stays longer in school would be lost in a system that delivers low quality education since they would not be translated into a more productive workforce.

It is, therefore, necessary to have schools in Brazil that provide better quality of education. At the moment, the quality of the Brazilian education is low. In 2006, Brazil had one of the worst performances
in the world with the PISA\textsuperscript{71} math score. Brazil was 54th among the 57 countries that participated in the PISA evaluation, with only Tunisia, Quatar and Krygyz scoring lower. Argentina, Chile, Indonesia, Mexico, Thailand and Uruguay all scored significantly higher. In other words, Brazil’s 2006 math performance defined the bottom of the distribution for countries with its income level [see World Bank (2010)]. At the same time figure 5.3 shows that Brazil has improved its performance in the PISA math score, but is still much below the performance of counterparts.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{pisa_math.png}
\caption{PISA Math Performance for Brazil and Selected Countries, 2000-2009}
\end{figure}

More qualified children and young working age population would also make these generations easier to be retrained as they get old and reach an age away of their peak productivity (Heckman, et al., 2005). Of course, an older population would require more resources to finance retraining of a larger share of older workers (who are likely to use their increased political position to ask for it). Under these conditions, it is even more important that those workers who will be retrained have been properly educated when younger.

5.3.2 Vocational Education

In section 5.2 was pointed that productivity declines at older ages seem to be particularly strong for work tasks where problem solving, learning, and speed are needed, but in jobs where experience and verbal abilities are important, older individuals maintain a relatively high productivity level. The ongoing economic changes in the world, with technological and organization innovation and the economic shift from manufacturing to services are causing job requirements to change. On the one hand, older workers might be better off because physical abilities are becoming less important. On the other hand, continuously changing types of work can mean that being able to absorb new information is becoming increasingly important relative to having long experience [see World Bank, 2007b].

A critical element will be how well training practices are adapted to help older workers realize their potential. A number of studies suggest that training for older workers may need to take place at a slower pace, be more closely tied to the work context, and involve self-directed learning rather than formal classroom training [see OECD, 2006]. The limited evidence available suggests that older workers who

\textsuperscript{71} The Program for International Student Assessment (PISA) is a system of international assessments that focus on 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy.
have adequate educational attainment and a history of participation in on-the-job training are good training prospects. Targeted training programs seem effective in softening or halting any age-related decline in the ability to learn new skills. Research has demonstrated that such programs can stabilize or even reverse age-specific declines in inductive reasoning and spatial orientation. Furthermore, exercising speed, reasoning and memory abilities can enhance the functional level of those who undergo training relative to those who do not. As the labor supply ages, firms and workers will need to adapt to the new reality. Until now, all evidence has indicated that access to training decreases substantially through one’s working life [see World Bank, 2007b and the evidence from Brazil in Figure 5.4]. In the future, firms will have no choice but to expand their training programs to invest more in older employees and to reorient the programs to meet the needs of those workers.

From a historic point of view, Brazilian vocational education started to becoming more important in the industrial development of 50s, with the expansion of the Industrial Learning National Service (Senai) and of the Commercial Learning National Service (Senac). These two private institutions are part of a public system (the “S” system) that collects payroll levies and uses it to fund small enterprises willing to invest in on-the-job-training. The institutions train workers for diverse areas: agriculture, commerce, industry, cooperatives, transport, etc. Moreover, after the 80s, and mainly at the 90s Brazil’s vocational training started to be also provided by public and private institutions not linked to the S system. Calculating from Brazilian National Household Survey (PNAD), it can be showed that, in 2007, 22.4% of Brazilian population above 10 years old had taken some kind of vocational course, among which 0.7% took a tertiary vocational course, 18.5% took a secondary course level, and 81.7% took professional qualification training without formal education degree. Also, among the ones that had taken a vocational course, 20.6% took the course in an institute linked to the S system, 22.4% in a public institution and 53.1% in a private institution.

The majority of the course offered in Brazil has few requirements in the entrance (45.1% of the students took a course that has not any requirement to entry and only 28% took a course in which the requirement was at least have completed primary education), which means that vocational courses are used to compensate the low level of schooling in the population. Additively, among the ones that took a course, 44% never worked in a job of the area of the course taken. And among those who never worked in a job of the same area of the course taken, 31.1% was because the area had not vacancies, 5.1% because the course didn’t prepare to the jobs in that area and 10.8% because the majority of the jobs in that area requires either experience or advanced formal education. This means that Brazilian training courses have to improve their link with private sector to provide training only in areas that have need to skills. Also, it seems that some kind of improvement in the quality of courses and in the requirement to entry is necessary to improve the matching between workers qualification and job needs.

The age distribution of the population that has taken vocational courses is presented in Figure 5.4. The age groups with higher share of people with vocational training are the age groups between 20 and 29 years old. After that, the percentage of people acquiring training monotonically decreases. It seems that workers at ages with higher unemployment rate (younger ages) are acquiring more training. But, workers at older ages, exactly the ones for who productivity is supposed to decline, are not acquiring sufficient training to keep them with a necessary level of productivity to compete for good jobs. Although unemployment is much smaller in older ages, previous section showed that changes from the formal to informal and less productive sector are much more common in this age group. Then, there is a room for improvement in vocational training in Brazil targeted on ages above 40 years old.
Brazilian effort to improve active labor market policies has been documented in some papers (see, for example, Rios-Neto and Oliveira, 2000). The vocational training in Brazil started with the “S” system during the 50’s, as discussed before. For a long period the “S” system was very well ranked in international comparison (see World Bank, 1991) because of its long-duration courses and professional insertion, especially in the Manufacturing sector. However, Amadeo (1992) shows many limits of the effectiveness of the “S” system. The level of schooling of people trained was above the Brazilian average and the system was targeted on employed people, and most part of the trained workers go more to big companies than small and medium enterprises. Unemployed people had difficult to be employed after trained. Then, with the goal of expanding vocational training the Federal government decided to organize actions in the area of professional qualification of workers. The first attempt was the Professional Recycling Governmental Program (PRP), with the goal of provide to unemployed workers basic and specific knowledge to help them to reinsert in the labor market and target in unemployment insurance beneficiaries. The program doesn’t work very well, but many aspects were incorporated in the Plan for the most ambitious government initiative that would train 15 million of employee between 1996 and 1999. The numbers achieved were much more modest, around 5 million of trained employees [see Cardoso, Façanha and Marinho, 2002].

The importance of training for workers productivity and wages is one of the hottest subjects discussed among Brazilian social protection authorities in the moment. Federal and some local governments have initiated training programs target to poor people eligible to receive the federal conditional cash transfer program Bolsa Família, as a part of government strategy of productive inclusion of beneficiaries of cash transfers. The idea is to improve skills of a population that otherwise would not acquires any kind of training, as they already leave school and depend on the transfer to survive, which means that they have not a job intensive in abilities. Recent study did by Alexandre Leichsenring from IPEA shows that the Bolsa Família beneficiaries have a very high turnover rate when in the formal sector. Around 50% of beneficiaries leave their job one year after they get a job and 30% stay in the same formal job only for 6 months. It seems that increase investments to train Bolsa beneficiaries together with link the training to the needs of the private sector could improve productivity of Brazilian society and provide the inclusion of many poor families in productive sector. Also, as Bolsa beneficiaries are father or mother, many of them are in adulthood phase and could be better trained when reach the decline productive phase.
5.4 WAGE – PRODUCTIVITY GAP

The neoclassical theory of firm assigns worker’s wage differentials to differentials in their marginal productivity. The demographic profile of wages follows, therefore, the demographic profile of human capital accumulation, increasing in the early stages of the career and decreasing jointly with the human capital depreciation [see Mincer (1974)]. This hypothesis is based on psychometrics studies undertaken by medical scientists [see Skirbekk (2003)], which we have referred to earlier in the chapter, showing that cognitive abilities tend to deteriorate with age.

However, many hypotheses have been put forward to explain the fact that, the age-productivity profile is not always similar to the age-wages profile. One of the most important explanations is the deferred compensation hypothesis according to which firms could pay workers whose performance is hard to monitor less than their productivity when they are young and more than their productivity when they are old, as a mechanism to incentivize effort [see Lazear (1981)]. Another important explanation is the one offered by the sorting and matching models according to which labor market search, by raising the chance of finding a good job-worker match, may also imply upward sloping experience earnings profiles in parallel with flat or declining productivity effects [see Manning (2000)]. In other words, employers may use wage as a signal to attract good workers offering a wage-experience premium.

Many authors have calculated the effects of workforce characteristics on productivity and wages using employee-employer firm or plant level data (in many cases the employee datasets are demographic surveys linked to the firm or plant level data). The work of Hellerstein and Neumark (1995) and Hellerstein, Neumark and Troske (1999) is particularly important. The first one, using Israeli firm data, shows that the earning and productivity age profiles are fairly similar. The second one shows very similar results using US data. These studies conclude that wages are roughly based on productivity and that the wage profile by age is consistent with the human capital hypothesis. However, using another US dataset they find that the wage profile by age is steeper than the productivity profile, which can be interpreted as evidence supporting the deferred compensation hypothesis.

Many other investigations reach the later conclusion. Crépon, Deniau and Pérez-Duarte (2002) use French data and conclude that the relationship of productivity and age follows an inverted U-shape, but wages increases with age. Using Finnish data, Ilmakunnas and Maliranta (2007) conclude that firms profit from laying off older workers (more than 49 years) in all sectors and hiring younger ones (less than 30 years) in the industry sector. Daveri and Maliranta (2007) separate the age and the seniority effects on productivity. They argue that a person that spends all his life in the same job would acquire only specific learning associated with that job. Then, the seniority (the time a worker spent in the same job) effect would be a specific human capital accumulation effect. The age effect, in turn, would be a general human capital accumulation effect, as workers would have worked in many firms, therefore acquiring general learning. Their hypothesis is that only seniority has negative effect on productivity in sectors characterized by rapid technological innovation. Indeed, they find that seniority, as a proxy for specific experience, has a negative effect on Total Factor Productivity in the electronic sector (i.e. a highly technological sector in Finland during 1990’s) and a positive effect on wages. At the same time, age, as a proxy for general experience, doesn’t have a negative effect on Productivity.

Dostie (2006) uses Canadian data and his results show an inverted U-shaped age-wage and age-productivity profiles. Wage-productivity comparisons show that the productivity of workers aged 55 and more with at least an undergraduate degree is lower than their wages. Finally, Vandenbghge and Waltenberg (2010) use Belgian data and their results indicate a negative productivity differential for older workers ranging from 20% to 40%, when compared with prime-age workers. These productivity differentials are not compensated by lower relative labor costs.
Blanchet (1993) states that it is not clear the effect of aging labor force on aggregate productivity, but if we assume that productivity remain stable while wages increase with seniority this may be a source of major difficulties in terms of competitiveness, profitability, investment and all related variables. He also calculates the necessary adjustment to avoid a growing imbalance between productivity and labor costs and shows that it is not very high. However, Brazil has regulatory legislation forbidding this kind of adjustment and the result of the imbalance could be a deal between the firm and worker to mandatory early retirement, which results to problems to the public financing social security system, as explained in chapter 2.

Brazilian evidence of age-wage profile shows that wages for employed workers in their main occupation do not decline before 65 years. It seems like wages remain stable between 45 and 65. Figure 5.5 shows the monthly wages in main occupation by age using data from PNAD 2008. Although a small decrease can be noticed when all workers are considered, the same thing is not observed when only formal employees are kept in the sample. For formal workers, the wages remain stable between 45 and 65.

![Figure 5.5 Monthly Wages by Sector, Main Occupation, 2008](image)

Source: Rocha (2010)

Figure 5.6 shows the pattern now considering hourly wages in the main occupation. Both for all workers and for formal employees, wages remains stable between 45 and 65, although are quite volatile during the older age interval. Therefore, it appears that in Brazil wages do not follow the human capital hypothesis, at least before 65 years old, that means, the human capital depreciation is not followed by a decrease in the wages between ages 45 and 65.
It is important to underscore that when we were considering all workers are considered monthly wages have a different pattern from hourly wages. Figure 5.7 presents the age distribution of hours worked, both for all workers and for formal employees only. The fall in hours worked is much more prominent for all workers than for formal employees. Clearly, Brazilian legislation makes rules of hours worked more rigid in the formal sector.

The evidence in the patterns described above, together with the evidence showed in section 5.2, suggests that many older workers drop out of the formal sector and start to receive smaller monthly wages, but it seems to be an effect only of fewer hours worked in informal sector, because the same declining effect is not observed when hourly wages are considered, even for the all workers sample.

The next section presents more robust evidence of the pattern discussed above from Brazil’s industrial firms with more than 30 employees. The effect of age and seniority on productivity and wages is analyzed.
by estimating the difference between the age-productivity profile and the age-wage profile and between the seniority-productivity profile and the seniority-wage profile.

5.5 AGE, PRODUCTIVITY AND WAGES: NEW EVIDENCE FROM BRAZILIAN FIRMS\textsuperscript{72}

If productivity declines with age, the aging population process could put a higher share of workers away from their peak productivity and then negatively affect growth. At the same time, if firms pay a wage premium for age and/or seniority as is expected by the deferred compensation hypothesis, it is possible that firms collude with the workers to adopt early retirement decisions, which could also affect savings and growth.

To identify the effect of age and seniority on wages and productivity, Rocha (2010) uses regressions at the firm level for industrial firms with more than 30 formal employees, from the Annual Industrial Surveys (PIA) between 1996 and 2007. These datasets have information about firms’ revenues, investment, number of workers, etc. This data is merged with workers data from the Annual Relation of Social Information Survey (RAIS), which has information about characteristics of all workers employed in the formal sector, such as gender, age, tenure, etc. The methodology is explained in Box 5.2.

Box 5.2 Workforce Characteristics, Productivity and Wages

To calculate the impact of an aging workforce on productivity and wages, Rocha (2010) follows the methodology of Hellerstein, Neumark and Troske (1999), in which they emphasize the importance of labor quality to calculate production functions. The production function is an econometric version of Cobb-Douglas production function:

\[
\log Y_{it} = \alpha \log L^A_{it} + \beta \log K_{it} + \gamma F + u_{it}
\]

where \( Y \) is the value added by firm \( i \) at time \( t \), \( L^A \) is an aggregate function of different types of workers, \( K \) is the capital stock, \( F \) is a matrix of firm’s characteristics that are chosen in order to make the specification in (1) as comparable as possible to the specification for wage equation, and \( u \) the error term. The key variable of the estimation of this production function is the aggregated quality of labor. Let \( L_{itk} \) be the number of workers of type \( k \) in firm \( i \) at time \( t \), and \( \lambda_k \) be their productivity. It is assumed that different types of workers are perfect substitutes, but may have different marginal productivities. The function can be specified as:

\[
L^A_{it} = \sum_{k=0}^{K} \lambda_k L_{itk} = \lambda_0 L_{it} + \sum_{k=1}^{K} (\lambda_{it} - \lambda_{0}) L_{itk}
\]

where \( L_{it} \) is the total number of workers in the firm, and \( \lambda_0 \) the productivity of the reference category of workers and \( \lambda_k \) the productivity of worker type \( k \). Using gender as an example, if the group of male’s workers is taken as the reference case, and its productivity is scaled equal to 1, the relative productivity of the group of female workers is measured by parameter \( \phi \). The increase in productivity when it goes from the reference group to the female group is therefore \( \phi \cdot 1 \). In the general case of \( K \) types of workers, it is possible to rewrite equation (2) as:

\[
\log L^A_{it} = \log \lambda_0 + \log L_{it} + \log \left( 1 + \sum_{k=1}^{K} \left( \frac{\lambda_k}{\lambda_0} - 1 \right) P_{itk} \right) = \alpha \log L^A_{it} + \beta \log K_{it} + \gamma F + u_{it}
\]

where \( P_{itk} \) is the ratio of the number of workers of type \( k \) over the total number of employees and \( \frac{\lambda_k}{\lambda_0} = \phi \). To reduce the dimensionality problem, two restrictions on the form of \( L^A \) written above are imposed. First, it is restricted the relative marginal products of two types of workers within one demographic group to be equal to the relative marginal products of those same two types of workers within another demographic group. For example, the relative productivity of senior women to senior men is restricted to equal the relative marginal productivity of junior women to junior men. Similarly, the seniority difference in marginal productivity is restricted to be the same across

\textsuperscript{72} This section draws heavily from Rocha (2010).
If we substitute equation (4) in equation (2), the production function can be written as:

$$\log Y_{it} = \alpha \log \lambda_{it} + \alpha \log L_{it} + \alpha \sum_{k=0}^{K} (\phi_k - 1) P_{ikt} + \beta \log K_{it} + \gamma F_{it} + u_{it}$$

(5)

Rocha (2010) follows Ilmakunnas and Maliranta (2005) and divides the workers’ characteristics into education [0 to 8 (Primary Education), 9 to 11 (Secondary Education), 12 or more (University Education) years of schooling], age [15-24 (Age1), 25-34 (Age2), 35-44 (Age3), 45-64 (Age4)] seniority [less than 10 years in the firm (Young), and more than 10 years in the firm (Senior)], and gender (Men and Women) characteristics. The idea is that seniority is an indicator of specific human capital accumulation and age by itself is an indicator of general capital accumulation. So the effect of each kind of human capital accumulation on labor productivity and wages can be measured. The wage equation is estimated in a similar way:

$$\ln(w) = d' + \ln L_{it} + \sum_{k=1}^{K} \left( \frac{\pi_k}{\pi_0} - 1 \right) P_{ikt}$$

(6)

where $\frac{\pi_k}{\pi_0}$ is the yearly labor cost differential between the worker type $k$ and the worker type 0. So, jointly estimating equations (4) and (5) by a SUR regression, it is possible then to test whether wage differentials across workers in different demographic groups reflect differentials of productivity between these demographic groups. The First econometric problem in this kind of estimation is that there is unobserved heterogeneity across firms. It is possible that the firm has unobserved time-invariant characteristics that are correlated with the independent variables and that drive at certain way the productivity outcomes. To control to this kind of effect firms fixed effects in the production function are added (and also in the wages equation).

The second econometric problem is the endogeneity bias. Firms could make adjustments in response to productivity shocks that are correlated with the age structure and other demographic characteristics of workers [see Griliches and Mairesse (1998)]. For example, firms could adjust its workforce in response to an innovation shock (be it technological or in the management) by hiring more workers in that specific activity. Therefore, if the shock is a technological innovation, firms tend to increase the share of younger workers and a positive productivity shock will be correlated with the share of younger workers, only because of the type of activity they have comparative advantage. At the same time, if the shock is a management shock, that depends on the capacity of communicate, for example, may be firms will prefer increase the share of older workers and than older workers will be positively correlated with productivity only because their comparative advantage in some kind of activity.

So, to avoid this kind of endogeneity some econometric proceeds can be taken. The most famous strategy is to use the Generalized Method of Moments as proposed by Blundell and Bond (1999). The strategy is to use lagged demographic characteristics to account this short-term simultaneity. This idea was used by Aubert and Crépon (2003) who find that taking into account unobserved productivity shocks completely reverse the OLS conclusion of Crépon, Deniau and Pérez-Duarte (2003). However, Gorodnichenko (2006) shows that Blundell and Bond estimator is in general weakly identified. The problem is that the results depends a lot on the specification choices, as the number of lags the authors use, and also the instruments are weak to explain the endogenous variables [see Vandenberghe and Waltenberg (2010)].

Another method first used by Hellerstein, Neumark and Troske (1999) and formalized by Levinsohn and Petrin (2003) will be used. The idea is that firms first adjust intermediate inputs in response to a productivity shock, before adjust the other inputs. Therefore it is possible to invert the demand for capital and materials to infer a value for the unobserved productivity shock. The estimated productivity shock is then used as a regressor in the production
function. The method assumes that the inversion function is non stochastic. Alternative, but similar, estimation procedures were proposed by Ackerberg, Caves and Frazer (2003) and Olley and Pakes (1996) and their carry out the same assumption. If this assumption is violated the estimation will be biased [see Bond and Soderborn (2005), Ackerberg, Caves and Frazer (2003) and Basu (1999)]. However, Grodnicenko (2006) provides a monte-carlo test showing that the LP estimator is less biased than OLS estimates at least in the case of return to scale estimation.

Finally, the variance-covariance matrix of Huber-White is calculated in order to account to heteroscedastic errors.

The first set of results is shown in Table 5.1. The first four columns present the effect of each variable on productivity. Clearly, firms’ productivity declines with age and with seniority. The four last columns show the effect of each variable on wages. Wages strongly increase with seniority, although they remain stable with age. This result is consistent with the compensation hypothesis. It seems like firms in Brazil pay less than the marginal productivity to younger workers, but compensate them with higher salaries later on, mainly if they stay in the same firm (i.e. have higher seniority).

Table 5.1 – Effect of Age and Seniority on Productivity and Wages

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Productivity</th>
<th>Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Approx Std Err</td>
</tr>
<tr>
<td>Size of Labor Force</td>
<td>0.52</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>0.17</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>0.45</td>
<td>0.02</td>
</tr>
<tr>
<td>University Education</td>
<td>0.54</td>
<td>0.02</td>
</tr>
<tr>
<td>15-24</td>
<td>-0.35</td>
<td>0.03</td>
</tr>
<tr>
<td>25-34</td>
<td>-0.48</td>
<td>0.02</td>
</tr>
<tr>
<td>Senior</td>
<td>0.23</td>
<td>0.02</td>
</tr>
<tr>
<td>Source: Rocha (2010)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How can we interpret these findings? To see better the effect of aging labor force on productivity, Rocha (2010) makes a simple exercise assuming that demographic profile in Brazil changes in the same way as the population projections made by IBGE (2008) and everything else remains constant. Using the estimated coefficients above and considering a productivity index equal to 100 in 2005 the results are in the Figure 5.8. Productivity of Brazilian industrial firms would decrease 16% because of the demographics between 2005 and 2050, everything else constant.
At the same time the estimates in table 5.1 show that productivity would increase with education. The Brazilian average number of schooling years has increased very rapidly during the past two decades [see World Bank (2010)]. Taking as a benchmark the educational distribution of average OECD countries, supposing Brazil would reach this same educational distribution in 2050 and using the coefficients in table 5.1, Rocha (2010) reaches the conclusion that productivity of Brazilian industrial firms would increase 9% between 2005 and 2050 only because of the change in education structure, which would partially offset the effects of demographic changes. Besides that, the coefficient of the older workers age group could change with changes in relative demand for jobs involving interactive skills, as discussed in section 5.2 and, more importantly, with the fact that population has become more educated, which makes training more efficient to prevent human capital depreciation at older ages. Then, the effect of demographics on productivity depends on the level of early stages education, which makes even more important provide basic education of good quality for everyone.

In summary, the evidence points out that in the Brazilian industrial sector wages increase or remain stable with age, and productivity declines with age. In this case an aging workforce would be a burden to firms, at least in the short run. In addition to the explanation given by the deferred compensation hypothesis, another possible explanation for these results is that legislation puts restrictions on the possibility of reducing wages for those workers who have been with the same firm for long and forces firms to pay high taxes to lay off workers. Under these circumstances, laying off workers when they become less productive is very expensive.

These findings are consistent with findings for European countries, as shown in the previous section. Most evidence confirms the conclusion that aging of the workforce could be a burden to the firms, as they pay more than the marginal productivity for older workers. As was discussed earlier, this can create incentives for the employer and the employee to settle for early retirement. The more advanced the population aging the stronger will be this incentive, as firms will have a higher share of older workers. Although contracts are dynamics and firms may change the way they design their payment schemes, evidence in developed countries shows that firms continue to pay the seniority-based wage even after the share of old population is very high [see Lazear (1990) and Lee, Mason and Lee (2004) to details]. A possible solution for firms to decrease the burden of an older workforce could be to adopt mandatory retirement rules. Many older workers could be forced to retire and firms could re-hire them in an informal way only, with a smaller wage and without obligation of contributing to the social security system. This
The evidence is supported by the pattern of early retirement observed in Brazil and described earlier in the chapter.

As workers continue to age in many middle and high income countries, the age profile of the workforce will move away from exhibiting a high share of workers at their peak productivity. Such scenario suggests that these economies will need to boost their labor productivity growth, which would require a substantial increase in broad capital investments, that is to say, human capital, intangible capital (research and development) and physical capital [see United Nations, 2007]. Section 5.3 showed how an aging workforce can improve human capital investments, and at least partly offset the effect of declining labor productivity associated with having higher share of workforce away of their peak productivity. In less developed countries, however, most policies still target industry sectors that have particular strategic importance to growth. Meanwhile, it is also necessary to improve productivity of the traditional low skilled informal sector that has huge importance in developing and emerging economies, including Brazil. In this context, investments in human capital and infrastructure in Brazil are very important to improve productivity as a whole. Moreover, improved access to technology and the creation of forward and backward linkages in the supply chain between the formal and informal sector can enhance worker skills and ultimately lead to higher overall productivity growth [see ILO (2004)].

To conclude, in this chapter was shown that negative effects of population aging on productivity at firm’s industrial level can be expected. This may have a negative impact on aggregate economic output (although evidence in this regard is mixed), as a higher share of the workforce would be away of its peak productivity. To offset these negative effects some traditional policies are recommended. The demographic changes currently under way in Brazil should result into more investment in human capital, and consequently, into improvements of labor productivity. However, better quality of education at younger ages, together with effective investments on re-training of older workers, may help Brazil to continue to raise its productivity even when the age structure of its population continues shifting towards older ages.
Chapter 6
Public Finance Implications of Population Aging: 2005-2050

6.1 INTRODUCTION

As illustrated in Chapter 2, the age distribution of the Brazilian population will change dramatically over the coming decades. The number of children in Brazil reached a peak of nearly 70 million children around 1999 and has been steadily declining since. Meanwhile, the number of elderly in Brazil has doubled over the last 20 years and is projected to double again in the next 20. This chapter explores the public finance implications that these shifts in the population age structure will bring. The focus is on three key areas of public spending: education, pensions, and health care.

The basic institutional framework for social policies in Brazil, including related expenditures and sources of revenue, was laid down in the 1988 Constitution. Its main determinants—to a large extent, a reaction to the patterns that prevailed over the authoritarian period—were to extend social rights and social protection to groups hitherto uncovered or unprotected; to promote decentralization in the provision of services; and to insure funding through earmarking of tax revenues. The outcome of the new framework was a significant increase in social expenditures and a more rigid budget associated with wider earmarking and mandatory expenditures (see Figure 6.1).

Figure 6.1

Table 6.1 presents data on total spending on Education, Health and Social Security for 29 countries, including Brazil. The data refer to 2006, year in which Brazilian spending had already reached current levels. Chile is an interesting case to compare to Brazil because it is also a Latin American country and its GDP per capita is more similar to the Brazilian one than the rest of the sample. Expenditures on Education, Health and Social Security as proportion of GDP in Chile are consistently lower than corresponding expenditures in Brazil. The result is that Chilean social spending (12.1% of GDP) is nearly half that of Brazil’s (23.18% of GDP), but this does not prevent that country from having average schooling higher than Brazil’s and a life expectancy that is at least four years longer.

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73 Data on spending on health by all levels of Government (federal, state and municipal) is available only starting in 2000. Figure 3.2 reports both total public spending during 2000-2008 and federal spending on health during 1980-2008.
<table>
<thead>
<tr>
<th>Country</th>
<th>Public Expenditure on Education as % of GDP</th>
<th>Total expenditure on Health as % of GDP</th>
<th>Total Expenditure on Social Security as % of GDP</th>
<th>Total Social Expenditure as % of GDP</th>
<th>GDP per capita PPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>4.7</td>
<td>9.0</td>
<td>17.6</td>
<td>31.3</td>
<td>31,909</td>
</tr>
<tr>
<td>France</td>
<td>5.6</td>
<td>11.0</td>
<td>13.4</td>
<td>30.0</td>
<td>34,689</td>
</tr>
<tr>
<td>Switzerland</td>
<td>5.5</td>
<td>10.8</td>
<td>13.4</td>
<td>29.7</td>
<td>43,104</td>
</tr>
<tr>
<td>USA</td>
<td>5.7</td>
<td>15.5</td>
<td>7.5</td>
<td>28.7</td>
<td>46,436</td>
</tr>
<tr>
<td>Belgium</td>
<td>6.0</td>
<td>9.5</td>
<td>12.9</td>
<td>28.4</td>
<td>36,048</td>
</tr>
<tr>
<td>Sweden</td>
<td>6.9</td>
<td>9.1</td>
<td>11.1</td>
<td>27.1</td>
<td>37,905</td>
</tr>
<tr>
<td>Germany</td>
<td>4.4</td>
<td>10.5</td>
<td>12.1</td>
<td>27.0</td>
<td>36,449</td>
</tr>
<tr>
<td>Finland</td>
<td>6.1</td>
<td>8.3</td>
<td>12.1</td>
<td>26.5</td>
<td>34,652</td>
</tr>
<tr>
<td>Denmark</td>
<td>7.9</td>
<td>9.6</td>
<td>8.8</td>
<td>26.3</td>
<td>36,763</td>
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<td>Poland</td>
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<td>6.2</td>
<td>13.9</td>
<td>25.8</td>
<td>19,059</td>
</tr>
<tr>
<td>Netherlands</td>
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<td>8.9</td>
<td>11.1</td>
<td>25.5</td>
<td>40,715</td>
</tr>
<tr>
<td>Greece</td>
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<td>9.5</td>
<td>11.9</td>
<td>25.4</td>
<td>29,664</td>
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<tr>
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<td>10.0</td>
<td>25.2</td>
<td>24,021</td>
</tr>
<tr>
<td>Hungary</td>
<td>5.4</td>
<td>8.1</td>
<td>11.0</td>
<td>24.5</td>
<td>19,765</td>
</tr>
<tr>
<td>United Kingdom</td>
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<td>24.4</td>
<td>36,496</td>
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<td>Brazil</td>
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<td>8.5</td>
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<td>23.8</td>
<td>10,427</td>
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<td>Spain</td>
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<td>8.4</td>
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<td>Norway</td>
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<td>8.6</td>
<td>8.2</td>
<td>23.3</td>
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<td>New Zealand</td>
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<td>9.3</td>
<td>6.5</td>
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</tr>
<tr>
<td>Slovakia</td>
<td>3.8</td>
<td>7.3</td>
<td>10.1</td>
<td>21.2</td>
<td>22,357</td>
</tr>
<tr>
<td>Canada</td>
<td>4.9</td>
<td>10.0</td>
<td>5.4</td>
<td>20.3</td>
<td>37,945</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>4.6</td>
<td>7.0</td>
<td>8.5</td>
<td>20.1</td>
<td>25,232</td>
</tr>
<tr>
<td>Iceland</td>
<td>7.6</td>
<td>9.1</td>
<td>2.0</td>
<td>18.7</td>
<td>37,602</td>
</tr>
<tr>
<td>Japan</td>
<td>3.5</td>
<td>8.1</td>
<td>6.9</td>
<td>18.5</td>
<td>32,443</td>
</tr>
<tr>
<td>Mexico</td>
<td>4.8</td>
<td>5.7</td>
<td>7.8</td>
<td>18.3</td>
<td>14,337</td>
</tr>
<tr>
<td>Ireland</td>
<td>4.8</td>
<td>7.1</td>
<td>4.6</td>
<td>16.5</td>
<td>41,282</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.9</td>
<td>4.8</td>
<td>7.1</td>
<td>14.8</td>
<td>13,904</td>
</tr>
<tr>
<td>Chile</td>
<td>3.2</td>
<td>6.0</td>
<td>2.9</td>
<td>12.1</td>
<td>14,331</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>4.2</td>
<td>6.0</td>
<td>1.3</td>
<td>11.5</td>
<td>27,169</td>
</tr>
<tr>
<td>General average</td>
<td>5.19</td>
<td>8.63</td>
<td>9.3</td>
<td>23.1</td>
<td>31,091</td>
</tr>
</tbody>
</table>

/a Social Expenditure are the sum of Education, Health and Social Security.
/b For these countries data on Education is referred to 2005.

Figure 6.2 (A through C) presents spending for each type of expenditure as a proportion of GDP and GDP per capita (in 2009 PPP) of each of the countries in the sample. The last chart (D) shows the total of social spending. All graphs also present the OLS regression line. Brazilian expenditures are consistently above the regression line, indicating that Brazil has higher spending than the average country in the sample when income levels are controlled for.
Figure 6.2
Expenditures on Education (A), Health (B) as % of GDP, Per Capita and Expenditures on Social Security (C) and Total (D) as % of Ln of GDP Per Capita


How can the size of the challenge for public finance be measured? How is it going to be affected by population aging? Addressing these questions is the main focus of this section. Our projections are based on a simple model by Miller and Castanheira (2010) in which aggregate public expenditures are driven by changes in the age structure of the population as well as changes in the average public benefits received by age. The likely increases in public spending over the coming decades are estimated, contrasting the divergent trends in public spending on education, pensions, and health care. The magnitude of these changes are assessed in terms of growth in spending relative to GDP annually over the next 40 years and estimate the present value of this increased spending relative to current GDP.

Demographic change is one of the most important forces shaping the outcome of social policy, but it cannot be observed in the short term. Its impact is readily apparent in the long-term projections of the sort that are presented in this chapter. The gradual changes in age structure unfolding in the coming decades will present different challenges and opportunities to education, health, and pension programs. Projecting all three expenditure paths with a comparable methodology will provide insight into the interconnections and tradeoffs available to national policymakers. Too often, policy reforms of pension, health care, and education systems are debated, analyzed, and implemented in isolation from each other without considering the fiscal links among these systems.
The validity of long-run forecasts, such as those offered in this chapter, is subject to discussion. There is considerable uncertainty about the future course of the economy and future policy decisions. In addition, there is considerable demographic uncertainty about how quickly and to what level fertility will decline and about how quickly mortality rates will continue to decline. Mortality may fall more rapidly or less rapidly than anticipated – but there is no doubt that the population of elderly in Brazil will soar over the coming decades. However, there is much more certainty about forecasting population age structures because they change slowly over time in very predictable ways. All of the individuals who will comprise the population of retirees in the year 2050 have already been born – which makes predictions about their future considerably more certain than predicting economic growth rates in the year 2050.

Mindful of the impact of population aging, a number of governments have begun to issue official long-term budget projections: the European Union (European Commission Directorate General for Economic and Financial Affairs, 2006), the United States (U.S. Congressional Budget Office, 2009), Australia (Australia, The Treasury, 2007), and New Zealand (New Zealand, The Treasury, 2006). This chapter presents long-run expenditure forecasts for Brazil – an important first step toward long-run fiscal forecasts.

6.2 THE PUBLIC SECTOR: AGE STRUCTURE AND THE GENEROSITY OF PUBLIC BENEFITS

Before projecting the future public finance impacts of population aging, it is useful to begin with an assessment of where Brazil stands today. Public spending on education, pensions, and health care is the product of the average generosity of the benefits received by each individual and the age structure of the population. The share of economic output directed toward education, health care, and pensions through the public sector can be decomposed into two multiplicative components. Equation 1 shows the example of public spending on education.

\[
\frac{B(t)}{GDP(t)} = \text{bgr}(t) \times \frac{P(6-21,t)}{P(20-64,t)}
\]

\(B(t)\) is aggregate educational expenditures in year \(t\); \(GDP(t)\) is GDP in year \(t\); \(\text{bgr}(t)\) is the average benefit per school-age person relative to economic output per working-age adult equaling \(\frac{B(t)}{P(6-21,t)} / \frac{GDP(t)}{P(20-64,t)}\); \(P(6-21,t)\) is School-age population (ages 6 to 21) in year \(t\); and \(P(20-64)\) is Working-age population in year \(t\).

Assume that all public education benefits are targeted to individuals between the ages of 6 and 21 and further that these benefits do not vary by age. In this case, aggregate public expenditures on education as a share of GDP is simply the product of two scalar factors: one demographic and the other economic. The first scalar quantity, \(\text{bgr}(t)\), is the Education Benefit Generosity Ratio and measures the generosity of average educational benefits relative to GDP per working-age adult. Standardizing by economic output per working-age adult is useful for making international comparisons of benefits as well as for projecting future expenditures, as will be discussed later.

In most countries, the wage bill is about two-thirds of GDP and the labor force is usually about two-thirds of the working-age population. Therefore, the ratio of GDP per working-age adult is roughly equivalent to the wage bill divided by the labor force or the average annual wage per worker. As a rough approximation, our benefit generosity ratios could be considered as measuring public benefits received relative to the average worker salary in the economy.
The second scalar quantity, $P(6-21,t)/P(20-64,t)$, is the Education Dependency Ratio and measures the size of the school-age population relative to the working-age population. By definition, the product of these two terms yields aggregate educational spending as a share of GDP. The results are shown in Figure 6.3.

**Figure 6.3**
The School-Age Population and Public Education Spending Per Youth by Country, 2005-2006


In Burkina Faso (red triangle in lower right of Figure 1), there is nearly one school-age child for every working-age person in the population. The average public investment per school-age child in Burkina Faso is approximately 4.5% of the average annual salary. Hence, public investment in education is approximately 4.5% of GDP. The average lifetime educational investment per youth by the public sector is less than a year’s wages in Burkina Faso. This low level of investment is a reflection of both low participation rates and low investment per student. Italy lies at the other extreme as shown in the red triangle in upper left of Figure 6.3. As in Burkina Faso, public investment in education is approximately 4.5% of GDP – but with vastly more public investment per youth. The more favorable age structure in Italy allows for much higher investment in youth at the same levels of aggregate spending. In Italy, there are nearly 4 working-age persons for every school-age child. Public investments per youth are 18% of the average annual salary – more than triple the investment in Burkina Faso.

Brazil, which like Burkina Faso and Italy also devotes approximately 4.5% of GDP to public investments in education, lies in between those two countries. In Brazil, there are approximately 2 working-age adults for every school-age child. Public investment per youth in Brazil is about 10% of the average wage or a lifetime educational investment of about a year and a half of annual wages. The governments of all 3 countries are investing approximately the same relative amounts in educating the next generation; approximately 4.5% of GDP – but with very different investments per youth on account of difference in the age structure of their populations. Based on this cross-national sample for 2005 and 2006, it appears that there is very little variation in aggregate public spending in response to the size of the young population – so that educational investments per student are inversely related to population size.

---

74 Most educational spending occurs in this age group – though increasingly expenditures are being directed to early education and continuing education.
Using Equation 1, aggregate spending on public pensions is decomposed into two components: the size of the elderly population relative to the working-age population and the generosity of the public pension – which reflects both pension coverage and the average pension benefit relative to GDP per working-age adult. Figure 6.4 presents the decomposition results for spending on national pension systems (excluding civil servant pension systems) for several OECD and Latin American countries. Brazil is a clear outlier: with by far the most generous public pension system in the world. In OECD countries, average public pension benefits hover in the range of 20 to 40% of GDP per working-age adult, while in Brazil the pensions are about twice as generous as those in the OECD group. Of particular note is the dramatic difference between Japan and Brazil. Governments in both countries are equally involved in financing pensions – accounting for 7% of GDP – yet the relative share of older adults in Brazil is only one-third that of Japan.

![Figure 6.4](https://via.placeholder.com/150)

**Figure 6.4**

*The Elderly Population and Public Pension Spending Per Older Adult by Country, 2005-2006*

In the case of education and pensions, there is a clearly defined demographic group to whom the benefits are directed. In these cases, our simple decomposition of aggregate spending into two scalar quantities (Equation 1) works well as a heuristic device. In the case of health spending, it is difficult to define a particular demographic group to whom health spending is directed. Therefore, the decomposition of spending into demographic and economic scalar values works less well than in the case of education or pensions. Later in the paper when discussing the forecast model, a more robust analysis is presented using age-specific vectors rather than scalar values – which overcomes this limitation. In keeping with the simple decomposition method of Equation 1, a population is defined for which most health care spending is directed: the population close to death.

Many studies of OECD countries have shown that most health costs for individuals occur in the final decade of life, and in that decade, in the final year of life (Miller 2001; Lubitz and others 2003; McGrail and others 2000; Zweifel and others 1999). That is, most health systems devote a large percentage of their resources to curative and palliative services rather than preventive services. To estimate the number of persons close to death in the population Miller and Castanheira (2010) use estimates and projections of the number of deaths over the next decade of the original cohort using population estimates and projections from CELADE (CELADE 2009). This is an approximation of the number of people who are likely to use a high proportion of all health care services consumed within the year – at least in developed countries.
The generosity ratio for public health benefits is calculated dividing public expenditures on health as a percent of GDP (from WHO data) by the health dependency ratio (i.e. the near-death population as a proportion of the working-age population). Under the assumption that all health care spending is directed toward those in their last decade of life, the benefit generosity ratio measures the average annual expenditures on health care for these individuals relative to the average wage.

Figure 6.5

The Near-Death Population and Public Health Spending Per Capita by Country, Circa 2006

Figure 6.5 presents estimates of the near-death population and the generosity of public health benefits around the world. South Africa and Costa Rica lie at opposite extremes. South Africa has one of the highest health dependency ratios in the world. The number of people who will die within the next decade is nearly one-fourth the size of the working-age population. Despite this large health dependency ratio, aggregate public health spending is low – at about 3.6% of GDP and the resulting generosity of average health benefits is quite low – less than 10% of the average wage. Costa Rica lies at the opposite extreme. Thanks to its high life expectancy and relatively young age structure it has one of the lowest health dependency ratios in the world: with a near-death population only 7% the size of the working-age person. Health spending in Costa Rica is rather generous – amounting to 90% of the average annual wage. The United States is a visible as a clear outlier in the graph -- with extremely generous public sector spending in health care, among the highest in the world. In Brazil, the health dependency ratio is slightly higher than that of Costa Rica. But owing to lower aggregate expenditures on health, the average generosity of the health care benefit is lower than Costa Rica – amounting to about 65% of the average wage.

Table 6.2 compares Brazilian public sector spending to that of OECD countries. Brazil’s public sector spending in education and pensions resembles that of OECD countries (as percent of GDP) but its population age structure is much younger. This results in markedly lower public education investment in youth (9.8% of average wages in Brazil vs. 15.5% in OECD) and markedly higher average public pension benefits (66.5% of average wage in Brazil vs. 30.4% of average wage in OECD). Aggregate public health care expenditures in Brazil are much below the OECD average – and average health benefits are somewhat lower.
Table 6.2
Summary of Brazilian and OECD Spending in 2005

<table>
<thead>
<tr>
<th></th>
<th>Public Education</th>
<th>Public Pensions*</th>
<th>Public Health Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brazil</td>
<td>OECD</td>
<td>Brazil</td>
</tr>
<tr>
<td>Aggregate Spending</td>
<td>4.4%</td>
<td>4.8%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Benefit generosity</td>
<td>8.7%</td>
<td>15.5%</td>
<td>61.1%</td>
</tr>
<tr>
<td>Dependency rate</td>
<td>50.5%</td>
<td>31.1%</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

Excludes civil servant pensions. In Brazil, pension payments to civil servants were 3.8% of GDP in 2005.

Source: Authors’ calculations based on various data sources: population data from CELADE (2008); expenditure data on Public Education (UNESCO, 2010), expenditure data on Public Pensions (NTA, 2010 and OECD, 2009); expenditure data on public health care (WHO, 2010).

How quickly might these changes in average benefits be expected to take place? In the projections several plausible scenarios are considered for each sector. For education, 2 scenarios are evaluated. In the first, aggregate public spending is maintained at its current level for the next few decades. Over time, as the school-age population declines, investments per student gradually climb toward OECD levels. In a second scenario, the more ambitious goal is set of reaching OECD levels of investment per student within a decade, by 2020.

For pensions, 3 scenarios are explored. The first is a counter-factual experiment that assumes no changes in average pension benefits. It represents the Brazilian future in which the pension reforms of 1998 and 2004 were never implemented. The second scenario models the changes in benefits that are likely to result from these newly legislated pension reforms. The third scenario ignores the recent reform legislation and instead predicts a set of future reforms that gradually and continuously reduce pension benefit generosity toward OECD levels. The rate of this reduction is set so that once Brazil reaches the levels of GDP/worker currently observed in OECD countries, its pension benefits will also reach OECD levels.

For health care, two scenarios are forecast. As was the case with pensions, one scenario assumes that average benefits remain constant relative to wages. In the second scenario, average benefits are assumed to rise relative to wages as GDP/worker rises.

Our projections of public spending are derived from Equation 1 based on forecast of the population, P(x,t), and average benefits, b(x,t). The population forecasts are derived from data from CEPAL for 2005 through 2050. A single population forecast based on the cohort component method is used in which a single trend in mortality rates, in fertility rates, and in migration rates are combined to generate a forecast of the age structure of the population. There is considerable uncertainty about the particular path of future mortality, fertility, and migration in Brazil—and, there is the added uncertainty of knowing the current levels of these factors.

Miller, Bay, and Ruiz (2009) produced probabilistic population forecasts for the population of Brazil based on random sampling from the historical time series of UN member countries. The results show the highest level of uncertainty for the school-age population reflecting the large uncertainty about how low and how fast fertility will fall in the future – but considerable lower levels of uncertainty for the old-age population. While uncertainty over the future course of population will affect the timing of the impacts discussed here, it does not affect the general conclusions regarding the overall demographic uncertainty.

75 The equation used for projections of spending is simply the vector version of Equation 1 which was used for our international cross-sectional comparisons.
The forecasts of average benefits should also be considered as highly uncertain. When faced with this challenge, many forecasters prefer to assume that average benefits remain constant through time. Therefore, their forecasts reflect the impact of demographic pressures under the assumption that current policy remains unchanged. In the case of education and health care, these sorts of forecasts ignore likely policy changes such as increases in school enrollment rates and increases in utilization of health services by the elderly. Hence, those forecasts greatly understate the likely fiscal impacts of population change in these sectors. In the case of pensions forecasts, holding the age profiles constant at current levels in Brazil ignores the future impact of reforms that have already been enacted into law (e.g., increases in retirement age, changes in benefit formulas).

Average public and private spending on education, health care, and pensions by age in Brazil and that of OECD countries are taken from the National Transfer Accounts (NTA) project (see Box 1.1 in Chapter 1 for a brief description of the NTA project). The next 3 sections present a discussion and our projections of public expenditures in 3 sectors: education, pensions, and health care.

6.3 EDUCATION

6.3.1 Changes in School-age Population

With the sharp decline in fertility in Brazil over the past few decades, the size of the school-age population has dramatically declined as shown in Figure 6.6. In 1950, the school-age population was 85% as large as the working-age population – a ratio higher than that observed in Burkina Faso at the time. By 2010, the school-age population was half the size of the working-age population. If fertility rates remain low in Brazil, it is expected that by 2040 the school-age population would be about 30% of the working-age population – a ratio currently observed in Italy and several other European nations. This long run decline in the school-age population substantially reduces the demographic pressures in the education sector in Brazil.

![Figure 6.6](image)

The School-Age Population Relative to the Working-Age Population Brazil, Italy, and Burkina Faso, 1950-2050


As with the discussion about demographic dividends for growth (see Chapter 2), this process of a reduced ratio between the school-age population relative to the working-age population can also be divided in two phases, as illustrated by Soares (2008). The first phase called Relative Bonus occurs when the working
age population and the school age population are both increasing but the working age population is increasing faster. The second phase, called Absolute Bonus, is characterized by population in school age that is decreasing and population in working age that is increasing. Brazil is the only country in LAC that already entered this second phase, which started at the beginning of the 1990s. The increase in the share of working age adults relative to school age people generates more resources available to finance public programs targeted to children, or for other fiscal purposes, as the economy grows faster.

6.3.2 Expenditures

Education investment per student depends not only on the amount of resources (as percent of GDP) that countries allocate on education but also on the number of students. A good measure of expenditure per student is the education benefit ratio, as described in Equation 1.

A good example is comparing education spending in LAC and in OECD. On average, both groups of countries currently assign about 5 percent of GDP to educating the next generation. A closer inspection using the framework presented above shows that this seemingly similar allocation implies vastly different levels of generosity due to the significantly higher proportions of children that exist in most LAC countries. The student-age population in LAC is about two-thirds the size of the working-age population, while in the OECD countries it is only about two-fifths. In terms of generosity, this implies that OECD secondary education spending per youth is about twice as high as it is in LAC. Within LAC there are significant differences that are often not appreciated. Comparing LAC countries that spend similar amounts of GDP on education—say Brazil and Nicaragua at about 5 percent of GDP or Peru and Uruguay at about 3 percent—the model makes clear that because there are higher school dependency rates in Nicaragua and Peru, the same investment in education implies significantly lower generosity in spending per student. Brazil and Mexico spend about twice as much per student as a proportion of GDP per worker as Peru does (World Bank, 2010).

**Figure 6.7: Public expenditure on education as a percent of GDP 2007, OECD and Brazil**


Figure 6.7 shows that Brazil’s current level of public spending is above the OECD mean. However, given the larger share of school age population in Brazil than in OECD countries, Brazilian expenditures per student are less than those observed in OECD countries for all types of education with the exception of higher education (Table 6.3). In particular, Brazilian current public expenditures per student in elementary education, high school and infant education are still very low compared to higher education (Tafner, 2010). As a consequence, the higher-to-elementary ratio is 1.2 in OECD, and 6.1 in Brazil.
### Table 6.3
Expenditures per Student (PPP-GDP US$) - 2006

<table>
<thead>
<tr>
<th>Countries</th>
<th>Basic Education</th>
<th>Higher Education</th>
<th>Higher-to-Elementary Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preschool Education</td>
<td>Elementary 1st-4th Gr</td>
<td>5th-8th Gr</td>
</tr>
<tr>
<td>OECD average</td>
<td>5,260</td>
<td>6,437</td>
<td>7,544</td>
</tr>
<tr>
<td>Brazil</td>
<td>1,315</td>
<td>1,566</td>
<td>1,726</td>
</tr>
</tbody>
</table>

Source: Education at a Glance, 2009

### 6.3.2 Projections

Two scenarios are presented for projecting future public spending on education in Figure 6.8. In the *Status-quo scenario*, the government maintains its current levels of aggregate spending on education. As the population of students declines over time, the average benefit per student would gradually rise toward OECD levels – but never reach these levels over the next 4 decades. An *Alternative scenario* considers an ambitious expansion of educational spending to reach OECD levels of investment per student within a decade. In this scenario, spending as a percent of GDP increases sharply over the decade reaching 6.3% by 2020. Once reaching this target level of investment per student, the share of GDP devoted to education would then gradually decline in concert with the decline in the school-aged population – while maintaining investment levels per student at those of OECD countries.

**Figure 6.8**
Public Spending on Education as Percent of GDP, Brazil, 2005-2050

![Public Spending on Education as Percent of GDP, Brazil, 2005-2050](image)

Source: Miller and Castanheira (2010)

What would it mean to reach OECD levels of investment per student? This investment is measured relative to the average wage in the economy. To the extent that education is a product solely of teachers salaries and average classroom sizes, then reaching OECD levels of investment per student would mean that Brazil had achieved the same level of “quantity” as measured by enrollment rates and “quality” as measures by class sizes and average teacher salaries as the OECD countries. Such an ambitious increase in educational investment would likely have profound implications for both economic growth and inequality in Brazil. Indeed, Lee and Mason (2010) present simulation results which suggest that such investments in human capital can offset the costs of population aging.

It seems that Brazil has made much effort to universalize primary education, but this effort is not followed yet neither by an improvement on quality nor by an improvement on early childhood development and
high school coverage. Now, the country has the chance to pay more attention to the construction of nurseries, to the quality of primary education and to the universalization of middle school. Some resources today applied to higher education could be re-allocated to these improvements in other levels of education, as spending on higher education per student in Brazil is much higher than OECD countries. And with only few more resources it will be possible to increase the per student spending, because there will be much fewer students enrolled than in the past.

6.4 PENSIONS

Given the structure and recent developments in pension finance in Brazil, what are the likely implications of aging for pension expenditure? Addressing this question is the main focus of this section.

6.4.1 Pension Expenditures

In 2005, the Brazilian government was spending one-tenth of its GDP on its two main pension programs: 6.6% of GDP on RGPS (Regime Geral de Previdencia Social) paying retirement benefits to former private sector workers and 3.8% of GDP on RPPS (Regime Proprio de Previdencia Social) paying retirement benefits to former civil servants. Throughout the last few decades, there has been relatively little change in the elderly population in Brazil relative to that of the working-age population. In other words, the large expansion of public pension benefits in Brazil took place under very little demographic pressure. This will all change dramatically in the coming decades as seen in Figure 6.9. In 2010, the elderly population in Brazil was about 11% the size of the working-age population. By 2050, this ratio will more than triple—with the elderly population in Brazil at about 39% of the size of the working-age population. Sometime during the decade of the 2040s, the elderly population of Brazil is projected to surpass that of youth.

Figure 6.9
The Elderly Population Relative to the Working-Age Population
Brazil, Spain, and Nicaragua, 1950-2050


Aggregate spending on pensions in Brazil is slightly below that of the OECD average, but the benefit generosity is more than twice as large—and this is even considering that the dependency ratio in Brazil is currently less than half of the OECD average (Table 6.2). A more thorough review of public spending on pensions is found in Chapter 7.
6.4.2 Projections

Three scenarios are presented for future public spending on pensions. The Status-quo scenario assumes no change in the current generosity of pensions. In this case, the rapid increase in the ratio of older adults to working-age adults directly translates into dramatic and unsustainable increases in public spending – with spending on pensions rising from 10% of GDP in 2004 to an astounding 37% of GDP by 2050. Clearly this path was not sustainable.

The Legislated Reform Scenario models the impact of several recent pensions reforms (1999 and 2003), which resulted in significant reductions to the generosity of pensions – both in the short and long-run.76 Our post-reform projections are calculated by a slight revision to Equation 1, shown below in Equation 2.

\[ \frac{B(t)}{GDP(t)} = \sum x \{ b(x,t) \times o(x,t) \times \frac{P(x,t)}{P(20-64,t)} \} \]  

(2)

A measure of the impact of these reforms was developed by calculating an “obligation” matrix, \( o(x,t) \), which measure the ratio of post-reform to pre-reform benefits. The “obligation matrix” measures the extent to which the pre-reform obligations are honored. It has values ranging from 1 (meaning benefits are maintained at pre-reform levels) to 0 (meaning benefits are completely eliminated).

A full modeling of the impact of these rules is beyond the scope of the current research and would require information on wage distributions, predictions of the future course of minimum wage relative to the average wage, prediction of behavioral responses to the new rules such as switching from retirement based on age to retirement based on contribution period, etc. This scenario simply presents a stylized version of the reforms by examining their impact on the “typical” retiree in each system. In the RGPS system payouts based on contribution period exceed payouts based on age, so the typical worker is assumed to retire based on contribution time. The main RGPS reform was the introduction of a new social security factor would reduce benefits to those retiring at age 52 by 29%. This factor is taken from Miessi and Portela Souza (2007) which they base on an average age of retirement of 52 and average length of contribution of 33 years. This transition is assumed to take place over the course of 5 years beginning in 1999. In addition, the new social security factor automatically reduces benefits of future cohorts as life expectancy increases. The reduction in benefits is based on projected changes in life expectancy at age 52 from 2005 to 2050.

For the RPPS system, the typical civil servant is assumed to retire based on age. Four distinct rule changes are modeled. In 1998, it is assumed that all new hires cannot retire until age 57.5 (the simple average of minimum ages for men and women of 60 and 55, respectively); while those currently insured as of that date have a minimum retirement age of 50.5 (the simple average of minimum ages for men and women of 53 and 48 respectively).77 As data on who are new hires are not available, it is assumed that 100% of 20 year olds are new hires and 0% of 50 years olds – with a linear transition in between. In 2005, 3 new reforms are introduced which are assumed to apply only to new hires: an increase in the minimum retirement age from 60 for men and 55 for women to 65 for men and 60 for women, benefits based on average of 80% of highest wage contributions rather than wage in year of retirement; and use of price-indexing rather than wage-indexing for post-retirement benefit increases.78

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76 Appendix 1 lists the pension rules for the two programs and highlights the recent reforms.
77 This impact is modeled as the ratio of life expectancy at these ages, \( e(57.5)/e(50.5)=0.81 \).
78 The change in benefits is modeled as 0.81 (based on change in expected length of retirement using \( e(62.5)/e(57.5) \) * 0.74 (assuming a real wage growth of 2.5% per year and an average retirement period of 20 years) * 0.75 (use of 80% highest rather than last year wage) or a benefit that would be 45% of the benefit prior to the reform.
These reforms served to delay the onset of the rapid increases in pension costs due to population aging (comparing the blue and red lines in Figure 6.10). The reforms—while implying substantial cuts in benefit generosity over the coming decades—were not enough to blunt the enormous public finance impact of a more than tripling of the size of the elderly population relative to the working-age population. Even in the reform scenario, projected pension costs rise substantially over the period reaching 22% of GDP by 2050.

In the *Predicted Reforms Scenario*, the impact of the legislated reforms on pension benefits is ignored. Instead, the benefits are assumed to decline toward OECD values as the Brazilian economy grows. Specifically, it is assumed that the GDP per worker will grow at 2.5% over the next 40 years and that the generosity of public pension benefits will fall toward OECD levels. In this scenario specific reforms are not modeled but instead reforms are assumed will be carried out in a continuous manner to lead to a smooth reduction in benefit generosity over time, as the economy grows. Interestingly, projected expenditures in this scenario are broadly similar over the next 15 years to the projections based on the specific reforms recently legislated. In this scenario, pension costs rise modestly to about 15% of GDP (on par with that observed in several European countries). Given that the recent set of reforms is not sufficient to curb the growth of pension spending, one would expect future sets of reforms. To insure fairness, such reforms would need to be implemented in a graduated way—which this third scenario attempts to imitate.

Figure 6.10 presents the findings of projections under the three scenarios. The costs projected under the legislated reform are below those of our third scenario up until 2027. Beyond 2027, the costs projections in the two scenarios sharply diverge. The scenario in which benefits continue to decline until reaching OECD levels serves to postpone the sharp increase in pension expenditures that accompany aging until the late 2040s.

![Figure 6.10: Public Spending on Pensions as Percent of GDP, Brazil, 2005-2050](image)

Source: Miller and Castanheira (2010)
6.5 HEALTH CARE

6.5.1 Health Care Expenditures

The government of Brazil is heavily involved in the financing and in the provision of health care. The current Brazilian public-sector health system was introduced under the new Federal Constitution (1988), which, inspired by the idea of a national health system, created the Sistema Único de Saúde (SUS, or Unified Health System), whose principles are free and universal access to health care, comprehensiveness, and public financing. The SUS functions across Brazil’s three levels of government (central, state, and municipality). Brazil’s constitution allows the existence of a private sector in health, so the Brazilian health system is composed of a mix of the public system and the private sector. In practice, the statutory system is the public one, and the private sector, which comprises both private voluntary health insurance and private providers, operates alongside the public system. In the private sector, people pay private providers using private health insurance or out-of-pocket payments.

Health care spending is a major, and over time growing, source of fiscal pressure. The 2000 Constitutional Amendment No. 29 – EC 29 – introduced important changes in the public financing of health care services. EC 29 determines the minimum percentage over the federative entities’ revenue committed to public expenditure on health. As expected, states’ compliance with the maximum limits imposed by EC 29 on public expenditure financing on health produced an increase in spending. Table 6.4 shows expenditures on health by all levels of Government. Between 2000, EC 29 approval year, and 2006, federal expenditure on health under federal government own resources grew 10.4 percent in actual terms. States and local governments show an actual growth of 73 percent and 75.6 percent respectively. Thus, spending through state and local governments’ own resources stimulated a total growth of 36.1 percent in the period. Total increase in spending by inhabitant and as percentage of GDP was 24.5 percent and 24.6 percent.

This reflects a shared view on the economic rationale for public sector involvement in health care markets based on efficiency and equity considerations. Health care markets suffer from the typical problems of insurance markets such as adverse selection (which may make it difficult for persons with higher health risks to obtain affordable coverage leading to a sub-optimal consumption of health care services), moral hazard (whereby the insured person may have an incentive to over consume health care services as they do not bear the full cost) and other asymmetric information (whereby health care providers may be in a position to induce the demand for treatment and extract economic rents).

For the Federal Government, in the year 2000, this minimum amount should be equivalent to the value spent on health public services in the 1999 fiscal year plus 5 percent. From 2000 onwards, it should equal the value obtained in the previous year, plus the nominal GDP variation. For states (including the Federal District) and local governments, the minimum amount of resources applied to health should be increased gradually - up 1/5 of the difference – until the fifth year after approval of EC 29. Until 2004, such resources would reach 12 percent at state level and 15 percent at municipal level. After that, they would stabilize at least at that threshold.

In 2000, when the minimum percentage was 7 percent, only 63 percent of the states fulfilled the commitment. In 2008, when this minimum value had already reached 12 percent, 85 percent of the states spent as much or more than what was mandatory.
Table 6.4
Federal, state, municipal and total Health Care spending financed by own resources in jan/2010 R$ million (A); per capita health care spending (B); and health care spending as percentage of GDP (C) between 2000 and 2006.

<table>
<thead>
<tr>
<th>Year</th>
<th>Central Government</th>
<th>States</th>
<th>Municipalities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A R 10^9</td>
<td>B R$</td>
<td>C % GDP</td>
<td>A R 10^9</td>
</tr>
<tr>
<td>2000</td>
<td>44,197</td>
<td>119.86</td>
<td>1.73%</td>
<td>13,710</td>
</tr>
<tr>
<td>2001</td>
<td>44,224</td>
<td>130.37</td>
<td>1.73%</td>
<td>16,270</td>
</tr>
<tr>
<td>2002</td>
<td>42,884</td>
<td>141.65</td>
<td>1.67%</td>
<td>17,818</td>
</tr>
<tr>
<td>2003</td>
<td>38,376</td>
<td>153.67</td>
<td>1.60%</td>
<td>17,147</td>
</tr>
<tr>
<td>2004</td>
<td>42,206</td>
<td>182.59</td>
<td>1.68%</td>
<td>20,686</td>
</tr>
<tr>
<td>2005</td>
<td>44,448</td>
<td>198.15</td>
<td>1.70%</td>
<td>20,992</td>
</tr>
<tr>
<td>2006</td>
<td>48,786</td>
<td>218.18</td>
<td>1.75%</td>
<td>23,703</td>
</tr>
</tbody>
</table>

Source: SIOPS / Ministry of Health.

6.5.2 Projections

As countries move through the demographic transition, the health sector dependency ratio follows a U-shape curve. Initially, declines in mortality rates lead to declines in the proportion of the population near death. As evident in the case of Nicaragua as shown in Figure 6.11, such declines can be quite rapid and substantial. The near-death population was about one-third the size of the working-age population in 1950 in Nicaragua. Over five decades, the near-death population declined to about one-tenth the size of the working-age population. Eventually as the demographic transition proceeds, the age structure of the population shifts substantially toward older persons and the near-death population begins to increase relative to the working-age population.

In virtually all Latin American and Caribbean countries the population near-death will grow more quickly than the population of working-age adults, which will tend to increase the financial burden associated with financing health care. In the case of Brazil, the near death population has been declining since 1950 when the near-death population was about one-fifth of the working-age population. It reached a nadir of about 11% of the working-age population in 2006 and is projected to continue increasing. After decades of favorable demographic chance, the health system in Brazil is set to experience increasing demographic pressures over the coming decades.
There are striking differences in health care expenditures by age between high-income and middle-income countries. Figure 6.12 shows health care expenditures per person of each age as a fraction of GDP per working-age adult based on our calculations using data taken from National Transfer Accounts. For those below age 40, health spending in high-income and middle-income countries is surprisingly similar. This cross-sectional data implies that health care spending at these ages increases proportionally with income. Above age 40, the pattern is quite different. In high-income countries health care expenditures per older adult are significantly greater in middle-income countries. That is, as incomes rise, health care expenditures at these ages increase more rapidly than income. In other words, in high-income countries health care for the aged is a “luxury good” whereas health care for those under 40 is a “normal good.”

It is very much an open question as to why societies seem to choose this path. Some possibilities include: Shifts in medical protocol in which chronic diseases are more aggressively treated; age-biased technological change, wherein advances in medical care favor the sorts of chronic medical problems that older people have; political power since these are mainly public expenditures, it could represent the rising political power of older people as societies age (and simultaneously become wealthier); and data measurement anomalies, older and wealthier countries may provide some care for senior citizens in the market, whereas in poorer countries such goods are home produced. A primary example of this would be the shift from personal home care provided by family members toward institutional care provided in nursing home facilities. Whatever the reasons for this pattern, the shift to higher expenditures at older ages as countries become richer magnifies the impact of population aging and is projected to lead to significant increases in health expenditures as a share of GDP in Brazil.
As was the case for pensions, two alternative scenarios are presented for future public spending on health. In the Status quo scenario, age-specific public spending on health remains constant relative to GDP per working-age adult. In this scenario, only demographic change drives public health expenditures. In Brazil, this results in about 1.6 percentage points increase in spending through 2050: rising from 3.3% in 2005 to reach 4.9% in 2040. In the Alternative scenario, public expenditures on health care move toward the patterns observed in high income economies – with large increases in the older ages, as GDP per worker increases (at a fixed rate of 2.5% per year). In this scenario, the fiscal impact of growing numbers of elderly is multiplied by this shift toward increasing levels of medical treatment of the elderly. Public expenditures increase by 4.4 percentage points of GDP by 2050 (reaching 7.7% of GDP). This increase is on par with that observed for pensions under the future reforms scenario.

Source: Miller and Castanheira (2010) based on data from the National Transfer Accounts project (2010).
6.6 ASSESSING THE OVERALL FISCAL IMPACT

The age structure of Brazil’s population will change dramatically over the coming decades. The elderly population is projected to increase from about 11% of the working-age population to 49% by 2050, while the school-age population is projected to decline from about 50% of the working-age population to 29% by 2050. These shifts in population age structure are likely to lead to substantial additional fiscal pressures on publicly financed health care and pensions, along with substantial reductions in fiscal pressures for publicly financed education.

Having assessed the impact of population aging in each sector, this section concludes the chapter by presenting an assessment of the overall impact on government spending. In 2005, total public spending on education, pensions (including those for civil servants) and health care amounted to 17.7% of Brazil’s GDP. Our projection shows an increase of 9.5 percentage points of GDP so that by 2050 public spending in these sectors would reach to 27.2 percent of GDP. This projection combines 3 sector forecasts: for education, an ambitious program is assumed of increased expenditures to reach OECD levels of investment per student by 2020; for pensions, a program of pension reforms is assumed which gradually reduces benefits to those of OECD by 2050; for health care, it is assumed that the impact of increasing numbers of elderly is multiplied by an increase in the costs of care for this age group. Figure 6.14 shows the path of public spending from 2005-2050 in this scenario. As an alternative, a scenario is shown in which aggregate expenditures in education remain constant over the projection and investments per student gradually approach OECD levels.

![Figure 6.14](image)

**Figure 6.14**

Public Spending on Education, Pensions, and Health as Percent Of GDP, Brazil, 2005-2050

The costs of these two alternative scenarios are evaluated by taking the present value of future cost increases as a share of current GDP. In the first scenario, these future cost increases amount to two times current GDP under an assumption of a 4% discount rate. These costs can be decomposed by program as shown in Table 6.8.
Table 6.8
Projected Increases in Public Spending: 2005-2050.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Scenario</th>
<th>Costs of future increases in spending relative to current GDP</th>
<th>Spending as percent of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Education, Pensions,</td>
<td>Rapid increase in education investment; Decline in pension benefits</td>
<td>188</td>
<td>17.7</td>
</tr>
<tr>
<td>and Health Care</td>
<td>according to current reforms through 2027 and then continued declines to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OECD levels thereafter; Increasing health expenditures at older ages.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gradual increase in education investment; Decline in pension benefits</td>
<td>149</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>according to current reforms through 2027 and then continued declines to</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OECD levels thereafter; Increasing health expenditures at older ages.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Rapid increase in student investment, reaching OECD levels by 2020.</td>
<td>39</td>
<td>4.0</td>
</tr>
<tr>
<td>Pensions</td>
<td>Average pension benefits fixed at current levels relative to average wage.</td>
<td>357</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Average pension benefits reduced according to recently legislated reforms.</td>
<td>156</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Gradual decline toward OECD levels.</td>
<td>107</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>Average pension benefits cut according to current law through 2026 and</td>
<td>99</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>future reforms reduce values toward OECD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health care</td>
<td>Increasing health expenditures at older ages.</td>
<td>50</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>No change in health expenditures by age.</td>
<td>18</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Source: Miller and Castanheira (2010) based on fiscal projection model.

The largest contributor to future costs increases are pensions whose cost increases amount to half the overall increase in public spending: 99% of current GDP. The remainder is split between health cost increases (50% of current GDP) and education increases (39%). It is worth stressing that the very ambitious program of increasing educational spending to reach OECD levels of student investment within a decade is far less costly than the projected increases in health care and pensions.

In terms of public health care, one of the key findings from our projections is that health care expenditures are likely to increase substantially in Brazil. An increase is projected of more than 4 percentage points of GDP, about the same increase as in pensions. These increases in health spending come relatively later in the projection period as compared to pensions – so the present value of cost increases in health care is about half that of pensions. There are two driving forces behind this increase in health costs: The increasing proportion of elderly in the population and a growing intensity of formal health care use among the elderly. Health care is, therefore, likely to emerge as a major fiscal challenge in the coming decades in Brazil.

Without public pension reform, the projected increase in costs through 2050 amount to more than 3.5 times of current GDP. Clearly the old system was unsustainable. Our stylized model of the recent set of pension reforms project future increases amounts to 155% of current GDP—with pension expenditures projected to double to 22.4% of GDP by 2050. Our model is admitted a crude estimate of the impact that tend to overstate the amount of savings from the reform. Therefore, our estimate should be taken as a lower bound on future increases. The current set of reforms more than halved the projected costs increases in the absence of reform. At the same time, our projections indicate that they have not solved the problem of increasing pension benefits. In our alternative scenario, a series of reforms is forecast that
gradually bring Brazil pension benefits into line with OECD countries. Even in this optimistic scenario, increased in pension expenditure dominate the fiscal outlook for Brazil.

In summary, Brazil is entering a new demographic phase in which changing population age structure will lead to increasing cost pressures of health care and, especially, of pensions. Our projections show that beginning around 2015, after a respite due to the recently enacted pension reforms, pressure on public spending will begin a sustained and rapid increase lasting several decades. The need for increased investment in students will compete against those of sustaining pension benefits and increasing demands for health care—especially among the elderly.
APPENDIX TO CHAPTER 6

RGPS (Private Worker System) rules to retire by retirement type

<table>
<thead>
<tr>
<th>Type of retirement</th>
<th>Old age</th>
<th>Length of contribution</th>
<th>Length of contribution + age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Minimum age</td>
<td>Urban worker: 65; Rural worker: 60;</td>
<td>Urban worker: 60; Rural worker: 55;</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>Male: 35 years; Female: 30 years</td>
</tr>
<tr>
<td>Minimum contribution length</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Benefit value</td>
<td>70% of salary-benefit + 1% to each group of 12 contributions until it reaches the maximum of a 100% of the salary-benefit. The benefit value will not be less than the official minimum wage.</td>
<td>-</td>
<td>Male: 35 years; Female: 30 years</td>
</tr>
<tr>
<td>Salary-benefit</td>
<td>● Insured in the system until November 28th, 1999: simple average of 80% highest wages since July 1994</td>
<td>● Insured in the system until November 28th, 1999: Simple average of the 80% highest wages since July 1994 multiplied by the social security factor.</td>
<td>● Insured in the system until November 28th, 1999: Simple average of the 80% highest wages since July 1994 multiplied by the social security factor.</td>
</tr>
<tr>
<td></td>
<td>● Insured in the system after November 29th, 1999: simple average of 80% highest wages of the complete contribution period</td>
<td>● Insured in the system after November 29th, 1999: simple average of 80% highest wages of the complete contribution period multiplied by the social security factor.</td>
<td>● Insured in the system after November 29th, 1999: Simple average of 80% highest wages of the complete contribution period multiplied by the social security factor.</td>
</tr>
<tr>
<td>Social Security Factor</td>
<td>Can be applied if advantageous</td>
<td>Mandatory</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Penury period to retire</td>
<td>● Insured in the system after 1991: 180 contributions</td>
<td>● Insured in the system after 1991: 180 contributions</td>
<td>● Insured in the system after 1991: 180 contributions</td>
</tr>
<tr>
<td></td>
<td>● Insured in the system before 1991: depends on the year of retirement requirement. If the requirement is in 1992 it's 60 contributions, for each additional year it's 6 additional contributions until it reaches 180 in 2011. The exception is from 1995 to 1996 that one years adds 12 contributions (from 78 to 90 contributions)</td>
<td>● Insured in the system before 1991: 60 contributions, for each additional year it's 6 additional contributions until it reaches 180 in 2011. The exception is from 1995 to 1996 that one years adds 12 contributions (from 78 to 90 contributions)</td>
<td>● Insured in the system before 1991: 60 contributions, for each additional year it's 6 additional contributions until it reaches 180 in 2011. The exception is from 1995 to 1996 that one years adds 12 contributions (from 78 to 90 contributions)</td>
</tr>
</tbody>
</table>

Notes: 1. Transition rule to Social Security Factor: To people in the system before December 15th, 1998 the Social Security Factor is applied to only 1/60 of the average 80% highest wages for people who retires at the first month after the reform. In the second month the Social Security Factor is applied to 2/60 of the average highest 80% wages. It keeps like that until it reaches 100% after 5 years of reform. 2. To people enrolled in the system but with no contribution since July 1994 the benefit value will be the official minimum wage. 3. Teachers from infant, basic and medium education will have a discount of five years in the minimum age to retire and in the contribution length.

RPPS (Civil Servants System) rules to retire to Civil servants enrolled in the system after or before the
### Constitutional Amendment n° 41 in 2003

<table>
<thead>
<tr>
<th>Type of retirement</th>
<th>Old age</th>
<th>Length of contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Minimum age</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>Minimum contribution length</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Benefit value</td>
<td>Proportional to time of contribution</td>
<td>100% salary-benefit</td>
</tr>
<tr>
<td>Salary-benefit</td>
<td>Average of 80% highest wages of the career with a ceiling of (R$ 2,500) if a private additional regime (RPC) is available. The salary-benefit will not be less than a minimum wage</td>
<td></td>
</tr>
<tr>
<td>Penury period to retire</td>
<td>10 years of performance in the public sector and five years in the retirement work occupation</td>
<td></td>
</tr>
</tbody>
</table>

### RPPS (Civil Servants System) rules to retire to Civil servants enrolled in the system before Constitutional Amendment no 20 in 1998

<table>
<thead>
<tr>
<th>Type of retirement</th>
<th>A</th>
<th>B</th>
<th>C²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Minimum age</td>
<td>53</td>
<td>48</td>
<td>Minimum age (60) will reduce 1 year old for each contribution year that exceeds the minimum contribution length (35 years)</td>
</tr>
<tr>
<td>Minimum contribution length</td>
<td>35 years + 20% of the time missing to complete 35 years of contribution in December 16th, 1998</td>
<td>30 years + 20% of the time missing to complete 30 years of contribution in December 16th, 1998</td>
<td>35 years</td>
</tr>
<tr>
<td>Benefit value</td>
<td>3.5% of salary-benefit reduction to each year less than 60 if the person have reached those retirement requirement until December 31st, 2005</td>
<td>3.5% of salary-benefit reduction to each year less than 55 if the person have reached those retirement requirement until December 31st, 2005</td>
<td>100% salary-benefit</td>
</tr>
<tr>
<td>Salary-benefit</td>
<td>Career condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 80% highest wages since July 1994</td>
<td>5 years in the retirement work occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% of last wage actualized by wage of active people in the person last occupation or function</td>
<td>25 years enrolled in the public sector, 15 years of career and five years in the retirement work occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% of last wage actualized by wage of active people in the person last occupation or function</td>
<td>20 years enrolled in the public sector, 10 years of career and 5 years in the retirement work occupation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1. The retirement type C it's for people enrolled in the system before the Constitutional Amendment no 41 in 2003.
2. The retirement in RPPS is mandatory when the servant reaches 70 years old.
3. Civil servants that are teachers will have a plus of 17% (if male) and 20% (if female) in their length of contribution if they are enrolled in RPPS before the Constitutional Amendment of 1998.
4. Inactive people already retired by RPPS will have to pay contributions to the government in the same proportion of actives employees (11% of the wage) if their retirement benefit is 50% more than the RGPS ceiling (R$2400,00) to retired civil servants of States, Municipalities and Federal District or 60% more than the RGPS ceiling (R$2400,00) to retired civil servants of the Union (Federal Sphere).
Chapter 7
Financing Brazil’s Aging Population: Implications for Saving and Growth

7.1 INTRODUCTION

Population aging in Brazil is an inevitable consequence of its demographic transition. Economic behavior and macroeconomic outcomes change both systematically and endogenously with aging. Therefore, Brazil is bound to experience pressure on fiscal sustainability, while saving and investment are in danger of falling short of what is needed to keep capital accumulation, wealth, and welfare at desirable levels.

Sufficient saving is important an economy in order to generate a high income per capita. Population aging has two direct effects on saving: First, aging is traditionally believed to reduce aggregate saving rates because the working age (elderly) share of the population—who generally have high (low) saving rates—will decrease (increase) as implied by the life-cycle hypothesis (LCH) by Modigliani and Brumberg (1954a,b). This effect will, ceteris paribus, lead to lower economic growth (Solow, 1956; Weil, 1997). Second, aging will probably increase the saving rate since life expectancy is increasing and people consequently anticipate a longer retirement period to be financed partly by private saving (Jorgensen and Jensen, 2010). These two effects may have offsetting impacts on saving—and thus on growth. It is therefore clearly an empirical matter which effect dominates—and whether the assumptions behind the LCH are valid in the context of Brazil.

To further point out the complexity of this issue, what if age-specific saving rates do not decline in old age as posited by LCH? That could entail completely different macroeconomic effects of aging than would be expected. There may be a desire to leave bequests (Kotlikoff and Summers, 1981; De Nardi, et al., 2009) or for elderly to share their pension income with their children (Barro, 1974). In addition, there are countless indirect effects of aging on saving. For example, the intensity of labor supply might fall when statutory retirement ages are often increased as a policy response to aging and people experience their lifetime leisure falling (Jorgensen and Jensen, 2010). Furthermore, the way in which the Brazilian government decides to finance the inevitably increasing costs for social security and health will also have major implications for the behavioral responses of Brazilians.

In this chapter—which builds on Jorgensen (2011)—the macroeconomic implications of population aging in Brazil are analyzed using four alternative yet complementary methodologies. First, the international and Brazil-specific econometric evidence on the aging-saving transmission channel is analyzed. Second, a partial equilibrium model is developed to exploit the rich household data on exogenous age-specific saving rates in Brazil. Third, as partial equilibrium analyses do not take into account the potentially endogenous behavioral responses to aging (Acemoglu, 2010) a general equilibrium framework is presented—under which a reduced form and a full-fledged version of the general equilibrium model is analyzed. Simulations are performed for different scenarios of poverty reduction and fiscal policies, and the implications for key macroeconomic aggregates, such as saving, wealth, and demographic dividends, are analyzed and discussed in light of the advantages and disadvantages of the different models.

The main findings of the four complementary analyses are the following: In relation to the econometric evidence for Brazil, a higher saving rate is found to lead to higher income growth. This is an empirically well-established relationship for most countries. What is more controversial is the econometric finding that an increase in the old-age dependency ratio has, so far, led to an increase in the private saving rate—suggesting that aging may lead to higher growth in the future due to higher saving rates. The econometric evidence is paired with a literature review that places Brazil in international context regarding the relationship between population dynamics and saving—revealing that Brazil is not the only developing
country that has experienced such unexpected dynamics. Ultimately, there is no econometric evidence suggesting that an increasing old-age dependency ratio has led to reductions in saving and growth.

The partial equilibrium results suggest that saving rates in Brazil depend crucially on public pensions. Elderly tend to save a large fraction of public pensions, effectively leading to just as high saving rates for elderly as for workers. If Brazil maintains relatively high public pensions, it is therefore likely that the saving rate will increase since the population structure will be composed by a larger fraction of high-saving workers and elderly—rather than low-saving young. On the other hand, it should be taken into account that high pensions themselves crowd out savings; if people are sure that they will receive high public pensions, why should they save for their retirement? Consequently, there are two counteracting forces. Moreover, if poverty levels fall further, there will be more high-savers because non-poor tend to save more than the poor—thus promoting savings even further.

In terms of financing the costs associated with aging, the chapter compares in a full-fledged general equilibrium model three financing-options: First, Tax-Financing, where taxes for health and pensions increase to finance an unchanged level of health and pension benefits as debt is left untouched; second, Benefit-Financing, where debt and taxes are unchanged while pension benefits per elderly decline; and third, Debt-Financing, where public debt is allowed to absorb all costs while the pensions and health contributions and benefits remain constant. Clearly, the different financing scenarios will have differential effects on economic behavior and fiscal costs, and the chapter analyzes their respective implications for saving, capital accumulation and demographic dividends.

The key driver of the general equilibrium results is endogenous capital accumulation—signifying the catalyst for the second demographic dividend. The key finding is that Benefit-Financing will be strongly preferable as a financing method since capital accumulation and growth-dividends would increase under this scenario when the population ages—while capital accumulation and growth-dividends are expected to fall under Tax-Financing or Debt-Financing scenarios. Consequently, with appropriate policies, there is scope for promoting the second demographic dividend over the period 2010 to 2050. A possible reform of the relatively generous Brazilian social security system should consider the advantages involved with indexing the age of eligibility to pension benefits (the statutory retirement age) to life expectancy. Such a policy response is analytically formulated by Jorgensen and Jensen (2010) and has informed policy debates across OECD countries in particular.

The scope of this chapter does not encompass all the transmission channels through which aging will lead to macroeconomic changes. Decisions over labor force participation, and endogenous changes in effective retirement ages, are not considered explicitly. The following section 7.2 presents new econometric evidence for Brazil on the aging-saving relationship, while reviewing the literature in order to place Brazil into an international context. Section 7.3 builds and simulates a partial equilibrium model in order to evaluate the likely implications that aging will have for household saving rates depending on scenarios for poverty headcounts. Section 7.4 concludes the triad of methodologies applied to analyze the macroeconomic implications of aging by constructing both a reduced form and a full-fledged general equilibrium model where both saving, capital accumulation and demographic (growth) dividends can be analyzed empirically for Brazil.

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82 Chawla, Betcherman, and Banerji (2007) analyze the LCH and potential saving responses to population aging in Eastern European and Central Asian countries and reach similar conclusions.

83 The second demographic dividend arises as the low dependency ratio (the demographic bonus) has lead to a larger share of prime savers in the economy, thus boosting savings. Such higher saving, combined with higher future saving due to an expectation of increased longevity, will lead capital accumulation to enhance growth through a higher capita-labor ratio (section 7.4.1 provides a more elaborate discussion on the demographic dividends).

84 Bloom et al. (2008, 2009) deal with such issues in a broader context, and the institutional settings for harvesting the demographic dividend is neither incorporated (Bloom and Canning, 2003; and Bloom et al., 2007). These and other excluded issues remain for future research on the economic implication of aging in Brazil—though chapter 5 touches upon labor participation, and chapter 6 adopts an institutional perspective on the socioeconomic implications of aging.
7.2 AGING, SAVING, AND GROWTH: THE EMPIRICAL EVIDENCE

Will population aging affect growth though saving in Brazil? The traditional view is that growth should be negatively associated with aging because aging would reduce saving—and lower saving would reduce growth. But is this really what aging has in store for Brazil? To address this question for Brazil, it is necessary to econometrically analyze the aging-saving and saving-growth relationships, respectively.

Before focusing on the aging-saving relationship, which is the main focus of this chapter, the saving–growth relationship needs to be firmly econometrically established in the case of Brazil. Rodrik (2000) argues that the accumulation of physical capital is the proximate source of economic growth and in the context of growth theory saving is critical in order to maintain a high income per capita (Solow, 1956). Jorgensen (2011) provides significant and robust evidence that saving is an important determinant of growth.85

To further support this finding, private saving is found to positively but insignificantly affect investment; growth is significantly increasing investment; and if investment increases in the short term, growth may fall since output is used for long term investment rather than consumption—over the long term investment positively affects growth. These relationships for Brazil conform well to the established macroeconomic literature, and all relationships (except one) confirm the conclusion by Attanasio (2000)—thus making the case even stronger that private saving causes growth.86

The international evidence on whether saving follow the LCH is quite clear—but mainly for industrialized countries. Cross-country econometric studies using aggregate time-series data reveal correlations between demographics and saving rates which broadly confirm the LCH (Graham, 1987; Koskela and Viren, 1989; Masson et al., 1998; and Miles, 1999). The international evidence is mixed, however, if low and middle-income countries are also considered—and highly dependent on how income is estimated. Households do not seem to run down their stocks of wealth in retirement at the rate predicted by the LCH (Poterba, 1994; Gregory et al. 1999). Miles (1999) clarifies that a key error in traditional estimations is to count all of pension receipts as income—one should adjust for private pension savings.87

A literature review—presented in Table 7.1—reveals that the expected correlation between the dependency ratio and private saving may be insignificantly positive for “transition” countries (incl. Brazil), though it would be expected to display a negative relationship for developed countries.88 This is likely to be caused

85 Building on Brazilian data from IPEA, a vector auto-regression (VAR) analysis is performed by Jorgensen (2011) to study whether gross or private saving positively (Granger) causes economic growth over time (see Table A1 in the Annex 7.1). In a separate VAR model where public saving and the old-age dependency ratio are included in the equation system, the result still holds. A key reference for this interrelation between saving and growth in a panel setting is Attanasio (2000). The findings for Brazil are compared to those by Attanasio (2000).

86 The findings are robust to the measure of saving being either gross or private. Cumulative impulse response functions from the VAR model further support the positive growth-implications over time of an increase in private saving (Jorgensen, 2011). There is one important caveat of this analysis, however. The data on public and private saving in Brazil is not as reliable as one would hope. The period 1984 to 1994 are somewhat unreliable, because the public and private saving were not available from IPEA, and this is the period where public and private saving is then seen to display a spike. The IMF is as the source for public saving within this period. On the other hand, Morandi (1998) finds a similar spike in private saving, though smaller. Oliveira et al. (1998) finds a similarly small spike within this period.

87 Bosworth et al. (1991) estimate the average savings rate for retirees in the United States, correcting for the pension adjustment suggested by Miles (1999), and finds that the traditional measure of the unadjusted savings rate was 14.9 percent, while the measure that was adjusted by private pensions was 1.8 percent.

88 Meredith (1995) estimated that a 10 percentage point increase in the old-age dependency ratio could reduce the savings rate by around 9 percentage point, while a 0.1 percentage point drop in the young-age dependency ratio would lead to an increase in the savings ratio of about 6.1 percentage points. Also, simulations by Miles (1999), based on a model that assume the LCH, found that the private savings rate in European economies could fall from 15.9 percent (of GDP) in 1990 to around 4.5 percent by 2060. Roeger (2006) furthermore finds that life expectancy in the euro area is
by the simple fact that household saving rates remain high in old age; which we will see is indeed the case for Brazil. Also, the old-age dependency ratio is likely to be insignificantly positive for Latin American and Caribbean (LAC) countries as a subgroup. An additional element of aging is increased life expectancy which may raise the rate at which individuals save during working life. Life expectancy is surely found to positively impact private saving in Table 4.1, and this is supported for LAC countries.

What is the econometric evidence for Brazil? Jorgensen (2011) finds that the old age dependency ratio positively (Granger) causes private saving both in the short and long term (Table A2 in the Annex 1). This is contrary to the international literature on developed countries but not necessarily contrary to what is observed in developing, middle-income, countries. It is furthermore found that public saving crowds out private saving, which is consistent with findings in Paiva and Jahan (2003) in the case of Brazil.

OLS estimations further reveal that the private saving rate is significantly and positively correlated with the total dependency ratio. Also, life expectancy is found to contribute positively to private saving—and to a strongly significant extent when pension benefits are included in the estimations. On the other hand, in the OLS estimations, the effect from the old age dependency ratio is negative—which is a finding that supports the LCH but counters the error-correction approach followed above, revealing some ambiguity in the econometric evidence. Higher inequality, as measured by the Gini-coefficient, is seen to positively affect the precautionary saving motive because it increases the private saving rate. This is also true in estimations where inflation is excluded and the Gini-coefficient is included in order to avoid double-counting the precautionary saving motive. Future econometric research on Brazil could address this ambiguity.

An important insight by Jorgensen (2011) is that, in the future, the dependency ratio will be driven mainly by the old-age dependency ratio rather than the youth dependency ratio. Could such demographic dynamics cast doubt about the empirical results found in this section? In the simple OLS regressions (over the period 1970-2008) the youth dependency ratio was found to positively and significantly increase the private saving rate while old age dependency ratio was found to lower the private saving rate. Since the total dependency ratio was found to increase the private saving rate—and because the total dependency ratio was mainly driven by changes in the youth dependency ratio—a stronger future role of the old age dependency ratio in driving the total dependency ratio may lead to the reverse relationship between the total dependency ratio and the private saving rate.

The econometric evidence above is valuable to establish a historical relationship between population dynamics, saving, and growth. However, for the purpose of projecting these relationships into the future there remains some ambiguity due to the shift in the main driver of the total dependency ratio from being the old-age to the youth dependency ratio. Therefore, the aim of the remainder of this chapter is to dig deeper into the relationships between population dynamics and economic behavior.

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89 Jorgensen (2011) uses an error-correction model to address this question. The problem with a single equation error-correction model could be a simultaneous equation bias if the causality between private saving and one of the other variables runs both ways, which could explain the negative coefficient of GDP per capita in the long run relationship. An alternative is to use Johansen approach of vector error-correction, but this is not pursued due to the small number of observations. It has been attempted to also include in the error-correction model the terms of trade, M2, and the inflation rate, but they did not produce significant results.

90 This approach avoids double-counting the precautionary saving motive; inflation is significantly positive on saving.

91 A further neglected issue is that reductions in income inequality may lead to a larger middle-class that generally saves more. One reason why poverty decompositions usually reveal that inequality increases poverty may be due to the saving-channel; the higher inequality is, the lower is the average private saving rate. So, high inequality may reduce savings which reduces growth and increases poverty.

92 The above evidence on the saving-growth and aging-saving relationships has been purely empirical. The evidence suggests that the old-age dependency ratio is likely not to have negative effect on private saving over the time period
Table 7.1
Determinants of the private saving rate (in panel studies)

<table>
<thead>
<tr>
<th>Variable category</th>
<th>Specific variable</th>
<th>Expected sign</th>
<th>Empirical finding (cross country)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td>Dependency ratio</td>
<td>–</td>
<td>–(3, 6) 0 (1, 7, 9, 10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+17 (insignificantly positive for transition economies incl. Brazil)</td>
</tr>
<tr>
<td></td>
<td>Old age dependency ratio</td>
<td>–</td>
<td>–(1, 4, 5, 6, 12, 14 (insignificantly positive for LAC)) 0 (7, 9, 13)</td>
</tr>
<tr>
<td></td>
<td>Youth dependency ratio</td>
<td>–</td>
<td>–(1, 4, 6, 12, 14 (insignificantly negative for LAC)) 0 (7, 13)</td>
</tr>
<tr>
<td></td>
<td>Life expectancy</td>
<td>+</td>
<td>+15, 14 (insignificantly positive for LAC)</td>
</tr>
<tr>
<td></td>
<td>Urbanization</td>
<td>Ambiguous</td>
<td>–(1, 4) + (17 (transition economies incl. Brazil))</td>
</tr>
<tr>
<td>Fiscal policy</td>
<td>Gross public saving to GDP</td>
<td>–</td>
<td>–(3, 4, 5, 8, 9, 10, 11, 17 (transition economies incl. Brazil))</td>
</tr>
<tr>
<td></td>
<td>Government net lending</td>
<td>–</td>
<td>–(1, 6, 7)</td>
</tr>
<tr>
<td></td>
<td>Public surplus</td>
<td>–</td>
<td>–(6, 13, 7) 0 (12)</td>
</tr>
<tr>
<td></td>
<td>Public consumption</td>
<td>Ambiguous</td>
<td>–(6, 7)</td>
</tr>
<tr>
<td>Rate of return</td>
<td>Real interest rate</td>
<td>Ambiguous</td>
<td>–(1, 8) 0 (1, 3, 4, 7, 9, 10, 11, 13) + (5, 6, 7)</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Inflation rate</td>
<td>+</td>
<td>0 (3, 5, 7, 8, 10) + (1, 6, 9)</td>
</tr>
<tr>
<td></td>
<td>Gini coefficient</td>
<td>+</td>
<td>–(12) 0 (11, 6, 4) + (1)</td>
</tr>
<tr>
<td></td>
<td>Measures of political stability</td>
<td>+</td>
<td>+ (3, 6, 4, 1, 10) 0 (9, 12, 13, 7)</td>
</tr>
<tr>
<td>Income</td>
<td>GDP</td>
<td>0 or +</td>
<td>0 (11, 6, 4, 12, 1, 17 (transition economies incl. Brazil)) 0 (13, 7)</td>
</tr>
<tr>
<td></td>
<td>Growth rate of GDP per capita</td>
<td>Ambiguous</td>
<td>+ (3, 6, 4, 1, 10) 0 (9, 12, 13, 7)</td>
</tr>
<tr>
<td></td>
<td>GDP growth</td>
<td>0 or +</td>
<td>+ (5) 0 (6, 7)</td>
</tr>
<tr>
<td></td>
<td>Labor productivity growth</td>
<td>0 or +</td>
<td>+ (8)</td>
</tr>
<tr>
<td>Competitiveness</td>
<td>Terms of trade</td>
<td>0 or +</td>
<td>+ (1, 6, 7, 8, 9, 12, 17 (transition economies incl. Brazil))</td>
</tr>
<tr>
<td></td>
<td>Current account to GDP</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Domestic borrowing constraints</td>
<td>Private credit flows</td>
<td>–</td>
<td>+ (3, 4) – (1)</td>
</tr>
<tr>
<td></td>
<td>Credit to GDP ratio</td>
<td>Ambiguous</td>
<td>0 (9, 10)</td>
</tr>
<tr>
<td>Foreign borrowing constraints</td>
<td>Current account deficit</td>
<td>–</td>
<td>–(1, 11, 4, 6)</td>
</tr>
<tr>
<td>Financial depth</td>
<td>Private or domestic credit stock</td>
<td>Ambiguous</td>
<td>–(13)</td>
</tr>
<tr>
<td></td>
<td>Money stock to GDP</td>
<td>Ambiguous</td>
<td>+ (11, 4, 12) 0 (1)</td>
</tr>
<tr>
<td>Pension system</td>
<td>Pay–as–you–go transfers</td>
<td>0 or –</td>
<td>–(4, 12, 13)</td>
</tr>
<tr>
<td></td>
<td>Mandatory funded pension contributions</td>
<td>0 or –</td>
<td>+ (12)</td>
</tr>
<tr>
<td></td>
<td>Fully funded pension assets</td>
<td>Ambiguous</td>
<td>0/+ (13)</td>
</tr>
<tr>
<td>Distribution of income and wealth</td>
<td>Income concentration</td>
<td>Ambiguous</td>
<td>0 (4)</td>
</tr>
<tr>
<td></td>
<td>Gini coefficient</td>
<td>Ambiguous</td>
<td></td>
</tr>
</tbody>
</table>

Source: The compilation was done by Jørgensen (2011). The results listed under Empirical findings summarize the significance of saving regressors in the following studies, where only statistically significant findings are reported: (1) Loayza, Schmidt–Hebbel and Servén (2000); (2) Fletcher et al. (2007); (3) Edwards (1995); (4) Edwards (1996); (5) Callen and Thimann (1997); (6) Masson, Bayoumi and Samiei (1998); (7) Haque, Pesaran, and Sharma (1999); (8) De Serres and Pelgrin (2002); (9) Ozcan, Gunay, and Ertac (2003); (10) Schrooten and Stephan (2005); (11) Corbo and Schmidt–Hebbel (1991); (12) Dayal-Gulati and Thimann (1997); (13) Bailliu and Reisen (1998); (14) Doshi (1994), (15) Bloom, Canning, and Fink (2008); (16) Paiva and Jahan (2003); and (17) Rodrik (2000).
7.3 AGING AND SAVING

It is well known that population aging is likely to reduce the saving rate because there will be a larger share of elderly in the population who may not have an incentive to save very much. What if, however, the LCH is not supported in Brazil if elderly also save? This is exactly the case, as this section will demonstrate, so a larger share of elderly will not necessarily reduce the saving rate. In fact, aging may even increase the saving rate—an effect that will be amplified by the expected fall in the share of children in the population in Brazil.

This section has two main purposes: To confirm or reject the LCH for Brazil, and to project the most likely trajectory for the future saving rate. A partial equilibrium treatment is offered for dynamics of household saving rates over the period 2010 to 2050 simulating the implications for the saving rates under various scenarios for income inequality building on the latest 2008 POF household expenditure survey and the 1995 to 2008 PNAD household surveys. The analysis assumes that age-specific saving rates do not change as a response to aging, but that the aggregate household saving rate will change as the population structure changes. Clearly, the assumption of constant age-specific saving rates is rather strong, so in the Section 7.4 the partial equilibrium present findings will be complemented with a general equilibrium analysis, where the saving rate is endogenous to macroeconomic and population dynamics.

A key finding is that age-specific saving rates increase up to the age of about 40, after which they remain virtually unchanged—but this is on average. As is evident from Figure 7.1b, it matters greatly to the measure whether or not public pensions are included as part of income. The literature is quite clear; private pensions should be deducted from the measure of income but public pensions should not (Bosworth et al., 1991, and Miles, 1999). Mason and Lee (2010) furthermore argue that pensions paid to public workers are components of labor income and simply a cost of producing public goods. As a result, they should be included in the income measure. We therefore adjust gross income for private pensions, all taxes, and pension contributions but not public pensions. Figure 7.1b illustrates the trajectories of the saving rate where income either includes or excludes public pensions, respectively.93

Figure 7.1a Fewer people of age 15-65, and more of the age 65+ in the future Brazilian population

![Chart showing percentage of retirees and workers in the future Brazilian population over time]

Source: UN Population Division: The 2008 Revision.

Figure 7.1b Average saving rates virtually unchanged after age 40, except if public pensions are excluded

![Chart showing saving rates with and without public pensions]

Source: Jorgensen (2011) based on POF 2008.94

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93 The measure that excludes public pension benefits is equivalent to evaluating the LCH relative to labor income.

94 Note: after age 63 the saving rates for both the rich and the poor become extremely low, varying between -500 to -23,000 percent. These savings are represented by very few households and therefore not shown, but are included in subsequent simulations with the partial equilibrium model.

158
As Figure 7.1b shows, the LCH is contradicted in the case of Brazil with the key implication that saving rates (and potentially economic growth through the channel of saving) will be not necessarily be depressed by population aging as would traditionally be expected. This pattern of saving is not unique to Brazil; rather, in several developing countries the saving rates do not decline in old age as they do in most developed countries (Poterba, 1994; Gregory, Mokhtari and Schrettl, 1999; Weil, 1997; Miles, 1999). In particular, Attanasio and Szekely (2000:38) note in a cross-country study including LAC countries that “a common feature across countries is that we do not find strong evidence of negative saving or even declining saving in the last part of the life cycle in any country”.

There are several possible explanations for why people save in old age. First, elderly may desire to leave bequests for their working age children or their grandchildren (Barro, 1974; Stokey, 1979). In the case of Brazil, however, analytical work on this issue is lacking, but there is evidence suggesting that intra-household transfers run from retired elderly to their adult children with whom they often cohabitate. Therefore, public pensions indirectly become a transfer that covers the entire household. The economic implications of such two-sided intra-household transfers are also explored theoretically by, for example, Nerlove and Raut (1997) but not in the case of Brazil. This remains as an issue for future research.

### 7.3.1 Implications of Income Inequality

On average, age-specific saving rates remain virtually unchanged after the age of 40, but this aggregate view on age-specific saving rates may hide some important heterogeneity among households in Brazil. In particular, the high income inequality in Brazil may lead to differential saving behavior by income group.

The difference between age-specific saving rates among the “non-poor” and the “poor” is illustrated by Figures 7.2a,b illustrating a crucial difference in their respective saving behavior.\(^{95}\) Despite the fact that their overall saving pattern is the same, the poor save much less at most ages. The poor also tend to display negative saving after the age of 45 until 65, while the non-poor have positive saving rates in the same age interval. This has a very important effect on the weighted average of the aggregate saving rate since a large fraction of the population in Brazil is between 45 and 65. The negative saving rates among the poor may be difficult to explain, but there may be informal credit possibilities for the poor which are not part of the established financial sector (“agiotas”), which may explain the possibly of negative saving.

![Figure 7.2a: Saving rates for the non-poor follow LCH except if public pensions are included](image1)

![Figure 7.2b: Saving rates for the poor are much lower but displays the same pattern as the non-poor’s](image2)

Source: Jorgensen (2011) based on POF 2008\(^5\)

Source: Jorgensen (2011) based on POF 2008\(^13\)

\(^{95}\) The “non-poor” and poor are classified according to the $2 PPP per day national poverty line.
The simple division of age-specific saving rates across people above and below the poverty line would therefore suggest the saving rate would be positively affected in the future if the share of the population below the poverty line were to fall with its recent trend. In fact, it does not make sense to speculate about future saving behavior without taking income inequality into consideration. Such dynamics are therefore incorporated into the partial equilibrium model employed below.

In 2008, 41 percent of Brazilian families had negative savings, which is 8 percentage points less than in 2002 (Figure 7.3a). What lies behind this change in saving patterns? Positive savings started at the 74th percentile in 2008 and at the 61st percentile in 2002. The main driver of the increase in saving rates is the decrease in the inequality of Brazilian income distribution which occurred between 2002 and 2008. Figure 7.3b supports this argument by illustrating that there are fewer poor elderly than young. Since the poverty is declining and the poor generally save less than the non-poor, we expect—everything else being equal—that aging will increase the weighted average of the saving rate. Such dynamics are incorporated into the partial equilibrium model presented in the next section.

### 7.3.2 Partial Equilibrium Implications of Population Aging

This section will present the partial equilibrium approach to determining the implications of population aging for the household saving rate. The methodology is outlined in, for example, Weil (1997) but is extended to include the important feature of differential saving behavior across income groups. To determine the projected trajectories for the weighted average household saving rate, the advantage of the partial equilibrium approach is to exploit the combination of detailed age-specific population projections and detailed age-specific saving rates available for Brazil—performed across income groups by using scenarios for different poverty headcount levels.

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**Figure 7.3.a**

Saving rates are increasing for all income groups, except for those above 85th percentile

**Figure 7.3.b**

Poverty rates for the young have are higher than for the elderly

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Source: Jorgensen (2011) based on POF 2002, 2008. The tendency for higher age-specific saving rates could be a feature that could lead to higher future growth.

Source: Jorgensen (2011) based on POF 2008; uniform projections when the share below the $2 PPP per day national poverty line falls by 1 percent.

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96 As Figure 7.3b illustrates, the trajectories for the population across different age-groups will display parallel shifts when the poverty headcount is reduced by, for example, by 1%.

97 The partial equilibrium model is described in Annex 7.2, including a description of the data used and a discussion of the assumptions for simulations.
The question is, of course, whether the saving rate is expected to rise or fall in the future when the population ages, since this will affect economic growth in the same direction. Population aging implies that older age groups increase in size and that they possible live longer due to increased life expectancy. Depending on the size of saving rates of the young, the middle-aged and the old people, such demographic changes are likely to change the weighted average of the saving rate.

By combining three types of projections for, (i) age-specific saving rate; (ii) age-specific population changes; and (iii) the share that is non-poor and poor, it is possible to project the weighted average household saving rate in Brazil. Figure 7.4a shows the two scenarios for the poverty headcount that is assumed in the projections of the saving rate. First, no change is assumed across any age-group in the poverty headcount; second, the trend poverty headcount of 8.93 percent per year is assumed. The simulations in Figure 7.4a then show that the household saving rate in Brazil is likely to increase over the medium and long term from 4.84 percent in 2010 to 7.49 percent in 2050. The figure illustrates four trajectories, where the solid line is the main baseline projection of trend change in the poverty headcount and the remaining three scenarios are presented for robustness purposes. If the poverty headcount remains unchanged, the trajectory of the trajectory for the saving rate will take a parallel shift downward and reach 6.92 percent in 2050.

The projected increase in saving rate is the result of two main factors. First, the change in the population structure leaves larger shares of the population in age-groups that save relatively more. Second, because the share of poor falls with age, the share of the population that is non-poor will increase with time (solid line in Figure 7.4b)—and this will lead to a higher weight on the saving rates by the non-poor in the average weighted saving rate. If the poverty headcount (inequality) then falls, there will be even fewer
poor people across all age groups but also for the population as a whole, leading to an even higher weight on the non-poor’s saving rates in the average weighted saving rate.98

7.3.3 Robustness and Sensitivity

When fertility is assumed to be higher (lower) than the projected by the UN Population Division’s medium fertility variant, there will be a larger (smaller) share of the population in younger age-groups who save relatively less (more), thus reducing (increasing) the weighted average of the saving rate. On the other hand, if the age-structure of mortality changes the share of “low-savers” to “high-savers” will also change. In that context, it is more likely that mortality falls relatively more for older age-groups than for younger age-groups—thus increasing the saving rate.

The same argument holds for the share of the population below the poverty line: If the share below the poverty line at falls for older age-groups, there will probably be a larger effect on the saving rate than if poverty in youth falls. However, if poverty uniformly falls with the same rate over the entire age-spectrum there will be a relatively larger increase in the saving rate from young savers since a relatively larger share of young live in poverty.

One might also expect the age-specific saving rates to endogenously change in one or the other direction—an issue that will be addressed in the following section 7.4. If an increase in the saving rate occurs, that would translate into increases in the age-specific saving rates used in this section. This may already be occurring, as illustrated in Figure 7.3a where age-specific saving rates have increased to a non-negligibly extent from 2002 to 2008.

In the case that saving rates increase relatively more for older age-groups, the weighted average of the saving rate is likely to increase substantially—since the elderly will constitute a larger share of the population and thus be assigned a larger weight in the average saving rate. If the saving rate mainly increases for younger age-groups, on the other hand, there may not be a marked difference in the average saving rate.

In conclusion, more research is needed in this area for Brazil in order to determine the likely implications for saving of changes in age-structures and poverty. However, the main finding from the partial equilibrium analysis is that the saving rate is likely to increase in the future—especially if poverty falls. This finding depends crucially, however, on whether there will be endogenous changes in age-specific saving rates, and this is the topic of the next section.

7.4 AGING, CAPITAL ACCUMULATION, AND DEMOGRAPHIC DIVIDENDS

This section provides a general equilibrium analysis of the policy challenges and tradeoffs the Brazilian government faces in the context of aging. This analysis complements the partial equilibrium analysis described in the previous section. The partial equilibrium model does not allow households to change

98 If public pensions are excluded from income, the main finding, that the saving rate is likely to increase, will be overturned. On that account, two robustness scenarios were performed in Figure 7.4b: Whether public pensions should or should not be counted as income which alters the main finding that the saving rate is likely to increase. As Figures 7.2a,b illustrate, the saving rates evolve in line with the LCH if public pensions are not included. Such a saving pattern would generate a weighted average of the saving rate that would fall over time when the population ages. It is our view, however, that these scenarios are not particularly credible, so while we present the implications for illustrative and transparency purposes, we choose rely on the income measurement that includes public pensions—and, thus, rely on the saving profiles that turn out to slight rise over time.
their saving behavior as a response to neither aging nor the economic implications aging may have. However, aging is likely to have major general equilibrium implications for household behavior in terms of, for example, consumption, saving, human capital investments, and labor supply.

Since people’s economic behavior is strongly associated to the stage they are at in the life cycle—as clearly evidenced by the partial equilibrium model above—changes in age structure tend to have a major impact on economic development (Bloom and Williamson, 1998; Lee and Mason, 2006). The demographic *bonus* may therefore lead to a demographic *dividend* and thus present an opportunity to growth rather than a challenge (Cutler et al., 1990). While the demographic *bonus* is a purely demographic phenomenon, the demographic *dividend* refers to economic returns related to the demographic *bonus*.

The demographic dividend operates through several channels. Bloom, Canning, and Sevilla (2003) mentions three major channels: Labor supply; savings for physical capital; and investments in human capital. Regarding labor supply, the generations of children born during periods of high fertility are now becoming workers. Furthermore, women now have fewer children than before, and they also tend to be better educated than older cohorts and are therefore more productive. In terms of saving, the shift away from a very young age distribution favors greater personal and national savings—an issue that was treated in detail above. Finally, relative to human capital, having fewer children enhances the health of women; parents will be under less strain to provide for many children. Thus, there are many interactions that promote the demographic dividend.

The dividends are sequential and overlapping: The first dividend initiates the process and later comes to an end; the second dividend begins somewhat later and continues indefinitely. In short, the first dividend signifies a transitory economic return, while the second dividend transforms the first dividend into greater assets and potentially sustainable development. These outcomes are not automatic but depend on the implementation of effective policies. Thus, the dividend period is a window of opportunity rather than a guarantee of improved standards of living.

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99 Moreover, macroeconomic responses to aging that endogenously affects growth—such as reductions in the availability of labor in production—were also not taken into account by the partial equilibrium model.

100 The miracle economies of Eastern and South Eastern Asian Tigers provide compelling and consistent evidence that the demographic dividend was an important contributor to that region’s economic success (World Bank, 1993; Bloom and Williamson, 1998; Mason, Merrick and Shaw, 1999; Birdsall, Kelley, and Sinding, 2001; Mason, 2001; Bloom, Canning, and Sevilla, 2003; Bloom, Canning, and Fink, 2008). Bloom and Williamson (1998) use econometric analysis to conclude that about one-third of the Asian Tigers’ increase in per capita income was due to the demographic dividend; while Mason (2005) uses growth accounting methods to estimate that the dividend accounted for one-fourth of the region’s growth.
Table 7.2
First and Second Dividends for Brazil and in International Context
(GDP Growth per Effective Consumer)

<table>
<thead>
<tr>
<th>Brazil and World Regions</th>
<th>Period</th>
<th>Demographic Dividends</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical estimates</td>
<td>1970-2000</td>
<td>First</td>
<td>0.64</td>
<td>1.30</td>
<td>1.94</td>
</tr>
<tr>
<td>Brazil (Mason, 2005)</td>
<td></td>
<td>Second</td>
<td>0.55</td>
<td>1.73</td>
<td>2.28</td>
</tr>
<tr>
<td>Brazil (Queiroz and Turra, 2010)</td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projections</td>
<td>2000-2045</td>
<td>First</td>
<td>-0.01</td>
<td>2.49</td>
<td>2.48</td>
</tr>
<tr>
<td>Brazil (Mason, 2005)</td>
<td></td>
<td>Second</td>
<td>0.08</td>
<td>2.19</td>
<td>2.29</td>
</tr>
<tr>
<td>Brazil (Queiroz and Turra, 2010)</td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regions (Mason, 2005)</td>
<td>1970-2000</td>
<td>Industrial</td>
<td>0.34</td>
<td>0.69</td>
<td>1.03</td>
</tr>
<tr>
<td>East Asia &amp; Southeast Asia</td>
<td></td>
<td>South Asia</td>
<td>0.59</td>
<td>1.31</td>
<td>1.90</td>
</tr>
<tr>
<td>Latin America</td>
<td></td>
<td>0.10</td>
<td>0.69</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td></td>
<td>0.62</td>
<td>1.08</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td></td>
<td>0.09</td>
<td>0.17</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Transitional</td>
<td></td>
<td>0.51</td>
<td>0.70</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>Pacific Islands</td>
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<td>0.57</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.58</td>
<td>1.15</td>
<td>1.73</td>
<td></td>
</tr>
</tbody>
</table>

Source: World Bank Staff estimations based on raw data supplied kindly by A. Mason, B. Queiroz and C. Turra, respectively. Estimate of dividends are annual, and the aggregate dividends presented in the table are calculated as the simple average across the time period covered. Estimated dividends signify the contribution to output growth per worker that the two dividends, and in total, contribute for.

7.4.1 The First Demographic Dividend

The first dividend has been described by, for example, Lee and Mason (2006) who provide empirical evidence for both the first and second demographic dividends using a “reduced form” general equilibrium framework calibrated for Brazil. The first dividend is measured as the increase in GDP growth caused by the growth of working age population. Their model (Annex 7.4) offers an empirical, but not particularly rigorous, analytical framework for studying the potential dividends that may arise due to aging.

The contribution of both the first and second demographic dividends to growth in GDP per effective consumer is presented in Table 7.2.101 Brazil is seen to have experienced a large first dividend compared to other regions in the world (Table 2.9). Furthermore, the two sets of estimations of the first dividend by Mason (2005) and Queiroz and Turra (2010), respectively, are close in magnitude. In the future, however, projections show that Brazil will experience a very small, and maybe negative, first dividend since the growth of workers as a share of the total population slows down—and the population starts aging102.

7.4.2 The Second Demographic Dividend

The second dividend arises to the extent that anticipated changes in the share of the population concentrated in the retirement ages induce individuals, firms, and/or governments to accumulate capital. A crucial point is that only in societies where capital deepening prevails will the effects of aging ultimately increase the output per effective consumer (Bloom and Williamson, 1998; Jorgensen and Jensen, 2010).

**Notes:**
101 The effective number of consumers is the number of consumers weighted by age-variation in consumption needs (Mason, 2005).
102 The first dividend contributed to almost 30% of the observed economic growth in Brazil from 1970 to 2010 according to Queiroz and Turra (2010). Mason (2005) estimates the first dividend to be 20% for the United States and about 10% for India during the same period.
During the later stages of the transition to low fertility, a growing share of the population consists of individuals who are nearing the completion of their productive years. They must have accumulated wealth in order to finance consumption in excess of labor income for many of their remaining years. Furthermore, the rise in life expectancy and the accompanying increase in the duration of retirement lead to an upward shift in the age-profile of wealth (Jorgensen, 2011; Jorgensen and Jensen, 2010).

The second dividend is found to be positive by Mason (2005) and Queiroz and Turra (2010) for all regions and substantially larger than the first dividend for the period 1970-2000 (Table 7.2). In East and South-East Asia, the second dividend was 1.31 percent per year in additional income growth—the largest of any region. Brazil is seen to display remarkable first and second dividends. Clearly, Brazil drives up the average for LAC countries for the second dividend, while the two sets of estimates suggest that the first dividend should be somewhere around the LAC’s average. The total demographic dividend will fall between approximately 2.29 and 2.48 percent of additional income growth.

Mason (2005) and Queiroz and Turra (2010) conclude that the second dividend does not turn negative to any important degree—the result being a permanent increase in the capital intensity of the economy and a permanent increase in output per worker. However, the Brazilian economy has so far failed to take full advantage of the second dividend just as they failed to take advantage of the first dividend. Queiroz and Turra (2010) show that for the last two decades the growth rate of GDP per effective consumer was lower than what the demographic dividends would predict. However, population change does still seem to be favorable to economic growth in Brazil in the near future. From 2010 to 2045, the demographic dividends could raise GDP growth per effective consumer by 2.48 percent per year on average according to Queiroz and Turra (2010).

7.4.3 Promoting the Demographic Dividends

In terms of policies to harvest the demographic dividends, the Brazilian economy has in the last few decades grown at much slower rates than what the demographic dividends alone would predict, contrary to the experience of other developing countries, for example, East Asian countries (World Bank, 1993).

103 The pro-growth effect of capital accumulation and wealth is the source of the second demographic dividend, but this wealth can take different forms (Mason, 2005). One possibility is that retirees will rely on transfers from public pension and welfare programs or from adult children and other family members. A second possibility is that individuals will accumulate capital during their working years and that this capital will serve as the source of support during the retirement period. Both of these forms of wealth can be used to deal with the life cycle deficit at older ages, but only capital accumulation influences economic growth—an issue that is incorporated in the general equilibrium model applied in the following section. If capital is invested in the domestic economy, the result will be capital deepening and more rapid growth in output per worker. If capital is invested abroad, the result will be an improvement in the current account and an increase in national income. In either case, per capita income will grow more rapidly than it would otherwise. It is important to note, however, that accumulation of capital does not need to be as high as when working age population is growing at rapid rates. Since there are fewer effective producers, the amount of capital necessary to keep capital-labor ratio constant is reduced.

104 For example, from 2000 to 2005 GDP per effective consumer growth rate was one-half of what the demographic dividends would predict.

105 The estimations by Mason (2005) Queiroz and Turra (2010) of the first and second dividend both assume that the cross-sectional profiles of consumption persist into the future. In a sense, it is assumed that the costs or benefits of aging are anticipated and shared across generations in the same manner as they are at present. Capital accumulation may rise, transfer programs could expand, families might provide more support, and the elderly may adjust their needs to the demographic realities. Alternative scenarios are definitely possible. The estimation presented here does not capture the costs that these possible generational crises would impose on societies. On the contrary, developed countries studied by Mason (2005) will have a small or even negative contribution from the demographic dividends to economic growth.
Unfortunately, therefore, the demographic dividends are not automatic and depend on institutions and policies to transform changes in population age structure into economic growth (Bloom and Canning 2001; Bloom and Canning 2004). For example, it is fundamental that the labor market creates enough opportunities for the growing working age population, and that a developed financial market exists to fulfill individual’s willingness to save (Mason, 2005).

To the extent that countries meet the challenge of aging by expanding unfunded familial or public transfer programs, asset growth will be reduced, and the second dividend will be diminished. By contrast, if workers are encouraged to save and accumulate pension funds, population aging can boost capital per worker, productivity growth, and per capita income. Thus, policymakers in Brazil will need to focus on establishing financial systems that are sound, trusted, and accessible to the millions who wish to secure their financial futures. The time to do so is now so that, as the population ages, its growth-inducing potential will be realized.

In the case of Brazil, Queiroz and Turra (2010) argue that low investments in human capital and the lack of proper social and economic institutions are responsible for jeopardizing the demographic dividends in the country. It is important that public policies in Brazil create incentives to private savings and that institutions are reliable for investors. Making public pension systems large and generous might crowd out the propensity to save, thus jeopardizing the second demographic dividend and reducing the capacity to invest. A population concentrated at older working ages and facing an extended period of retirement has a powerful incentive to accumulate assets—unless it is confident that it’s needs will be provided for by families or governments.

One of the main findings by Queiroz and Turra (2010) is that the demographic dividends explain a very large degree of GDP per effective consumer from 1970 to 2010. However, their results also indicate that the economic growth rate could have been greater if the country had taken advantage of the changes in population age structure. While they find that most of the contribution to dividends happened in the 1970s, the last two decades have observed economic growth rates much smaller than what demographic changes would predict. These findings reveal that Brazilian policy makers have not made necessary decisions to transform changes in population age structure into economic growth. Moreover, if policies are not adopted, future benefits of the dividends will also be lost.

The empirical evidence using a reduced form model with capital accumulation suggests that great economic dividends may emerge as a consequence of aging. These findings are, in the following, put to the test in a full-fledged general equilibrium model in order to go even deeper into the behavioral and macroeconomic responses of aging.106

### 7.4.4 General Equilibrium Implications of Population Aging

Since aging, broadly speaking, consist of two elements: (i) lower population growth due to reductions in fertility; and (ii) changes in life expectancy due to reductions in mortality, they should be considered as a composite demographic development in any general equilibrium analysis on the economic implications of aging. There are differential economic implications of these two demographic changes, however, and it

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106 A general equilibrium model has its own advantages and disadvantages compared to the partial equilibrium model and the reduced form model since the demographic changes are usually more broadly defined compared in a general equilibrium model to the detailed accounting in a cohort-component demographic model used in the partial equilibrium analysis, and market structures are usually quite crudely defined compared to reality.
important to distinguish these in order to identify what drives the aggregate results of the general equilibrium analysis.107

7.4.4.1 Economic Implications of Lower Fertility and Lower Population Growth

The general equilibrium implications of an isolated drop in the population growth rate—which changes the age-structure of the population over the demographic transition and lead to future aging—is that the capital-labor ratio increases and makes labor a more scarce production factor. This may cause factor prices to change—leading to upward pressure on wages and downward influences on the return to capital.

A reduction in the population growth rate may also lead to transitory changes in saving behavior as well in labor supply decisions in which case the capital-labor ratio may change even further and amplify the direct effect originating from fewer workers. This effect on saving rates is not present in the simulation of saving rates in the partial equilibrium analysis. Importantly, this effect partly leads to the potential second demographic dividend, which was found to be positive for Brazil as documented above.

Additional dynamics appear when the government manages systems that are influenced by the population structure—in particular pay-as-you-go (PAYG) pensions systems but also health and education systems.108 If the model includes more features such as, for example, human capital, and intra-household bequest dynamics, the aggregate effect of changes in population growth will become more difficult to elucidate. The bottom line is that the fiscal partial equilibrium effects are not sufficient to get an accurate measure of the fiscal costs associated with population growth—the general equilibrium effects could both be counteracting or reinforcing.

7.4.4.2 Economic Implications of Higher Life Expectancy

The macroeconomic implications of higher life expectancy is more straightforward than changes in fertility and population growth but immensely important in the case of Brazil where it is projected to increase by as much as 11 percent over the period 2010-2050. If people expect to live longer they are likely to increase their saving—simply in order to finance a longer life in retirement. These incentives will lead to an amplified second demographic dividend due increased capital accumulation.109

In an economic environment where the government plays a large role there will be additional partial equilibrium effects of increased life expectancy. For example, in the case of constant pensions for retirees, increased life expectancy will lead to higher contributions on the workers’ part (ceteris paribus). However, larger contributions are likely to produce distortionary saving behavior and thus lead to general equilibrium effects through the capital-labor ratio. The quantitative projections will strongly rely on how the Brazilian government decides to finance the fiscal costs associated with aging; i.e. the government policy response to aging—an issue that will shape the remainder of this chapter.

107 The general equilibrium model is described in Annex 7.3, including a description of the data used and a discussion of the assumptions for simulations.

108 There is a large body of literature on the subject of demographic change and viability of social security arrangements (e.g. Auerbach and Lee, 2001; Campbell and Feldstein, 2001; Cutler et al., 1990), but this is not the focus here. Furthermore, Weil (2006) finds that the distortion created by taxes needed to fund PAYG pension systems is a key channel through which a higher dependency ratio affects aggregate output and welfare.

109 In Brazil, a higher capital-labor ratio is beneficial for welfare since consumption and income will approach the optimal level. The capital-labor ratio can also be too high and may “steal” all the consumption possibilities of households and thus eventually reduce welfare.
7.4.4.3 Macro-Policy Responses

The Brazilian government faces a major policy dilemma in addressing the increasing financial burden associated with population aging. First, the government may decide to keep transfers, such as pensions and health benefits, unchanged. But this requires increasing taxes or debt. Second, the government may decide to reduce public transfers that depend on the population age structure in order to refrain from increasing taxes or debt or cutting other government programs. Third, the government may decide to abstain from changing neither taxes nor benefits but simply borrow on financial markets to finance the costs—thereby pushing the financing-burden towards future generations.

The bottom line is that something has to give—even taking into account possibly high labor productivity in Brazil in the future. In other words, in the general equilibrium framework it is assumed that the Brazilian government has three instruments to use for tackling the financing burden associated with aging: Taxes (social security contributions and health contributions); Benefits (social security benefits and health benefits); and Debt (public sector debt).

7.4.5 Policy Scenario I: Tax-Financing

It will become fiscally more expensive to have fewer tax-payers and more retirees because the pension and health benefits bill will increase in size. Fewer workers would therefore need to finance such benefits—given that replacement rates and debt are assumed to be kept constant. As a consequence of aging a larger fiscal burden will therefore arise under such policy assumptions. This is the Tax-Financing policy scenario.

Given that tax rates absorb the entire burden—leaving benefits and debt unchanged—it is possible to simulate the implications for the economy. The general equilibrium model by Jorgensen (2011), described in Annex 7.3, is employed for this purpose, and the population projections fed into the model are illustrated in Figure 7.5a—comprising the projected trajectories for the population growth rate and life expectancy.

Furthermore, it is not likely that envisaged Pre-Salt oil windfalls will “take care” of the problem, since such commodity revenues are often associated with low saving and investment incentives (Papyrakis and Gerlagh, 2006) or an outright curse for the economy (Sinnott et al., 2010). There is also likely to be important tradeoffs in terms of intergenerational distributions of enhanced consumption possibilities in light of Pré-sal oil and gas windfalls. Jorgensen (2010b) finds that the optimal allocation of oil windfalls is strongly affected by the long term economic implications of population aging, and that aging is a key driver of a policy rule for the efficient and equitable allocation of Pré-salt windfalls.
Figure 7.5a
Population growth is likely to slow down and life expectancy will rise

Figure 7.5b
To cover the fiscal costs of aging, either debt or contributions must rise, or benefits must fall

Source: UN Population Division
Source: Jorgensen (2011)

A key issue when interpreting the projected trajectory for the saving rate and other macroeconomic variables is the combination of the demographic factors that contribute to population aging. The fall in the population growth rate will generally reduce the saving rate, while the increase in life expectancy will tend to increase the saving rate. The rate of decline in the population growth rate is seen from Figure 7.1a to decrease over time, so the life-cycle response of the model—in which workers save and retirees do not—will become smaller over time. However, the increase in the saving rate from longer life expectancy will also flatten out over time. The percentage changes are much larger for the reduction in population growth than it is for life expectancy. As a result, over the longer term, the saving rate is projected to fall.

Jorgensen (2011) finds that, in order to keep benefits constant, the social security contribution rate would need increase by 8 percentage points from its current level of approximately 31 percent to 39 percent between 2010 and 2050 (Figure 7.5b).

The aggregate rise in the tax rate to cover constant health and social security benefits is 9.5 percentage points consisting of the 8 percentage points for social security contributions and 1.5 percentage points for health.

This choice of financing method will have macroeconomic implications. First, capital accumulation will be further crowded out by the 9.5 percentage points of higher taxes. This means that capital per worker will decline as in Figure 7.6b. There is a counteracting mechanism, however, since there will be fewer workers in the future and therefore increase the capital per worker ratio. Furthermore, higher life expectancy will have a tendency to reduce the saving rate (Figure 7.6a) and the capital per worker ratio.

111 The system for social security contributions are, naturally, more complicated than simply two rates referred to. However, to make the general equilibrium model tractable, it is assumed that the contributions to the social security system can be reasonably replicated by an aggregate 31 percent contribution rate (Annex 7.3).

112 This increase in the pension contribution rate assumes that the health system balances such that fewer workers also finance the health expenditures of more retirees and fewer workers. The contribution rate for the health system consequently does not rise as much.

113 These dynamics are all interdependent over the projected period, and as the saving rate starts falling, the steepness of the decline in the capital worker ratio would also increase.
In terms of wealth and welfare, the Tax-Financing scenario will yield a lower lifetime income mainly because increased taxes lead to lower income in people’s working life (Figure 7.7a). Also, as net income falls the slightly increased saving rate will not increase aggregate saving sufficiently but reduce it slightly. This is evident from the evolution of capital per worker which falls only a little over the next 20 years but falls faster after that. Consequently, income in old age also falls—rendering lifetime income smaller at an increasing rate. This reduced wealth accumulation corresponds to the simulated path for lifetime welfare in Figure 7.7b.

The key message from the analysis of this Tax-Financing scenario is that capital accumulation and, thus, wealth will fall, which means that this policy choice will negatively affect the second demographic dividend. This will in turn reduce lifetime income. Altogether, raising taxes will negatively affect welfare.

7.4.6 Policy Scenario II: Benefit-Financing

The results of the Benefit-Financing scenario are based on the same model and therefore include the same demographic and macroeconomic dynamics. The only change from the Tax-Financing scenario described
above is that contribution rates for pensions and health are now held constant and the corresponding benefits are now adjusting to the demographic dynamics. As more retirees enter both of the systems in the future, there will be fewer tax payers to contribute with an unchanged rate—and there will be more retirees to be covered. Naturally, the replacement rate would need to fall, and the general equilibrium model estimates an approximate magnitude of such a decline in benefits.

The projections reveal that, in order for contribution rates to remain constant, the pension replacement would need to fall by 9 percentage points over the period 2010 to 2050 from 45 percent to 26 percent. This would balance the government budget given that the debt/GDP ratio is held constant.\textsuperscript{114} If pension benefits were reduced to the extent proposed by our simulations, there would be several beneficial effects on the economy. Regarding capital accumulation, there would be less crowding out of the current capital per worker ratio if taxes and debt were not increased. Furthermore, since lower population growth yields fewer workers and higher life expectancy leads to a higher saving rate (Figure 7.6a) the capital per worker ratio is bound to rise (Figure 7.6b).

The effect on lifetime income, when benefits are reduced to accommodate the fiscal pressure, is an outright increase (Figure 7.7a) and lifetime income will tend to rise and lifetime welfare will follow the same pattern—though falling slightly towards the end of the simulation period. A pension reform, where adjustments to the age of eligibility to pension benefits, could be considered along with the reduction in the pension replacement rate, since such an indexation mechanism would potentially render the effective labor supply larger and the retirement periods shorter (Jorgensen and Jensen, 2010).

7.4.7 Policy Scenario III: Debt-Financing

Under the Debt-Financing scenario, contribution and replacement rates are held constant and the entire fiscal burden of providing for more retirees by fewer workers will be covered by issuing debt. The debt/GDP ratio is seen to explode in Figure 7.5b over the projected period, 2010-2050, when the population growth rate falls and life expectancy increases (Figure 7.5a). In fact, debt/GDP is likely to rise by 99 percentage points from 41-140 percentage points.

Debt-financing is likely to have devastating implications for capital accumulation and lifetime income (Figures 7.6a,b).\textsuperscript{115} The second demographic dividend will therefore be negatively affected. Lifetime welfare, on the other hand, is seen to increase sharply as the current generation of workers realize that all costs associated with aging is merely postponed for future generations to pay off. Over time, however, future generations of workers would need to pay off the debt and welfare then falls quickly as the debt/GDP Ratio might have doubled or tripled by that time.

The bottom line of this Debt-Financing analysis is that current generations of workers are likely to gain in terms of welfare while leaving it to their children and grandchildren to pay off the debt. Ultimately, the choice of debt-financing will be detrimental to the economy and intergenerationally skewed in terms of welfare distributions. The main conclusion is that if the social security system is not to be touched, there is awaiting a massive bill for other sectors in the government budget to pay. Clearly, the second demographic dividend will be positively stimulated by a Benefit-Financing scenario which is the opposite result compared to the two other alternatives considered. Capital accumulation will be promoted under the Benefit-Financing scenario and this is likely to lead to enhanced wealth and welfare.

\textsuperscript{114} This reduction in pension benefits is accompanied by the need for a simultaneous reduction in the health benefit rate, as the model has been formulated.

\textsuperscript{115} If domestic public debt increases, the capital stock will be crowded out even further—and thus worsen the current situation where “only” the generous social security system in Brazil neutralizes the incentive to save.
7.4.8  Further Policy Implications

In the population aging debate, there is especially one public finance concern: Fiscal sustainability. This will not be dealt with explicitly here, but it is worth pointing out that tax policy may not be appropriate since the life expectancy component of aging is likely to be somewhat permanent (Oeppen and Vaupel, 2002; UN, 2004). If they had not been of a permanent nature, a tax-smoothing strategy (Barro, 1979) could be an option to overcome the fiscal sustainability concerns, but since they are, in fact, likely to be of permanent nature, some more structural policy measures are called for.

A sensible policy mix could consider the appropriateness of the generosity of the social security system in connection with a reform of entitlement ages to such transfers. The international experience, especially from Scandinavian countries, with longevity-indexed mandatory retirement ages is ample—and theoretically thoroughly analyzed by, e.g., Jensen and Jorgensen (2008). Effective labor supply is very likely to increase if the government decides to increase the statutory retirement age because people are likely to stay in the labor force for a longer period of time. Leisure may increase when the statutory retirement age increases, however. This is mainly because there will be less need to save since the retirement period will also be proportionally shorter (Jensen and Jorgensen, 2010).

An additional implication of the increase in the retirement age is that lifetime leisure will fall—further increasing the demand for leisure during the working period. These mechanisms will counteract the increase in effective labor supply from the increase in the statutory retirement age which is an important endogeneity issue that policy makers should be aware of. Consequently, if policy makers want to achieve a certain increase in effective labor supply from increasing the statutory retirement age, this increase must be even higher than initially presumed, since one must account for the endogenous reduction in the intensity of labor supply (Jorgensen and Jensen, 2010). This is exactly the opposite of what is intended by a policy rule of increasing the statutory retirement age in line with life expectancy.

7.4.9  Robustness and Sensitivity

Behind the general equilibrium result results presented above lies the specific model assumption of a closed economy, where factor payments are endogenous and fully respond to changes in the capital per worker ratio. In reality, Brazil is not a closed economy and the response of factory payments should be adjusted downward to some extent when considering the long term implications of aging. Increased immigration and labor force participation, as well as an increasingly open capital account, would lead to such reductions in magnitudes.

The openness of the capital account, and whether domestic saving turn into domestic investments, are crucial questions. Rodrik (2000) argues that, as a matter of accounting necessity, investment has to be financed by saving, from either domestic or foreign sources: “in an economy investing, for example, 30 percent of its GDP, relying on foreign saving beyond this limit, would imply running a persistent current account deficit in excess of 6 percent of GDP, which would be courting with disaster” (Rodrik, 2000).

---

116 Proposals for using the retirement age as a policy instrument are found in, e.g., de la Croix et al. (2004) and Andersen et al. (2008).
117 This could also be interpreted as an endogenous drop in the voluntary early retirement age, financed by workers’ own savings.
When analyzing an open-economy version of the model, the results remain broadly the same—depending on whether factor prices are assumed to endogenously change to a full extent (closed economy) or whether they remain constant (open economy). Table 7.2 testifies to the robustness of these results.

The main difference in the simulations is the smaller reaction of the debt/GDP ratio in an open economy setting, which is due to real interest rate which will not “explode” in size when capital accumulation is crowded out by debt issuance that reduces the capital-labor ratio to a major extent. In fact, the real interest rate will not change at all in an open economy setting so the debt/GDP ratio will not be further inflated by higher interest rates on debt service. The “true” response of, especially, the debt/GDP ratio should be found in a hybrid of the closed and open economy versions of the model, and will therefore lie between a 51 and 99 percentage point increase in the debt/GDP ratio by 2050.

The general equilibrium model is structured such that retirees do not save, while retirees in Brazil, in fact, save a lot out of their aggregate income—which includes pension transfers (section 7.3). Bequests and reverse intra-household transfers from retirees to their working aged children should therefore also be incorporated into future research on this topic (Weil, 1997).

### 7.4.10 Heterogeneity in Economic Behavior

The high income inequality in Brazil is likely to have important consequences for the possibilities and incentives for saving and investment—as the poorest income groups face somewhat different economic circumstances and incentives that non-poor income groups. This section will analyze the implications of such heterogeneity for economic behavior, capital accumulation, and the second demographic dividend.

The poor part of Brazil’s population is still in a situation with high but decreasing fertility and mortality rates (section 7.3). Fertility should therefore be treated as an endogenous variable, because poor people to some extent use children as an alternative means of saving for old age. In addition to our personal joy of having children, to which we seem to be more or less genetically programmed (Dasgupta, 1993), the motivation for having children can indeed be considered an economic one. Children can provide labor that will benefit the household; they can provide care for parents in old age; and they may be an instrument of altruism from parent to child (Barro and Becker, 1989). Another motivation for having children is the expectation of receiving altruistic intra-household transfers from one’s children after retirement (Ehrlich and Lui, 1991; Wigger, 2002; Jorgensen, 2010a).

These mechanisms should be accounted for in the analytical framework by endogenizing fertility and altruistic intra-household transfers. A revised version of the general equilibrium model has therefore been developed in Jorgensen (2011). The result that improved health conditions will increase capital savings and economic growth (Jorgensen and Jensen, 2010; Chakraborty, 2004), may not hold when the economy is modeled with endogenous fertility decisions and altruistic transfers (Caldwell, 1982).

---

118 There is a growing tendency for elderly people to live alone in Brazil, which might lead to a reduced prevalence of the bequest motive, which is an issue that should be taken into consideration in future research on this topic.

119 To be poor is defined in this section as living below the $2 PPP national poverty line.
Simulations for the effects on the household saving rate and per capita income are made by Jorgensen (2011) for projected increases in child survival (which increases the size of the labor force) and adult life expectancy (which increases the share of elderly in the population) over the period 2010-2050. An increase in the child survival rate increases the number of dependents and reduces household resources. Furthermore, an increase in adult life expectancy encourages savings, as we expect to live longer. This implies that improvements in child survival should have negative effects on economic outcomes, while improvements in adult life expectancy should have positive effects.

Once three aspects are taken into account: first, the negative fertility response to child survival, second, the possibility of intra-household transfers and, third, the possible compounding effect on capital savings from adult survival due to substitution for less expensive children as a savings mechanism, then we observe that child survival has a net positive effect on economic outcomes compared to the direct negative effect on savings from adult survival. Brought together, the composite change in child survival and adult life expectancy leads to an increase in the saving rate and in productivity growth, given the demographic projections by the UN Population Division for Brazil.

In this adjusted general equilibrium model, when fertility has declined to a certain level, there will be no altruistic transfers as retirees obtain more and more income through capital savings. When the economy reaches the point in the demographic transition where fertility has declined so much that the only motive for having children is the genetic motive, parents realize that they can no longer save child-rearing resources by switching to capital savings and away from having children as an old age savings mechanism. After this point, an increase in public pensions will reduce the steady state capital stock in line with conventional wisdom.

However, while altruistic transfers are still operative, a rise in public pensions increases productivity growth and reduces fertility and therefore speeds up the process by which a country will go through the demographic transition. As a result, the “savings motive for having children”, gradually disappears and workers only have children based on the “genetic motive”. When adult life expectancy then increases further, the impact upon capital savings will be positive, in line with existing literature (e.g. Chakraborty, 2004; Jensen and Jorgensen, 2008).

In conclusion, the economic dynamics among poor people suggests that saving rates are likely to increase as child and adult survival increases. This will, however, depend on the degree of altruistic transfers from workers to their retired parents. Therefore, the estimates presented above should be adjusted upward—especially when viewed in the light of the generous pension system which is likely to reduce fertility rates among the poor. A complicating mechanism is the reverse transfers from retirees to their working-aged children which is evident among some groups in Brazil. More research is therefore needed in this area in order to determine the implications of PAYG pension benefits on fertility.
Annex 7.1

Table A7.1
Private Saving is Found to Granger Cause Growth

<table>
<thead>
<tr>
<th></th>
<th>Private saving and private investment (VAR regressions on Brazil)</th>
<th>Gross saving and gross investment (VAR regressions on Brazil)</th>
<th>Gross saving and gross investment (Multi-country panel analysis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving on Growth</td>
<td>+*<strong>[+</strong>]</td>
<td>[+][+]</td>
<td>+++</td>
</tr>
<tr>
<td>Growth on Saving</td>
<td>[+][+]</td>
<td>[+][+]</td>
<td>+++</td>
</tr>
<tr>
<td>Investment on Growth</td>
<td>-<strong>[-</strong>]</td>
<td>-[-]</td>
<td>-**</td>
</tr>
<tr>
<td>Growth on Investment</td>
<td>+<em>[+</em>]</td>
<td>+*[+]</td>
<td>+++</td>
</tr>
<tr>
<td>Saving on Investment</td>
<td>[+][+]</td>
<td>[+][+]</td>
<td>+++</td>
</tr>
<tr>
<td>Investment on Saving</td>
<td>-[-]</td>
<td>-[-]</td>
<td>+++</td>
</tr>
</tbody>
</table>

Source: VAR regressions, Jorgensen (2011). Results in brackets for difference estimations. Significance at 10, 5, and 1 percent levels are denoted by ***, **, *. The dynamic tri-variate model by Attanasio et al. (2000) was OLS-based with a sample of 38 countries over the period 1960-1994—controlling for simultaneity and country heterogeneity. See Orazio et al. (2000) for another comparative study.

Table A7.2
The old-age dependency ratio increases private saving

<table>
<thead>
<tr>
<th>Step 1 Dependent variable: Private saving rate</th>
<th>Coefficient (Standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log of GDP per cap</td>
<td>-5.53* (3.03)</td>
</tr>
<tr>
<td>private investment rate</td>
<td>0.89*** (0.20)</td>
</tr>
<tr>
<td>public saving rate</td>
<td>-1.22*** (0.13)</td>
</tr>
<tr>
<td>growth of old dependency rate</td>
<td>1.40* (0.82)</td>
</tr>
<tr>
<td>real interest rate</td>
<td>0.02 (0.03)</td>
</tr>
<tr>
<td>Constant</td>
<td>52.36* (28.69)</td>
</tr>
<tr>
<td>(R^2) (Phillips-Perron test)</td>
<td>0.87 (-16.94*)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2 Dependent variable: (\Delta) Private saving rate</th>
<th>Coefficient (Standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\Delta) log of GDP per cap</td>
<td>4.73 (8.50)</td>
</tr>
<tr>
<td>(\Delta) private investment rate</td>
<td>0.96*** (0.20)</td>
</tr>
<tr>
<td>(\Delta) public saving rate</td>
<td>-1.00*** (0.10)</td>
</tr>
<tr>
<td>(\Delta) growth of old dependency rate</td>
<td>3.02* (1.52)</td>
</tr>
<tr>
<td>(\Delta) real interest rate</td>
<td>0.04* (0.02)</td>
</tr>
<tr>
<td>Adjustment coefficient (\alpha)</td>
<td>-0.42*** (0.16)</td>
</tr>
<tr>
<td>Constant</td>
<td>52.37* (0.35)</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Source: Jorgensen (2011). Significance at the 10, 5, and 1 percent levels are denoted by ***, **, *, respectively. Data includes 38 observations.

Annex 7.2 The Partial Equilibrium Model

This annex describes the main features of the partial equilibrium model by Jorgensen (2011) used to analyze the future implications of population aging in Brazil. The model is used for simulating the implications for the household saving rate when the population structure changes over the period 2010 to 2050—combined with scenarios for the share of poor and rich households. The model combines age-specific saving rates; age-specific population projections; age-specific income distribution relative to the poverty line; and the household saving rate as the starting value for the projections.
Age-specific saving rates:
The information about income and consumption is available across age group from the Brazilian POF survey (Pesquisa de Orçamento Familiar), where the household head is taken as the age-reference point when pairing age and saving rate. Only the age-groups above 20 years are used, since the number of households below 20 years are relatively small and are likely to provide unreliable estimates for the saving rate. Importantly, net income is adjusted by private pension contributions—and as a second scenario, also for public pensions.

Saving rates is found to differ across age-groups between the share of the population above and below the poverty line. The POF 2002 gives similar results, so the latest available 2008 POF data is used. In order to compare we used the average of their preceding ten years for each of the missing years. The equation below indicates how the weighted average of the saving rate is estimated, but the equation illustrates only how it is weighted by people in their youth, middle age, and old age. The estimation is, in fact, done by age. The second to fourth equation show how the saving rate is estimated based on income levels, where the fourth equation indicates the final weighting.

\[
\begin{align*}
S &= s_{children} \left( \frac{N_{children}}{N} \right) + s_{workers} \left( \frac{N_{workers}}{N} \right) + s_{elderly} \left( \frac{N_{elderly}}{N} \right) \\
S_{poor} &= s_{children}^{poor} \left( \frac{N_{children}^{poor}}{N_{poor}} \right) + s_{workers}^{poor} \left( \frac{N_{workers}^{poor}}{N_{poor}} \right) + s_{elderly}^{poor} \left( \frac{N_{elderly}^{poor}}{N_{poor}} \right) \\
S_{non-poor} &= s_{children}^{non-poor} \left( \frac{N_{children}^{non-poor}}{N_{non-poor}} \right) + s_{workers}^{non-poor} \left( \frac{N_{workers}^{non-poor}}{N_{non-poor}} \right) + s_{elderly}^{non-poor} \left( \frac{N_{elderly}^{non-poor}}{N_{non-poor}} \right) \\
S &= S_{poor} \left( \frac{N_{poor}}{N} \right) + S_{non-poor} \left( \frac{N_{non-poor}}{N} \right)
\end{align*}
\]

Population projections:
The population is incorporated for each age and over the period 2010 to 2050 based on the medium fertility variant from the UN Population Division, the 2008 Revision. The data are available on a 5-year interval by age, so sprague-multipiers are used to interpolate for each age. The age-specific population projections are combined with the age-specific share below the poverty line in order to divide the population into a non-poor and poor segment by age group.

Inequality measure:
The share of the population below the poverty line is calculated based on the Brazilian PNAD household survey data for the available years: 1995 to 2007 (except 2000). As inequality scenario 1, the average annual percentage change in the share below the poverty line is used as the future percentage trend change in the share below the poverty line; scenario 2 is a fairly pessimistic scenario with regard to inequality since it is based on zero change in the share below the poverty line. Note that the share below the poverty line is also estimated at an age-specific level, where the share that is poor is seen to shift downwards as the projected share below the poverty line is reduced over time.

Simulation:
The combination of age-specific saving rates, population projections and inequality levels is used for projections of the weighted average of the saving rate. 2006 is used as the initial year for the projections based on IBGE estimates for Families’ Saving. The levels of the saving rates are used in the simulations but for the final analysis, the percentage changes in the saving rate are used to project the aggregate family saving rate as it was reported by IBGE at 4.84 percent in 2006. This is because the levels are based
on a sample of households in Brazil and may not necessarily be representative to the whole population of non-poor and poor households.

In the simulations, the new rich—the share of the population that would still have been poor if the poverty headcount rate did not fall—are not assumed to save with the full amount as the rich population segment. Instead, we assume that the simple average of the age-specific saving rates for the rich and poor population segments applies to this “intermediate” group. Therefore, it is assumed that the transition from high to low saving rates is phased in line with improvements in the poverty headcount.

Annex 7.3 The General Equilibrium Model

This annex describes the main features of the general equilibrium overlapping generations (OLG) model by Jorgensen (2011) used to analyze the future implications of population aging in Brazil. The purpose of using the model is to simulate the effect on key macroeconomic variables given the projected changes in population aging (population growth and life expectancy) from 2010 to 2050.

The model builds on Jorgensen and Jensen (2008a, 2010) and features the decisions made by households, firms, and the Brazilian government and the associated economic developments over the life-cycle of a representative agent and firm. Within this demographic-economic framework it is possible to analyze the behavioral and economic implications of population dynamics. The government can then respond to aging with various parametric or structural policies in order to meet its objectives.

An OLG model is appropriate to use in the context of aging because it incorporates the endogeneity of key variables which a partial equilibrium model does not. Therefore, the model addresses the weaknesses of the partial equilibrium model of saving presented above. On the other hand, the weakness of the stylized version of the deterministic OLG model applied here is that it cannot incorporate some key features specific to Brazil—such as endogenous bequests and the complexity of the social security system. It will, however, deliver estimates of the overall direction of the economic implications of aging in Brazil since the model is calibrated with in line with what is believed to be suitable magnitudes of parameters for Brazil. Key structures of the model relating to population aging are as follows.

Demographics:
The population grows at a certain rate which falls when the population ages; life expectancy (i.e. the length of the retirement period) is incorporated since aging encompasses both changes in age-structures and in longevity; the population is assumed to either work or to be retired.

Households:
The representative agent maximizes utility subject to consumption in their working and retirement periods, respectively. In addition, an increase in life expectancy is assumed to lead to higher lifetime utility.

\[ U = \frac{c_{1,t}^{1-\sigma}}{1-\sigma} + \phi_t \frac{c_{2,t+1}^{1-\sigma}}{1-\sigma} \]

where, \( U \) is lifetime utility; \( c_{1,t} \) is consumption in the generation \( t \)'s working period; \( c_{2,t+1} \) is consumption in the retirement period of the same generation \( t \); \( \sigma \) is the inverse elasticity of substitution; and \( \phi_t \) is the (relative) length of the retirement period for generation \( t \), incorporating also the discount rate (Jorgensen and Jensen, 2010).
Out of labor income workers decide how much to save and consume given their mandatory contributions to health and pension systems (the two systems most directly fiscally affected by aging); workers’ saving leads to investment in this closed economy—which in the next generational period is assumed to be transformed into physical capital used for production; retirees consume the principal and interest on their savings in addition to the pension and health benefits. The intertemporal budget constraint, featuring, the relative prices on intertemporal consumption as well as lifetime income:

\[ c_{1,t} + \frac{\phi_t}{R_{t+1}} c_{2,t+1} = \left(1 - t_1 - t_2 + \frac{\psi \phi_t}{R_{t+1}}\right) w_t + h \left(1 + \frac{\phi_t}{R_{t+1}}\right) \]

where, \( R_t \) is gross real interest earnings in period \( t \); \( w_t \) is the real wage rate; \( h \) is the public health expenditures; \( t_1 \) is taxes devoted to the public pension system and debt; \( t_2 \) is taxes devoted to the public health system and debt; \( n_t \) is the exogenous population growth rate between the population; and \( g_t \) is the exogenous technology growth rate between period \( t \) and \( t+1 \).

**Firms:**
Firms employ labor and capital to produce output according to a Cobb-Douglas production function—from which the wage and real interest rate is generated. So, when labor supply falls due to historically lower fertility, the return to labor supply—the now more scarce production factor, increases and the return to capital falls.

**Government:**
The Brazilian government manages a pay-as-you-go (PAYG) pension scheme, where workers contribute and retirees receive benefits; and a health system, where workers contribute and both workers and retirees receive the benefits. Both systems depend crucially on the number of workers contributing and the number of retirees (and workers) benefitting. In addition, the government is able to issue debt (domestically). As a result, in each period, the government finances pension and health expenditure as well interest payments on debt and amortization of previous periods’ debt. Related to aging is the fact that public debt is essentially the debt of taxpayers, so the fewer taxpayers (workers) there are to bear the debt-burden of previous generations the less sustainable a given level of debt/GDP is. The government budget constraint is stated in the following equation, where the left-hand side is tax revenue and debt in period \( t \) which finances the expenditures on the right-hand side which is the reimbursement of last periods debt with interest and the public pension benefit for retirees and health care expenditures—all denoted in units of effective labor,

\[
(t_1 + t_2)w_t + b_t = \frac{b_{t-1} R_t}{(1 + n_{t-1})(1 + g_{t-1})} + \psi \phi_{t-1} w_t + h \left(1 + n_{t-1} + \phi_{t-1}\right) \]

where \( b_t \) is public debt as a share of GDP per worker, and \( \psi \) is the share of real wages received as a public pension annuity.

**Calibration:**
The model is calibrated for Brazil with the following data: Time periods of the model are assumed to be 20 years; as evident from Figure 7.5a, the population growth rate equals 56% (growth rate over the period 1970-1990; UN Population Division); in order to calibrate for life expectancy, the length of the model’s first period is normalized at unity while the length of the second period equals 61% (estimated as the share of total life spent in retirement: average retirement age equals 57.83 (Queiroz and Figoli, 2010), average entry-age into the labor force is 13.3 (Leme & Malaga, 2001), life expectancy equals 69.3 (average life expectancy at birth over the period 1998-2088, UN Population Division)); the share of capital in output equals 18% (average gross capital formation over the period 1990-2010; IMF WEO);
For the base year 2010 in the simulations a debt/GDP ratio of 41 percent (Banco Central do Brazil); the contribution rates to the health system is residually estimated based on 1.46% for health benefits (based on health spending/GDP over the period 1984-2009; Tafner, 2010); the contribution rate to the social PAYG pension system is calibrated to 31% (11% from workers and 20% from employers; Queiroz and Figoli, 2010). The average replacement rate, weighted by the share of the population receiving pension benefits at various rates, for pensions is estimated to be 45%.

The replacement rate to public servants is assumed to be 95% since older public servants participated in a plan of virtually 100% replacement rate, while younger generations receive slightly less; the replacement rate for non-public servants is estimated residually based on pension payment data for the two groups; the weighted average is constructed based on the share of the population is each group; the effective weighted average is found to equal 45%; sources: DATAPREV, SUB, Plano Tabular da DIIE, and Ministerio da fazenda. Productivity growth is assumed to follow output growth and equals 168% (growth over the period 1988-2008: World Bank GDP); discount rate equals 0.9.

Simulations:
The model simulations start in 1990 so the past 20 years of demographic transition is taken into account in projecting the economic implications from the year 2010 to 2050. The model is simulated in Matlab using Dynare software (Jorgensen, 2006). The results should be interpreted as the economic implications over generational periods of 20 years; i.e. over the period 2010 to 2030 and 2030 to 2050. The projections are based on 20-year projections in population growth and life expectancy (UN Population Division).

Annex 7.4 The Reduced Form General Equilibrium Model

The methodology for estimating the first and second demographic dividends follows Lee and Mason (2004) and Mason and Lee (2010). The method is also described in Queiroz and Turra (2010), but the key equation for separating the aggregate demographic dividend into the first and second dividends are, in fact, due to Bloom and Williamson (1998). The methodology is briefly described in this box.

Estimates of the first demographic dividend use age profiles of income and consumption combined with population age distributions. The results for Brazil by Queiroz and Turra (2010) were estimated using Brazilian profiles for 1996. This cross-sectional profile is assumed constant during the period of analysis (1970-2050). The demographic bonus gives rise to two demographic dividends: The first dividend is measured by purely demographic factors, while the second is an economic measure.

To estimate the second dividend Queiroz and Turra (2010) follow Mason (2005) and applies several simplifying assumptions: The ratio of capital to labor income at ages 50 and older is assumed to represent the wealth accumulated over the individual life cycle; age patterns of consumption and labor income are assumed no to change over time; consumption and income levels are allowed to increase by 1.5 percent per year. To estimate the present values of consumption and labor income an interest rate of 3 percent is further assumed. An elasticity of labor income with respect to capital is assumed to equal 0.5. The first and second dividends are formalized in Mason (2005) and Queiroz and Turra (2010). If the effective number of consumers is denoted by $N(t)$ and the effective number of producers by $L(t)$, then

\[
N(t) = \sum_{\alpha} \alpha(\alpha) P(\alpha, t),
\]

\[
L(t) = \sum_{\alpha} \gamma(\alpha) P(\alpha, t)
\]
where \( P(\alpha, t) \) is the population of age \( \alpha \) at time \( t \), and \( \alpha(\alpha) \) and \( \gamma(\alpha) \) are age-specific coefficients reflecting relative levels of consumption and production. Output per effective consumer (Y/N) is given by

\[
\frac{Y_t}{N_t} = \frac{L_t}{L_t} \frac{Y_t}{L_t}
\]

where \( Y_t \) is the total output. The effective number of producers (consumers) is the population weighted by the age income (consumption) profile (Cutler et al., 1990; Mason, 2005). The support ratio \((N_t/L_t)\) is given by the ratio of effective producers to the number of effective consumers. By taking the natural log of both sides and deriving with respect to time, Mason (2005), as well as Bloom and Williamson (1998), obtain rates of growth:

\[
y^*(t) = L(t) - N(t) + \dot{y}(t)
\]

The rate of growth in output per effective consumer \((\dot{y}^*)\) is the sum of the rate of growth of the support ratio, \(L(t) - N(t)\), and the rate of growth of output per worker \(\dot{y}\). The first dividend is then defined as the rate of growth of the support ratio, while the second dividend operates through productivity growth by inducing the accumulation of wealth and capital deepening. Mason (2005) shows that the rate of growth of productivity is proportional to the ratio of capital to labor income when both capital and transfer wealth grow at the same rate (i.e. when there are no changes in intergenerational transfer policy).

The relationship between life cycle wealth, capital, and economic growth can be clarified further by assuming that output depends on capital and effective labor only and that the production function is Cobb-Douglas. It can be shown that growth in output per worker is proportional to the growth in the ratio of capital to labor income, \(\dot{k}\)

\[
\dot{y}(t) = \frac{\beta}{1 - \beta} \dot{k}(t)
\]

where \(\beta\) is the elasticity of output with respect to capital (Solow, 1956). Note that capital deepening in this formulation is measured as an increase in capital relative to labor income rather than capital relative to labor. A more general formulation of the production process that incorporates human capital does not alter estimates of the effect of capital deepening (Mankiw et al., 1992).
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