

Brazil Economics Digest

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Zero growth in labor productivity in Brazil since 1980

Income per capita in Brazil declined compared to that of developed countries in recent decades. Income per capita in Brazil grew at a faster pace than that of developed countries from 1950 to 2016. However, this dynamic was not continuous, with opposing behaviors in different sub-periods. The period from 1950 to 1980 was marked by strong convergence of Brazil's income per capita to a level closer to the income per capital of developed countries. Conversely, income per capita declined from 1981 to 2016 compared to that of developed economies.

High employment drove income per capita in Brazil up from 1981 to 2016. The per capita income of a country can be broken down into labor productivity and the employment rate. Labor productivity in Brazil has been stagnant since 1980, and the rise in income per capita in this period was explained by an increase in the number of people employed in the total population. Such contribution of the employment rate will decline in the next few years, as this measure in Brazil is high compared to that of other emerging or developed countries. Thus, a rise in income per capita in Brazil in the next few decades will depend even more on the dynamics of labor productivity.

Absence of productivity gains from 1981 to 2016 attributable to contraction in Total Factor Productivity (TFP). The breakdown of growth in labor productivity into components of a production function indicates that the absence of productivity gains since 1980 is associated with a reduction in TFP, which measures how efficient the allocation of production inputs is. The low level of efficiency of Brazil's economy led several countries to surpass Brazil's income per capital in recent decades.

The bulk of productivity gains in countries with highest increase in productivity in recent decades resulted from an increase in investments. Of the ten economies with highest growth in labor productivity from 1981 to 2014, the majority saw a sharp acceleration in investments, which increased the stock of capital per worker in these economies. However, the rise in productivity in Brazil would be higher if the dynamics of TFP in the country were the same as that of the countries with highest productivity gains from 1981 to 2014 than if we assumed the individual path of the other productivity factors (i.e., physical capital and human capital) in those economies.

Higher GDP growth calls for microeconomic reforms. Even assuming labor productivity expansion equal to that of periods with highest growth in this variable in recent decades, GDP growth in Brazil would be close to 2.5% in the next few years, in view of the lower contribution of demographic factors. Accordingly, GDP growth above this level would require a more substantial acceleration in labor productivity. In the last cycle of TFP growth in Brazil, from 2003 to 2010, the microeconomic reforms implemented contributed to the sharp expansion of labor productivity.

Wider gap between per capita income of developed countries and that of Brazil since 1980

The main theoretical models in the literature on economic development predict that the per capita income of emerging and underdeveloped economies will converge to a level closer to that of developed economies¹. Despite this prediction, empirical evidence does not corroborate the thesis of convergence of income levels among countries². According to data of The Conference Board³ on per capita income in 98 economies from 1950 to 2016, there was little convergence in economies with lower income levels to the income levels of more developed economies in this period⁴. The convergence was most significant in the period from 1981 to 2016, when there was substantial acceleration in the per capita income of various economies in Asia (e.g., China, India, and South Korea).

The dynamics of Brazil's per capita income from 1950 to 2016 show slight convergence toward the income levels of more developed economies (Figure 1). However, this convergence was concentrated in the first few decades and was partially reversed after the 1980s:

- (i) 1950 to 1980 – Growth in Brazil's per capita income exceeded that of other countries.
- (ii) 1981 to 2016 – The low growth of the Brazilian economy distanced the country's level of per capita income from that of the main developed economies (Figure 2).

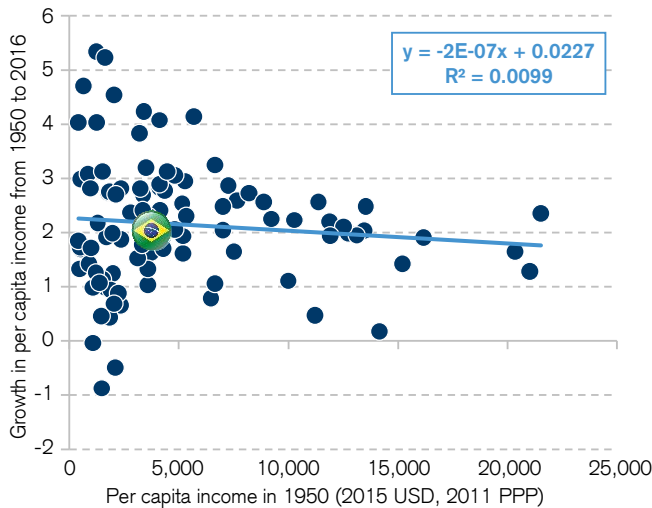
¹ The Solow growth model forecasts two types of convergence of income among countries: absolute convergence and conditional convergence. The hypothesis of absolute convergence assumes that the savings rate, the population growth rate, and depreciation of capital are the same for all countries, which would imply unconditional convergence of income levels in the long term, i.e., all countries have the same steady-state levels. The hypothesis of conditional convergence works with a more flexible definition that allows countries with different characteristics to converge to different steady-state levels. For example, the conditional convergence in the Solow-Swan model with human capital is compatible with convergence of income levels of poor countries to the income levels of developed countries if the less developed countries have similar savings rates for both physical capital and human capital as a percentage of GDP.

² Empirical results may differ, depending on the number of countries or the forecasting horizon used in the study.

³ In our study, we considered the following economies: Albania, Algeria, Angola, Argentina, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Bolivia, Brazil, Bulgaria, Burkina Faso, Cameroon, Cambodia, Canada, Chile, China, Colombia, Congo, Cyprus, Costa Rica, Denmark, Dominican Republic, Ecuador, Egypt, Ethiopia, Finland, France, Germany, Ghana, Greece, Guatemala, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kenya, Luxemburg, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Morocco, Mozambique, Myanmar, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Saint Lucia, Saudi Arabia, Senegal, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Sudan, Syria, Taiwan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe.

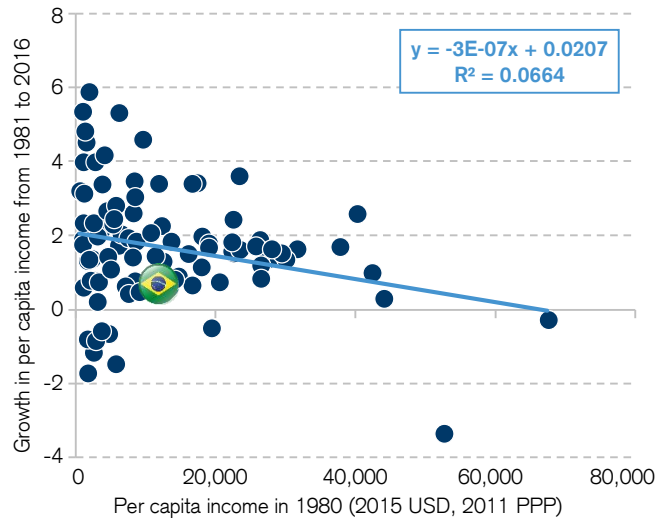
⁴ Exhibits 1 and 2 prove that the correlation between growth in per capita income and the per capita income level in the initial period is low; the R² of this correlation is close to zero in the period from 1950 to 2016 and 0.07 in the period from 1981 to 2016.

Figure 1: Correlation between growth rate and level of GDP per capita in various countries from 1950 to 2016



Source: The Conference Board, Credit Suisse

Figure 2: Correlation between growth rate and level of GDP per capita of countries from 1981 to 2016



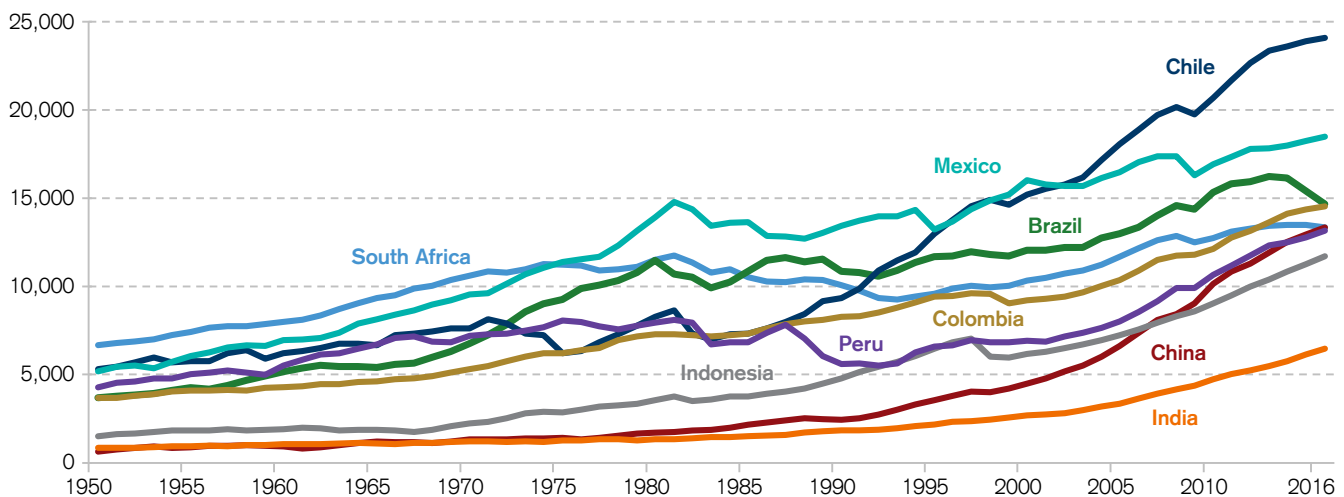
Source: The Conference Board, Credit Suisse

This lower growth in Brazil's per capita income in recent decades has maintained the gap between the country's per capita income and that of developed economies. At the same time, it enabled the approximation of the incomes of other emerging economies to a level closer to that of Brazil.

The deep recession in 2015 and 2016 further widened the gap between Brazil's per capita income and that of better performing economies in Latin America (e.g., Chile and Mexico) and narrowed its gap to the level of other emerging economies (e.g., China and India). Even Latin American countries that were poorer than Brazil a few decades ago currently have a per capita income level similar to that of Brazil's. For example, Colombia's per capita income was 64% of Brazil's in 1980 but reached near parity in 2016 (Figure 3).

Figure 3: Evolution of per capita income in Brazil and in selected countries

2015 USD, adjusted for 2011 PPP



Source: The Conference Board, Credit Suisse

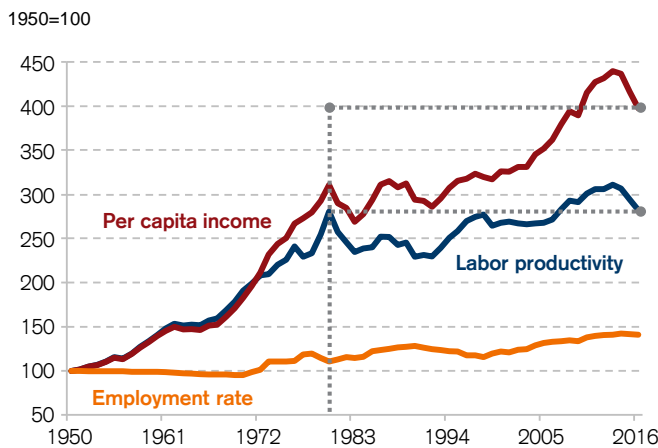
Rise in per capita income explained by higher employment rate in recent years

The per capita income of a country can be broken down into two terms: labor productivity (ratio of total output to number of employed workers); and the employment rate (employed persons as a percentage of the total population):

$$\frac{GDP}{Total\ population} = \frac{GDP}{Working\ population} \times \frac{Working\ population}{Total\ population}$$

- 1950-1980: Growth in per capita income was significant: 3.9% p.a. This increase was explained almost entirely by the sharp acceleration in labor productivity, which grew by an average 3.5% p.a. In that period, the rise in the employment rate contributed only 0.3pp p.a. to the growth in per capita income (Figure 5).
- 1981-2016: Per capita income grew very little: 0.7% p.a., on average. Labor productivity stagnated, while the employment rate contributed 0.7 percentage point (pp) per year. This period can be subdivided as follows:
 - 1981-1990 – Contraction in per capita income of -0.5% p.a., explained by a significant reduction of -2.0% p.a. in labor productivity. The rise of 1.5% p.a. in the employment rate prevented an even greater decline in per capita income.
 - 1991-2000 – Per capita income increased by 1.0% p.a. Contrary to the previous period, labor productivity rose 1.6% p.a., while the employment rate contracted -0.5% p.a., offsetting the rise in per capita income.
 - 2001-2010 – Per capita income rose by 2.4% p.a. This increase was explained by continued strong growth in productivity (1.2% p.a.) and by acceleration in the employment rate (1.3% p.a.).
 - 2011-2016 – Per capita income declined by -0.7% p.a. The decline of -1.1% p.a. in labor productivity explained the reduction in per capita income, which was not higher only because of the contribution of 0.4pp from the employment rate in the period.

Figure 4: Historical per capita income, productivity, and employment rate



Source: The Conference Board, Credit Suisse

Figure 5: Breakdown of per capita income

	Per capita income	Productivity	Employment rate
1950-1980	3.9	3.5	0.3
1981-2016	0.7	0.0	0.7
1981-1990	-0.5	-2.0	1.5
1991-2000	1.0	1.6	-0.5
2001-2010	2.4	1.2	1.3
2011-2016	-0.7	-1.1	0.4
Total	2.1	1.6	0.5

Source: The Conference Board, Credit Suisse

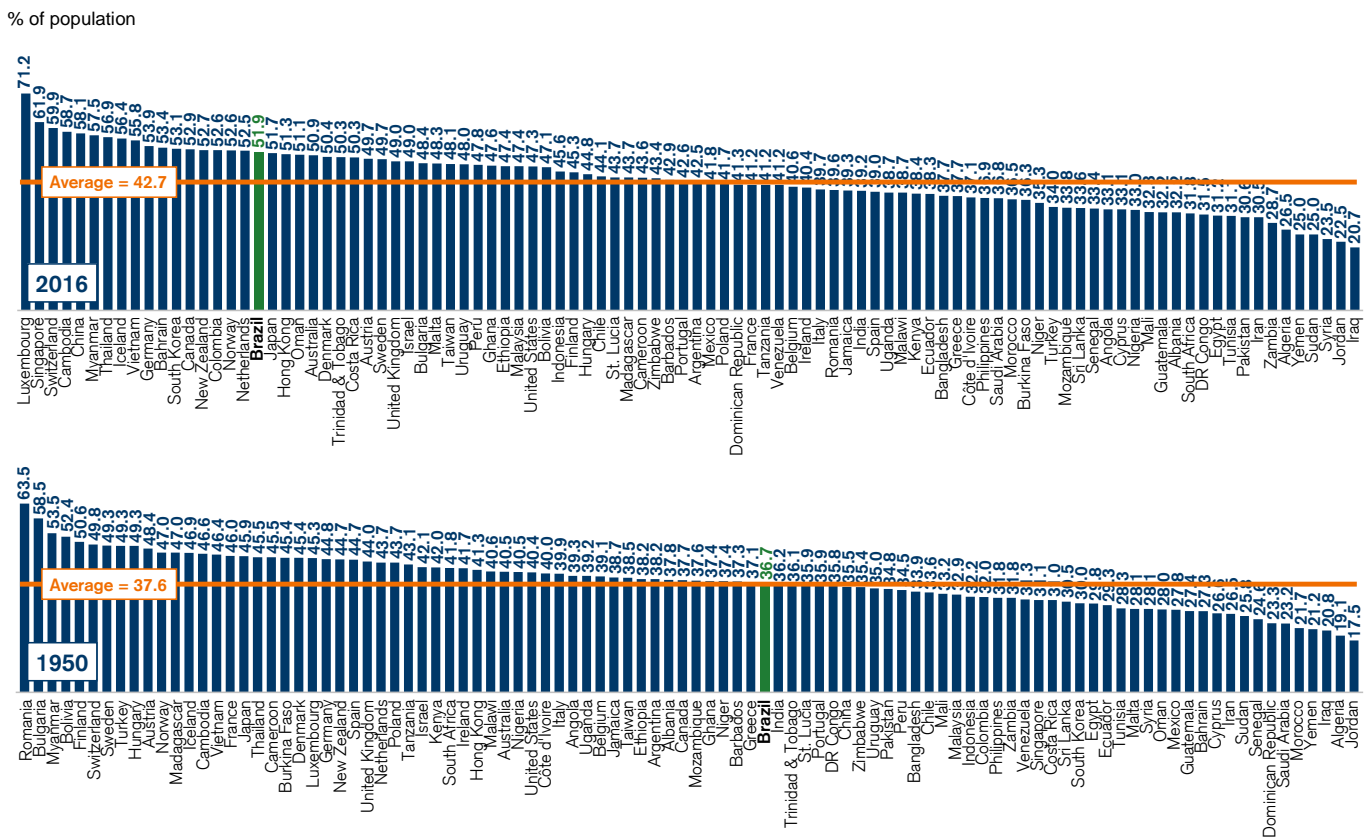
Brazil's per capita income expanded by 2.1% p.a. from 1950 to 2016; labor productivity explained 75% of the gain and the rise in the employment rate accounted for the remaining 25%. However, Brazil's economy has been influenced by various factors, and labor productivity has been highly volatile. As expected, the performance of the employment rate was more stable and explained the entire rise in per capita income from 1981 to 2016.

Greater contribution of employment rate to rise in per capita income in coming years

The contribution from the employment rate to growth in per capita income will probably not continue to be substantial in the years ahead, despite the cyclical economic recovery expected for the next few quarters, which would tend to generate more jobs and consequently raise the percentage of employed persons. This expectation is justified by the fact that the employment rate is already relatively high in Brazil compared with that of other countries.

According to a database of 98 economies, Brazil's employment rate rose from 37.6% in 1950 (similar to the average of the sample), the 55th highest in the sample, to 52% in 2016 (much higher than the average of the sample of 42.7%), the 18th highest of the countries analyzed (Figure 6).

Figure 6: Historical employment rate of countries analyzed



Source: The Conference Board, Credit Suisse

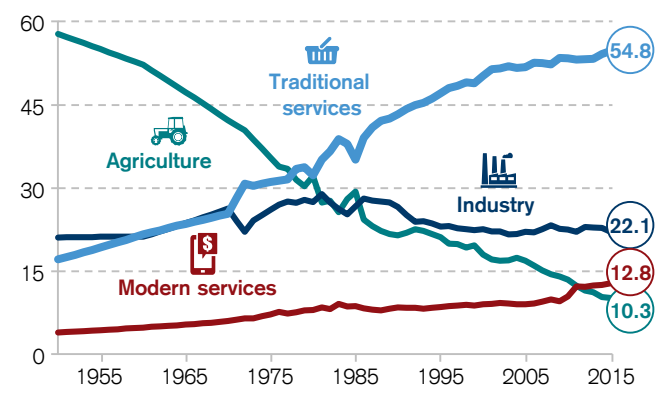
The results suggest that the growth in per capita income in Brazil will be even more dependent on the dynamics of productivity in the coming years.

Stagnant labor productivity in Brazil since 1980

Labor productivity has remained stable since the 1980s. The sharp decline in growth in labor productivity in this period compared with the period from 1950 to 1980 is associated mainly with the decline in total-factor productivity (TFP), explained by the following:

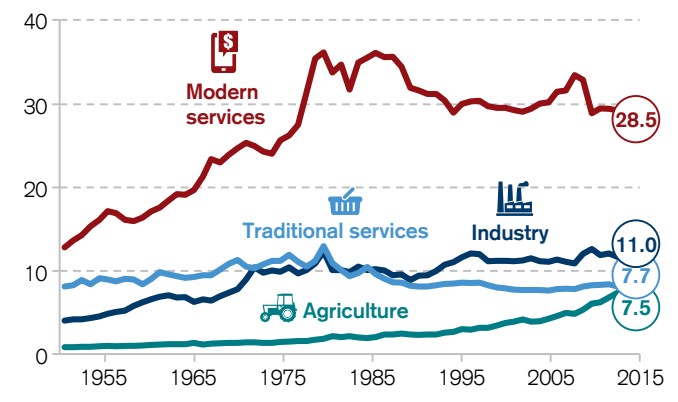
- Productivity gains from the reallocation of workers declined significantly in recent decades. An important part of the productivity gains since 1950 is attributable to the reallocation of labor from less productive activities (e.g., agriculture) to more productive sectors (e.g., services and industry)⁵. This contribution was most significant from 1950 to 1980, when the transfer of workers from agriculture to other sectors of activity made a large contribution to the rise in the average productivity of the economy (Figure 7). However, the productivity of the agricultural sector grew at a faster pace than that of other sectors in recent decades. In 2016, the productivity of the agricultural sector exceeded, for the first time, that of traditional services⁶ (e.g., other services, commerce, and public administration), which reduced the contribution from this reallocation effect. In addition, the number of farm workers as a percentage of total workers fell from nearly 60% in the 1950s to less than 10% in the past few years, leaving less room for productivity to expand through this mechanism. As mentioned in our Brazil Economics Digest “We forecast an average unemployment rate of 13% in 2017,” published on January 23, the contribution from labor reallocation has been negative in recent quarters.
- Low adoption of technology and an increase in economic distortions (e.g., sharp rise in taxes), which contributed to the low growth in labor productivity in the majority of sectors of economic activity. Only the agricultural sector posted strong growth in labor productivity in recent years (Figure 8).

Figure 7: Share of each sector in working population (% of total number of workers)



Source: Brazilian Statistics Bureau (IBGE), Groningen Growth Centre, Credit Suisse

Figure 8: Labor productivity, by sector of activity (1995 BRL1,000)



Source: Brazilian Statistics Bureau (IBGE), Groningen Growth Centre, Credit Suisse

⁵ For more details, please see our *Brazil Economics Digest* "Low growth in productivity thwarts substantial economic recovery," of August 19, 2015.

⁶ Traditional services are those with lower productivity (e.g., domestic workers, commerce, and tourism). These services registered a higher share of employment in recent decades than other sectors of the economy.

Lower total-factor productivity since 1980s

Labor productivity can be represented by a function of production that considers the following production factors: stock of capital per worker, human capital, and total-factor productivity, i.e., term that measures the efficiency of the use of capital and labor inputs:

$$Y = Af(K, L) = AK^\alpha(LHC)^{1-\alpha}$$

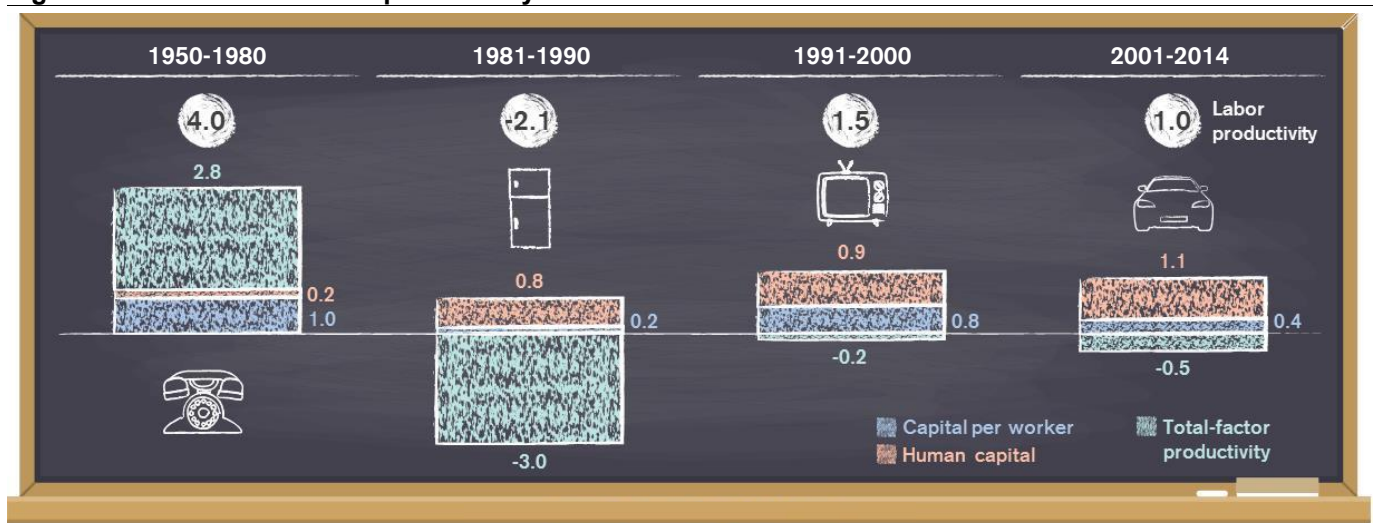
$$\frac{Y}{L} = A \left(\frac{K}{L}\right)^\alpha (HC)^{1-\alpha}$$

where Y/L is labor productivity, K/L is the stock of capital per worker, HC is the stock of human capital per worker, α is the share of capital in total production, and A is the total-factor productivity.

The negative performance of labor productivity in Brazil in the past few decades is explained by the continued decline in TFP, as registered by the Penn World Table database, with information for the period from 1950 to 2014⁷:

- 1950-1980 – Labor productivity rose swiftly, with TFP explaining 2.8ppps of the average growth of 4.0% p.a.
- 1981 to 2014 – Labor productivity rose just 0.2% p.a. (Figure 9). The increase in schooling and moderate contribution from the stock of capital per worker added 1.0pp and 0.4pp, respectively, to growth in productivity in the period. On the other hand, the weak performance of productivity was due to the negative contribution from TFP of -1.1pp p.a.

Figure 9: Breakdown of labor productivity



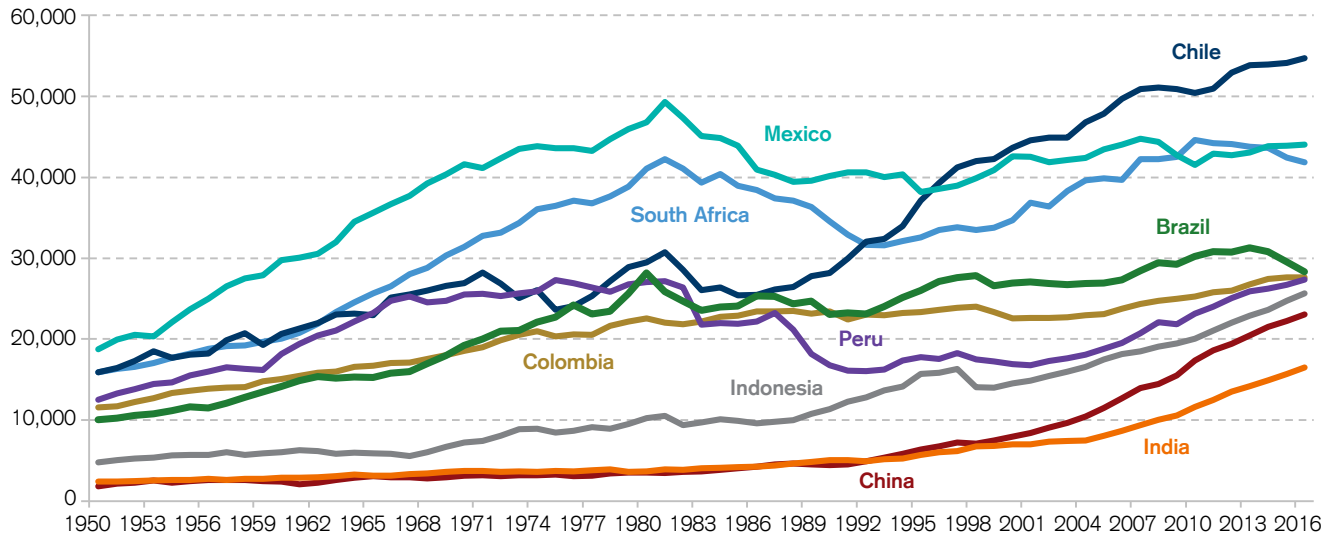
Source: Penn World Table, Credit Suisse

Various countries with less efficient workers than Brazil's began to record labor productivity higher than or similar to Brazil's in 2016. As with the comparison of per capita income, labor productivity is higher in Chile and in Mexico, just to name countries in Latin America. In Asia, the acceleration in productivity in China and India was significant, especially from 1981 to 2016, when labor productivity was stagnant in Brazil (Figure 10).

⁷ The Conference Board database does not contain this breakdown by physical capital, human capital, and TFP for the entire period. Although they are different databases and the Penn World Table does not contain data for 2015 and 2016, the path of labor productivity is very similar in both databases. Due to this difference in the databases, the rates of growth in labor productivity in this section are slightly different from those in previous sections.

Figure 10: Historical productivity level in selected countries⁸

2015 USD, adjusted for 2011 PPP



Source: The Conference Board, Credit Suisse

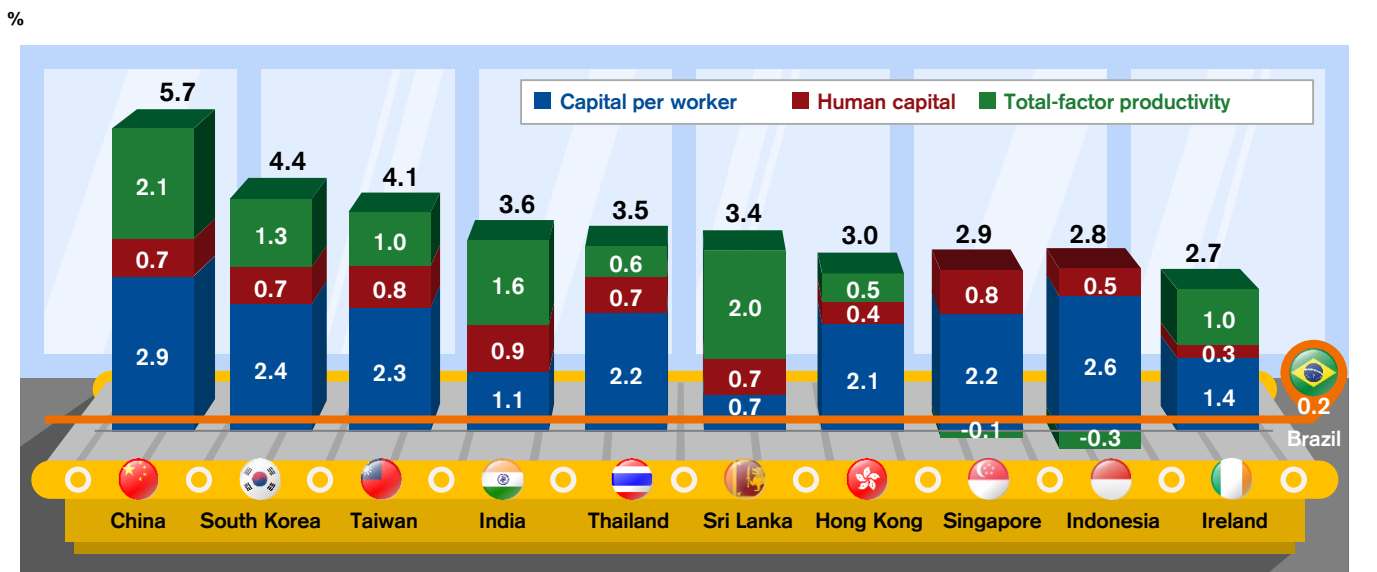
⁸ We used in this exhibit the productivity data of the Conference Board, which already include the information for 2015 and 2016. The results are very similar if we use the Penn World Table database.

Strong growth in investments boosted productivity in several countries

We have identified the economies with the highest labor productivity based on the Penn World Table database, which has information on 82 countries from 1981 to 2014⁹. Most of the ten economies with the highest growth in labor productivity are emerging countries: China, South Korea, Taiwan, India, Thailand, Sri Lanka, Hong Kong, Singapore, Indonesia, and Ireland (Figure 11).

The acceleration in productivity in eight of these ten countries was prompted mainly by the high contribution of the stock of capital per worker. In the other two cases (India and Sri Lanka), productivity gains resulted from an increase in TFP.

Figure 11: Breakdown of growth in labor productivity in most successful countries from 1981 to 2014



Source: Penn World Table, Credit Suisse

Based on hypothetical performance of the stock of capital per worker, human capital, and TFP in Brazil similar to the average for each of these variables in the group of countries with the greatest increase in labor productivity, it is possible to note that (Figure 12)¹⁰:

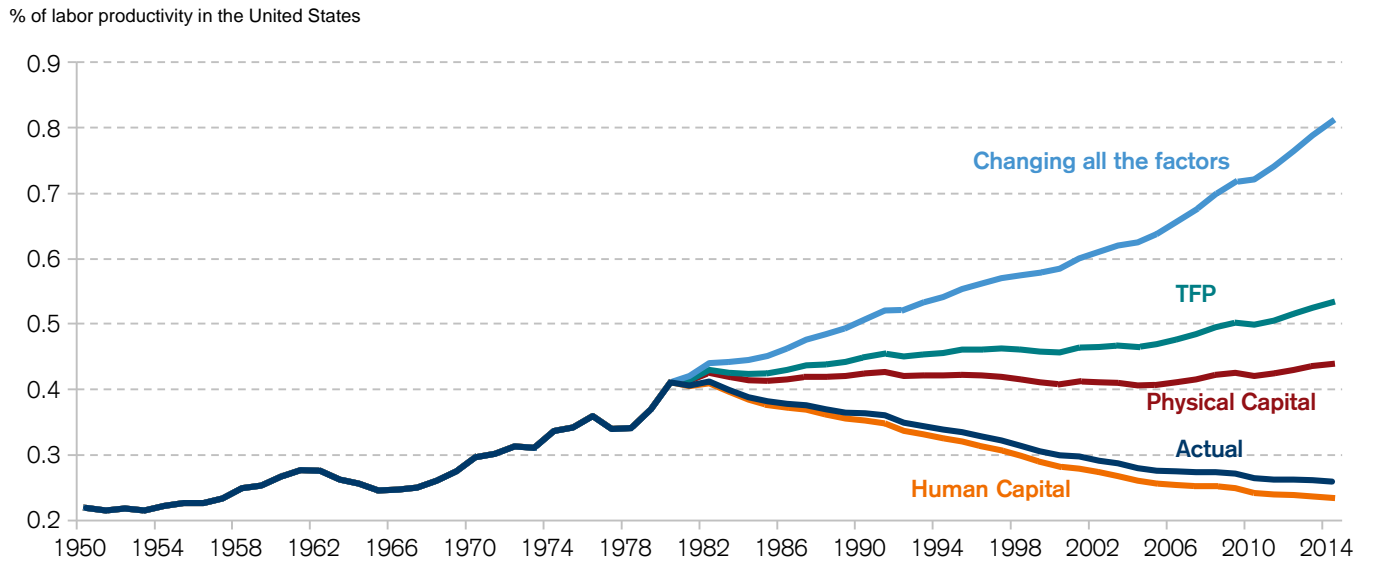
- Expansion of the stock of capital per worker in Brazil similar to that of the average of the group of countries with the greatest increase in productivity: Labor productivity in Brazil would be 45% of the labor productivity in the USA.
- Growth in human capital in Brazil similar to the average of the group of countries with the highest rise in productivity: Labor productivity in Brazil would correspond to 24% of labor productivity in the USA, or 2.0pps lower than the current level of 26%. This result does not consider the quality of education in the human capital measure. The stock of human capital is calculated as a function of the increase in the level of schooling, which results in overestimation of the quantity effect and underestimation of the quality of education effect.

⁹ Such 82 countries are: Argentina, Australia, Austria, Bahrain, Barbados, Belgium, Bolivia, Brazil, Bulgaria, Burkina Faso, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, Finland, France, Germany, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kenya, Kuwait, Luxemburg, Malaysia, Malta, Mexico, Morocco, Mozambique, Netherlands, New Zealand, Niger, Nigeria, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Saudi Arabia, Senegal, Singapore, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, and Venezuela.

¹⁰ The simulations in this exercise were based on relative productivity, since this measure considers the relative gap of Brazil compared with developed economies, mainly the United States.

- Expansion in TFP in Brazil similar to the average of the group of countries with the highest rise in productivity: Labor productivity in Brazil would increase to 53% of the labor productivity in the USA.

Figure 12: Simulations for relative productivity in Brazil



Source: Penn World Table (PWT), Credit Suisse

The results of the simulations show that the gap in Brazil's per capita income in the past few decades was explained by contraction in TFP.

Economic reforms would accelerate TFP in Brazil

Was explained by the dynamics of TFP. The most successful of them, India, posted the fourth-highest growth in productivity of all countries analyzed.

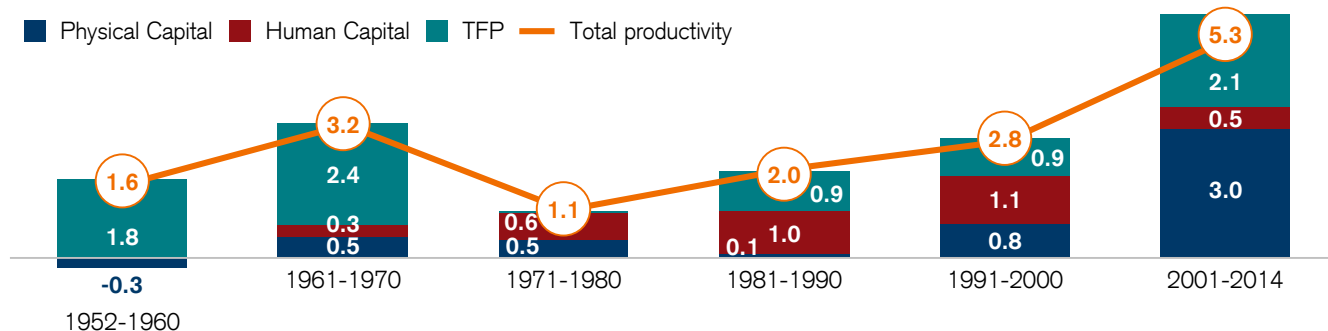
Since the gradual opening up of the economy in the 1980s, labor productivity in India has increased substantially, after the deceleration observed from 1971 to 1980. India's average GDP per worker growth rose from 2.0% until 1980 to more than 3.6% from 1981 to 2014. In the past ten years (2005–2014), its labor productivity grew, on average, 6.9%.

Literature on India's growth identifies two periods of implementation of microeconomic reforms:

- i. 1981 to 1990 – Growth in TFP of 0.9% p.a., with the expansion of labor productivity reaching 2.0% p.a.
- ii. 1991 to 2000¹¹ – TFP grew 0.9% p.a. (Figure 13). The contribution from the stock of human capital per worker rose, but maintenance of substantial growth in TFP allowed the growth in labor productivity in India to exceed 5.0% p.a. in the past few decades.

Figure 13: Breakdown of growth in productivity in India

%, pps, average per year



Source: Penn World Table (PWT), Credit Suisse

The most recent microeconomic reforms in Brazil occurred during the Lula administration, from 2002 to 2010, when measures such as the following were implemented: (i) Payroll Loan Act; (ii) social security reform; (iii) system of separate accounting by legal mandate for real estate developments; (iv) New Bankruptcy Act; (v) opening up of the reinsurance market; (vi) portability of loans; and (vii) new Stock Corporations Act.

Many of these measures boosted the credit market in Brazil, significantly increasing the credit-to-GDP ratio since 2002. GDP growth accelerated substantially and remained high for a few years (average of 4.1% from 2003 to 2010). Although it is difficult to measure the effect of these microeconomic reforms on GDP growth, Brazil saw the highest increase in TFP of the past few decades from 2002 to 2010, when average growth was 0.4% p.a., much higher than the average contraction of -1.1% p.a. from 1981 to 2014.

If we assume that growth in labor productivity in Brazil will return to a level close to that recorded in 1991-2000 (1.6%) and 2001-2010 (1.2%), Brazil's GDP would grow 2.6% p.a. for a sustainable period, based on annual growth in the employment rate of 0.5% and population growth of 0.7% p.a. in the next few decades. This more positive scenario requires the implementation of economic reforms in Brazil to reduce economic distortions¹².

¹¹ For more details on the economic reforms implemented in India, please see "Why Growth Matters: How Economic Growth in India Reduced Poverty and the Lessons for Other Developing Countries," by Jagdish Bhagwati and Arvind Panagariya.

¹² Such distortions are of several types. To mention a few: (i) high share of subsidized credit in the domestic capital market; (ii) complex tax system; (iii) high tax burden and low efficiency of the public sector; and (iv) low trade flows.

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Disclosure Appendix

Analyst Certification

Nilson Teixeira, Paulo Coutinho, Iana Ferrao, Leonardo Fonseca and Lucas Vilela each certify, with respect to the companies or securities that the individual analyzes, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

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