Chapter 4
Achieving strong and sustainable growth

Over the past decade Brazil has managed to achieve economic stability, and more recently its economy proved very resilient in response to the global economic crisis. The key challenge for the country is now to continue to grow at a fast pace to close its income gap with the OECD countries, while choosing a development pattern that is consistent with long-term sustainability concerns both socially – in terms of ensuring all Brazilians benefits from gains in living standards – and in terms of protecting the environment.

Brazil will experience major changes in the decades to come, which will have implications for the design of policy. Like many other emerging-market economies, the country is going to age much more rapidly than today's advanced economies. As a result, long-term output growth is expected to slow in line with a deceleration in the working-age population. The effect of this ageing process on saving will depend on a range of factors, including the effectiveness of social policies. In addition to increasing the burden on public finances, ageing will also tilt the composition of public expenditure toward more pension and health spending. The country is also going to rely increasingly on oil resources. Oil production has steadily increased since 2003, but production from the pre-salt fields will move the country into the top ten oil exporters in the world. While net foreign assets and rising oil production appear to have pushed up the equilibrium exchange rate and the country has benefited from sizeable terms-of-trade gains, there are very few signs of de-industrialisation thus far.

Income redistribution and education policies as well as environmental policies are key areas where reforms will help to maintain economic development on a path of long-term sustainability. Poverty and inequality reduction is probably the area where Brazil has made the most significant progress in the last decade, owing in large part to Bolsa Familia, a targeted conditional cash transfer programme, whose resources should be increased. Brazil should continue with the main pillars of its recent success in the area of education, but a stronger focus on teaching quality and on reducing drop-out rates in secondary education would speed up the pace at which it can catch up with educational attainment in OECD countries.

Cutting greenhouse-gas emissions is a policy priority, and the country has managed to slow the pace of deforestation dramatically in recent years. As a result, it will achieve its emission reduction targets ahead of the 2014 deadline. Given the importance of deforestation in climate-change policies, the authorities should persevere with their efforts. In addition, they should pay particular attention to the greening of infrastructure investment and account for this in project selection within the Growth Acceleration Programme.

Brazil implemented major policy changes over the last few decades and has managed to put in place a well-functioning macroeconomic framework. Most recently, the economy recovered very rapidly from the global financial crisis and in 2010 experienced its best growth outcome in two decades. Strong economic performance over an extended period of time will be needed to catch up with high-income countries. The three preceding chapters focused on ways to spur robust economic growth through sound stabilisation policies, enhanced incentives to save and invest and faster development of infrastructure in network industries. Although these measures also have some redistribution implications and can help to reduce poverty, they will not be sufficient to ensure all segments of the population benefit from gains in prosperity and that economic development is consistent with a sustainable management of natural resources. Income redistribution and education policies, as well as environmental policies, will have to play a major role.

This chapter first discusses two issues that are going to modify Brazil's economic landscape over the medium term. First, demographic changes are expected to impact macroeconomic performance and to heighten pressures on fiscal sustainability. The most rapid ageing phase has not yet occurred, so that policymakers have a window of opportunity to prepare for this change. Second, the country is going to have access to plentiful domestic oil resources that will need to be properly managed. The chapter then turns to examining key policies to ensure that growth can be sustained in terms of income distribution, poverty reduction, education policies and climate-change strategy.

Coping with an ageing population

Brazil will soon enter into an extremely rapid phase of demographic transition, which will drive profound economic changes as key drivers of economic growth tend to vary depending on where most people fall in the life cycle. This section reviews the impact of population ageing on labour input, savings, as well as the public-spending mix.

Demographic changes in Brazil

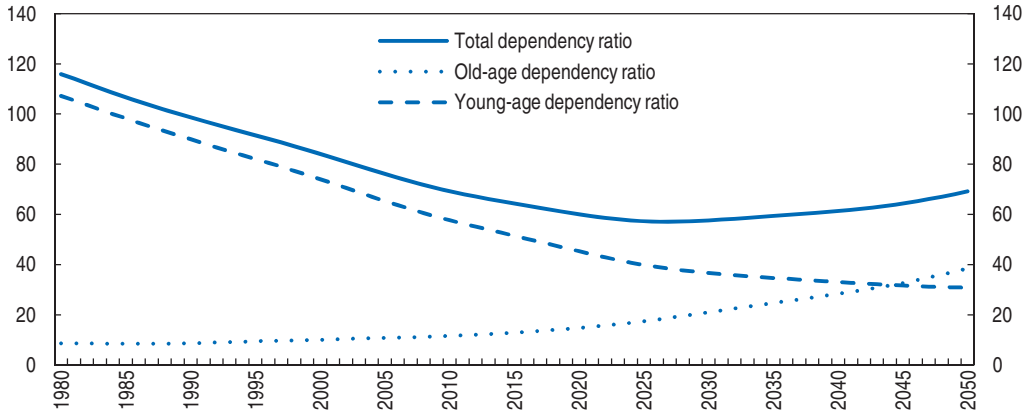
The speed of population aging in Brazil is going to be significantly faster than what has been experienced by developed economies (except Japan) over the last century (World Bank, 2011). The same demographic aging process that unfolded over more than 60 years in the United States will occur in only two decades in Brazil. According to the United Nations population projections, the elderly population (over 65) will more than triple within the next four decades, increasing from about 7.6% of the population in 2010 to 38% by 2050. As a result, the dependency ratio, which has been declining since 1965, will reach a trough in 2025 and increase subsequently (Figure 4.1).

Effect of ageing on labour input

Reforms undertaken since the 1990s have finally begun to bear fruit. Potential output growth has been steadily improving since 2000 to reach 4.6% in 2010 (Table 4.1). A sound macroeconomic framework combining inflation targeting, a flexible exchange rate and

Figure 4.1. **Dependency ratios**

Percentage of working age population



Note: The old-age (resp. young-age) dependency ratio is computed as the ratio of the population of over 65 years (resp. of 0 to 19 years) on the working-age population (20-64 years). The total dependency ratio is the sum of the two.
Source: IBGE and OECD calculations.

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Table 4.1. **Actual and potential output growth and contribution to growth**

	GDP growth	Potential GDP growth	Contribution to potential output growth		
			Percentage point		
	Per cent	Per cent	TFP	Capital	Labour
1981-89	2.3	2.6	–0.9	1.7	1.8
1990-94	1.3	2.0	–0.3	1.2	1.0
1995-99	2.0	2.3	0.1	1.2	0.9
2000-08	3.7	3.3	0.7	1.3	1.3
2009	–0.6	4.4	1.3	1.8	1.3
2010	7.5	4.6	1.4	2.0	1.2

Note: Potential output is estimated using a production-function approach (see Box 4.1).
Source: OECD calculations.

rules-based fiscal management has gradually been put in place and has succeeded in stabilising the macroeconomic environment. This has been complemented by structural reforms to liberalise the country's trade and investment regimes and to inject competition in product markets. As a result, the contribution of total factor productivity (TFP) – the efficiency with which the factors of production are used to produce output – which detracted from output expansion in the 1980s and the early 1990s, appears to have risen steadily since then. It reached almost 30% of potential output growth in the 2006-10 period, from only 10% at the beginning of the century. Capital accumulation also contributed to the rise in potential output growth. Although labour input increases supported growth in the last two decades, there is some evidence that Brazil did not take full advantage of the demographic dividends and the resulting growth in the working-age population (Queiroz and Turra, 2010). Low investments in human capital and the lack of proper social and economic institutions have been put forward to explain this missed opportunity.

Over the medium to long term, assuming no major reforms, projections point to a substantial slowdown in potential output growth (Figure 4.2). These projections rely on the United Nations' medium population scenarios and assume that capital and trend TFP grow

Box 4.1. **Estimation of potential output**

Potential output is calculated using a Cobb-Douglas production function. The methodology is similar to that used for OECD countries, which is described in Beffy *et al.* (2006) but has been adapted to account for Brazil's data limitations.

Potential output is calculated using the following equation:

$$y_t^* = tfp_t^* + (1-\alpha) * k_t^* + \alpha(1-u_t^*) * lf_t^*$$

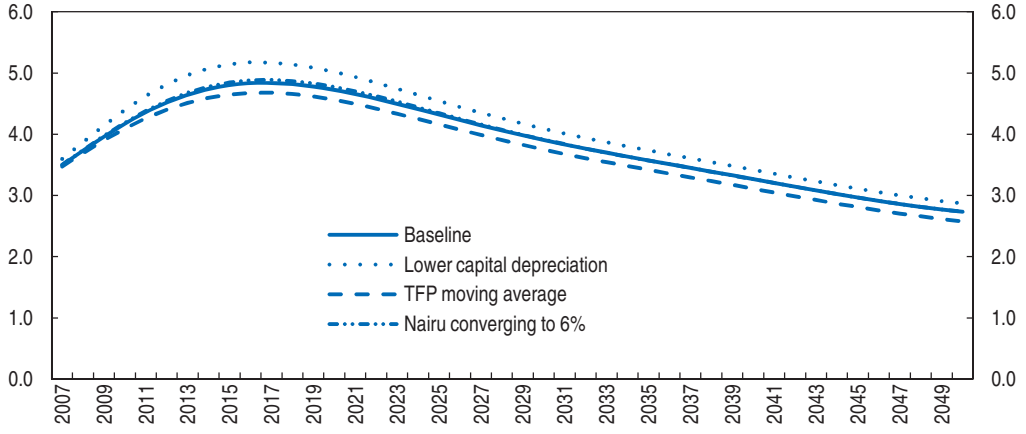
where all the variables are expressed in logarithms. y_t^* denotes potential output, k_t^* the optimal capital stock, u_t^* is the structural rate of unemployment, lf_t^* is the labour force and tfp_t^* total factor productivity (TFP). Structural unemployment, labour force, capital and tfp have been filtered using a double-sided Hodrick-Prescott filter.

Data for GDP, gross capital formation, labour force and the unemployment rate are taken from national accounts and labour force surveys. The capital stocks were constructed using the perpetual inventory method (for investment series starting in 1960 and using a fixed depreciation rate of 5%). Missing values in the unemployment rate series were interpolated linearly. TFP data have been computed as a residual from the following equation using data on real GDP, actual capital, unemployment and the labour force: $tfp_t = y_t - (1-\alpha)k_t - \alpha(1-u_t) * lf_t$. The share of labour in GDP, α, is set at 60% to fit the Brazilian data. This is consistent with Bonelli (2010) and OECD (2009). Potential output estimates are not significantly modified when alternative plausible values of this parameter are used.

As underlined in Cotis *et al.* (2005), production-function-based potential output estimates, as well as those derived from other approaches, should be interpreted with caution. They are in particular sensitive to the measurement errors in TFP. Moreover, factor quality is treated in the calculations as constant over time, whereas increases in the stock of human capital of the labour force are expected to affect the economy's overall efficiency.

Figure 4.2. **Effect of ageing on potential output**

Per cent



Source: OECD calculations.

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at rates observed in 2005-10 and that the participation and structural unemployment rates remain constant at their 2010 levels. Reasonable alternative assumptions do not dramatically change this assessment. In the same vein, using population projections from

IBGE, the national statistical office, would lead to the same conclusions. These projections incorporate solely the mechanical effect of the change in age structure and assume unchanged age-specific behaviour. More importantly, they do not account for the effects on activity and on total factor productivity of the Growth Acceleration Programme (PAC), a large planned infrastructure programme. This omission could be serious, because there is evidence that variations in public infrastructure spending in Brazil have contributed to the evolution of productivity growth in the past (Mussolini and Teles, 2010). Assuming standard elasticities, the PAC programme is estimated to boost economic growth by 0.8-1.1 percentage points in the long term, assuming 30% of it is privately financed.

Effect of demographics on domestic saving

The effect of ageing on saving is uncertain. The life-cycle theory predicts that population ageing is likely to depress it. Nonetheless, it is unclear whether such a pattern will be observed for Brazil, where saving rates remain virtually unchanged after the age of around 40 (Jorgensen, 2011). Empirical evidence on the link between the old-age dependency ratio and private saving in Brazil is mixed. This is consistent with other analyses in Latin American countries, where the relationship is often found to be insignificant. This unexpected dynamics is traditionally explained by the desire to leave bequests or for the elderly to share their pension income with co-habiting children. In the case of Brazil, public pensions play a crucial role. When public pensions are excluded from income, re-computed saving rates by age display a hump-shaped curve, in line with the life-cycle theory. In the end, personal saving prospects will depend on the way the government will finance the increasing costs associated with social security and health.

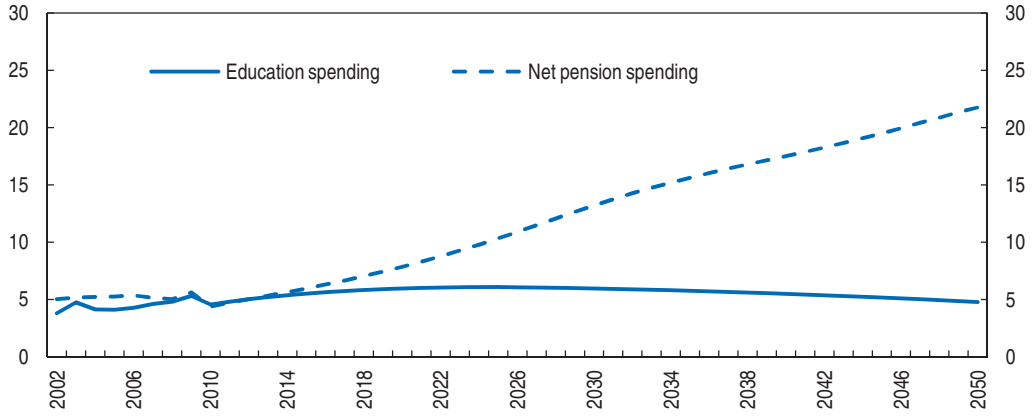
Developments in poverty are also likely to matter as there are differences in saving behaviour between poor and non-poor households in Brazil. Indeed, the poor tend to display negative saving after the age of 45 until 65, while saving remains positive for the non-poor at these ages. In addition, the poor save much less within each age category. In this respect, prospects for aggregate savings will depend on the effectiveness of social and labour-market policies to continue to lower the share of poor households in the economy (see below). Simulations undertaken in Jorgensen (2011) suggest that, if the declining trend in the poverty headcount observed since the beginning of the 2000s continues, the household saving rate excluding public pensions would increase to 7.5% by 2050 from an estimated 4.8% in 2010. If, however, the poverty headcount stays constant, the end-point saving rate would be around 0.5 percentage point lower.

Effects of ageing on public finances

Shifts in population age structure will lead to substantial fiscal pressures on publicly financed health care and pensions, offset only partly by a reduction in education spending. At the moment, public spending on education and health are well below the OECD average. Despite the 1999 and 2003 pension reforms, which are estimated to have more than halved pension costs, public pension benefits have remained at above 60% of the average wage in Brazil, while they are below 40% in many OECD and Latin American countries (World Bank, 2011).

Population ageing will cause significant shifts in the pattern of these three spending items (Figure 4.3). Assuming no policy changes, education spending as a percentage of potential output will decline steadily. Net spending on pensions (*i.e.* pension benefit minus contributions) is projected to increase to more than 20% of GDP by 2050, if spending per

Figure 4.3. **Effect of ageing on pensions and education spending**



Note: Net pension spending is the difference between pensions received by old-age workers and contributions paid by the working-age population.
Source: OECD calculations.

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head continues to rise at a rate observed in the last few years in inflation-adjusted terms. These increases stemmed from the successive gains in the real value of the minimum wage, on which the minimum pension is indexed. Ways to contain further increase in public pension spending are examined in Chapter 2.

Health care expenditure is expected to grow significantly, as the proportion of frail elderly in the population increases. In addition, a more intensive use of the formal healthcare sector and technology will put pressure on spending. Public spending on health could rise from 3.6% of GDP in 2010 to 5.1% by 2030, with ageing accounting for more than one third of the increase (IMF, 2010). This rise is of the same order of magnitude as what is expected for other Latin American countries but much stronger than what is foreseen for Asian emerging-market economies, where the public health system coverage is more limited. These projections account for differences in spending by age group as well as the expected changes in the age structure of the population. Given the paucity of data, the projections assume similar excess cost growth (*i.e.* the excess growth in real per capita health expenditure over the growth of real GDP per capita, after controlling for demographic changes) to what has been observed in the developed economies over the last three decades. This is a relatively cautious assumption for Brazil, where recent data point to higher estimates of excess cost growth.

A growing oil industry

This section examines the implications of the expanding oil sector on several macroeconomic issues, with a particular focus on exchange-rate developments.

Brazil is experiencing a resource boom

The production and export of oil has been growing at a steady pace since the beginning of the 2000s, and the long-standing national objective of achieving self-sufficiency in oil was first attained in 2006 (Table 4.2). A range of different energy policies, which in the late 1990s injected competition in the oil market and eliminated subsidies to imports and price controls, has facilitated these developments, even though the industry remains dominated by the state-owned company *Petrobras* (Guan, 2010; Caselli and

Table 4.2. **Selected data on oil in Brazil**

Thousands barrels per day

	2003			2010		
	Brazil	Central and South America	World	**Brazil**	Central and South America	World
Production of crude oil[2]	**1 496.1**	5 911.1	69 430.3	**2 054.7**	6 413.7	74 051.9
Total petroleum consumption	**2 055.7**	5 195.7	79 722.0	**2 599.0**	6 420.7	85 294.6
Imports of crude oil[2]	**351.2**	1 921.7	41 402.9	**375.0**[1]	1 876.2[1]	42 233.3[1]
Exports of crude oil[2]	**241.7**	2 643.2	39 964.1	**505.01**[1]	2 671.0[1]	41 298.6[1]
Crude oil proven reserves (billion barrels)	**8.3**	98.6	1 212.3	**12.8**	124.6	1 341.6[1]
Crude oil distillation capacity	**1 865.1**	6 633.9	81 995.2	**1 908.3** [1]	6 607.8[1]	85 900.4[1]

1. 2009.
2. Includes lease condensate.

Source: EIA, *International Energy Statistics*.

Michael, 2009). Looking forward, the economy is likely to rely even further on oil production, especially of offshore oil, for both domestic use and export. In 2007, *Petrobras* discovered massive oil reserves in the Tupi and subsequently other offshore fields, known under the name "pre-salt" because the oil is located very deep underwater under a thick layer of salt. These fields have been estimated to double Brazil's current reserves, placing the country within the top ten countries in terms of oil reserves (Lobão, 2009). Notwithstanding the technical difficulty of extracting oil from these fields, *Petrobras* plans to increase production to 3.6 million barrels per day by 2017 and to export approximately 1 million barrels per day.

Is Brazil suffering from Dutch disease?

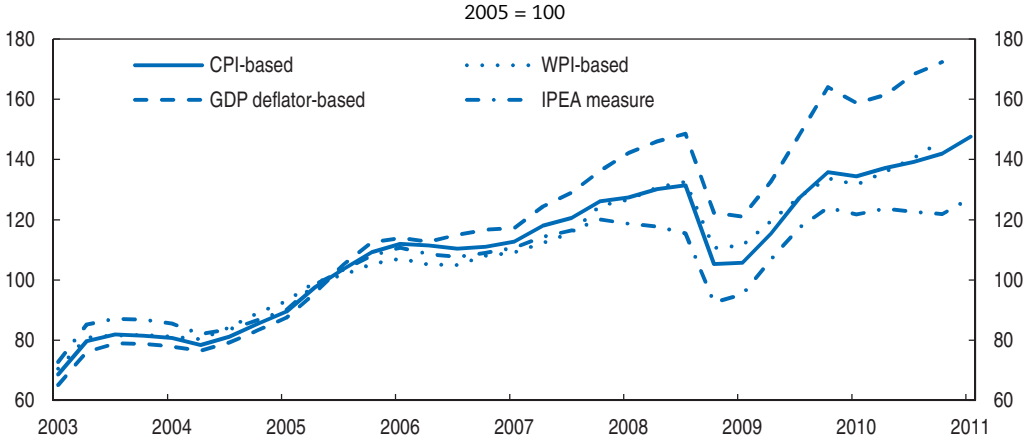
Dutch disease refers to the effects of discoveries or price increases of natural resources that result in real exchange-rate appreciation, positive spending or wealth effects and factor reallocation leading to de-industrialisation through reduced manufacturing output and net exports (see Magud and Sousa (2010) for a review of the literature on the effects of Dutch disease on economic growth).

Currency appreciation

The appreciation of the *real* started in 2003, but the extent of the appreciation varies widely depending on which exchange rate measure is used. The bilateral rate against the dollar rose by 74% from 2003 to 2010. During the same period, the effective rate, based on the relative importance of Brazil's main trading partners, appreciated by around 63%. Developments in real effective rates, which are those which ultimately matter for price competitiveness, depend on the deflator considered. A GDP deflator-based measure would point to a more marked appreciation of the *real* in the recent period than a CPI- or wholesale price-based measure (Figure 4.4).

There is some evidence that foreign capital inflows have contributed to push the currency up over the period, and have played a predominant role in explaining short-term developments (Box 4.2; Figure 4.5). In addition, structural factors such as growing oil production have increasingly contributed to the appreciation of the *real* over the long term. By contrast, the contribution of the productivity differential between Brazil and its trading partners has been decreasing. Interest-rate differentials are not found to influence exchange-rate developments, probably because their effects are already captured by

Figure 4.4. **Real effective exchange rates**



Note: See Box 4.3 for more information on the calculation of the different real exchange rate measures.
Source: OECD and IPEA.

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Box 4.2. **Explaining the appreciation of the *real***

This box casts some light on the main factors underlying the *real* appreciation and the extent to which developments in the oil sector have explained these developments.

Approach

The analysis relies on a Behavioural Equilibrium Exchange Rate (BEER) framework and seeks to explain the real effective exchange rate as a function of the productivity differential between Brazil and its trading partners, as well as capital flows and developments in the oil sector:

$$q_t = c_0 + c_1 * rprod_t + c_2 * oil_t + c_3 * nfa_t \quad (1)$$

with q_t the real effective exchange rate (in logarithms), $rprod_t$ a proxy for relative productivity, oil_t the production of oil, which is used as a proxy of development in the oil sector and nfa_t net foreign assets as a per cent of GDP.

Given the limited number of observations, the estimation relies on a two-stage Engle and Yoo (1991) procedure, which adapts cointegration tests to small samples. In a first stage we estimate equation (1). The stationarity of the residual is then tested and injected in the following error correction model (equation 2).

$$\Delta q_t = c_{10} * \Delta q_{t-1} + c_{11} * \Delta rprod_t + c_{12} * \Delta oil_t + c_{13} * \Delta nfa_t + c_{14} * ecm_{t-1} \quad (2)$$

where ecm_{t-1} is the residual from equation (1).

Data

The estimations are carried out using different measures of the real effective exchange rate, namely CPI-based, GDP deflator-based and wholesale price-based measures. These exchange rates have been re-computed using time-varying weights for 30 trading partners of Brazil, representing about 80% of its total trade. The indicator published by the IPEA has also been tested to check the robustness of the results. The IPEA measure is based on wholesale prices with fixed 2001 weights for 16 trading partners.

Following Paiva (2006), the relative productivity measure is computed as the difference between productivity in Brazil and in its main trading partners (using the same weights as for the real effective exchange rate). Given the difficulty to get reliable relative productivity data, the latter is captured by relative prices in the tradable and non tradable sectors, respectively captured by CPI and the GDP deflator. This is clearly a strong assumption, as developments in relative prices may differ from those of relative productivity.

Box 4.2. **Explaining the appreciation of the *real*** *(cont.)*

Data for net foreign assets are taken from the IMF's IFS database and expressed as a percentage of GDP. The production of oil uses ANP data. As a robustness check oil exports, using FUNCEX data, have also been tried. Both series are available on a monthly basis and have been seasonally adjusted and converted into quarterly terms. Both variables display an upward trend since at least the beginning of the 2000s. Other indicators such as the terms of trade using either national accounts or balance of payments definitions have also been tested.

Results

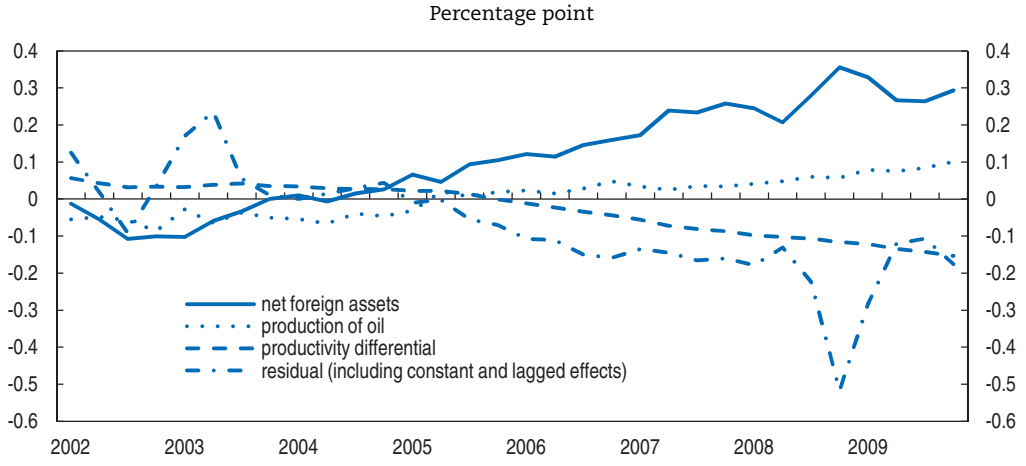
Granger tests have been run to investigate a possible causality between the real exchange rate and the two proxies for oil developments, but the results of these tests are inconclusive.

By contrast, estimations of equations (1) and (2) point to a significant effect of oil developments in explaining exchange-rate movements, on top of traditional factors. More specifically:

- In most equations, net foreign assets and the productivity differential are found to be significant determinants of real effective exchange rate in the long run. The effect of net foreign assets is also found to be the most prominent factor influencing exchange-rate developments in the short term.
- The production of oil appears to be a significant determinant of the real effective exchange rate in the long run. This also holds for the terms of trade and the export of oil.
- The equations appear to be well specified. In general, the residual derived from the long-term relationship is found to be stationary and appears to be significant in equation (2). The dynamics vary widely from one equation to the other, as well as the overall fit of the equations. These making use of the GDP-deflator version of the real effective exchange rate appear to be less well determined.

The state of fiscal policy is likely to affect exchange rate developments through market expectations. To test this assumption fiscal variables are introduced in equations (1) and (2). Several measures were tested: the primary fiscal balance and the headline balance (as a per cent of GDP) as well as the debt-to-GDP ratio. In most cases, these variables do not explain real effective exchange-rate developments. As a test of robustness, real GDP growth was included in the specification, but this did not modify the results. Economic growth was not always significant, but when it was, the oil proxy continued to explain developments in the real exchange rate. A similar exercise was undertaken for the terms of trade. The latter were found significant in the equation including the production of oil but not the one with export of oil. In both cases, the oil proxy remained significant. Finally, to test whether the significant effect of the production of oil was not capturing the more general influence of commodities in the economy, several measures of commodity prices (using IPEA data) were also tested. These variables were found to be significant in some specifications, but oil production remained significant in explaining exchange-rate developments in the long term.

Figure 4.5. **Contributions to the CPI-based real effective exchange rate quarter-on-quarter changes**



Source: OECD calculations.

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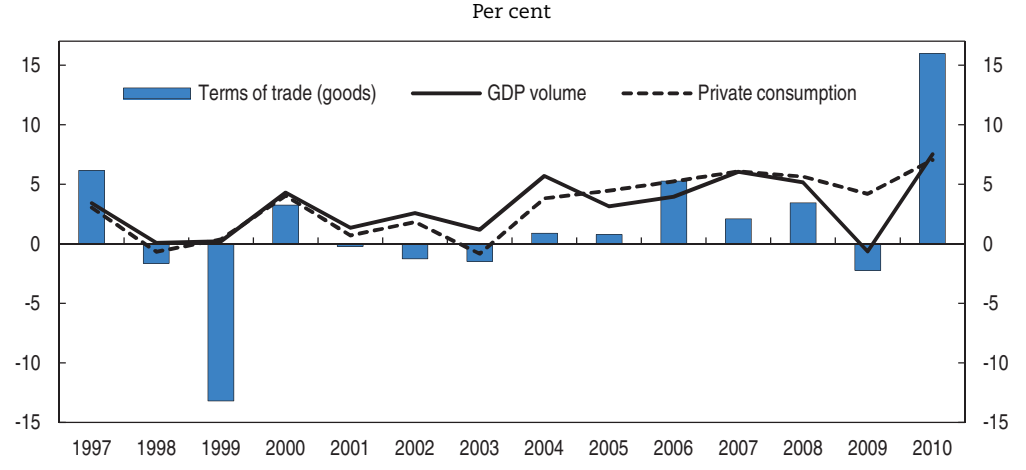
capital inflows, which are included in the specification. Estimations using alternative measures of the exchange rate would lead to qualitatively similar conclusions.

Spending effects

The resource boom has generated significant wealth effects through terms-of-trade gains, which have helped to support consumption and economic growth (Figure 4.6). From 2006 to 2008, after Brazil became self-sufficient in oil, the rise in oil prices added to the currency movement and boosted the terms of trade, which reached a temporary plateau in 2009 when the *real* depreciated in the aftermath of the financial crisis. It rebounded strongly in 2010.

Figure 4.6. **Terms of trade, private consumption and GDP growth**



Source: IBGE and Funcex.

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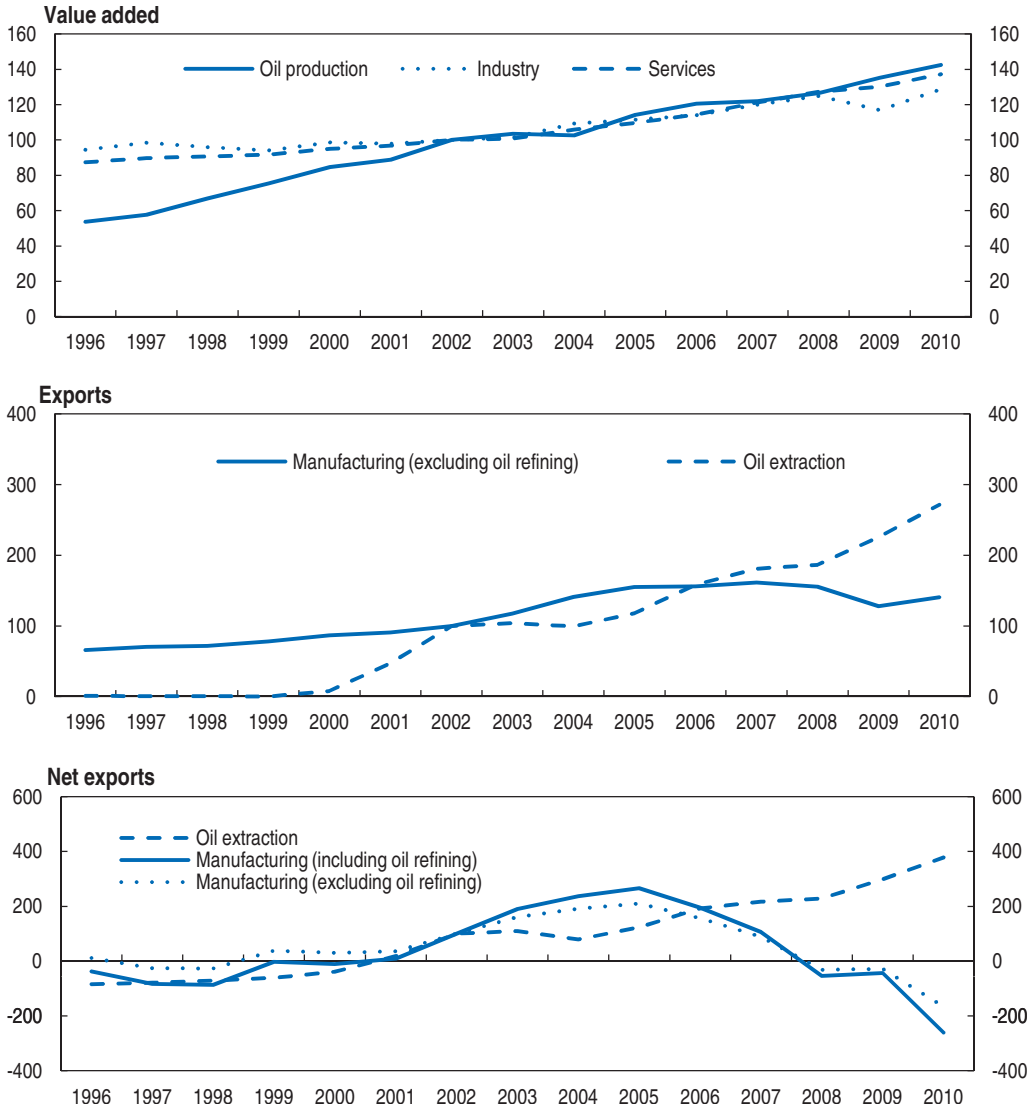
Factor reallocation

Signs of de-industrialisation are mixed. Manufacturing production has declined, but only in the aftermath of the financial crisis (Figure 4.7). At the local level, there is no evidence of a reallocation of production factors away from manufacturing stemming from the existence of offshore operations, though onshore operations have triggered some reallocation (Caselli and Michaels, 2009). Employment growth in the manufacturing sector has underperformed that of the service sector, but other forces may also be at play as shifts to tertiary activities are usually a natural outcome of development. There is more evidence of Dutch disease effects on the trade side, as net exports of manufactures started to decline in 2005 while net exports of crude oil continued to grow at a rate of more than 30% on average per year from 2005 to 2010. Part of these developments may nonetheless be

Figure 4.7. **Value added and exports by product**

2002 = 100



Source: ANP, IBGE and FUNCEX.

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explained by the increasing trade linkages between China and Brazil, with Brazil exporting mostly commodity products and importing manufactures from China.

More generally, it remains to be seen whether the resource boom that Brazil is experiencing will have an adverse impact on aggregate growth. While it could lead to further contraction of the manufacturing sector, this may not necessarily fully offset the positive wealth effect and income gains associated with term-of-trade increases. Extra fiscal resources will also allow the government to finance higher expenses without raising tax rates nor worsening the public deficit. In the end, economic policy should aim at taking advantage of the positive effects while mitigating the undesired consequence of the resource boom. Structural reforms aiming at enhancing labour- and product-market flexibility would facilitate factor reallocation.

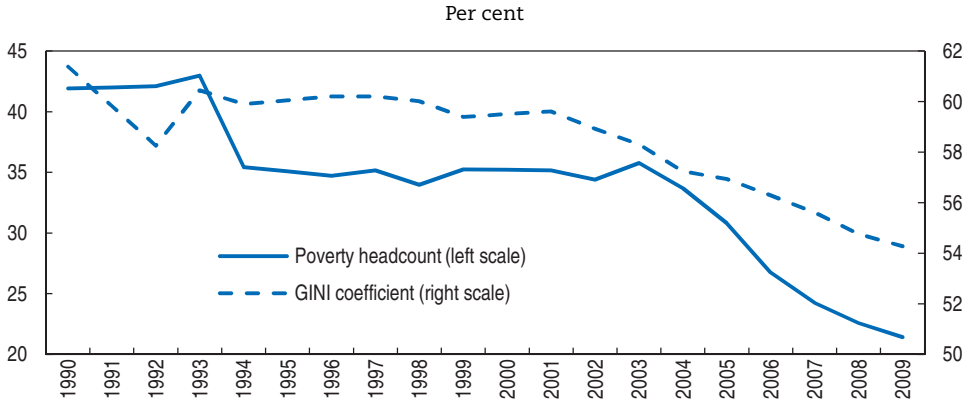
Achieving inclusive and environmental-friendly growth

For strong economic growth to be sustainable, it is essential to ensure that prosperity gains are widely shared among the population and that economic development is pursued with environmental costs and benefits in mind. This is consistent with the Brazilian government's priorities of fighting against extreme poverty and improving environmental outcomes. This section examines policies that will help to reach these goals. It first focuses on the need to further reduce poverty and social inequality and to upgrade student skills, following up on the tremendous achievements made over the last decade in these areas. Finally, the section reviews climate-change policies, underlining the success in dramatically reducing deforestation in recent years and the need to maintain such efforts, while using the Growth Acceleration Programme (PAC) to promote green infrastructure projects.

Further reducing poverty and inequality

Income redistribution is one of the pillars of Brazil's current growth model, and the country has made tremendous progress in reducing poverty and inequality over recent decades (Figure 4.8). While the bottom decile of Brazilians enjoyed very fast annual income growth rates comparable with China's per capita GDP growth rates, the top decile had a slower income growth rate closer to that of Germany. This faster income growth of the poor

Figure 4.8. **Poverty and income distribution**



Note: Poverty headcount refers to the number of persons below the poverty line, in per cent of total population.
Source: IPEA (IPEADATA).

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has resulted in declines in inequality and is predicted to allow Brazil to reach the Millennium Development Goal (MDG) of reducing extreme poverty by 2015, almost ten years ahead of schedule. Absolute poverty has fallen by 67.3% between the beginning of the stabilisation in 1994 and 2010 (*Fundação Getulio Vargas*, 2011). Despite this progress, Brazil remains an unequal society with a significant incidence of poverty. There remain 16.3 million Brazilians (8.5% of the population) who live in extreme poverty, defined as having incomes below the federal poverty line of BRL 70 per month, which is approximately USD 1.5 per day.

While the solid growth rates of the economy have supported poverty reduction, Brazil's achievements cannot be explained by growth alone, but also reflect an effective redistribution of incomes. The Gini index, a commonly used measure of inequality, has declined at an average rate of 1.2% a year, and simulations suggest that even without any growth in GDP per capita, the MDG would have been met in time (Barros *et al.*, 2010). Put differently, the economy would have had to be growing at an extra 4 percentage points a year to achieve the same reduction in poverty without redistribution. Changes in both labour and non-labour incomes received by households can explain the redistribution of income in about equal proportions.

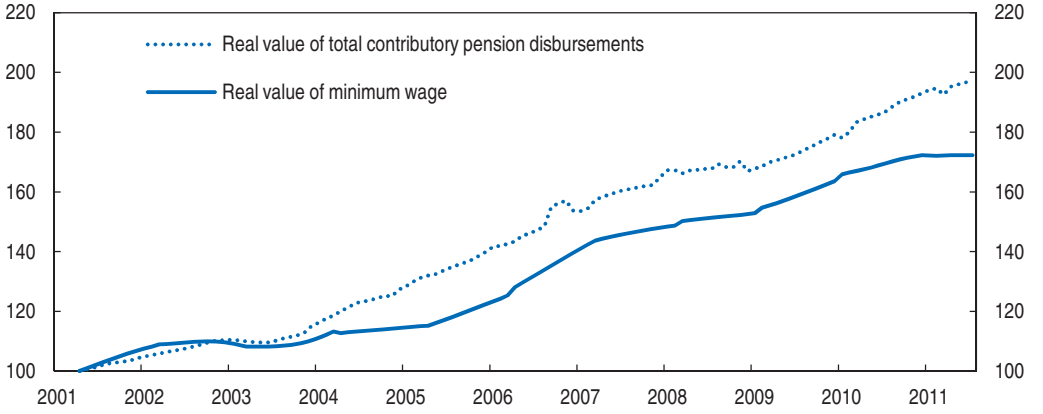
Labour incomes have become more equally distributed because education premiums – which have traditionally been very high in Brazil and are still higher than in any OECD country – came down markedly as the supply of skilled labour increased, reducing the gap between the labour incomes of low income earners and other households. At the same time, better access to education has allowed more households to earn higher wages. Falling wage premiums can explain a larger share of the observed fall in inequality than higher educational attainments, suggesting significant positive externalities of education for the reduction of inequality (Barros *et al.*, 2010). Regional disparities in labour incomes have also come down for workers of comparable skills, although more so between small and large cities within states than across states. This may be the result of economic activities that demand skilled labour expanding into smaller towns while still staying close to the economic core regions of the country.

Changes in the distribution of non-labour income have also contributed to declines in inequality and poverty. This was largely the result of public transfers that accounted for around 82% of non-labour incomes in 2009. Social policies in Brazil have been based on two main kinds of public transfers: contributory and non-contributory pensions, on the one hand, and the conditional cash transfer programme *Bolsa Familia* which provides transfers to low-income households conditional on school attendance and health check-ups on the other hand. Contributory social security payments amount to around 9% of GDP, while non-contributory pensions for the poor elderly and the disabled (based on the constitutional right of the elderly and disabled to an independent living) and conditional cash transfers from *Bolsa Familia* each account for around 0.4% of GDP. An estimated 30% of Brazilian households receive contributory social security benefits, whereas *Bolsa Familia* benefits are paid to about 17% of Brazilian households and non-contributory pensions reach a much smaller number of recipients. Average benefit levels are much higher for recipients of contributory and non-contributory pensions, who receive a monthly payment of at least one minimum wage (currently BRL 545), while the average benefits paid by *Bolsa Familia* amount to BRL 115 per household per month (Vegas Soares, 2011).

Over the last decade, public transfers have become an increasingly important component of household income, contributing to the decline in inequality. In the case of contributory pensions, this was almost exclusively the result of a rise in benefit levels due to increases in the minimum wage, which tracks the minimum pension benefit and whose real value has increased by over 70% over the last decade (Figure 4.9). In contrast, a widening coverage of *Bolsa Familia* and to some degree also of non-contributory pensions explains the increasing share of these transfer payments in household income. A specific feature of Brazil's current transfer system is that it redistributes a larger share of national income to the elderly than any other Latin American country (Neri, 2010).

Figure 4.9. **Minimum wage and pension payments**

Deflated by consumer price index (INPC), 12 months moving average, April 2001 = 100



Source: OECD calculations based on data from Central Bank of Brazil.

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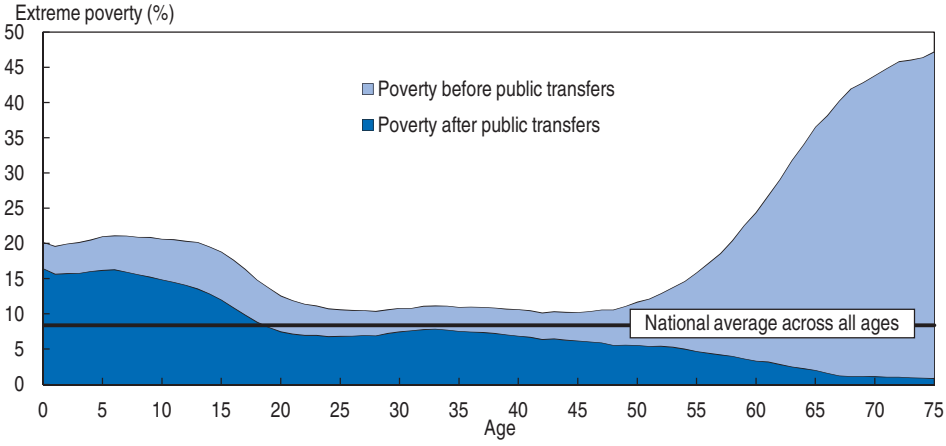
When evaluating the impact of the public transfer system, it is essential to distinguish between its respective effects on poverty and on inequality. The conditional cash transfer programme *Bolsa Familia* has proven a powerful tool to reduce poverty, while the rise in the real value of pension payments has been the major cause of the fall in inequality because their volume dwarfs all other transfers.

Analysing the effects on inequality, Barros *et al.* (2010) decompose the fall of the Gini index and find that between 2001 and 2007, pensions accounted for a three times larger share of the decline in inequality than *Bolsa Familia*. Pension benefits have reduced inequality because the pension beneficiaries tend to have below-average incomes. The rise in pension benefits stems from the rapid increases in the minimum wage, whose adjustment is linked to the sum of the real GDP growth (experienced two years before) and CPI inflation. However, minimum wage increases do not affect the bottom 5% of the income distribution who are neither in formal employment nor in receipt of a pension, and hardly any of Brazil's pensioners are poor given that they receive at least the minimum wage. In addition, a number of measures in the pension system do not appear to be cost-effective in fighting against poverty and would best be scaled back. These include granting a survivor pension to beneficiaries who already receive their own pension or providing additional free services such as free public transport to pension recipients through the Elderly Statute.

As regards poverty, the current transfer system reduces the incidence of poverty to levels well below the overall average for the elderly, but it leaves poverty rates among youths visibly above average (Figure 4.10). By contrast, *Bolsa Familia* has proven a very effective and well-targeted tool for fighting child poverty and now reaches almost 13 million families. Benefits depend on family income and the number of children. Families with per capita income below the extreme poverty line of BRL 70 per month receive a basic benefit of BRL 70, plus BRL 32 for each child up to the age of 15 and BRL 38 for each adolescent aged 16 or 17, with a maximum of three children and two adolescents taken into account. Families with per-capita incomes between BRL 70 and BRL 140 receive only the benefits for children and adolescents, but not the basic allowance. The maximum monthly benefit that a family below the extreme poverty line with three children and two teenagers can receive from *Bolsa Familia* is therefore BRL 242 (Veras Soares, 2011). Each family's eligibility is re-assessed every two years through personal visits of social workers. These regular assessments have resulted in the establishment of an almost exhaustive register of poor families in the country, called *cadastro único*. Additional benefits of the programme include the increased schooling rates and the number of vaccinations and health check-ups that have been achieved through the conditions attached to transfers. While cash transfers are effective tools to alleviate poverty in the short term, the eligibility requirement that children attend school fosters literacy and numeracy skills acquisition and human capital investment more generally, with clear long-term benefits. Increasing *Bolsa Familia*'s resources would be useful to reach the government's objective of eradicating poverty in Brazil.

Figure 4.10. **Poverty impact of public transfers by age group**

2009



Note: Extreme poverty is defined as households having incomes below the federal poverty line of BRL 70 per month.
Source: Barros *et al.* (2010) based on *Pesquisa Nacional por Amostra de Domicílios data*.

StatLink http://dx.doi.org/10.1787/888932519814

The government has recently launched a new social policy programme called *Brasil sem Miseria*, which builds on and extends *Bolsa Familia*, and aims to eradicate extreme poverty in Brazil by 2014. One focus of the programme is to enhance the sustainability and efficiency of *Bolsa Familia*'s successes by providing poor families with more than just income transfers. In particular, the extensive information about the living conditions of poor families that has been acquired through *Bolsa Familia* and collected in the *cadastro*

único will be used to make other social services available to poor families, according to their specific needs. This may include services like care for children and the elderly, training, assistance in finding employment or the provision of loans. Offering such services through the local contact points that administer *Bolsa Familia* will help to overcome informational barriers of poor families with respect to the social policies already on offer, extend these policies into regions where they are currently underdeveloped and improve their targeting. This new programme is a welcome and promising measure, and should be given priority.

Improving access and quality of education

In the longer term, widespread education is paramount for securing higher incomes for the poor, as well as an important investment into future competitiveness and growth. Brazil has made impressive progress in this area over the past decade. While only 30% of the labour force had completed secondary school in 1993, this share stands at 60% today, and this development is part of the reason for the remarkable decreases in inequality mentioned above. Student performance has also increased, and the country has moved from being one of the lowest performers in the PISA assessment to a model case for what kind of improvements can be achieved. Comparing 2000 test results with those of 2009, Brazil's students have gained the equivalent of a full academic year of math skills, and the increase in the overall score is the third largest advancement recorded in the PISA database. A large part of these dynamics has occurred among the lower income groups: today, a Brazilian six-year-old in the bottom quintile of the income distribution will benefit from twice as many years of education as his/her parents. Despite these achievements, the performance of Brazilian students is still significantly below OECD, East Asian and Eastern European countries, and much work remains to be done to close this gap.

Major elements of the success in recent years included mechanisms to equalise and top up per-student school funding across regions, states and municipalities via the FUNDEB programme. With an increase from 11.2% to 17.4%, Brazil witnessed the greatest relative expansion in the share of public expenditure on education between 2000 and 2008 of all countries featured in the OECD's Education at a Glance report (OECD, 2011). But improving funding has not been the only factor. Brazil has created incentives for good performance at the local level, coupled with a uniform PISA-referenced benchmarking mechanism across educational institutions that has allowed measuring student attainments and school performance. Nationwide aptitude tests for Portuguese language and maths skills (SAEB) evaluate students' learning achievements after the 4th, 8th and 11th grades, and are used to construct indicators of school performance (IDEB) that allow comparisons across 175 000 primary and secondary schools in the country. As with any indicator, these aptitude tests can measure only a subset of student learning objectives, and narrowing the curriculum to what is asked in the standardised tests should of course be avoided. The ability to monitor progress at the school level in a comparable manner is a major achievement that has been very helpful in improving the performance of the education system as a whole, and will continue to be a powerful tool to evaluate the success of future reforms. At the same time, the conditional cash transfer programme (first *Bolsa Escola*, later integrated into *Bolsa Familia*) created both the incentives and the means for poor parents to send their children to school. All these measures have delivered important improvements in Brazil's education system and should be continued.

While the responsibility for primary and secondary education lies with state and municipal authorities, the federal government has played a successful role in co-ordinating

and improving education policies at lower-level jurisdictions through measures such as setting uniform standards for teachers and the funding of teacher training and learning materials. The federal government has also created incentives for medium-term planning at the school level through the *Fundescola* programme.

The main challenges going forward include improving the quality of instruction, lengthening the school day and reducing drop-out rates in secondary education. While access to primary and secondary education was the most urgent issue in the past, Brazilian children nowadays complete between 9 and 11 years of schooling, regardless of their family background.

The quality of instruction and teachers has struggled to follow the rapidly growing number of students, which has implied large hiring needs for teachers over a relatively short time. Accordingly, a non-negligible share of teachers has not completed university training. In addition, as in most Latin American countries, teaching is not regarded as a high-status profession, and teachers are frequently hired from the lower third of secondary school graduates, as opposed to Finland, Korea and Singapore where the top graduates often become teachers (World Bank, 2010a). Attracting more qualified individuals into the teaching profession may imply improving school working conditions, improving pay and creating stronger performance incentives. Currently, pay gradients are tightly defined by seniority (World Bank, 2007). Some Brazilian states and municipalities have acknowledged this problem and started paying a teacher bonus related to school performance. These programmes appear to be successful and it may be worth considering deploying them on a broader scale. Appointments of school principals have in some cases served local political objectives rather than being organised through an open, merit-based competition. Such practices hamper the progress of reform and should be avoided. Moreover, principals should have full discretion over teacher hiring decisions.

Improving the quality of instruction will also entail investing more in appropriate educational school infrastructure, including libraries, science labs and computer facilities, as has become standard in most OECD countries. A lack of physical infrastructure implies that many schools run several shifts during the day, with the result that Brazilian secondary students receive an average of only 4 hours of instruction per day, while schools in OECD countries deliver around 7 hours (World Bank, 2010b). Around 42% of secondary students are enrolled in night shifts. The government has launched efforts to increase spending on education further and set targets on education expenditures and quality improvements in the National Plan for Education (*Plano Nacional de Educação*), with the aim of increasing public investment in education from the current 5% to 7% of GDP within a decade.

Tackling comparatively high drop-out rates in secondary education is a challenge for future education reforms. In many cases, social issues including teen pregnancy, gang and drug involvement, family instability or developmental deficits are behind the failure of around 40% of secondary schools to graduate at least 60% of their students, resulting in high school enrolment of only about 70% of a given cohort (World Bank, 2010a).

Students with these kinds of problems may not be well served by a one-size-fits-all education system with a largely academic orientation. Dropping out should be seen as a cumulative process of student disengagement or withdrawal that occurs over time. Measures to reduce drop-outs should begin at a young age with the improvement of the quality of Brazilian early childhood education services and primary schools as well as the

reduction of grade repetition, one of the main predictors of drop-outs. Brazil still has one of the highest levels of grade repetition in the region (24.5% in primary first grade according to UNESCO, 2011). Students with a high drop-out risk should receive adequate support (such as tutoring) as early as possible in their schooling. Teachers and other education staff should be trained to adequately support these students. Secondary students with a high drop-out risk should be offered more attractive alternative options to the standard curriculum, including a stronger vocational content, technical education and labour training. The *Pronatec* initiative, launched in April 2011, facilitates the access of the unemployed and beneficiaries of the *Bolsa Familia* to technical schools and is a step in the right direction. However, some of these measures are only available to graduates from the regular secondary curriculum, a condition that may place them out of reach for groups with a strong propensity to quit school. To reach students from less favourable backgrounds and reduce drop-out rates, vocational degrees should be offered, with financial support and validity for the labour market being independent of successful graduation from a regular academically oriented curriculum. After all, it is preferable to equip such students with a less challenging education that will improve their labour market performance even if it will not lead all the way into higher education than to lose them entirely.

Reducing GHG emissions

Brazil is expected to suffer significantly from the adverse effects of climate change, leading in particular to less available water for hydropower-based electricity and lower crop yields in the Central-West and Northeast regions. Deforestation – much of it in the form of illegal logging – is responsible for almost half of Brazil's greenhouse gas emissions (Table 4.3). In some regions, activities associated with deforestation represent a sizeable source of employment and resources for the local economy. Agriculture is the second largest GHG-emitting sector due to cattle rearing and some farming practises in managing soil nutrients and burning waste. Contrary to most other countries, emission levels from the power and the transportation sector are relatively low, thanks to the preponderance of hydroelectric plants for power generation and the high penetration of sugar-based ethanol as an automotive fuel. In addition, domestic crude oil production appears to be less carbon intensive in Brazil than in many industrial countries. This stems from the type of crude oil produced, the technology used to extract and refine it and the significant environmental measures adopted by the industry.

Table 4.3. **GHG emissions by sectors**

Sector	2008		Reference scenario 2030		Low-carbon scenario 2030	
	$MtCO_2$ eq	Per cent	$MtCO_2$ eq	Per cent	$MtCO_2$ eq	Per cent
Energy	232	18	458	27	297	29
Transport	149	12	245	14	174	17
Waste	62	5	99	6	18	2
Livestock	237	18	272	16	249	24
Agriculture	72	6	111	6	89	9
Forestry	536	42	533	31	196	19
Total	1 288	100	1 718	100	1 023	100

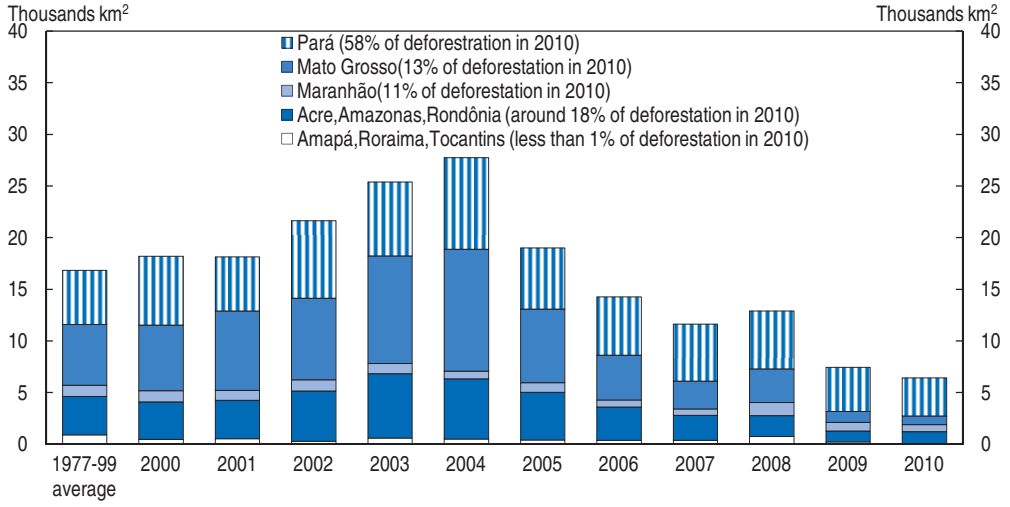
Source: World Bank (2010b).

The 2008 National Climate Change Plan aims to gradually reduce deforestation by 40% from 2008 to 2017. Projections to 2030 by the World Bank suggest that deforestation will level off. Excluding forestry, emissions are expected to rise in line with sustained economic growth. Power generation is likely to rely more extensively on fossil fuel than at present, leading to increased emissions from the energy sector. The exploitation of the pre-salt fields is not expected to increase emissions markedly as a large share of this production is destined for exports.

Against this background, at end-2009 the government legislated the *National Climate Change Policy* shortly after the United Nations Copenhagen Conference and set a national target of emission reductions between 36.1% and 38.9% by 2020 compared to a business–as–usual scenario. The law provides more details on how Brazil will finance its climate change policies and estimates the necessary emissions reductions per sector. It also requires mitigation actions to be quantifiable and verifiable.

The government has also introduced several initiatives to curtail deforestation, including the Action Plan to Prevent and Control Deforestation in the Amazon. Efforts have also been directed to create conservation areas, introduce new regulations that limit credit for properties that have environmental liabilities, establish new credit facilities for reforestation and create State programmes to fight deforestation and discourage the use of illegal timber. An Amazon Fund has been set up to support systemic initiatives to reduce deforestation and promote sustainable developments in the region. Overall, deforestation rates have declined markedly over the last decade, due to better enforcement and control over illegal logging (Figure 4.11). However, progress has been uneven across regions, and deforestation rates remain high in the region of Pára. In addition, the latest monthly data suggest that deforestation rates have risen sharply in early 2011, notably in the region of Mato Grosso.

Figure 4.11. **Deforestation rates in the Amazon**



Source: National Institute for Space Research.

StatLink http://dx.doi.org/10.1787/888932519833

Thanks to significant progress in reducing the pace of deforestation, the country is on track to achieve its emissions targets four years before the 2020 deadline. The authorities should persevere in their efforts. *First*, better enforcement of existing law could be achieved

by increasing human resources to monitor and control compliance in forestry in regions where deforestation rates remain high. *Second*, further developing job opportunities and social protection in regions whose economies depend on deforestation could lower the attractiveness of illegal logging. *Third*, the authorities should resist the proposed changes to the Forest Code that would lower the proportion of a property in the Amazon (currently at 80%) and of land in certain areas (currently between 20 to 35%) that must remain forested. Such changes could accelerate deforestation and reverse recent trends. *Finally*, given the large areas of land that have been degraded in the past, the potential for afforestation and reforestation is sizeable. According to some estimates, land available for these activities in Latin American countries is close to 3.4 million km^2, most of it in Brazil (de la Torre *et al.*, 2009). The authorities should encourage activities in this direction.

Climate-change policies are also closely related to infrastructure developments (Box 4.3). Well-planned infrastructure developments can reduce water and air pollution. In turn, damage to infrastructure can be limited if climatic changes are accounted for in the initial design, location and material selection (Fay *et al.*, 2010). The Growth Acceleration Programme (PAC) offers the Brazilian authorities an opportunity to introduce greener infrastructure and to improve its climate resilience. At the moment, the programme includes only some limited green investments. Measures to promote renewable energy and foster energy efficiency account for less than BRL 39.4 billion out of the 462 billion in total allocated to energy measures. To some extent this reflects the very high uncertainties surrounding this type of project which make them less attractive to investors. Given the

Box 4.3. **The greening of infrastructure**

Tackling climate change requires modification in the planning and design of infrastructure. The use of infrastructure in services and transport is expected to contribute to 39% of Brazil's greenhouse gas emissions over the period 2010-30, and will also contribute indirectly through industry and commercial buildings. At the same time, infrastructure services are also very vulnerable to changing climatic conditions.

Climate change introduces deep uncertainties that complicate investment decisions. First, the extent of likely change in climate conditions is highly uncertain, as are the timing and location of specific impacts. At the moment, both the level and the period when carbon will be priced are still unknown. Second, there are uncertainties regarding the technologies that will be available to deal with climate change and higher carbon prices. These uncertainties are magnified because infrastructure cannot adjust rapidly.

Estimates of investments in developing countries required to adapt infrastructure to a changing climate are relatively modest compared to the additional annual investment that will be needed to close the development gap. Parry *et al.* (2009) estimated that the infrastructure deficit (including housing) amount to USD 37 billion in the Latin America and the Caribbean countries, while the average infrastructure-related adaptation cost would range between USD 2 to 7 billion per year by 2050. Estimates from the World Bank (2010) are in the lower part of this band. Contrary to adaptation costs, mitigation costs would be much higher and associated with large upfront costs in developing countries, with more than half of it concerning infrastructure. At the same time, greener investments also carry co-benefits such as a reduction in road congestion and local pollution. Better cost-benefit analyses are needed to completely assess the consequences of investment decisions and account for both high uncertainties and co-benefits.

potential high co-benefits of green investments, the authorities should ensure that investment decisions appropriately account for environment-related externalities in project selection within PAC. This could be done, for example, by taking full account of environmental impacts in cost-benefit analysis.

A summary of policy considerations is presented in Box 4.4.

Box 4.4. **Summary of recommendations: Social and education policies and climate change**

Social and education policies

- Expand the conditional cash transfer programme *Bolsa Familia*, and its follow-up programme *Brasil sem Miseria*.
- Improve the quality of instruction and teachers and increase opportunities for technical education and labour training not contingent on successful graduation from the regular academically oriented curriculum to students with high drop-out risk.

Climate-change policies

- Increase human resources for forest monitory and regulatory enforcement.
- Develop job opportunities and social protection in regions whose economies depend on deforestation resources.
- Resist proposed changes to the Forest Code that lower the percentage of a land that should remain forested.
- Ensure that investment decisions appropriately account for environment-related externalities in project selection within the PAC infrastructure programme.

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