Social Security
Running against population aging

Nuclear Energy
Speeding up nuclear energy operations

Interview
Mauricio Antonio Lopes
President of Embrapa



THE BRAZILIAN ECONOMY

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Structural challenge

Brazil's fiscal crisis call for changes to make public spending predictable, transparent, and sustainable in the long run

FGV IBRE

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THE BRAZILIAN ECONOMY

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8 Structural challenge



With the political deadlock exacerbated by proceedings to impeach the president, Brazil needs urgently to find a way to halt the fiscal deterioration. Solange Monteiro reports on joint seminar on Brazil's fiscal policy cosponsored by the International Monetary Fund and the Getulio Vargas Foundation in April. Seminar participants agreed that the fiscal policy should focus on broader reforms to make public spending more predictable, transparent and sustainable in the long run.

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Dealing with higher public deficits in a weak economy is a problem that is not unique to Brazil. Carlos Mulas-Granados, IMF, says this is a trend in both advanced and emerging economies. Throughout Latin America there is concern about the deterioration of international prices for minerals and agricultural products and their effects on growth and tax revenues. Solange Monteiro reviews the lessons that can be learned by countries that have adjusted their economies.

19 The credibility issue

Former director of the IMF and current consultant Teresa Ter-Minassian talks to Solange Monteiro about Brazil political and economic challenges. During the seminar, she said that Brazil sustainable recovery first requires resolution of the current political uncertainties and emergence of a government with broad support in Congress so that it can make difficult adjustments and adopt reforms, move to restore business confidence and promote recovery of investment.

Social Security

20 Running against population aging

Social security imbalance is one of most serious threats to Brazilian public finances and growth. Brazil's population is rapidly aging and social security already spends the same as richer countries such as Japan and Germany. Keeping the current retirement rules, it is estimated that by 2060, social security spending will be at 18% of GDP. Solange Monteiro consults the experts about social security economic costs and what can be done to make it financially sustainable.

Nuclear Energy

26 The value of speeding up nuclear energy operations



The nuclear industry seeks policies to speed up the construction of new nuclear power plants and encourage the exploration of Brazil's rich uranium reserves and possibly produce and export enriched uranium. Brazil is one of very few countries that can manage the full cycle of uranium enrichment. Solange Monteiro discusses with industry representatives their expectations about the future of nuclear energy in Brazil.

Interview

30 "We want more open innovation"



President of the Brazilian Agricultural Research Corporation (Embrapa) and agronomist Mauricio Antonio Lopes talks to Solange Monteiro about the agency's new business model to attract private finance for research projects, making it less dependent on government's funding. Lopes believes there is room to substantially increase agricultural productivity and production through research and innovation.

Editors' Note

THROUGHOUT BRAZIL'S HISTORY, major public finance reforms have generally been preceded by major crises. The decision to confront opposition to reforms and make changes is often made when fiscal imbalances that are harming public welfare raise public awareness of the magnitude of the crisis—and the proximity of the abyss. This happened, for example, in 1997 when the federal government started restructuring the debts of the states, paving the way for approval of the Fiscal Responsibility Law in 2000, which itself had been inspired by the best international practices to remedy a fiscal crisis.

Today, large deficits make the trajectory of Brazil's public debt unsustainable, prompting the government to carry out emergency measures to address the full breadth of the public finance crisis. The hope of resolution of the political crisis with the proceedings to impeach President Rousseff may begin to open space for discussing alternative measures to bring Brazil back from the brink and onto a sustainable public finance path to revive confidence and lead to resumption of economic growth. This issue was discussed at FGV in April at the Second Joint IMF-FGV International Seminar on Fiscal Policy and the Pension Reform Conference: An Opportunity for Brazil. As is reported in this issue, both events provided a rich and thoughtful analysis of Brazil's public finance crisis. The main takeaway from both was that Brazil needs to prevent the one-off adjustments advocated by political interests and invest in structural reforms that will be effective through the medium and long term.

This issue also profiles two sectors that hold great promise for Brazil, agribusiness and nuclear energy. In an interview, Mauricio Lopes, president of Embrapa, describes the agency's new business model to attract private finance for research projects, making it less dependent on the Treasury. Lopes believes there is room to substantially increase agricultural productivity and production. Meanwhile, the nuclear industry seeks policies to encourage it to explore Brazil's rich uranium reserves and possibly produce and export enriched uranium. Brazil is one of very few countries that can manage the full cycle of uranium enrichment.



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POLITICS

Senate votes to suspend President Rousseff

Brazilian senators voted 55-22 on Thursday in favor of suspending Dilma Rousseff from the office of president for six months and starting an impeachment trial against her. The fact that 55 supported the constitutional instrument was most significant, since 54 votes or two thirds of the upper house are needed to conclude the process and permanently remove Rousseff. She is charged with having illegally tapped state banks and taken loans to cover up budget deficits violating the Fiscal Responsibility Law. Rousseff and her Workers Party (PT) argue no responsibility crime was committed, since the mechanism is common practice in Brazilian administrations. Rousseff has been replaced by Vice President Michel Temer, head of the country's largest political party.

The impeachment process is not expected to alter the ongoing Supreme Court investigation into the state-oil company Petrobras corruption scandal, which has virtually bankrupted the company, and the scheme involving dishonest company officials, the main public works contractors and politicians. About over 30% of elected members of congress, current and ex-cabinet ministers, political leaders including former president Lula da Silva are under investigation. (May 12)

Rousseff vows to keep fighting the "coup"

Suspended by Brazilian Senate, President Dilma Rousseff called the impeachment a "coup," the result of a fraudulent process that ignores the 54 million people who voted for her, and vowed to keep fighting. Rousseff, Brazil's first female president denies breaking any fiscal laws. "I have made mistakes, but I have not committed any crimes. I am being judged unjustly, because I have followed the law to the letter," she said. Yet polls show a majority of Brazilians support impeaching her and disapprove her management of the economy. It took Rousseff less than an hour to make two speeches slamming the vote: One to reporters inside the presidential palace, and one to crowds outside after she was suspended. (May 12)

Photo: Marcello Casal Jr./Agencia Brasil



Acting President Michel Temer

Photo: Marcello Casal Jr./Agencia Brasil.



Suspended President Rousseff speaks to supporters

Temer's Cabinet: Inflation hawk in Finance and an anti-populist in foreign affairs

Acting President Michel Temer appointed Henrique Meirelles and Senator José Serra as Finance Minister

Photo: José Cruz/Agencia Brasil.



Finance Minister Henrique Meirelles

Photo: Valter Campanato/Agencia Brasil



Foreign Minister José Serra

and Foreign Minister, respectively. Meirelles, an inflation hawk who was the Central Bank governor during the 2003-2011 administration of President Lula da Silva, is expected to win the approval of the private sector and investors, according to media reports. Serra, a former São Paulo state governor and presidential candidate in 2002 and 2010, is expected to lead to a shift in Brazil's foreign policy toward U.S and EU and away from leftist populist-led neighbors such as Venezuela and Bolivia. Temer's decision to include nine centrist and conservative parties in his Cabinet also shows he is prioritizing a strong relationship with Congress to pass legislation. Temer's Brazilian Democratic Movement Party, PMDB, a former Workers' Party (PT) ally turned foe, will hold the largest number of ministries of any single political grouping with 6 out of the 24. However, the choice of Henrique Eduardo Alves to head the Tourism Ministry and Gilberto Kassab to lead the Science, Technology and Communications portfolio came as surprise since both men had been part of Rousseff's Cabinet until just a few weeks ago. (May 13)

Temer names a woman to head the National Development Bank, BNDES

Acting President Temer appointed Maria Silvia Bastos Marques, a career bureaucrat and onetime steel executive who most recently worked on Rio de Janeiro's Olympics preparations, to replace departing Chief Executive Luciano Coutinho at the bank. The development bank has been criticized for its part in Brazil's twin political and economic crises. Ongoing corruption investigation has uncovered evidence of rampant graft in many of the projects that the BNDES financed in recent years. (May 17)

ECONOMIC POLICY

Central bank keeps rates on hold

The Monetary Policy Committee voted to keep the central bank's benchmark rate at its near-decade high at 14.25% for the sixth straight meeting on Wednesday. It was the committee's last decision before the government lead by President Temer took over. (April 28)

Budget deficit widens in March

Plummeting tax revenues drove up Brazil's budget deficit, excluding interest payments, amid a deep recession. Central bank data shows the country posted a primary budget deficit of R$10.6 billion (US$3.1 billion) in March. In the 12 months through March, the primary budget deficit rose to an equivalent of 2.28% of GDP from 2.11% in the 12 months through February. (April 29)

Government taps markets' favorite to lead central bank

Interim government on Tuesday named Ilan Goldfajn, chief economist of Itau Unibanco Holding, to replace Alexandre Tombini as central bank governor. Goldfajn, 50, has been widely praised by market participants for his orthodox policy approach and is expected by investors to be less vulnerable to political interference than Tombini, a career technocrat appointed by the previous leftist government. A graduate of MIT, Goldfajn has said Brazil urgently needs to rebalance its fiscal accounts with pension reforms and public spending caps. He recently warned against a hasty interest rate cut, while acknowledging that slowing inflation would allow monetary policy easing, probably starting in July. (March 17)

Photo: Wilson Dias/Agencia Brasil



New central bank governor Ilan Goldfajn

ECONOMY

First-quarter unemployment rises to 10.9%

Joblessness rose to 10.9% in the first quarter, from 9% in the fourth quarter of 2015, and 7.9% a year earlier, the government statistics agency IBGE said. Worker's incomes also deteriorated in the period. Average monthly wages, adjusted for inflation, fell to R$1,966 (US$561), from R$2,031 a year ago. (April 29)

Inflation accelerates in April

Brazil's consumer-price index rose more than expected to 0.61% in April, compared with an increase of 0.43% in March, the government statistics agency IBGE said. The 12- month inflation was up 9.28% through April, well above the central bank's inflation ceiling of 6.5%. (May 6)

DICOM

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Structural challenge

Brazil's acute fiscal crisis call for changes to make public spending predictable, transparent, and sustainable in the long run.



Solange Monteiro

WITH THE POLITICAL DEADLOCK exacerbated by proceedings to impeach the president, Brazil needs urgently to find a way to halt the fiscal deterioration: public debt is unsustainable because of large central government deficits, states have severe cash flow problems, state-owned companies are also deeply indebted, and state-owned banks are highly exposed to risk. And there is no end in sight to the economic downturn.

Many of the problems were identified long ago, but the policies adopted have not resolved them. The result is one of the most serious fiscal crises in Brazilian history.

In 2013 in a joint seminar cosponsored by the International Monetary Fund (IMF) and the Getulio Vargas Foundation (FGV),

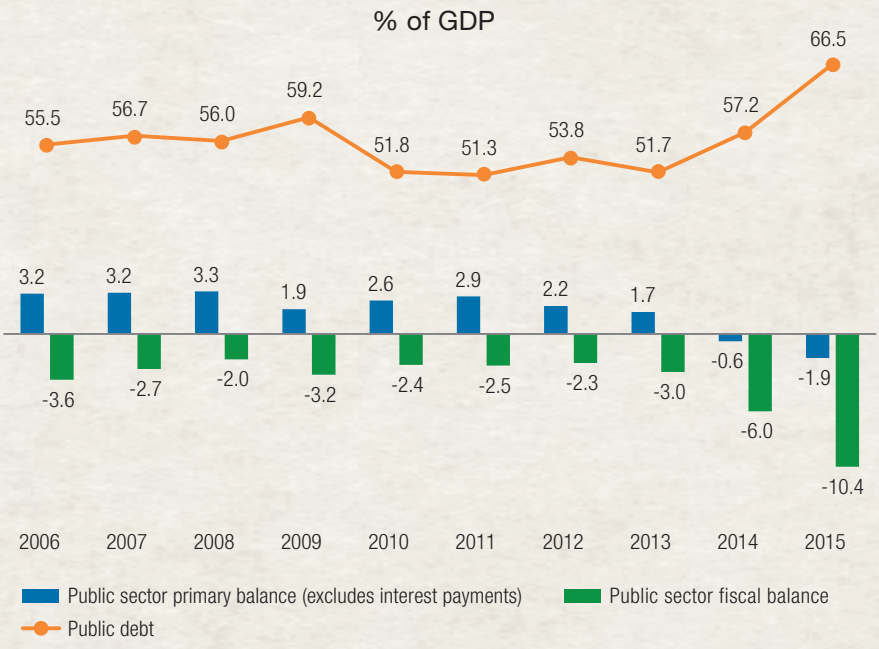
concerns were raised about the proliferation of accounting gimmicks the government was using on the public accounts to artificially meet its fiscal targets. Three years later, at a follow-up seminar in April, it was clear not much has changed. "There is no doubt that to resume growth, the country will have to reverse this fiscal situation; the indicators suggest that the growth crisis will be severe," said Teresa Ter-Minassian, former IMF department director and current consultant. In its latest *World Economic Outlook*, the IMF estimates that in 2021 Brazil's per capita GDP will be lower than in 2011, making this a new lost decade.

Beyond accounting gimmicks and fiscal easing, there is another long overlooked factor: "It is no secret that some of Brazil's ailments today comes from a long tradition of fiscal policy that is inconsistent with reality," Carlos Ivan Simonsen Leal, president of FGV, commented. Leal attributed this to an immature budget process that overestimates revenues and inflates expenses. Since 1988, he said, there have been

"There is no doubt that to resume growth, the country will have to reverse this fiscal situation; the indicators suggest that the growth crisis will be severe."

Teresa Ter-Minassian

Brazil's fiscal deficit and public debt have increased sharply since 2013.



Source: Central Bank of Brazil.

"It is no secret that some of Brazil's ailments today comes from a long tradition of fiscal policy that is inconsistent with reality."

Carlos Ivan Simonsen Leal

just two improvements in public financial management: spending caps and the Fiscal Responsibility Law.

With the fiscal balance focused on the short term, there is little room to invest in infrastructure, innovation, and other factors to make the Brazilian economy more competitive. The result is less growth, which then reduces tax revenues. Jorge Arbache, chief economic advisor to the Ministry of Planning, pointed out the high volatility of Brazilian economic growth, second only to sub-Saharan Africa, adding that "Tax collections tend to deteriorate more in bad years than improve during the good years," which explains Brazil's "permanent situation of fiscal risks.," he says.

Given Brazil's serious structural fiscal problems and the severe recession, Manoel Pires, Ministry of Finance secretary of economic policy, argued for changing the policy focus from one-off fiscal adjustment to broader reforms "that would mitigate recessionary effects and steer the country to a more sustainable path." Mario Falcão Pessoa, division chief in the IMF Fiscal Affairs Department, said that policies to ensure fiscal discipline have become a public good in the world—"something nonpartisan which must be observed by all governments, but heightens the challenge of building political consensus for permanent public policy."

However, Brazil's rigid budgeted spending is preventing immediate fiscal adjustment—usually cuts are limited to investments—and leads to higher public spending. As the country's population ages, mandatory social spending goes up accordingly. From 1991 to 2015, social spending accounted for 75% of the growth in primary expenditure of the central government and this year accounts for 80%. With growth in GDP per capita modest, low productivity, and rapid growth of the elderly-to-active worker ratio, health expenditures, pension and welfare benefits will increase. "Much of this imbalance has to do with the rules of public spending, which we criticize but end up supporting, and every day the fiscal situation gets worse," said consultant Mansueto Almeida. "For example, according to current legislation, the central government needs to spend 13% of its net current revenue on health, but Congress raised the minimum to 19% recently, with almost unanimous support." A government that spends so much on social programs normally cannot carry out active policies.

Potential fiscal risks

In addition to the worrisome trend in social spending, there are unpredictable fiscal risks related to contingent liabilities that Brazil has accumulated involving state-owned banks and companies. Almeida pointed out that from 2007

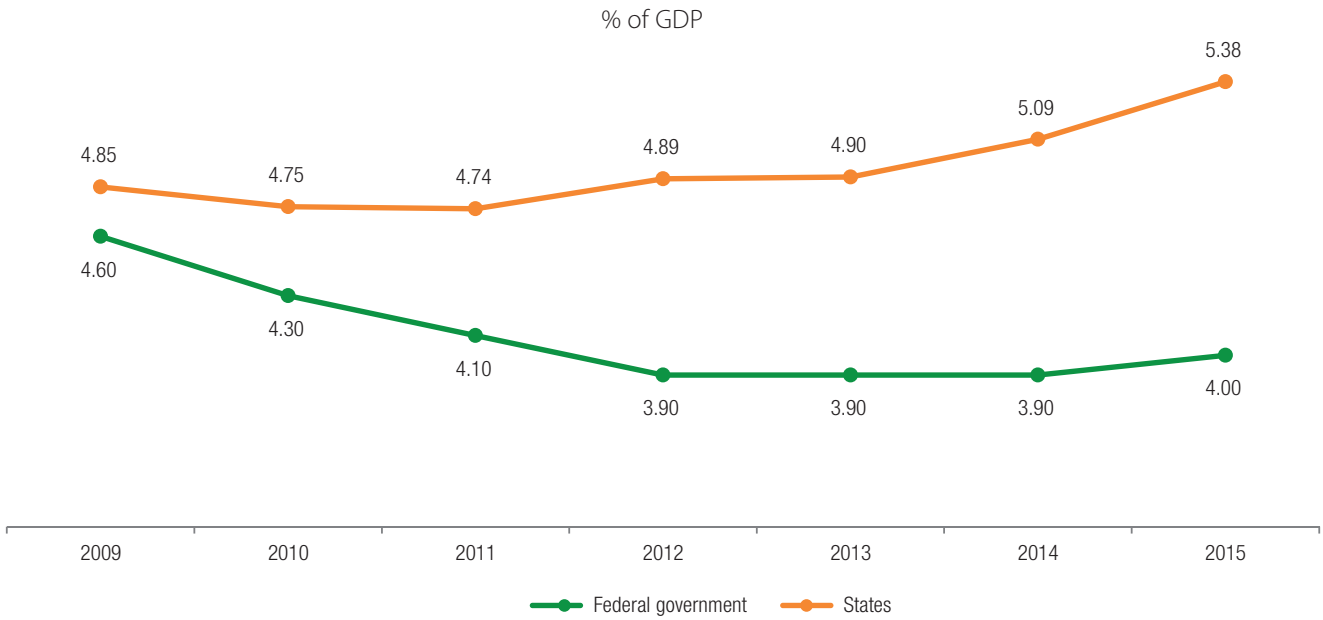
to 2014, Treasury loans to state-owned banks shot up from 0.5% to 10% of GDP, noting that "In seven years, the Treasury borrowed money to lend to state-owned banks, increasing public debt by 9.5 percentage points of GDP." The Treasury borrows at market interest rates and lends at subsidized lower interest rates, generating a huge subsidy. According to Fabiana Rodopoulos, general coordinator of economic studies of the National Treasury, in January 2016 the estimated implicit subsidies in Treasury contracts with the National Development Bank (BNDES) alone reached R$182 billion.

Moreover, Almeida pointed out, in the last four years the state-owned savings bank, Caixa Economica Federal (CEF), increased its share in the commercial credit market from 6% to 12%. "Any bank in the world that increases its market share in a recessionary economy will see its loan portfolio suffer," he says. Almeida estimated that the bank's losses in the next few years could add up to R$1 billion.

With the fiscal balance focused on the short term, there is little room to invest in infrastructure, innovation, and other factors to make the Brazilian economy more competitive. The result is less growth, which then reduces tax revenues.

Another problem for state-owned banks is their involvement with nonfinancial state-owned

Public spending in wages and welfare benefits have expanded rapidly



Source: Ministry of Finance.

"Every day the market speculates whether bank claims will be transformed into equity in Petrobras or whether the government will have to capitalize Petrobras by issuing new public debt."

Mansueto Almeida

enterprises. Oil company Petrobras alone owes them R$90 billion. Almeida said that "Every day the market speculates whether bank claims will be transformed into equity in Petrobras or whether the government will have to capitalize Petrobras by issuing new public debt." He explains that changes in legislation since 2008 have allowed state-owned banks to increase their exposure in the oil, gas, energy and mining and authorize the government to use its equity in state-owned companies to capitalize the CEF and BNDES.

"Any government has the right to grant subsidies to companies and industries as long as it is done transparently," Almeida said. "But the government expanded public debt by R$500 billion to give grants and only now, for the first time in eight years, has it published a report detailing the cost … . We should have done this from the beginning, because when you do not know the cost, the tendency is to overdo it."

Another contingent liability clouding Brazil's fiscal outlook is the cash flow crisis in the states. "Public finances in the 27 states have different degrees of deterioration, but the trend is unambiguously the same for all," said Ana Carla Abrão, Finance Secretary of Goiás state. In Rio de Janeiro state, the fiscal deficit has already reached 2.3% of GDP. In Goiás, Abrão said, the main cause of the mismatch between spending and revenues was personnel expenses: "In Goiás, personnel expenses increased on average by 12.8% a year for the last six years. This means a real increase of 6% in spending that is not linked to productivity gains." The state has 6.6 million inhabitants and



"The federal government has also contributed to the states' fiscal crisis by allowing states to borrow more."

Marcos Mendes

Photo: Luciana Vermell

150,000 public employees, whose salaries use up 76% of the taxes collected.

Ter-Minassian, the IMF consultant, noted that often federal government decisions directly affect state cash flows. Lower federally controlled prices also reduce revenues from state taxes on services, and the federal government mandates for public employee salaries also apply to state and municipal workers, said Marcos Mendes, legislative consultant to the Senate. He also pointed out that the federal government has exacerbated state fiscal crises by allowing states to borrow more even if they did not meet previous conditions for contracting new debt.

In recent months, state governments have resorted to a number of artifices to avoid servicing their debt to the federal government, even appealing to the Supreme Court to change how interest payments are calculated, which could cut their debt by R$400 billion. Mendes believes, however, that default on state debt obligations to the federal government would provide at best only temporary relief; it does not address the structural causes of the state and municipal fiscal crisis.

To mitigate fiscal risks, the 2017 federal budget introduced a risk assessment. "We found that if projected revenue does not materialize because of unforeseen changes in the macroeconomic outlook, the deficit could increase up to R$87.7 billion in 2017," said Arbache. The new budget law will also review non-macroeconomic risks, such as increases in welfare benefits and the need to

Neutralizing contingent liabilities

One IMF recommendation for countries to keep their current accounts in balance is to resist the temptation to underestimate the fiscal risks of contingent liabilities. For the period 1990–2015, the IMF was able to calculate the gross fiscal cost of 174 episodes of contingent liability problems. The highest incidence, with the greatest fiscal impact, was in the financial sector: in 82 episodes governments had to recapitalize banks; the average cost was 9.7% of GDP, though during the 1997 crisis it reached 56.8% in Indonesia. Among emerging countries, the highest incidence was also in the financial sector (about 50 cases, costing on average 10% of GDP), followed by natural disasters and problems in state-owned companies, each costing about 2% of GDP.



Photo: Luciana Vermell

"The weight of these sources of additional cost can be significant. And once they are better known, the next challenge is to manage them," said Gilbert Terrier, deputy director, IMF Fiscal Affairs Department. To do this, the IMF suggests four steps:

- Systematize the identification of risks, their probability, and their likely magnitude.
- Find ways to reduce the possibility that they will occur.
- Study how to use public policies and market instruments to reduce the exposure of the country.
- Finally, create fiscal space to absorb any remaining risks, by, e.g., creating a provisional budget and specific funds.

"Public finances in the 27 states have different degrees of deterioration, but the trend is unambiguously the same for all."

Ana Carla Abrão

capitalize state-owned banks. The next step of this work, Arbache said, is to produce a regular risk assessment report dealing with specific issues. "For the first issue we will look at how the minimum wage affects municipal finances," he said. He also saw the need for a comprehensive risk assessment of state and municipal debt and pension fund liabilities, capitalization of state-owned companies, and default risks in programs such as My House My Life and the Student Finance Fund: "To manage fiscal risk, we need to better identify and monitor these items, promote medium- and long-term planning, build up institutions, and continuously review policies and programs."

Efficiency and transparency

Otavio Ladeira, Treasury Secretary, spoke of the agency's efforts to make public accounts more transparent in order to "reveal to the public the consequences of each policy." He cited progress in the publication of Treasury documents and in Brazil's progress on convergence to International Public Sector Accounting Standards by 2021. Weder Oliveira, Deputy Minister of the Court of Audit, underscored the importance of initiatives to explain clearly to society the magnitude of the fiscal challenges the country is facing, stating, "Today we see technical capacity in the Treasury and will in the society. This situation is favorable for driving change."

Antonio Nucifora, World Bank chief economist for Brazil, supports fiscal reforms to ensure efficiency. He argued for fiscal planning based on medium-term budget and performance targets, starting with the fiscal policy. IMF's Pessoa agreed that medium-term fiscal planning encourages spending efficiency by encouraging fiscal discipline



Photo: Luciana Vermell

and strategic prioritization of expenditures. "Once a sustainable fiscal framework, [the overall revenue envelope and financing],is determined, the budget sets spending ceilings for each ministry, imposing discipline on public sector managers, … [and] leading to operational decision-making, where government institutions promote dialogue with society to identify medium- and long-term goals for the delivery of public goods and services," he explained.

Pessoa noted that countries at different stages of economic development, such as the United States, Colombia, and El Salvador, have already expanded their fiscal projections to as much as 10 years. A good example is Uruguay's five-year budget, he said: "With a multiyear budget, everyone in the economy can identify what is expected to happen in the coming years. There is an annual review of fiscal targets to calibrate the execution. But no one loses sight of the public spending trajectory." Experts also recommend appointment of independent fiscal councils to carry out studies of fiscal impacts and support preparation of the budget.

Manoel Pires, secretary of economic policy in the Ministry of Finance, cited IMF and OECD studies to support the view that currently the best alternative for Brazil is a broad reform that avoids measures that could deepen the recession and aims at long-term sustainability. "Building a long-term fiscal anchor could improve the perception of the risks of the Brazilian economy. With it, short-term fiscal instruments would become more effective for making fiscal adjustments," he said. Pires added that a reform that permanently reduces current public spending would make room for more investment in improving the quality of spending.

"Today we see technical capacity in the Treasury and will in the society. This situation is beneficial for driving change."

Weder Oliveira

Though these recommendations seem to deny the urgency related to Brazil's current fiscal crisis, experts agreed they are crucial if the country is to avoid future fiscal traps. Ter-Minassian summed up the essential policy agenda:

- Reduce the rigidity of public spending.
- Budget for the long term.
- Make public spending more efficient.
- Ensure that fiscal projections are reliable, including projections of contingent liability risks supported by independent councils.

"These measures will tend to reduce the procyclical bias of Brazilian fiscal policy," she said. Ter-Minassian acknowledged that in the short term Brazil's economic, political, and social problems will push demand for more public spending, "But I believe that the country has the fundamentals to deal with the current crisis."

It's not just Brazil



Solange Monteiro

DEALING WITH higher public deficits in a weak economy is a problem that is not unique to Brazil. Carlos Mulas-Granados of the IMF's Fiscal Affairs Department pointed out recently that today this is a global concern. In its April 2016 *World Economic Outlook*, the IMF revised world growth estimates down to 3.2%, down from 3.4% January, and suggested that in many countries lower tax revenues could play against efforts to balance public finances. "This is a trend that can be seen in both advanced and emerging economies," he said. Among growth estimates revised downwards are those for the US (from 2.6% to 2.4%), the Euro Area (from 1.7% to 1.5%), and Japan (from 1.0% to 0.5%). For Brazil, the projection was already negative for growth in January, with growth falling by 3.5%; now the estimated drop is further, to 3.8%

According to the IMF, in developed economies public debt-to-GDP ratios are approaching levels not seen since just after World War II. These countries, Mulas-Granados said, have the triple challenge of managing low growth, low inflation, and high debt. Of 34 economies analyzed by the IMF, 24 had carried out fiscal tightening in 2011, compared to just 8 still tightening in 2016. The reasons why fiscal policy seems to be loosening vary, he said. For instance, Germany and Austria have loosened because their fiscal position is strong, France to stimulate growth, and Portugal because of fiscal tightening fatigue.

In emerging markets, the level of public debt has already surpassed that in the global crisis of 2008–09, and the IMF considers oil-exporting countries to be at greatest risk. "Between 2013 and 2015 in Bolivia the fall in tax revenues resulting from low commodities prices reduced

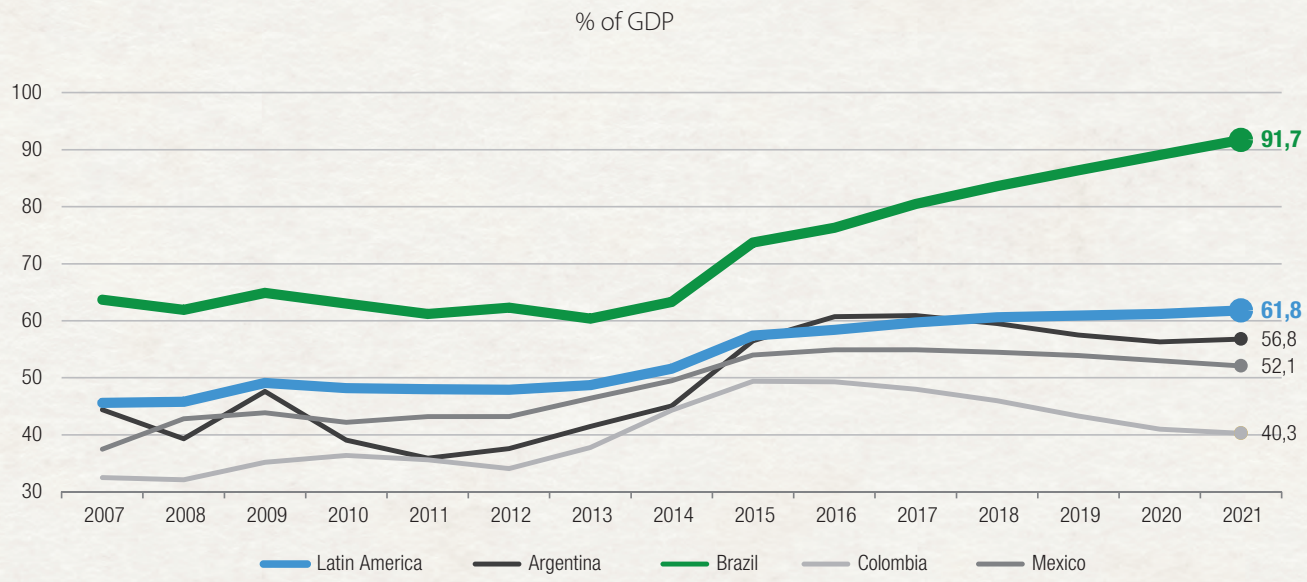
Bolivian GDP by 6 percentage points," Mulas-Granados said. Throughout Latin America, he added, there is concern about the deterioration of international prices for minerals and agricultural products. He also warned that "The region faces a significant increase in investors' risk aversion generated by doubts about the medium-term sustainability of public finances, which is reflected in the fall in confidence of consumers and businesses."

Perverse debt dynamics

Ricardo Martner of the tax affairs unit of the United Nation's Economic Commission for Latin America and the Caribbean pointed out that there have been several episodes of contingent liability problems in Latin America's history as a result of exchange rate depreciation, subnational debt defaults, and the weight of the 1980s debt crisis on the financial system. Yet although these have been addressed by specific policies, in his opinion contingent liabilities are still underestimated. "We continue to think that such things do not need much attention, about which there is no need to worry," he said—which does not encourage the market to have a more positive assessment of fiscal risks of the region.

Martner noted that today Latin American debt is in some ways less worrying than the debt dynamic was not too long ago: "In the 1990s the region had far worse public debt. Today, however, the increasing debt of subnational governments and state-owned companies is not clearly reflected in policy goals and that is

IMF projects increasing public debt in Latin America over the next five years



Source: IMF Fiscal Monitor 2016.

worrying." In addition, public debt has been growing because of the "snowball effect" of deteriorating economic growth and rising costs of debt service—a problem particularly troubling for Brazil.

Despite the cloudy world outlook, Mulas-Granados said, the IMF is somewhat more optimistic about the potential to reverse this situation than are the markets. "It is not yet an alarming scenario, but it requires vigilance," he said, adding that most countries have sufficient tools to reverse this situation. For advanced economies, the recommendation is to increase spending to stimulate growth, investing in innovation, infrastructure, and education. In Latin America, the IMF points out, the focus should be on restoring confidence in fiscal policy. Although there is no single recommendation that would fit all countries, Mulas-Granados said, countries should consider policies that have proved successful in the past, such as stimulating investment by reducing the cost of capital, as Malaysia did in 1989, and making public investment more efficient, as Tanzania did in 1998. He also offers Latin American economies the same advice as for developed countries: increase productivity by encouraging innovation, prioritize public investment in R&D, and offer tax incentives for the private sector. "When it comes to innovation, our advice is never cut spending," he said. To ensure success, however, monitoring the effectiveness of such measures is essential , as is ensuring that they complement, rather than replacing, private investment, he said. He explained that "a study of advanced countries showed that every 0.4% of GDP public investment in tax credits and subsidies for R&D meant 40% additional investment from the private sector, generating a 5% increase in GDP in the long term."

For Latin America, the important point is that fiscal adjustment needs to be done gradually over the medium term, Martner agreed, adding that "It is important to draw attention to fiscal multipliers, which are high in the region. During recessions, the effect of fiscal policy on growth may be relevant. Procyclical policies are harmful in times of recession." He argued that it takes time to bring public finances back into balance and requires discussion of macrofiscal rules—something particularly important for Brazil. Martner pointed out that "Chile, Ecuador, and Colombia have adopted structural fiscal rules for the medium term that take into account cyclical aspects of the economy. Now it is important that Brazil adopt a medium-term fiscal framework that is not affected every month by the credibility of policies and people."

The credibility issue



Photo: Luciana Vermell

Teresa Ter-Minassian
Consultant to the IMF

Solange Monteiro

In the first joint IMF-FGV seminar in 2013, you warned about the problematic reliability of Brazilian fiscal performance indicators. Was it possible to imagine then that Brazil would have a fiscal crisis of the current proportion?

It was very clear that in its first term the government of President Dilma Rousseff was making extensive use of creative fiscal policy—accumulating arrears, cashing in dividends from state-owned companies that were having financial difficulties, anticipating revenues—and state-owned banks had large-scale quasi-fiscal operations. The problems were amply discussed by economic observers and in the Brazilian media, who indicated that the fiscal situation was substantially weaker than would appear from the official statistics. But at that moment, it would have been difficult to predict the magnitude of the 2014–16 fiscal gap because the gap reflects, in addition to creative accounting and the fiscal risks of quasi-fiscal operations, several other factors, especially the plunge in GDP growth, higher interest rates, and the impact of exchange rate depreciation on gross public debt.

The IMF's slower growth projections for the world do not leave much room for an export-led recovery of the Brazilian economy. What could help the country to revive economic activity in the short term and contain the fiscal deficit?

I have said on several occasions, most recently at the fiscal policy seminar in Rio, that for Brazil sustainable recovery … first requires resolution of the current political uncertainties and emergence of a government with broad support in Congress so that it can make difficult adjustments and adopt reforms, move to restore business confidence and promote recovery of investment, and reach an agreement on a program of structural fiscal reforms that restores credibility. Such reforms cannot be done immediately, but once they are begun the private sector may see both a sincere and significant effort and a clear horizon for their investment projects in the coming years.

At the close of the seminar, you said that, although the Brazilian economic outlook is serious, you were optimistic about its reversal, since various segments of society were aware of the causes of the current crisis. Will that be sufficient to carry out a necessarily unpopular reform agenda?

Society's emerging awareness of the extent of the current difficulties and the need for substantial reforms to address them is essential, but not sufficient, to overcome these problems. It will be very important that the government in charge in coming weeks and months quickly discuss measures to ensure some quick wins in containing the economic deterioration and giving a credible signal of hope for a gradual economic recovery in the medium term.

Running against population aging

Delay in conducting a broad pension reform of social security reduces scope for promoting a gradual transition system.

Solange Monteiro



SOCIAL SECURITY IMBALACE is one of most serious problems threatening Brazilian public finances and growth. Brazil's population is rapidly aging and we have not been able to reform the social security, which already spends the same as richer countries such as Japan and Germany. In 2015, expenditure on pensions amounted to R$683 billion, or 11.6% of GDP. Of this total, the pension is 7.4% of GDP. In other economies with similar demographic and development profiles like Brazil, such as Chile and Mexico, this spending takes up a much smaller share of around 2%.

Keeping the current retirement rules, it is estimated that by 2060, when elderly Brazilian population is expected to more than triple, social security spending will be at 18% of GDP. The population aging and bad economic conditions of the country highlight that the failure of promoting a comprehensive reform of the social security model increasingly reduces the possibility of a smooth transition to a financially sustainable model. "We have wasted a lot of time and if we have the need to carry out a stronger fiscal adjustment, this transition will have to be even shorter," says Marcelo Abi-Ramia Caetano,

coordinator of social security studies at Institute of Applied Economic Research (IPEA).

The concern is that if on one hand the economy's recession adds urgency to the social security reform; on the other also it carries risks of resulting in limited reforms, which in the future can compromise the social security sustainability. This was one of the top alerts in the seminar *"Pension Reform: An opportunity for Brazil"*, sponsored by the FGV Graduate School of Economic (EPGE), FGV Law School, and the Brazilian Institute of Economic (IBRE) in April, in Rio de Janeiro. At the event, Joaquim Falcão, Dean of FGV Law School, argued for analyzing the social security problem as a structural problem separate of the current dire economic situation, highlighting the difficulty of reaching a consensus on "reconciling the government's cash flow with social security benefits, among the various social groups, the current generation to future generations, and political interests of Congress and the Executive." Manoel de Castro Pires, Secretary of Economic Policy of the Ministry of Finance, recognizes the challenge to educate society about the importance of a technically complex and inevitably unpopular issue. "Yet, we need to find a narrative that reflects correctly the serious economic dimension of the social security issue," he says.

Economic costs

For Afonso Arinos de Melo Franco, EPGE, the starting point for a comprehensive reform is to look into the current social security regime of transferring working population's income (consumption capacity) to retired and assess its costs in terms of fiscal and economic growth. "The current social security regime affects savings and



Brazil's population is aging rapidly

Projected population in millions

	0 to 14 years	15 to 65 years	more than 65*	elders-to-adults ratio (%)
2015	47.4	140.9	16.1	11.5
2020	44.3	147.8	20.0	13.5
2030	39.3	153.9	30.0	19.5
2040	35.4	152.6	40.1	26.3
2050	31.8	143.2	51.3	35.8
2060	28.3	131.4	58.4	44.4
Change in % 2015 to 2060	**-40.3%**	**-6.7%**	**262.7%**	**286.1%**

Source: IBGE.

* According to IBGE, life expectancy of a 65 year old person will increase from 18 year in 2015 to 21 years in 2060.

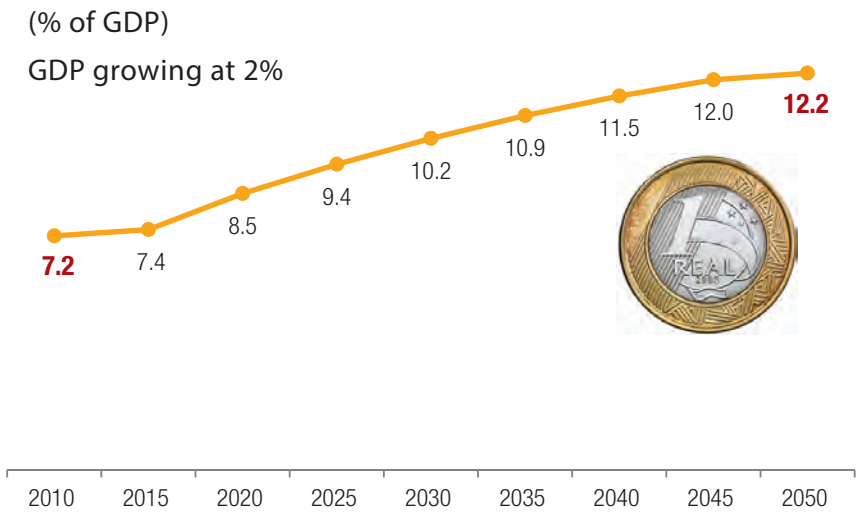
"The current social security regime affects savings and investment, [and consequently growth]."

Afonso Arinos de Mello Franco

investment, [and consequently growth]," he says. The impact on growth results, among others, from the low retirement age in the General Social Security System (RGPS): on average, 58 years, against average 64 years in 34 countries in The Organisation for Economic Co-operation and Development (OECD). Franco points out that the current regime encourages the early retirement of productive people and increases consumption. "As a result, it reduces aggregate savings of the economy and investment in physical capital," he says.

Luis Eduardo Afonso, School of Economics, Business and Accounting of the University of São Paulo (FEAUSP), highlights the lack of progressivity of the current social security regime: the average lower age retirees in Brazil are individuals with higher pensions and contributed only for working time. "The regime allows the better educated individuals that spent more time in the formal labor market—therefore, higher income—to retire before the others," he says. He adds that, compared to other countries, Brazil has a high social security benefit-to-contribution ratio, which implies "a relatively high benefit for

Projections indicate that Brazil's social security benefits would reach 12% of GDP by 2050, adding public employees' pensions benefits would total 16% of GDP more than Italy spends in social security.



Source: IBGE.

a long time period," as life expectancy has risen. Government statistics agency (IBGE) projects that the life expectancy of 60 year-old Brazilians will increase from 22 years in 2015 to 25 years in 2060.

At the seminar, experts pointed out that the mix of social security, assistance and income redistribution objectives of the current social security system, as well as the accumulation of a number of exceptions, results in a high level of payroll taxes with negative effects for the labor market, encouraging informal labor or arrangements that reduce payroll taxes. Bernard Appy, director of the Tax Citizenship Centre, indicates that low-income workers are not encouraged to pay social security taxes "because the value of social assistance benefits is the same social security benefits floor," while professionals with higher income "avoid paying social security taxes through loopholes." The difference between the alternative ways to pay social security taxes is significant. While the basic social security taxes range from 28% to 31%—employers pay 20% on the total wages and employees pay between 8% to 11% on the contribution salary—an individual can pay 11% of minimum wage or 5% of earnings as an individual micro-entrepreneur, guaranteeing the same rights, except for the possibility to retire by working time. In addition to reducing tax collection, Appy notes that the search for less expensive working arrangement from the taxation point of view can result in less efficient businesses, harming economy's productivity.

The experts also advocated the need to eliminate the subsidies resulting from different

Keeping the current retirement rules, it is estimated that by 2060, when elderly Brazilian population is expected to more than triple, social security spending will be at 18% of GDP.

retirement age or social security tax rules for gender and rural workers—which, they say, are no longer consistent with the labor market reality in the country. Paulo Tafner, IPEA researcher, points out that the actuarial deficit of women's retirement is almost 40% higher than male's, with an upward trend. "Women retire five years earlier, live eight years longer, and today their participation in the labor market is growing at a faster rate than the male," he says. Tafner points a global tendency to equalize the retirement age of men and women. "Countries like Germany, Spain, Netherlands, Portugal, South Korea, Mexico and Peru have set the same age for both men and women at 65 years." The same applies to in rural worker's retirement. Despite the great development of agribusiness in the country, with more skilled workers, rural workers contribute relatively little for their pensions—only 2% of total social security revenue in 2015. "If we changed the rural sector's social security taxes closer to the urban sector, we would have more tax collections and provide more legal certainty

A successful social security reform could have significant impacts in the short term as it would diminish the perception of fiscal risk and signal budget flexibility, reducing long-term interest rate and stimulating the economy.

in granting social security benefits to rural workers," says Pires.

Another issue contributing to the social security imbalance is the indexation of pension benefits to the minimum wage. "The minimum wage indexes more than 60% of welfare benefits and 40% of spending. Letting benefits grow much more than the economy in a context where the population is aging rapidly is not sustainable," Tafner says. He estimates that, all else constant, every 1% real increase in the minimum wage implies 0.44% more in welfare spending. "And despite this impact, the effect of this policy on poverty reduction is very limited," he adds.

Consensus and communication

In view of all distortions numbered, experts at the seminar see that the reform agenda needed to make social security financially sustainable cannot be limited to a partial fix. Experts view as critical elements of a broad social security reform: delinking benefits from the minimum wage, gradually eliminate retirement for working time, increase the retirement age, make the same the eligibility for retirement benefits between men and women and urban and rural workers, separate non-contributory social assistance benefits from contributory social security benefits, and set stricter rules for granting non-contributory social assistance benefits, which in Brazil represent more than double the spending recorded in the world average. Kaizô Beltrão, EPGE, estimated the impact of these changes on social security financial balance: it would reduce social security spending by 8 percentage points of GDP by 2030, stabilizing spending at the 2010 level.

Afonso, FEAUSP, sees as critical the combination of the various reform measures; if they are badly orchestrated, they can generate imbalances. He believes the ideal would be to establish an automatic adjustment mechanism that adjusts benefits and contributions according to demographic and economic variables within the defined rules. "Thus there would be no need to renegotiate the rules, something painful to be done through Congress."

On the side of tax collection, Afonso also advocates the elimination of different rules for gender and rural workers. Appy supports separating contributory social security benefits from non-contributory social assistance benefits, which should have its own funding. "Reducing the payroll taxes on low-income workers generates gains, including from the political point of view," he adds.

Pires, Ministry of Finance, believes a successful social security reform could have significant impacts in the short term as it would "diminish the perception of fiscal risk and signal budget flexibility, reducing long-term interest rate [and stimulating the economy]." In the long term, Pires points out the reform would reduce the incentives for early retirement, raise savings and increased productivity. He points out that, with the increase in the number of retirees compared to the working population, Brazil will require a 28.6% labor productivity over 2016–2050 to maintain social security sustainable.

Seminar participants agreed that the challenge for a broad reform of social security is not technical, but political consensus, for which is essential to raise society's awareness of the costs of their choices. "We need to dispel popular myths that if the economy grows the social security deficit will disappear as it is impossible to stimulate the economy with the current structure of public spending, and a paternalistic view of the government as benefactor. Things have their price and someone has to pay for it," says José Cechin, CEO of Fenasaúde and former Minister of Social Security. Rubens Penha Cysne, director of EPGE, underlined the initiative of the seminar as the creation of a permanent forum for debating Social Security reform, contributing to the dissemination of ideas and consensus building.

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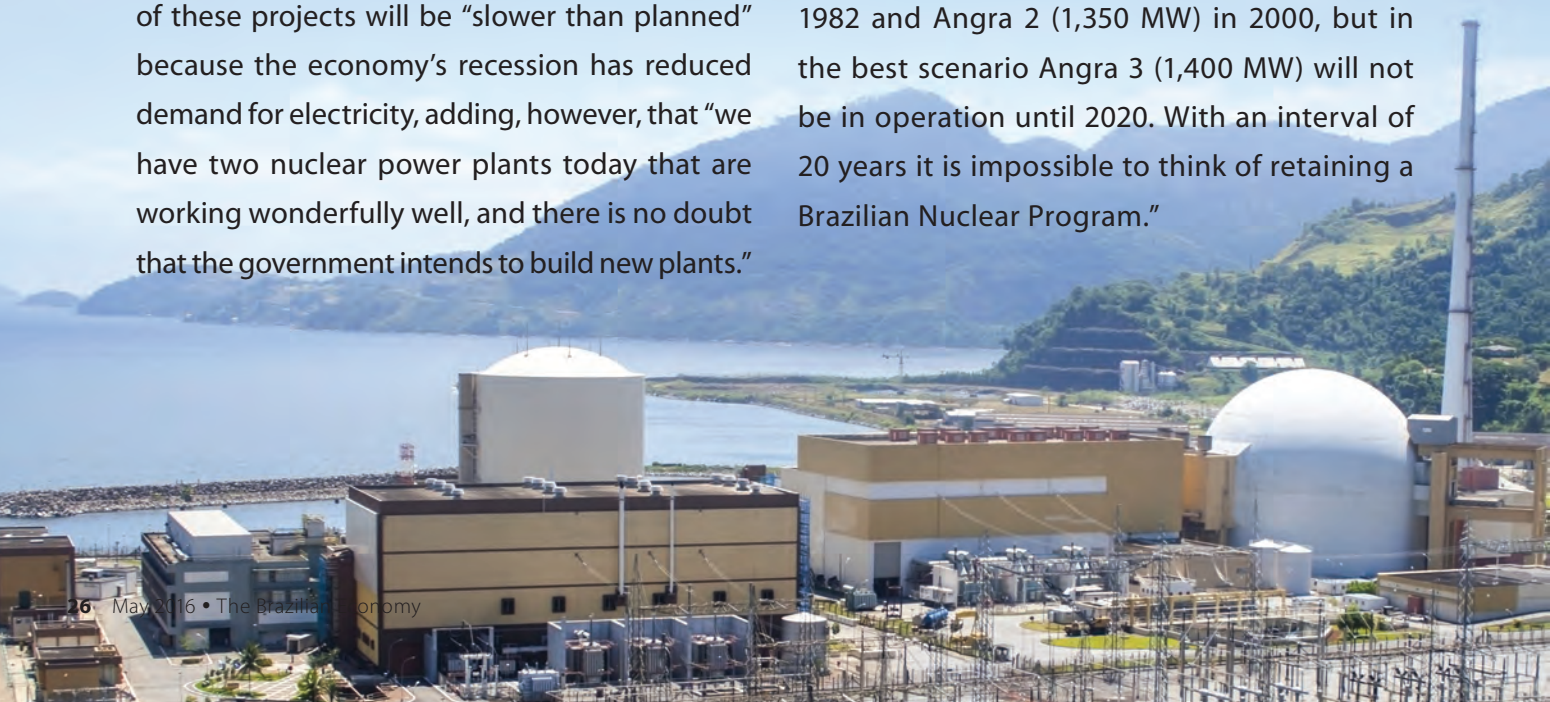
"Today people hold the common view that retirement pension will replace income, but no country in the world does this," says Afonso. He argues that social security reform debate should be accompanied by financial education and savings incentives for private supplementary pensions. "If we do not this, we can fuel a backlash against social security reform in the future due to dissatisfaction about the fall in benefits," says Caetano, IPEA, warning about the Brazilian historical record of reforms in search of social security sustainability followed by reversal of reforms, involving long judicial processes by claimants.

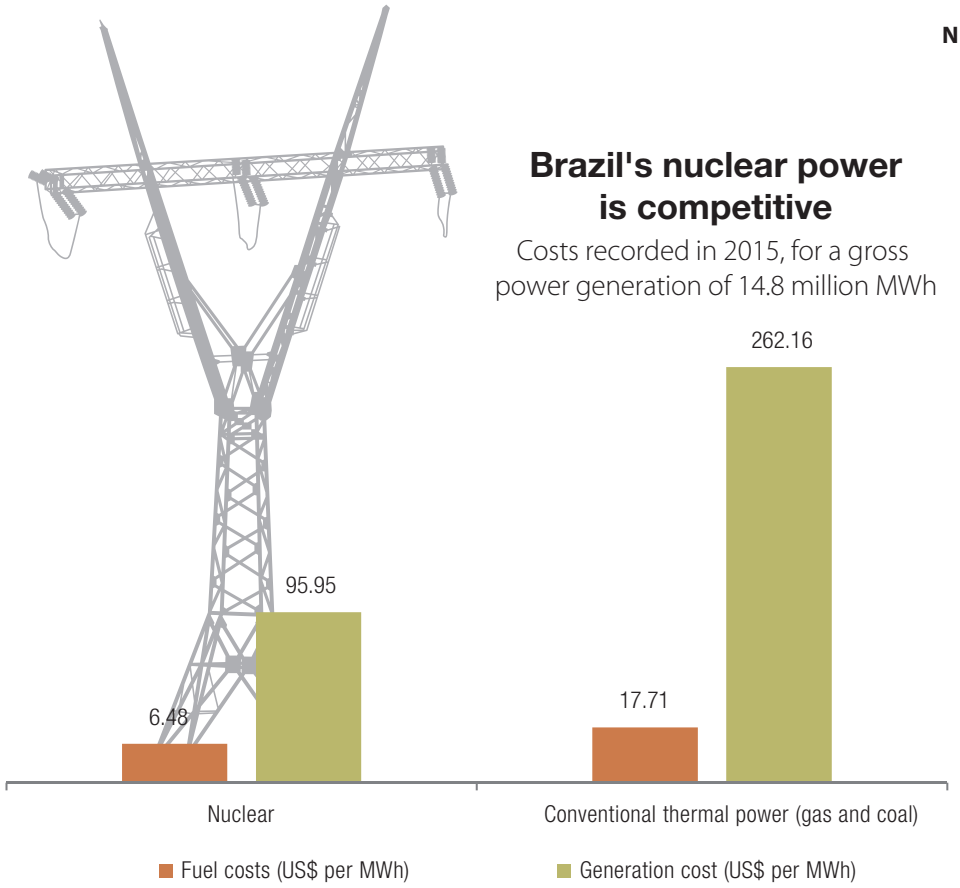
The value of speeding up nuclear energy operations

Solange Monteiro

IN THE PUBLICATION *Nuclear Energy* released by FGV Energy on April 27, industry representatives revealed their expectations about the future of nuclear energy, which currently accounts for 2.74% of Brazil's electric power. Luiz Carlos Barata, executive secretary of the Mines and Energy Ministry, who has since been confirmed as the new director general of the National Grid Operator (ONS), said that the 2050 National Energy Plan (PNE), now nearing completion, should call for construction of more nuclear power plants—without specifying, however, how many and their location. The 2030 PNE planned for four more units besides Angra 3 and among possible sites are Pernambuco, Espírito Santo, and Sergipe states. According to Barata, execution of these projects will be "slower than planned" because the economy's recession has reduced demand for electricity, adding, however, that "we have two nuclear power plants today that are working wonderfully well, and there is no doubt that the government intends to build new plants."

To achieve this expansion, Barata acknowledged, it will be necessary to review how the construction and financing of nuclear plants is regulated, and open them to private participation. "Today the government believes that operation of nuclear power plants should be the responsibility of Eletronuclear, but not construction and financing," he said. Nuclear industry representatives are advocating for more speed and clarity in government signals to the market about resumption of the Brazilian Nuclear Program. Pedro Figueiredo, president of Eletronuclear, said that if it continues to take a long time to build each plant, the goal of adding four more will be compromised: "Angra 1 (640 MW) started operations in April 1982 and Angra 2 (1,350 MW) in 2000, but in the best scenario Angra 3 (1,400 MW) will not be in operation until 2020. With an interval of 20 years it is impossible to think of retaining a Brazilian Nuclear Program."





Source: Eletronuclear.

Work on Angra 3 was stopped in late 2015 because of irregularities; if the investigation is not completed by August, Figueiredo said, Eletronuclear cannot guarantee commercial operation of the plant will start on time. What needs to be done is to complete the internal investigation, set a new budget for assembling electromechanical equipment, cancel contracts, and hold new tenders, because "only then can we return to the banks for financing." According to the current PNE, if the other four planned power plants are to start up by 2030, plans must be defined by next year, since they entail complex programming, ranging from contracting large equipment to site licensing and definition of energy sales conditions—all of which are essential, experts say, to attract private investment.

Industrial development

Antonio Muller, president of the Association for the Development of Nuclear Activities, pointed out that the requirement to reduce greenhouse gas emissions has again raised interest in nuclear power generation projects worldwide. In 2015, according to World Nuclear Association data, 69 plants were being constructed. Muller pointed out that "even the United States, which has not invested in the nuclear sector for 30 years, is extending the lives of its nuclear plants and building new ones." He noted that new licensing models have emerged to guide the demand for financing, because nuclear plants require intensive capital investment. "The technology has also advanced, reducing both the time to construct nuclear power plants—some can be built in 48 months—and their cost. While in the

"Angra 1 (640 MW) started operations in April 1982 and Angra 2 (1,350 MW) in 2000, but in the best scenario Angra 3 (1,400 MW) will not be in operation until 2020. With an interval of 20 years it is impossible to think of retaining a Brazilian Nuclear Program."

Pedro Figueiredo

United States the cost of one installed kW can reach US$5,000," he said, "in Asia the cost of some projects is only US$1,700."

In Brazil, breaks in the continuity of the nuclear program, which requires planning and long-term investment, has slowed the training of workers and technical staff. Aquilino Martinez, professor at Alberto Luiz Coimbra Institute of Graduate Studies and Research in Engineering (Coppe/UFRJ), said that "Today there is no skilled labor available for new nuclear projects … . The professionals currently working in the nuclear industry were trained in the 1970s and 1980s." Figueiredo said that lack of investment has also prevented Brazil from catching up technological developments in the world nuclear industry, noting that "South Korea began its nuclear industry at the same time we did. Today South Korea already sells its own nuclear reactors, and we continue to be left behind." In 2009, South Korea won the contract to build and operate reactors in the United Arab Emirates, at a cost estimated at US$40 billion, that are expected to be in operation by early 2017. "If you look at the success stories, such as South Korea, you will see heavy investment in professionals and research institutes and universities that supports the absorption of technology," agreed Admiral Luciano Pagano Junior, technical and commercial director of the Brazilian Navy's Nuclear Program.

João Carlos Tupinambá, president of Nuclear Industries of Brazil (INB), argued that if the national industry is to catch up with advanced nuclear technology there must be a stable regulatory environment for exploitation of Brazilian uranium reserves and enrichment of uranium for export, which can be done without necessarily breaking the government monopoly of the nuclear sector. "Today uranium is the best currency to attract large players in this market. … Everyone wants uranium and is willing to trade technology for it," he said. Tupinambá described the licensing process for opening up the Catité mine in Bahia state, which has the capacity to produce 3,500 metric tons of uranium for 14 years, and the consortium for phosphate and uranium in Santa Quiteria in Ceará state. With only 30% of its territory being prospected, he pointed out Brazil already has perhaps the most uranium reserves in the world. And, he added, Brazil is one of the few countries in the world that can dominate the full cycle of uranium enrichment—a process that accounts for about 35% of the cost of processing nuclear fuel. "When we deploy the sixth cascade enrichment plant, we will be able to enrich about 33% of the uranium needed to fuel Angra 1," he concluded.


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Photo: Jorge Duarte



"We want more open innovation"

Mauricio Antonio Lopes

President of the Brazilian Agricultural Research Corporation (Embrapa)

Solange Monteiro

SINCE ASSUMING the presidency of Embrapa in October 2012, agronomist Mauricio Antonio Lopes has been working to make the corporation less dependent on public funding. This year, with enactment in January of the new Legal Framework for Science, Technology and Innovation, Lopes plans to launch Embrapatec, which he expects to accelerate generation of businesses based on Embrapa's knowledge assets and technology and attract more private resources for research. An Embrapa researcher since 1989 with a PhD in molecular biology from the University of Arizona, Lopes argues for expansion of genetic improvement programs to prevent plant diseases and for continuous gains in productivity of Brazilian agriculture. "Side by side with large producers, there are also poor, small, excluded agricultural producers where there is substantial room for efficient growth," he says.

How has Embrapa's budget grown in recent years?

Embrapa's budget has been relatively constant at about US$1 billion, though in 2015 the total executed budget was down to US$909 million, reflecting the situation that the country was in and the strong devaluation of the real. For this year, we anticipate US$914 million. But we have sought other sources of funding. We no longer depend solely on the National Treasury. Since I became president, I have been making great efforts to give Embrapa the ability to access funds from other sources.

What are these alternative sources?

As an example, we have just signed a major agreement with the National Development Bank (BNDES), totaling R$66 million (of which we have already received R$33 million) for the Amazon Integrated Project (research and technology for recovery and conservation). We are moving ahead with another big project with BNDES, R$40 million, for creation of a new Embrapa unit in Palmas, Tocantins state, which will be doing the most advanced fishing and aquaculture research in Latin America. We also have many public-private partnerships. One of the most interesting is the network for Crop-Livestock-Forest integrated systems. It was developed completely in partnership with five companies: John Deere, Dow, Cocamar, Syngenta, and Parker, who invest about R$500,000 a year. They support Embrapa's entire technology transfer work, which disseminates technologies for sustainable intensification of Brazilian agriculture. Today we have cooperation agreements with 200 public-private partners, national and international companies. This brings in a substantial amount; though it varies from year to year, it represents 20–30% of our research funding.

Minister of Agriculture Katia Abreu argued for the creation of Embrapatec as a commercial arm of Embrapa. How do you intend to achieve it?

This story begins in 2007 when Senator Delcídio Amaral (Workers' Party, Mato Grosso do Sul state) introduced a bill to broaden the capitalization of Embrapa. This generated a huge controversy, and many people pointed out risks that the company's first sale of stock would attract strong investors who would skew the interest and focus of Embrapa, which

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is a public company with a mission to generate public goods. When I became president in October 2012, I talked to the senator. I said I did not particularly agree with his project, and suggested that, instead of opening up Embrapa's capital, we encourage formation of a subsidiary. We have studied several cases where institutions like ours have subsidiaries. In France, for example, the INRA [National Institute of Agronomic Research] has a subsidiary. Senator Amaral agreed and presented a substitute bill to allow Embrapa to create a privately held subsidiary, controlled exclusively by Embrapa, to promote Embrapa's knowledge assets and technology, make deals with companies, receive resources from investors, and stimulate development of startups. The bill was approved by the House Economic Affairs Committee in December 2012 and the Committee on Constitution and Justice, but during the 2014 elections it was on a back burner and 2015 was a very difficult year. The new Legal Framework for Science, Technology and Innovation, approved last December by

The network for crop-livestock-forest integrated systems was developed completely in partnership with five companies: John Deere, Dow, Cocamar, Syngenta, and Parker, who invest about R$500,000 a year. They support Embrapa's entire technology transfer work, which disseminates technologies for sustainable intensification of Brazilian agriculture, which disseminates technologies for sustainable intensification of Brazilian agriculture.

Congress and by the President in January has created a new opportunity … to realize what we had envisaged for Embrapatec. The Technological Innovation Center (NIT) will allow Embrapa to create Embrapatec with virtually all the privileges and ability to do business in the innovation market that we had foreseen.

When do you expect to launch it?

Today the necessary regulations are still pending, but we are not waiting for it. We are establishing Embrapatec version 1.0, entirely linked to Embrapa but without the freedom we would want it to have. When the regulations are ready, Embrapatec will have considerably more autonomy to negotiate with public and private, national and international partners, and boost Embrapa's participation in the market of technological innovation. That will generate more resources, feed back into our research programs and development, and gradually reduce Embrapa's dependence on the National Treasury. We have all the elements ready to launch Embrapatec's version 1.0 and I foresee that by the middle of this year Embrapa will do that.

Embrapa is recognized for its contribution to Brazilian agribusiness, the country's exports, and world food security, thanks to developments such as the tropical soybean seed. You stated, however, that Embrapa should not be seen only as a provider of seeds. Why?

It's no longer possible to expand Embrapa's role as a supplier of seeds. Embrapa's share of the soybean seed market reached 60% when the private sector did not have capacity to fill this space. To the extent that Brazil now has a legal framework for patents, a plant variety protection law, and a thriving competitive agriculture, … the private sector it taking market share in the supply of seeds. Why would a public company, using public resources, operate in a market that is already very well served by the private sector? The public sector should have a strategic role, but not be a supplier. Embrapa's role is to ensure that Brazil has breeding programs with a strategic vision, looking for challenges in the medium and long term, which have greater risk than the private sector would usually consider. But Embrapa still has to have a presence in the market because our researchers have to continue participating in the competitive market to know how it works, and what products the market requires.

What is Embrapa's strategic direction today?
Embrapa is working to expand programs we call preventive breeding. There are about 400 pests and diseases around the world that have not yet arrived in Brazil but eventually will come, causing tremendous problems. Some rice diseases have already made it to Central America, so we have partnered with institutions in Panama, where our researchers are identifying Brazilian genetic material that is most resistant to these diseases. We also managed to access the entire US genetic soybean bank, about 22,000 samples, to identify genes and features that will help us face these disease challenges should arise. These are examples of investments that the private sector would never make.

Another concern is climate change, how the gradual rise in global temperature will affect Brazilian agriculture. We know that in the tropics … the effects will be felt more strongly. So we are seeking, through breeding, biotechnology, enhancement of production systems, to adapt Brazilian agriculture to a reality of increasingly more intense stress from high temperatures and increased greenhouse gases.

According to Embrapa, to double agricultural production by 2050, as is necessary for food security, total factor productivity (TFP, the efficiency of investment in physical and human capital) will have to grow by at least 1.75% annually until then. How does Brazil stand before this challenge?
Brazilian agriculture is at the forefront of world agriculture. A U.S. Department of Agriculture (USDA) study showed the large TFP growth of Brazilian agriculture in the last seven years—the increase in Brazilian TFP is above the main producing countries and second only to China. This occurred because the Brazilian agriculture has emerged from a very difficult situation in the 1970s, when it produced only coffee and sugar; in 40 years, it has become one of few sectors where expansion was rooted in science, technology, and knowledge. However, Brazil has different agricultural sectors. … Beyond the big producers, we also have small excluded poor producers, who have substantial room to become more efficient and productive. Although some corn farmers are producing 12 tons per hectare, the average Brazilian farmer still produces just 4.5 to 5 tons. … The Food and Agriculture Organization expects Brazil to become the greatest supplier of good to the world's food supplier but we have both commercial high-tech agriculture, with very strong productivity growth, and less efficient agriculture, with room to grow substantially… . We have to promote productivity gains, which will require appropriate technologies. Today we are looking at the integrated systems (crop-livestock-forest), already mentioned to … create recovery conditions with smaller investment.

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Today, automation is bringing about major changes in industrial processes in general. What is happening in agriculture?

Automation is more than a necessity, it is an imperative. In 2010, for the first time the urban population was larger than the rural population. This has several consequences. Gradually agriculture will need to incorporate more machinery, equipment, sensors, to deal with increasingly scarce and more expensive labor. This will require automation in all production systems. You can find the most suitable genetics to plant, harvest, and cultivate using sensors. Even small farmers can no longer find workers to milk their cows by hand. … As agriculture becomes more automated, it will be better able to take care of issues such as the environment and product quality and standardization.

In general, we are concerned that capacity to think strategically is very limited in Brazil compared, for example, to the attention that advanced manufacturing trends receive in countries like Germany, South Korea, and the United States. Such capacity is essential to support decision-making and formulation of public policies that lead to structural and strategic changes that will ensure bold development goals.

What is the role of Embrapa in this?

Biotechnology, automation, and information technology will significantly impact agriculture. Embrapa puts great emphasis on developing mobile applications, which promise to revolutionize the dissemination of the technologies and knowledge generated by agricultural research. We have a digital platform, webagritec, where we post information on production systems, control of pests and diseases, water management, and pesticides that farmers can access from mobile phones. Embrapa devotes much attention to helping shape an increasingly automated agriculture. We are applying the concept of precision agriculture on many fronts, such as management of inputs and crops, using information from satellites, sensors, and unmanned aerial vehicles to guide farmers to manage their businesses more efficiently and faster.

There are several ways to disseminate this new knowledge to make progress on the goal of productive inclusion—strengthening the rural middle class—which is Minister Abreu's flagship. … Technology is part of complex changes that must be implemented in the countryside, … but many farmers have great difficulty dealing with technology, so we need much more sophisticated technology transfer and support services, so that more farmers in Brazil can achieve adequate income, quality of life, and market participation.