

# Brazil's Productivity Dynamics

Rong Qian, Jorge Thompson Araújo and Antonio Nucifora

February, 2018

## I. Introduction

1. **Recent developments in the theory and empirics of growth have emphasized the interplay of macroeconomic and microeconomic factors in long-term development.** Most notably, the Schumpeterian growth paradigm<sup>1</sup> has highlighted the crucial role of creative destruction, namely, the displacement of old technologies by new innovations, in promoting sustained aggregate productivity growth in the long run (see Box 1 for a discussion on the concept and measurement of productivity). In particular, the Schumpeterian approach is underpinned by three core notions: (i) innovations are the primary reason for sustained productivity growth, particularly for firms, sectors and countries closer to the technological frontier; (ii) innovations are often driven by entrepreneurial initiative, which in turn responds to economic incentives that can be positively or negatively affected by policies and institutions; and (iii) innovations can translate into economic growth insofar as creative destruction—or the “competition process between the old and the new”—can run its course more or less unimpeded.

2. **This chapter shows that distortions have prevented the Brazilian economy from benefiting fully from the Schumpeterian forces of innovation and creative destruction.** In order to so, it examines determinants of productivity growth in Brazil from aggregate, sectoral and firm-level viewpoints. The chapter highlights an economy with significant dysfunctions, which are at the root of the feeble performance in productivity. The chapter provides an analysis of Brazil's aggregate macro level trends in growth and structural transformation. It discusses the rate of productivity growth and the extent of reallocation of resources toward the most productive sectors. In particular, the analysis shows that the Brazilian economy is characterized by: (i) *limited structural change*, with recent economic performance driven mainly by the increasing productivity in agriculture and the expanding size of the services sector; (ii) the existence of *widespread policy distortions*, notably in the financial sector and through the adoption of certain types of industrial policies, which have contributed to low capital accumulation and to a suboptimal allocation of resources, keeping economic performance below potential; (iii) *dysfunctional firm-level dynamics* where low productivity firms are able to survive indefinitely, possibly because of a policy framework which undermines competition and results in stagnant productivity, weak jobs creation, and feeble export performance. These findings shed light on an economy in which barriers to the workings of Schumpeterian creative destruction has resulted in businesses competing for government privileges (rents) rather than investing in frontier technologies to be more competitive in the market place, resulting in an weak rate of aggregate productivity growth in the economy as a whole.

---

<sup>1</sup> Aghion, Akcigit and Howitt (2013) and Aghion and Bircan (2017) provide useful summaries of the latest developments of the Schumpeterian growth paradigm.

3. **The chapter is organized as follows.** Section II outlines the main trends in productivity at the aggregate level and examines the role of structural change in overall productivity growth, introducing the notion of factor misallocation that will permeate much of the discussion in this chapter. Section III looks into the firm-level evidence and sheds light on the productivity dynamics of Brazilian firms. Section IV concludes.

### **Box 1. Understanding and Measuring Productivity**

#### **What is productivity and why is it important?**

Productivity is an indicator of technical efficiency that captures how firms, industries (groups of firms in the same product market), sectors (groups of industries) or the country transform measured inputs into the production of goods and services. The two most common productivity measures are: labor productivity (LP) and total factor productivity (TFP). While these two concepts are related, they are in fact distinct.

LP captures the value of the outputs produced (or value-added) divided by the number of workers. It is therefore a measure of the amount of wealth creation per worker. This is determined by the amount of capital and other non-labor inputs available to workers, as well as the efficiency with which these inputs are used. Nobel prize winning economist Paul Krugman famously said: “Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.” (Krugman 1994). Hence the evolution of labor productivity is key to understand the growth in living standards over time.

TFP is derived as a residual of output once the impact of all measured inputs is accounted for, notably labor (augmented by the quality of human capital) and capital (including physical capital, such as machinery, computers and buildings, and also energy, materials, and services, plus some measures of intangible capital). TFP therefore captures the efficiency with which all inputs are combined into the productive process. The evolution of TFP can be thought of as an economic measure of technical progress. TFP growth can be the result of reallocation (shifting resources from less to more efficient firms within the same industries or across industries and sectors) or innovation. Innovation can include the development of entirely new products and technologies and the adoption and adaptation of existing technologies and processes.<sup>(\*)</sup> In the long-term, how efficiently countries use all available inputs is the key determinant of differences in economic growth rates and resulting income levels.<sup>(\*\*)</sup>

Although the two measures of productivity are generally highly correlated, since efficiency gains obtained through TFP will make labor more productive, they will not be correlated if LP gains are obtained through the accumulation of capital instead of TFP.

Accurately measuring productivity is a challenging task. For instance, deriving TFP as a residual from a production function will yield accurate estimates only if output and factor prices adequately reflect marginal costs and marginal factor productivity. If this is not the case, the effect of price distortions due to market power or government intervention may be misinterpreted as changes in efficiency. Another common difficulty is associated with measuring quality of output and factor inputs accurately. These measurement issues need to be borne in mind in the discussion that follows.

#### **Notes:**

(\*) See Haskel et al. (2011) and Cirera and Maloney (2017). The benefits from innovation and resulting productivity growth go significantly beyond income: Lichtenberg (2014) documents a large impact of foreign drug research on life expectancy. Hence, the ability to transfer and adapt health advances developed elsewhere with modest amounts of innovative effort likely generate large social returns for adopting countries.

(\*\*) Cross-country evidence confirms that TFP is the main driver of income differences across countries and of sustainable per capita income growth (Easterly and Levine, 2001; Caselli, 2016).

## II. Aggregate Trends in Productivity

### *Growth between 1996 and 2015 has mainly been driven by labor accumulation*

4. **The Brazilian economy benefitted from a prolonged – but ultimately unsustainable – period of very high growth which ended with the “lost decade” of the 1980s.** Between 1950 and 1980—which Bacha and Bonelli (2015) call the Post WW-II Golden Age—Brazil’s average GDP growth rate averaged an impressive 7.4 percent per year. Growth was volatile since 1961, however, with a downward trend from 1974 to 1981, and was followed by a decade of stagnation. During the “lost decade” (1981-1992), in the wake of the debt crisis, Brazil’s GDP growth rate averaged a paltry 1.4 percent per year and the economy virtually stopped catching up with the developed world.<sup>2</sup>

5. **A period of faster growth started in the 1990s and reversed again after 2010.** During 1993-2010, the GDP growth rate kept fluctuating, but basically maintained positive levels. However, after 2010, the deterioration in both the external environment and domestic policies led to a steady decline in growth (Figure 1). Growth declined from an average of 4.5 percent per year in 2006-2010 to 2.4 percent in 2011-2014, followed by contractions of 3.8 percent and 3.6 percent in 2015 and 2016, the deepest recession in Brazil’s history.

6. **Economic growth since the mid-1990s has been driven largely by labor accumulation, namely an expansion of the employed labor force and its quality.** An analysis of the decomposition of GDP growth highlights that Brazil’s growth over the past two decades was largely driven by factor accumulation, with only a small contribution from improvements in Total Factor Productivity (TFP).<sup>3</sup> During the 1996-2015 period, 39 percent of growth was driven by capital accumulation (Figures 2 and 3, and Table 1). The contribution of capital decreased from 31 percent during 1996-2003 to just 19 percent during 2003-2009. It subsequently accounted for 88 percent of the (meager) growth from 2010. “Labor accumulation”, namely the increase in the labor force and its quality (human capital) jointly accounted for 64 percent of growth during the 1996-2015 period. Labor accumulation has been decreasing over time, from 98 percent of growth in the 1996-2003 period, down to 43 percent in the post 2010 period. As discussed below, these patterns may reflect the combination of the gradual reduction in the contribution of labor and its

---

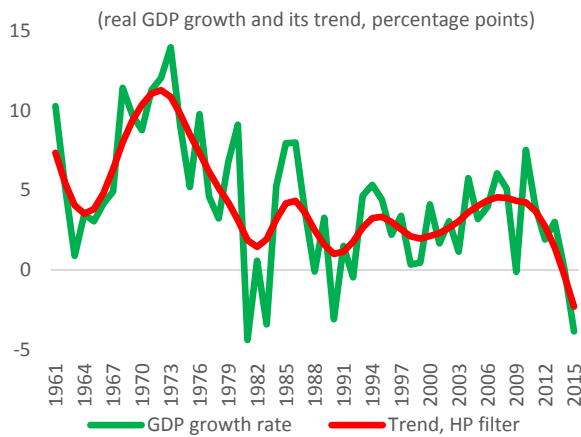
<sup>2</sup> This pattern can be seen throughout Latin America. Ferreira and et. (2011) point out that mean (median) TFP for Latin America relative to the US averaged 82% (79%) between 1960 and 1980, plummeting to 54% (60%) in 2007.

<sup>3</sup> Total Factor Productivity (TFP) is a commonly used measure of productivity. In a nutshell TFP is calculated as the residual growth that cannot be attributed to increased use of labor and capital. In other words, everything not captured by changes in labor or capital is picked up by TFP growth. This includes measurement errors and changes in utilization rates of factor inputs. This growth accounting analysis is based on a simple production function that allow to assess the sources of growth since 1996. It uses a constant return to scale Cobb-Douglas production function with a share of capital of 46 percent of GDP. The labor supply is estimated adjusting the working age population by participation rate, employment rate and average year of education. The stock of capital was estimated using the Perpetual Inventory Method assuming a depreciation rate of 5 percent. It should be noted that estimating the capital stock is beset with problems. It is also worth noting that Total Factor Productivity can be shown to be a component of labor productivity (which we will discuss below), but that the two do not coincide as the latter is also influenced by the amount of capital per worker.

quality, as well as a strong government effort to increase credit and investment into some sectors of the economy through public banks since 2007, and especially after 2011.

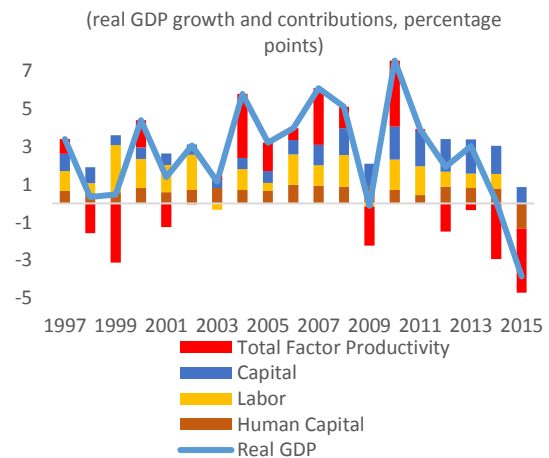
7. **Total factor productivity has been a drag on growth (i.e. a negative contribution) on average over the 1996-2015 period.** The contribution of TFP to economy-wide growth has moved from negative 29 percent during 1996-2003 to positive 39 percent during 2003-2009, to negative 57 percent during 2009-2015 (Figure 3). This largely reflects our calculation of TFP as a residual (in line with standard growth accounting methodologies) such that the recent period of growth slowdown and recession appears caused by a negative contribution of productivity, when in fact it was driven by other unobserved factors which are bundled into the TFP residual, such as for instance an increase in spare capacity and inventories. Nevertheless, the results of this analysis show that over time the Brazilian economy has not grown as a result of improvements in productivity. The results also show that labor’s contribution has been declining steadily.

**Figure 1. Downward trend in growth, particularly during 1974-1981 and after 2010**



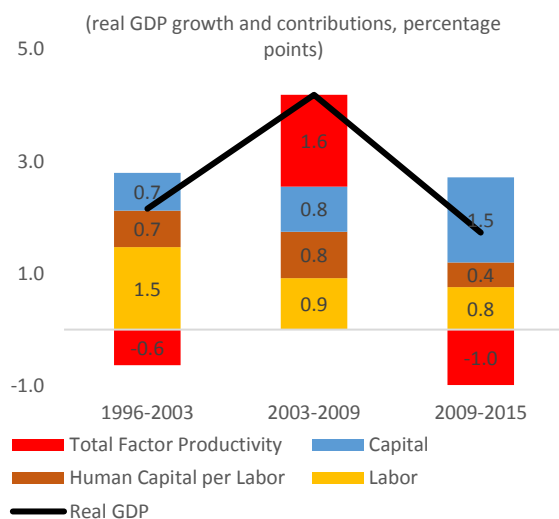
Source: WDI

**Figure 2. TFP has been volatile, but did not contribute to GDP growth on average over the entire period**



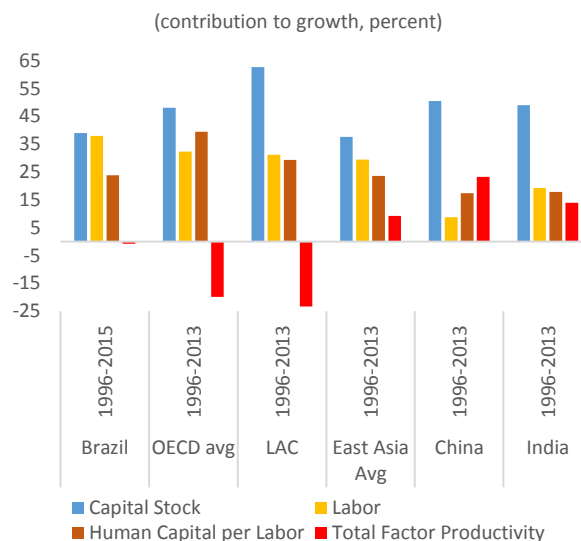
Source: IBGE, world bank staff calculation

**Figure 3. TFP only contributed to Brazil’s growth performance during 2003-2009**



Source: IBGE, world bank staff calculation

**Figure 4. TFP contribution to growth was above LAC and OECD averages but well below Asian countries’**



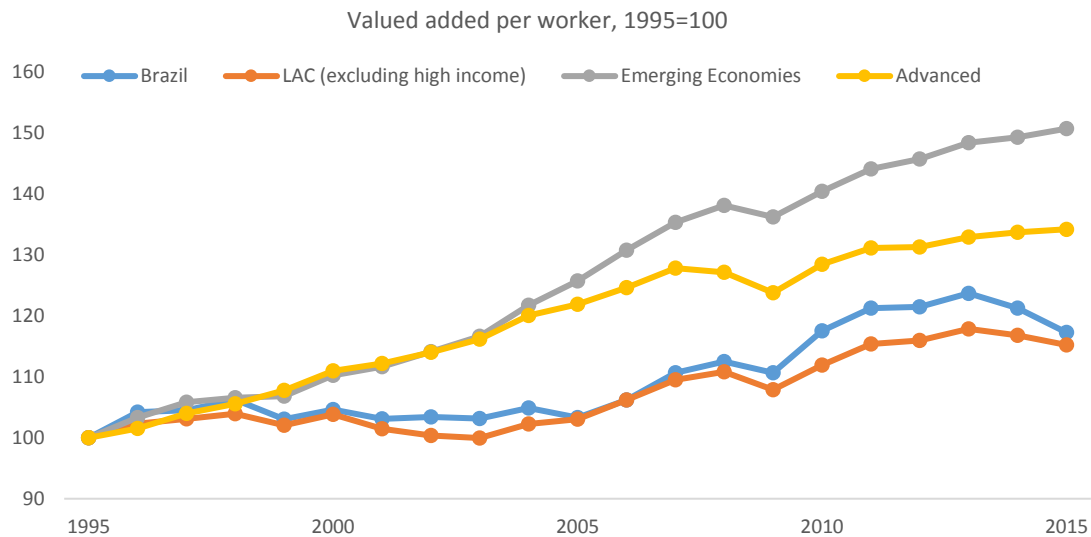
Source: IBGE, WDI, world bank staff calculation  
 Note: countries included in OECD: OECD members; in LAC: Argentina, Chile, Colombia, Mexico and Peru; in East Asia: Indonesia, Malaysia, Thailand, and Philippines.

**Table 1: Percentage Contributions to GDP Growth, 1996-2015**

	1996-2015	1996-2003	2003-2009	2009-2015
Capital Stock	39	31	19	88
Labor	38	68	22	44
Human Capital per Labor	24	30	20	25
Total Factor Productivity	-1	-29	39	-57
Real GDP	2.6	2.2	4.2	1.7

8. **International comparisons confirm that Brazil’s growth has been heavily dependent on labor accumulation.** The results of the growth accounting are affected by various broader economic fluctuations such as the East Asia crisis in the late 1990s, the global financial crisis in 2008, and the ongoing recession in Brazil. Nevertheless, a few clear findings emerge. Capital accumulation has played a greater role in all comparator countries, whether looking at the OECD average, the LAC average, China and India (Figure 4). The contribution of labor has been very large in Brazil, far above any other comparator. The improvement in the quality of human capital was broadly in line with the rest of the LAC region and East Asia, but much larger than experienced in China and India where, as mentioned, capital has played the driving role, and also productivity growth.

**Figure 5. Value added per worker grew less than from other emerging economies over the period and decreased in recent years**



Source: WDI

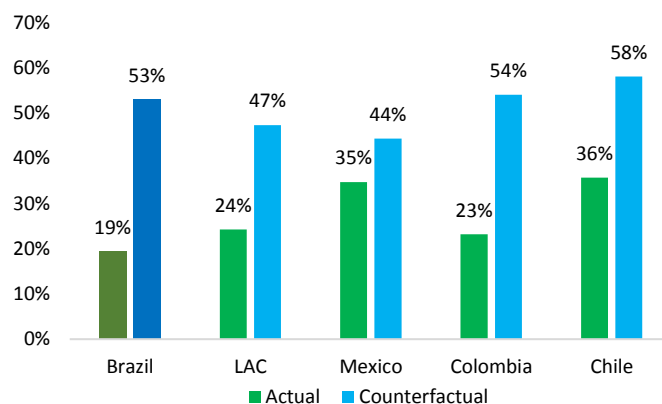
Note: Chile and Uruguay are excluded from the LAC group (as they are high income countries).

9. **Low TFP is reflected in Brazil’s labor productivity, which grew less than advanced countries and other emerging countries over the past 20 years.** We calculate value added per worker as a proxy for labor productivity. Between 1995 and 2015, value added per worker in Brazil has been growing at about the same rate as the rest of Latin America and the Caribbean (LAC) countries, but much below advanced economies and other emerging economies (Figure 5). It declined briefly in 2009 as in the rest of the world. However, since 2014, while the rest of emerging economies and advanced economies continued the upward trend in value added per worker, the trend in Brazil and the rest of LAC reversed, with Brazil declining at a faster rate than LAC. Over this entire period, the gap in labor productivity between Brazil (and LAC) and advanced countries and other emerging countries continued to increase steadily. This contrasts with other emerging countries, whose labor productivity has been rising faster than advanced economies notably since 2004, thereby moving to gradually close their productivity gap.

10. **Overall, these results highlight that productivity has contributed little to growth in Brazil, and that growth has been driven by demographics and higher employment levels.** Although potential gains from increasing capital stock and human capital are significant, compared to other countries Brazil would benefit the most from increasing its TFP (Box 2). Before looking at the determinants of productivity at the firm level, it is useful to briefly explore possible characteristics of the Brazilian economy which could give rise to this pattern of productivity.

### Box 2: Brazil would benefit largely from increasing TFP, almost tripling its GDP per worker if Brazil achieves the US TFP level

Within LAC, Brazil would benefit the most from increasing its TFP. Brazil's output per worker is only 19 percent that of the United States, the lowest among main LAC economies. At the same time, Brazil does not have notably lower capital stock per worker, or notably lower education levels than its LAC comparators. The reason for a much lower output per worker is the low level of TFP. Brazil would increase its income per capita by 2.7 times if its TFP were as high as that in the United States against an increase of around two times for the average LAC country. It is notable that countries like Chile and Mexico, who have gone through a process of deep international integration and have largely open markets, show the lowest productivity gap to the US. One of the messages of this report is that by following suit with more open markets, Brazil would be able to raise substantially its own productivity level and re-start economic convergence even without major increases in investment.



Source: Caselli (2016) and author' calculations.

Note: Counterfactual refers to output per worker that countries would have had if their TFP were equal to that of the US

### Limited structural change and weak productivity growth

11. **The growth accounting exercise highlights a lack of improvement in Total Factor Productivity.** Higher productivity growth is important because it implies greater wealth creation per capita, which results in more jobs creation and the creation of better quality jobs. An economic growth strategy entailing large factor accumulation is appropriate when a country has a large stock of untapped human resources, such as is the case in demographically young countries with high unemployment. Productivity growth, however, is required to generate more wealth per capita and ultimately faster and better jobs creation. The rate of TFP growth is a good indicator of the overall efficiency of the economy—it measures the improvement in the use of these factor inputs. Increases in TFP (that is, efficiency improvements in the use of factor inputs) can take place within a given production activity or sector (through within-firm improvements as well as through reallocation of resources across firms within sectors), or can be the result of a reallocation of resources across sectors. Therefore low TFP growth suggests the existence of barriers that prevent a reallocation of resources toward more productive activities and/or innovation (better uses of resources wherever they are located), thereby hampering the economy's capacity to generate wealth and jobs.

12. **Brazil differences in productivity across sectors are in line with international patterns.** Persistent productivity gaps across firms within sectors are likely to be indicative of misallocation of resources. Large productivity gaps across sectors suggest that reallocation of workers from lower-productivity to higher-productivity sectors can be an important driver of growth. In fact, in many high-growth countries, in particular in Asia, re-allocation of workers

across sectors has contributed positively to growth during the last twenty years (McMillan and Rodrik 2011). Labor productivity in extractives, one of Brazil’s most productive sectors, was 10.6 times higher than productivity in the agricultural sector, which had the lowest productivity in 2005 (Table 1). In comparison, this ratio was 12.7 in Turkey and 11.2 in Chile (McMillan and Rodrik 2011). The agriculture-manufacturing gap in Brazil is also in line with other countries. In 2005, labor productivity in manufacturing in Brazil was 4.1 times higher than in agriculture—this is above the 2.8 in Latin America and 3.9 in Asia (McMillan and Rodrik 2011). What is noteworthy, however, is the low productivity of the retail sector, which was only 1.4 times more productive than agriculture in 2005 (and the same as agriculture by 2013). Box 3 offers additional detail on the evolution of sectoral value-added per worker.

**Table 1: Productivity levels (VA per worker) and productivity gaps across sectors, 2000-2013**

Year	Agriculture	Extractive	Utilities	Manufacturing	Construction	Wholesale & Retail	Transport & Communications	Gov service	Other Activities
2000 (level)	2484.0	27137.6	32635.8	12541.3	8315.4	4318.6	11706.5	14807.8	10804.2
(gap from agric.)	1.0	10.9	13.1	5.0	3.3	1.7	4.7	6.0	4.3
2005 (level)	2923.7	30919.6	31895.3	11880.3	7694.8	4063.4	11754.3	14964.9	10791.9
(gap from agric.)	1.0	10.6	10.9	4.1	2.6	1.4	4.0	5.1	3.7
2010 (level)	3999.4	33413.5	32786.8	11690.9	8368.3	4808.8	13078.6	14226.1	12806.8
(gap from agric.)	1.0	8.4	8.2	2.9	2.1	1.2	3.3	3.6	3.2
2013 (level)	5107.9	28344.2	32793.4	11509.1	8698.1	4992.8	13432.7	13636.4	13061.4
(gap from agric.)	1.0	5.5	6.4	2.3	1.7	1.0	2.6	2.7	2.6

**13. Sectoral productivity gaps have been reducing sharply over time, suggesting the presence of desirable structural change.** The extractives-agriculture gaps decreased to 5.5 percent by 2013. Similarly, the agriculture-manufacturing gap decreased to 2.3 by 2013 (Table 1). In both cases this was due to a combination of increasing VA in agriculture and relative stagnation in VA in extractives or even a contraction in manufacturing. This reflects the fact that with the notable exception of agriculture, sectoral productivity in Brazil has grown extremely little. Hence the contribution of agriculture has been twofold. First, an increase in within-sector productivity, and second shedding labor in what is still the lowest productivity sector towards other higher-productivity-albeit-relatively-stagnant sectors. Since the middle of 2003, productivity has been slowly increasing also in the services sector (notably wholesale and retail and other services), which in parallel expanded its employment substantially. In a sense these findings capture the dynamics of the problem with the Brazilian economy, which seems to be driven by productivity increases in agriculture and an expansion in the size of (the mildly productive) services sector, but has seen widespread stagnation (and in fact a drop) of productivity in manufacturing and in most of the services sectors. Box 2 summarizes the main medium-term trends in sectoral VA per worker in Brazil.



### Box 3. Trends in Sectoral Value-Added per Worker in Brazil

While sectoral shifts in employment have had a favorable impact on aggregate value-added per worker (at least since 2005), it is instructive to examine how labor productivity has evolved in specific sectors. This can shed light onto an apparent paradox: while agriculture displayed the fastest rates of productivity growth, employment shifts away from the agricultural sector have overall been “productivity-enhancing”. Based on the analysis in this section, as well as on the findings reported in Lisboa and Mello (2017), the following sectoral value-added trends are worth summarizing:

- **Agriculture.** Starting from a low base, agricultural VA per worker has systematically grown at relatively high rates since at least the early 1990s. In particular, between 2000 and 2013, cumulative labor productivity growth in agriculture was 105.6%, while services grew 11.7% and manufacturing shrunk by 5.5%. To a large extent, this period of sustained growth reflects technological advances, such as labor-saving technical progress, as documented in Bustos *et al* (2016). In fact, the nature of technological change in agriculture affects the overall productivity in the economy. In particular, the positive impact of agricultural productivity growth on manufacturing depends on labor-saving technological change in agriculture reallocates workers towards the industrial sector, while land-augmenting technical progress can retard industrialization. However, it is important to distinguish between labor productivity *levels and growth rates*: Despite its fast and nearly continuous growth, the agricultural sector as a whole continues to generate relatively low levels of VA per worker, thus dampening its impact on the overall economy. In addition, there is a *composition effect* at play: The agricultural sector is also shedding labor, which by construction means that VA per worker is going up, all else constant.
- **Manufacturing.** In contrast with agriculture, manufacturing has seen a continuous decline in its overall VA per worker during the same period, which has contributed to concerns about “premature deindustrialization”—the shrinking of the manufacturing sector at much lower income levels than those at which developed countries started to deindustrialize—in Brazil.<sup>4</sup> In absolute terms, however, manufacturing is still much more productive (in the sense of having higher VA per worker) than both agriculture and services in the aggregate.
- **Services.** Employment shifts towards the services sector have been “productivity-enhancing” during the period considered. The evolution over time of VA per worker in the services sector since the 1990s followed a U-shaped pattern, with the lowest levels of labor productivity being registered between 2001 and 2006. This pattern is largely driven by the retail services subsector, of which VA per worker plummeted from 1997 through 2003, following a V-shaped recovery in the subsequent years. It is interesting to note that VA per worker for the financial intermediation and insurance services subsector displayed a significant acceleration in its growth rate since 2003—which probably contributed to the “productivity-enhancing” shift of employment from agriculture to services.

---

<sup>4</sup> Rodrik (2016) highlights both economic and political concerns with premature deindustrialization. On the economic side, since manufacturing exhibits unconditional convergence (as per Rodrik, 2013), a declining share of the industrial sector could signal a lower potential for overall income convergence with advanced economies. On the political side, Rodrik argues that early deindustrialization may damage the sustainability of democratic regimes, as manufacturing decline could reduce the discipline and coordination—and thus the bargaining power—of the labor force.

14. **To assess how much structural transformation has contributed to Brazil’s growth in the past, we carried out a different decomposition of growth in per capita Value Added.** In order to explore the dynamics of the Brazilian economy we decompose per capita Value Added growth in the contribution of changes in the demographics, the level of employment and participation in the labor force, and the level of productivity growth (Box 4 and Figure 6). The latter can then be further divided into two additional components: changes in sector level productivity (“within” component) and changes arising from a reallocation of labor between sectors (“across” component), which measures the extent of structural change in the economy. In turn the structural change component can be further decomposed into “between-static” and “between-dynamic” components, where the former (between-static) measures whether workers

#### **Box 4: Decomposing labor productivity measures at the firm level**

Analysts are particularly interested in understanding what drives *changes* in productivity—which in turn are the main engine of long-run economic growth, prosperity and poverty reduction. It is useful to decompose changes in productivity into its sources or components, both at the aggregate/sectoral and firm levels:

1) At the aggregate level, the sources of economy-wide productivity change can be decomposed as follows:

- **Between-sector change or structural:** measures the contribution of changes in sectoral employment shares between sectors to economy-wide productivity growth. It contributes positively (negatively) if high-productivity sectors increase (decrease) their market share.
- **Within-sector:** measures the average contribution of productivity growth occurring within each sector. It contributes positively (negatively) to economy-wide productivity if labor productivity increases (decreases) within a sector.

2) Similarly, the sources of labor productivity change within a sector (aka within each industry), can be decomposed into five subcomponents, which include the Schumpeterian notions of firm entry and exit:

- **Within-firm:** measures the contribution of productivity growth within surviving firms. It contributes positively (negatively) to sector-level productivity if labor productivity of surviving firms increases (decreases).
- **Between-firm:** measures the contribution of changes in market share to sector-level productivity through reallocation between surviving firms. It contributes positively (negatively) to sector-level productivity if there are market share expansions (reductions) of high-productivity firms or reductions (expansions) of low-productivity firms.
- **Cross:** measures the contribution of firm-size growth through reallocation between surviving firms. It contributes positively (negatively) to sector-level productivity if fast-growth firms expand (shrink) in size or slow-growth firms shrink (expand).
- **Entry:** measures the average difference between entering firms’ productivity and initial productivity at the sector level. It contributes positively (negatively) to sector-level productivity if entering firms have higher (lower) productivity than the initial sector average.

**Exit:** measures the average difference between initial productivity at the sector level and exiting firms’ productivity. It contributes positively (negatively) to sector-level productivity if exiting firms have lower (higher) productivity than the initial sector average.

move to above-average productivity level sectors whereas the latter (between-dynamic) measures whether productivity growth is higher in sectors that expand in terms of employment shares.

15. **The results confirm that Brazilian economy has been characterized by low productivity and some structural change over the past decades.** Per capita VA increased significantly from 1996-2002 (0.6 percent) to 2003-2008 (2.8 percent), and dropped remarkably in 2009-2014 (1.8 percent) (Figure 7). Between 1996 and 2014, demographic factors and employment contributed more than labor productivity to increases in per capita value added (VA), more than 60 percent. A Shapley decomposition of per capita VA growth between labor productivity (VA per worker) and employed labor force highlights that changes in labor productivity contributed negatively to per capita VA growth between 1997 and 2002, and only turned positive after 2003. Throughout the period increases in employed labor force (as a result of demographic growth and increases in employment rate and in labor force participation) played an important role and maintained a positive contribution between 0.7 to 1.3 percentage points to annual VA growth (Figure 7). During 1996 to 2002, the change in labor productivity (VA per worker) was negative 0.4 percent, but turned positive to 1.5 percent for 2003-2008, and remained above 1 percent after 2008.

16. **While most of the productivity originated from within-sector productivity improvements, a positive contribution came from sectoral shifts.**<sup>5</sup> The decomposition of VA per worker in its “within” and “across” components highlights that between 1996 and 2014 the contribution of structural change to economic growth has been positive although not very strong.<sup>6</sup> While employment movements across sectors contributed to overall productivity growth (positive between static), labor did not move to sectors that were becoming more productive (negative between dynamic) (Figure 8). The negative between-dynamic effect for 1996-2002 is driven by a decline in labor productivity in utilities while expanding employment share. Between 2003 and 2008, manufacturing absorbed labor while labor productivity decline resulting in negative between-dynamic, although much smaller than previous period. Similarly, between 2009 and 2013, mining and government services expanded their labor share while labor productivity of these sectors declined slightly.

---

<sup>5</sup> It is interesting to note that previous analysis (McMillan and Rodrik 2011; Schiffbauer, Sahnoun and Araujo (2016)) – based on data covering the 1990-2005 period – found a “productivity-reducing” pattern of structural change for Brazil.

<sup>6</sup> In line with Figure 6, aggregate labor productivity growth is decomposed into within-sector productivity change, between-static and between-dynamic. The within-effect is positive (negative) when the weighted change in labor productivity levels in sectors is positive (negative). The between-static measures the contribution of labor reallocation across sectors, being positive (negative) when labor moves from less (more) to more (less) productive sectors. The between-dynamic captures the joint effect of changes in employment shares and sectoral productivity growth. It is positive (negative) if workers are moving to sectors that are experiencing positive (negative) productivity growth. In other words, between-static measures whether workers move to above-average productivity level sectors whereas between-dynamic measures whether productivity growth is higher in sectors that expand in terms of employment shares.

Figure 6: GDP Growth Decomposition

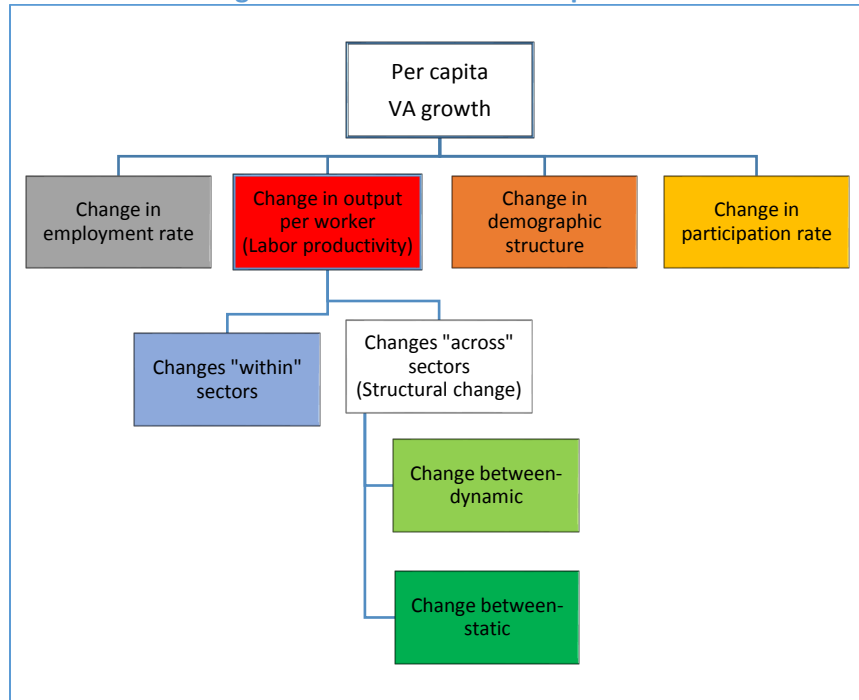
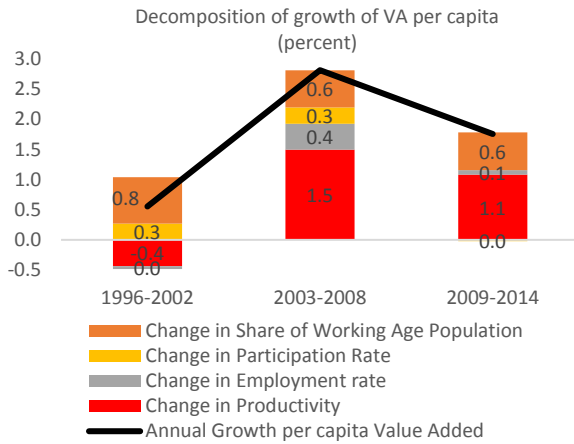


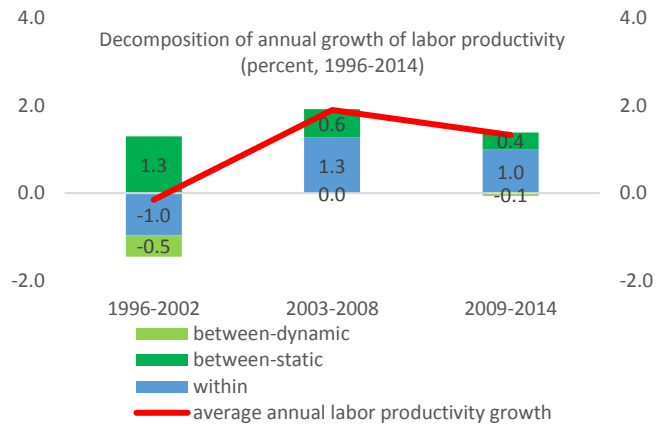
Figure 7. Productivity contributed to growth in VA per capita only after 2003



Source: IBGE, WDI, Groningen, world bank staff calculations

Note: Reported per capital VA growth is annualized growth rate between 1996-2014.

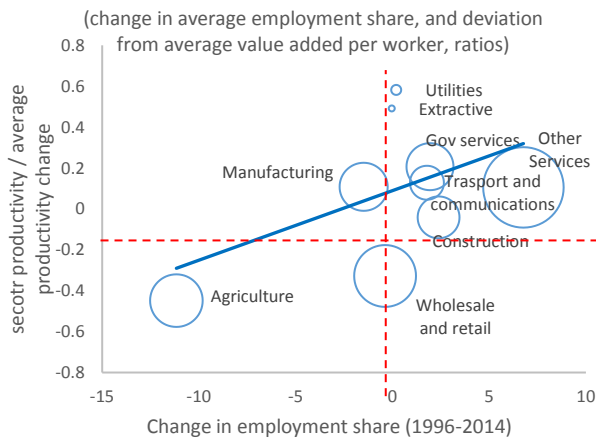
Figure 8. A significant portion of the productivity contribution was the result of structural change



Source: IBGE, WDI, Groningen, world bank staff calculations

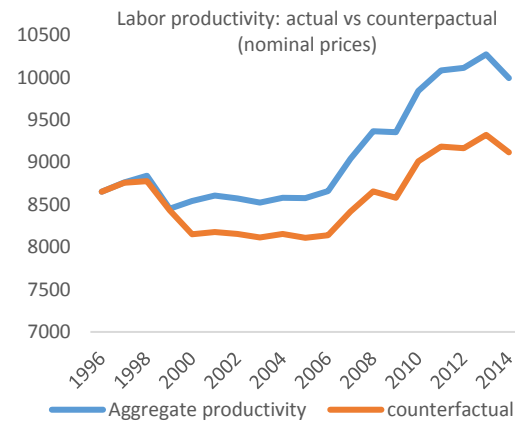
Note: Reported growth of VA per worker is average growth rate between 1996-2014. The methodology for this decomposition is different from that used for Figure 28.

**Figure 9. Overall, labor shifts contributed to aggregate productivity improvement**



Source: IBGE, WDI, Groningen, world bank staff calculations

**Figure 10. Structural change increased productivity 10 percent in 2014**



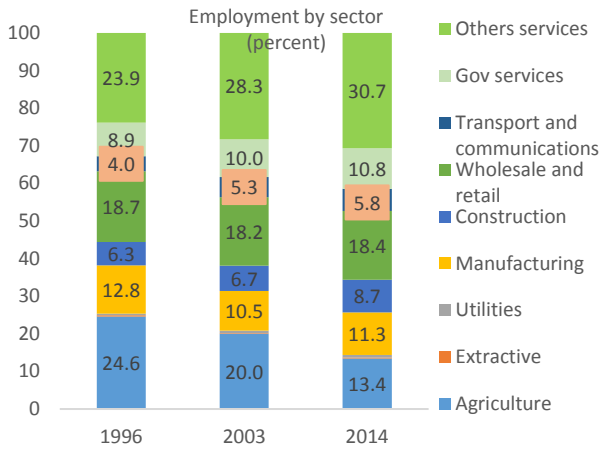
Source: IBGE, WDI, Groningen, world bank staff calculations

Note: to calculate the counterfactual labor productivity, it uses 1996 employment distribution and actual labor productivity.

17. **As mentioned above, labor productivity increased very little between 1996 and 2014, at a rate of 0.6 percent per year, contributing roughly 39 percent to GDP growth per capita.** A share of this productivity growth took place “within” sectors, accounting for 18 percent of real GDP growth per capita over the period (or 0.3 percent per year). Structural change, the reallocation of labor from low-productivity to high-productivity sectors, contributed a further 25 percent to the change in VA per capita between 1996 and 2014 (or 0.43 percent per year). For comparison, Macmillan and Rodrik (2011) calculated that during 1990 to 2005 the “within” component in China, Hong Kong SAR, India, Malaysia, Mauritius, Taiwan, China and Turkey ranged from 7.8 percent per year to 1.7 percent per year, while the structural change component accounted for between 1.4 percent per year to 0.4 percent per year. They also found, however, that in many Latin American and Sub-Saharan African countries “structural change” between 1990 and 2005 has been negative, depressing economic growth (McMillan and Rodrik 2011).

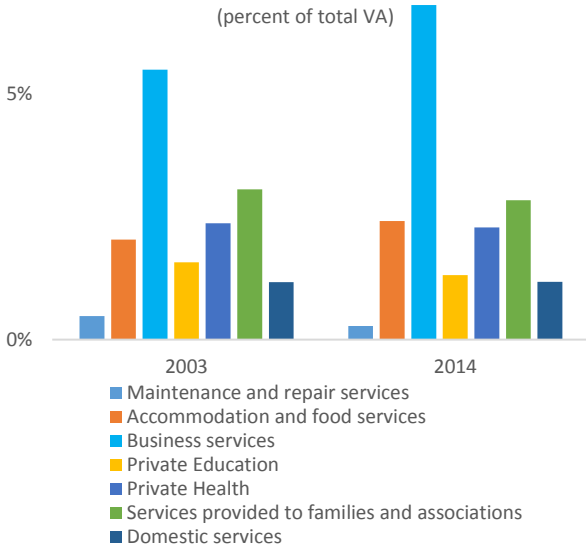
18. **A steady shift in employment from agriculture to services underpins the productivity gains from structural change.** Figure 9 shows changes in employment shares and the relative productivity of sectors, measured as log of the ratio between sectoral productivity and average productivity between 1996 and 2014. For positive gains to occur through structural change, sectors would either be located in the top-right corner (e.g. other services) where labor shifts into relative high-productivity sectors or the third quadrant (e.g. agriculture) where labor shifts out from low productivity sectors. Similarly, computing the counterfactual aggregate productivity using 1996 employment distribution and actual labor productivity dynamics and labor force increases, shows that aggregate productivity increased purely due to structural change by around 5 percent in 2000 and roughly 10 percent in 2014 (Figure 10). Structural change (inter-sectoral reallocation) was contributed 0.7 percentage points per year to per capita VA growth between 1997 and 2002, and 0.4 percentages points per year after 2003 (Figure 14 and Figure 15).

**Figure 11. Employment shift from agriculture to services**



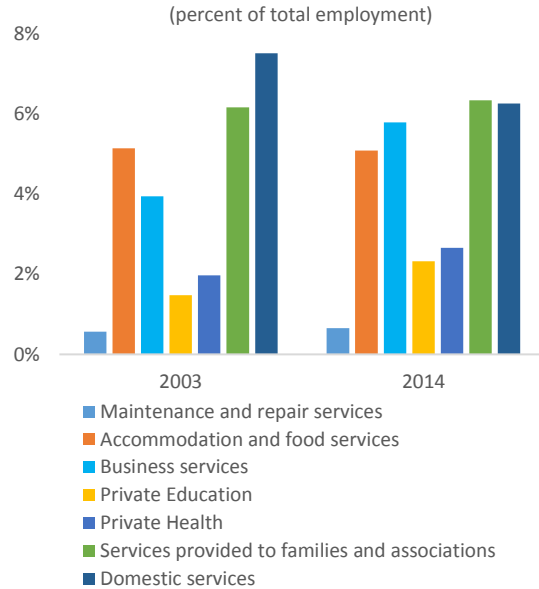
Source: IBGE, WDI, Groningen, world bank staff calculations

**Figure 12. Within other services, business services increased the most as share of total VA...**



Source: IBGE, WDI, Groningen, world bank staff calculations

**Figure 13. ...while labor shifted out from domestic services to business services.**



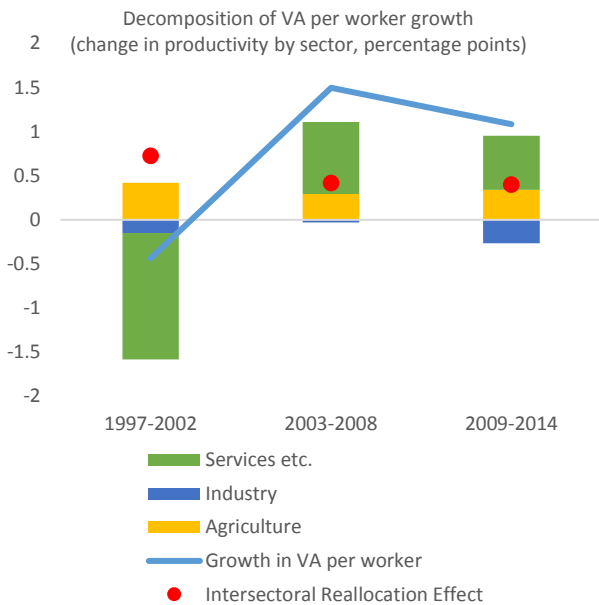
Source: IBGE, WDI, Groningen, world bank staff calculations

**19. Employment shifted from agriculture to services while the share of labor in industry remained stable.** Between 1996 and 2014, total employment increased from 72 to 106 million workers as a result of demographic change and rising labor market participation. Most of the new labor force went to services while agriculture shedded labor. The employment share of services increased from 56 percent to 66 percent while the shares of employment in agriculture declined from 25 percent in 1996 to 13 percent in 2014 (Figure 11). Within services, the main expansion was in business services, accompanied by a contraction in domestic services. Labor shifted out

from agriculture to mainly other services. The employment share of other services increased from 23.9 percent in 1996 to 28.3 percent in 2003 to 30.7 percent in 2014 (Figure 12). Within other services employment shifted out from domestic services, 7.5 percent of total employment in 2003 to 6.2 percent in 2014 while business services employed more labor increasing from 3.9 percent of total employment in 2003 to 5.8 percent in 2014. Business services also increased its share in total VA, from 5.5 percent in 2003 to 6.8 percent in 2014 (Figure 13).

20. **The services sector made the greatest contribution to growth in VA per capita.** Decomposing labor productivity changes at the sectoral level, enables us to identify within and between sector variations. Changes in services labor productivity (services VA per worker) was the most important contributor to increase in overall VA per capita. It improved from -1.4 percentage points per year between 1997 and 2002 to 0.8 percentage points per year between 2003 and 2008, and 0.6 percentage points per year between 2009 and 2014 (Figure 14). At a more disaggregated level, the only negative “within” sector changes after 2002 were from manufacturing and government services (Figure 15). This is confirmed when looking at labor productivity growth by sectors. While agriculture increased steadily, although from a low level, manufacturing labor productivity started a declining trend in 2009, and services labor productivity experienced a fast growth between 2007-2010 (Figure 16-19). Within services, the largest improvements in within sector productivity were in other services (and as shown below this is focused in financial services and real estate, wholesale and retail, and transportation).

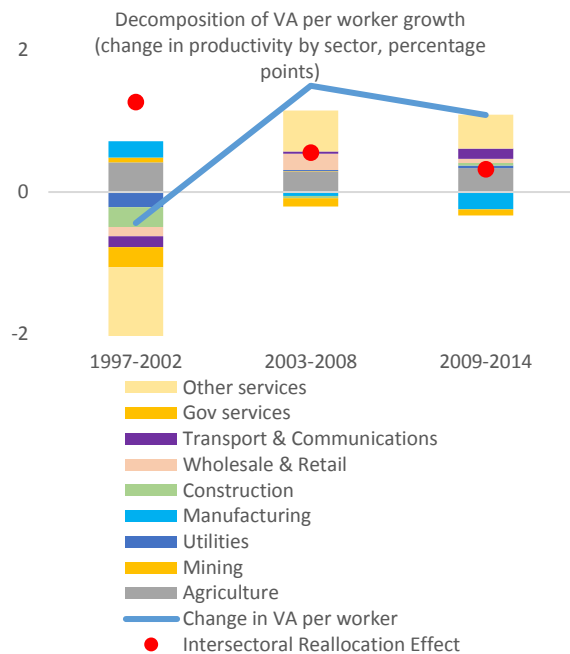
**Figure 14. Services contributed largely to per capita VA growth...**



Source: IBGE, WDI, Groningen, world bank staff calculations

Note: the methodology decomposes per capita VA growth into changes in output per worker within sectors and reallocation of workers across sectors. Reallocation is positive when labor moves from less productive sectors into more productive sectors.

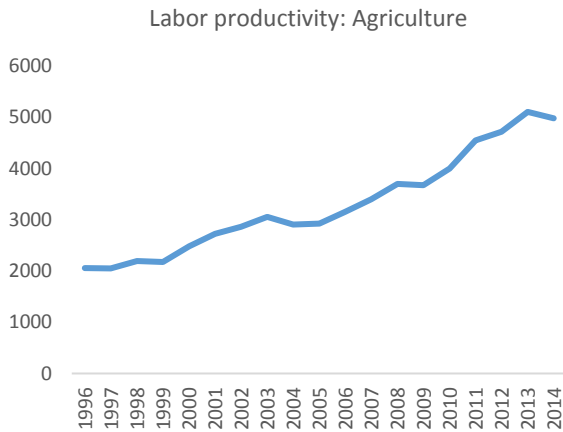
**Figure 15. ...which was driven by “other services”, mainly financial services and real estate**



Source: IBGE, WDI, Groningen, world bank staff calculations

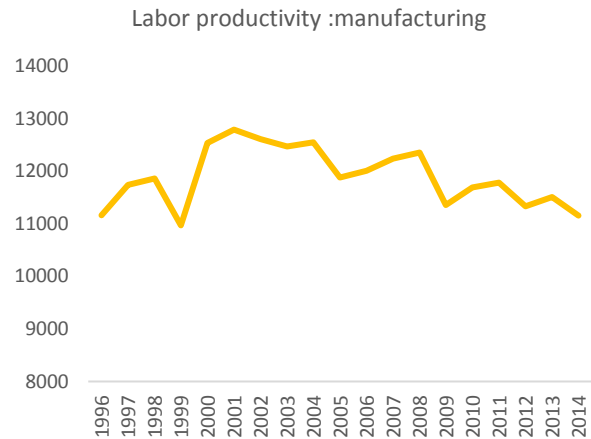
Note: the reallocation terms are different from Figure 13 because labor moves among more narrowly defined sectors.

**Figure 16. Agriculture labor productivity increased steadily**



Source: IBGE, Bank staff calculation

**Figure 17... while manufacturing labor productivity started a downward trend in 2009**



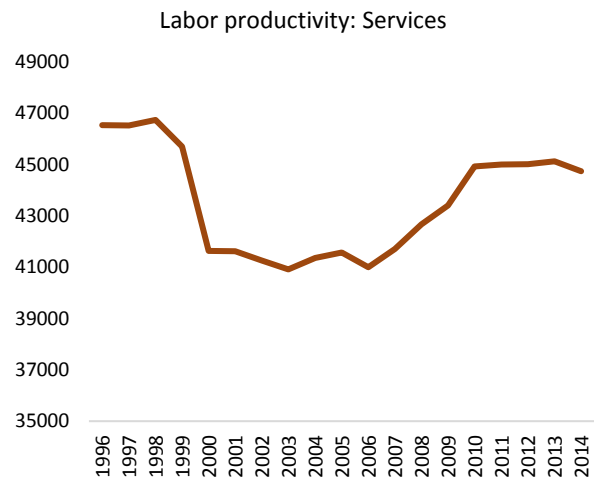
Source: IBGE, Bank staff calculation

**Figure 18. Labor productivity in construction started to decline in 2014**



Source: IBGE, Bank staff calculation

**Figure 19. Service labor productivity increased rapidly until 2011 when it plateaued**



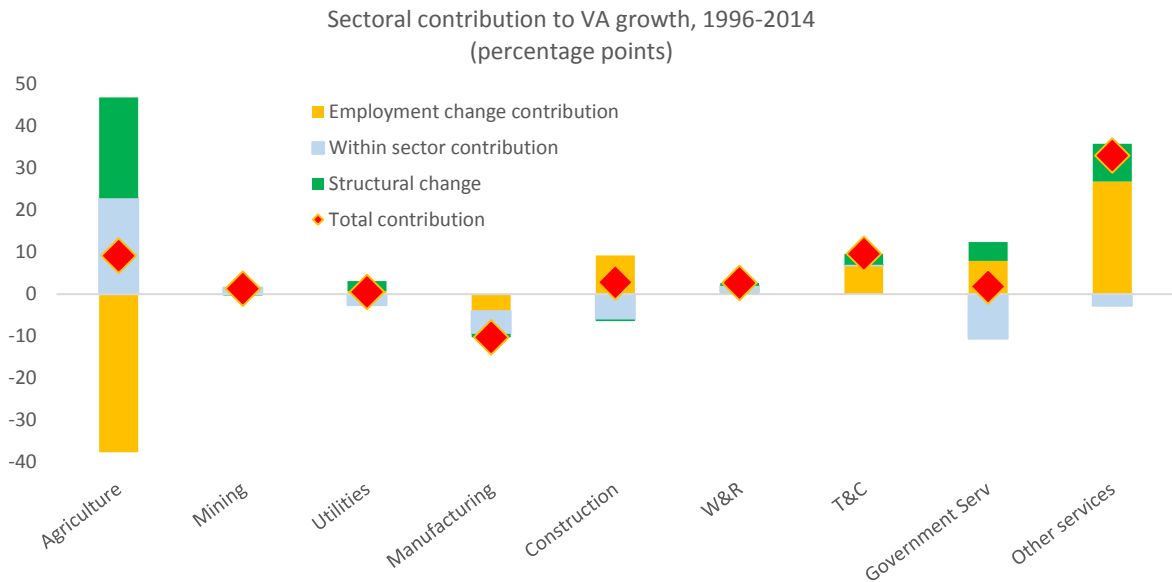
Source: IBGE, Bank staff calculation

21. **The Brazilian economy has been able to efficiently reallocate resources from low-return agriculture to high-return services.** The results also highlight, however, that apart from the reallocation of resources from agriculture to services, most of the economy appears to have remained fairly stagnant. A decomposition of the sectoral contributions to VA growth during 2000 to 2014 shows that the positive structural change was largely limited to agriculture. There was almost no structural change in manufacturing (except for the machinery), and within sector productivity was negative such that manufacturing actually contributed negatively to growth. Some services sectors were characterized by rapid productivity growth, notably financial services and real estate, but absorbed little or no additional labor. Most of the employment growth within the services sectors was in business services and other services (and in the public sector) which are the less dynamic services sector—the expansion of these sectors contributed (positive)



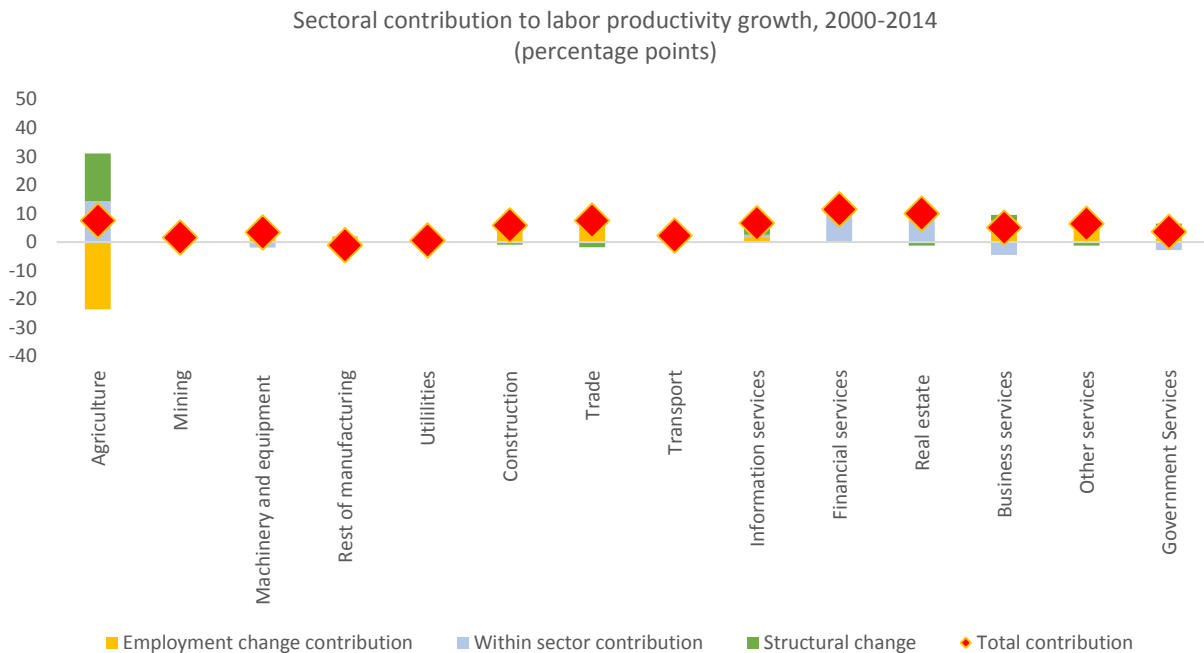
structural change since they absorbed employment from agriculture, and the average productivity of these sectors is higher than in agriculture. It is interesting to note that within sector productivity growth was negative in these services sectors (i.e most of the services sectors actually experienced a contraction in productivity). Important parts of the economy therefore appear not to be affected by factor reallocation and productivity improvements.

**Figure 20. Decomposition of sectoral contributions to VA growth, 1996-2014**



Source: IBGE, WDI, Groningen, world bank staff calculations

**Figure 21. Decomposition of sectoral contributions to VA growth, 2000 -2014**



Source: IBGE, WDI, Groningen, world bank staff calculations

22. **In fact while structural change has made a contribution to increasing productivity in the past, Brazil’s structural composition is not the main source of its productivity gap.** A recent study across 35 economic sectors shows that if Brazil had the same sectoral labor allocation as the US, aggregate productivity would increase 68 percent. But if Brazil had the same sectoral productivities as the US, aggregate productivity would increase 430 percent (Veloso et al., 2017). Hence, low Brazilian productivity relative to the US is mainly due to low productivity “within” most activities.<sup>7</sup> The next subsection examines one possible cause of this low productivity: the poor allocation of resources across firms.

23. **Further, there is a question as to whether our measure of productivity is inflated by the monopolistic profits in the transport and telecommunications sectors, and in the other services (notably financial services).** Our assessment of productivity performance would be even lower if we consider that at the sector level productivity appears to have increased the most in financial services and real estate (Figure 20). These sectors appear to be characterized by limited competition, such that the increase in value added per worker is likely to reflect an increase in rents enjoyed by these sectors, in a sense syphoning off wealth creation from the rest of the economy. As discussed below, and as will be elaborated in Chapter 3, the financial sector is characterized by distortive interventions and limited competition which appear to generate significant rents.

### III. Firm-Level Productivity Dynamics

24. **Productivity patterns at the aggregate level are expected to be broadly reflected in firm level dynamics.** Productivity may grow by increasing output per worker within a firm or by workers and capital moving from less efficient to more efficient firms, within sector and across sectors—that is, the process of creative destruction underpinning structural change as envisaged in the Schumpeterian growth paradigm.

#### *Productivity growth at the firm level dominated by within firm productivity improvements*

25. **Firm-level analysis confirms that productivity growth in Brazil has been hampered by a combination of limited “within” firms labor productivity improvements and limited reallocation of resources across firms.** Firm-level data for the period 1987-2009 across 20 industries (of which 11 are manufacturing and the remaining services industries) allow such a decomposition to be made for Brazil. By decomposing labor productivity growth into growth from within-firms and those coming from various reallocation channels, Bazzi et al (2014) show that the within-sector component explains most of the evolution in labor productivity over the period. On average over 1991 through 2005, structural change accounted for about 18 percent of the improvement in labor productivity, while within-sector labor productivity accounts for the balance of 82 percent (Figure 22).<sup>8</sup> The firm level results therefore suggest that the contribution of

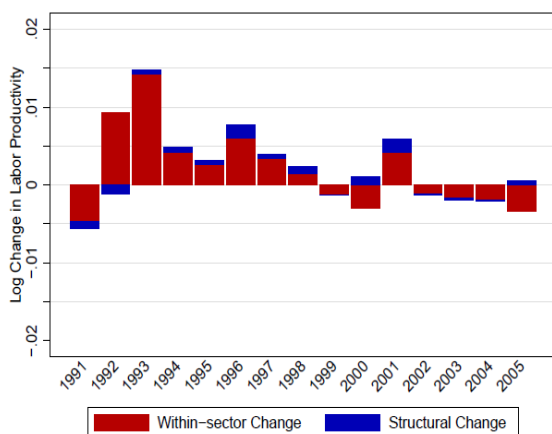
---

<sup>7</sup> Veloso et al. (2017)

<sup>8</sup> Within-sector change measures the average sectoral productivity growth contribution to aggregate productivity change while structural change measures the contribution of changes in sectoral employment shares to economy wide productivity. Thus, an increase in the market share of sectors with relatively high productivity in the final year results in rising aggregate productivity.

structural change is even smaller than what is observed at the aggregate level, although overall labor productivity growth estimated with firm level data also remains very modest. Within sectors, the within-firm component greatly dominates the cross-firm component over this period across all firms (Figure 2.11). There are limited immediate gains from entry and exit, with both entering and exiting firms exhibiting lower than average productivity.<sup>9</sup> The patterns of entry, exit and firm growth differ across size categories, however. Small firms with fast productivity growth seem to attract more employment, potentially related to the shift of workers from informal to formal employment, particularly in construction, retail and transportation (Barbosa Filho and Veloso, 2016). Among large firms, by contrast, labor appears to shift to less productive firms over time (Bazzi et al., 2014). The latter pattern in particular indicates the presence of distortions in the allocation of resources to the detriment of overall productivity growth

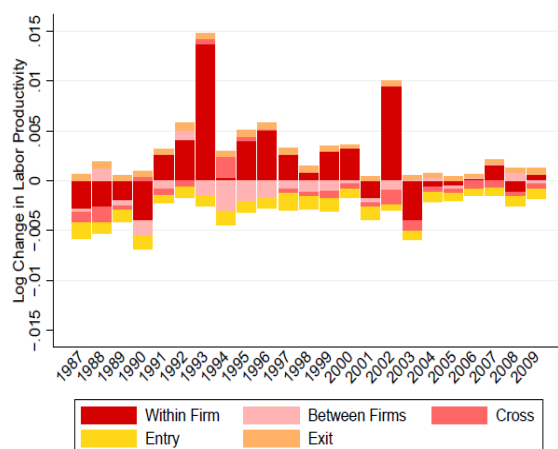
**Figure 22. Within sector labor productivity changes dominated overall changes, 1991-2005**



Source: Bazzi, Muendler and Ricky (2014)

Note: All sectors (20 industries of which 11 industries within manufacturing).

**Figure 23. Entrant firms reduce labor productivity growth while exit contributes positively within all industries, 1991-2005**



Source: Bazzi, Muendler and Ricky (2014)

### *Dynamic entry of small firms contributes to slow productivity growth*

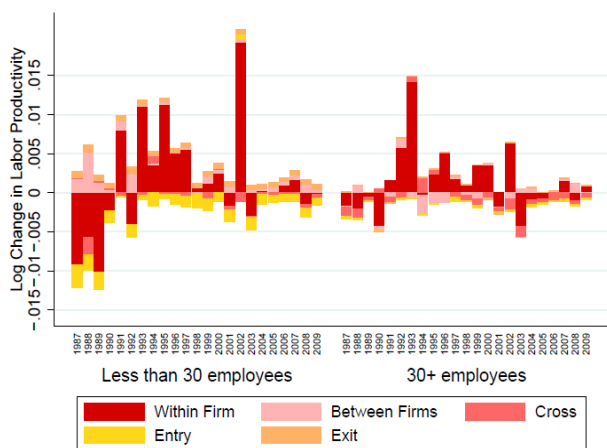
26. **Despite cost of opening and closing firms, entrepreneurship drive is strong in Brazil.** Brazil firms entry rates are above many LAC and other emerging countries (Figure 25). This suggests that while the country's environment to open up new firms is not especially restrictive, there are barriers which do not allow for a more dynamic environment (thus hampering the process

<sup>9</sup> The fact that new entrants have lower productivity is not that surprising. The critical point about the role of entry in a well-functioning high-productivity growth economy is the contribution of relatively large numbers of new successful firms to growth thanks to their rapid expansion after their initial adjustment to prevailing demand patterns. For the US, Haltiwanger et al. (2013) find that high-growth firms tend to be relatively young and make disproportionate contributions to output, productivity and employment growth. For Brazil, Bastos and Silva (2017) find that less than 1 percent of new entrant firms account over a third of the relatively low number of new jobs created by the cohort 13 years after birth.

of creative destruction which would lead to faster productivity growth). These entry rates (of limited liability companies) may not, however, be good proxies for overall entry rates in the economy.<sup>10</sup>

27. **Entrant firms tend to reduce labor productivity while exiting firms contribute positively to overall labor productivity growth.** To look into more details on within-sector sources of productivity change, when decomposing the within-sector part into five terms: within-firm, between-firms, cross, entry, and exit, within-firm changes still dominate the overall changes, while entry and exit effects also play important roles (Bazzi et al., 2014). Between 1987 and 2009, entrant firms reduce labor productivity growth while exits contribute positively within all industries of the economy (Figure 23). This entry-exit turnover suggests that although low productivity firms exit, entering firms also have lower productivity than the exiting sector average. In addition, in some years there was a reallocation of employment from high to low labor productivity firms, indicated by the negative changes of between terms.

**Figure 24. Negative contribution to labor productivity of new firms is larger in small firms. However, among small firms more productive firms expand faster.**



Source: Bazzi, Muendler and Ricky (2014)

**Figure 25. Firm Entry Rates in Various Countries, 2004-2009**



Source: Klapper and Love (2010)

Note: Entry density measures the number of newly registered limited liability firms per 1,000 working-age people (ages 15-64).

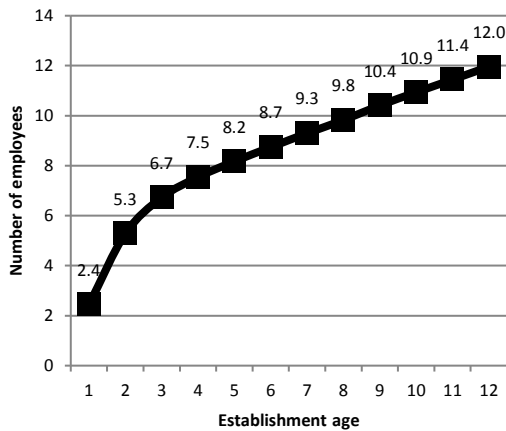
28. **The negative effect on labor productivity from entrant firms is stronger in small firms, although productive small firms tend to expand faster.** When firms are split into below and above 30 employees, the productivity impact of entrant firms is mostly negative among small firms, meaning entering firms have lower productivity than the initial sector average driving down sector-level productivity, while this is not the case for larger firms (Figure 24). However, between-firm effects are mostly positive and larger among smaller firms, which suggests that more productive small firms expand faster. On the other hand, among large firms, the between-firm term

<sup>10</sup> Reliable cross-country data on entry rates are difficult to come by. In interpreting the figure it is important to bear in mind that limited liability companies comprise only a subset of all firms, and the numbers may thus not be representative of the private sector at large

is negative on average across years, indicating the expansion of market share of less productive firms.

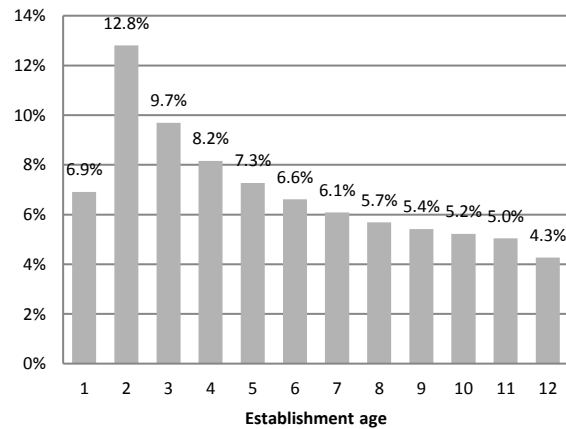
29. **Most formal firm entry is by micro firms, which grow fast the second year and grow slowly thereafter, or immediately die in their second year.** The average number of employees of plants in their first year is 2.4. Firms experience a high growth rate in second year when mortality rate is also the highest (Figure 26 and Figure 27). After the second year, size of the survived firms continues to increase, but at decreasing rates. Although typical establishment born in the Brazilian formal sector grows almost fivefold in the first 12 years in the firm size, small firms rarely ever become medium or large size firms (Figure 28). In contrast, surviving large firms expand at a steadily rate from year 5 onward.

**Figure 26. Brazilian formal firms are typically born small, grow fast the second year and then grow slowly thereafter**



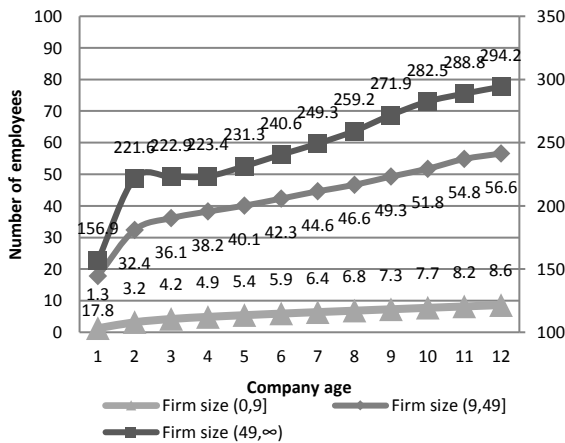
Source: Coelho, Corseuil, and Foguel (2016)

**Figure 27. Mortality rate of firms is also highest the second year**



Source: Coelho, Corseuil, and Foguel (2016)

**Figure 28. Smaller firms at birth grow slower than larger firms**



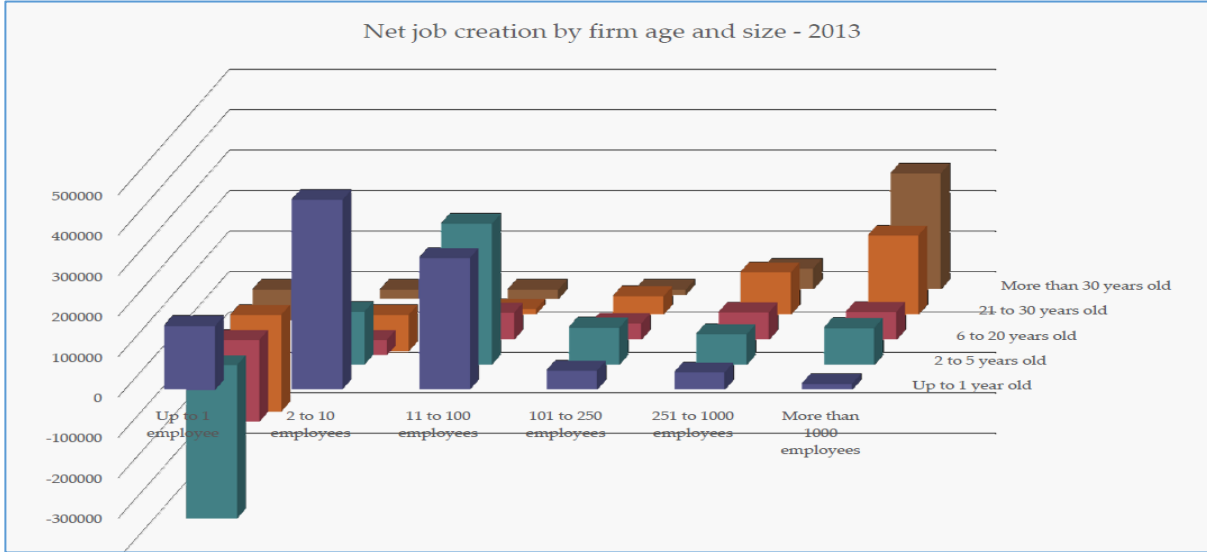
Source: Coelho, Corseuil, and Foguel (2016)

30. **Beyond micro firms, firm dynamics and jobs creation in Brazil's manufacturing and agriculture sectors are characterized by extremely high firm survival rates.** The permanence of firms in the same size category is high—in other words firms' growth is extremely constrained—and large old firms dominate the market, based on firm entry, exit and employment data from 2004 to 2013 (Silva, Maciente and Gukovas, 2015). Very large firms (with more than 1000 workers) consistently account for more than 35 percent of all jobs, even though they represent only 0.16 percent of all firms. Most jobs are in older firms (aged 20+) (60 percent), although young firms (aged 5-10) gained employment share vis a vis mature firms (aged 10-20) since 2007. The construction and trade sector gained employment share while manufacturing and agriculture loss, but no other major pattern of structural change occurred. Employment share of exporters decreased, especially among small exporters. Employment shares of high, medium and low skill firms remained fairly stable. "Old and large" and "new" (<1yr) firms account for most net job creation and there is very few firm entry at large scale. Small and young firms had negative net job creation, however, as these firms mostly die very young. The share on net job creation of very large and old firms remains remarkably constant through time. The large (with more than 1000 workers) and old (30+yrs) and "high employment growth" (20%+) firms operate mostly in construction and manufacturing (and are a total of 154 firms).

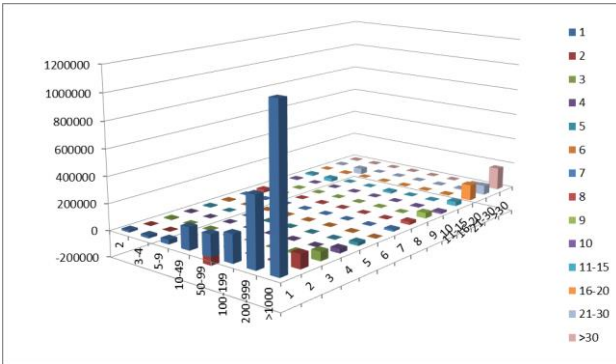
31. **High entry rate driven by small firms contributes to slow productivity growth.** An international comparison of jobs creation by firm size and age further highlights the same limitations with firm dynamics in Brazil. The pattern of new firm entry and jobs creation appears focused on small firms in Brazil, while it is driven by medium and larger firms in other countries (Figure 29). In Germany medium and large firms grow for several years, and some of the more established firms also continue to grow. In Brazil the main source of jobs creation is from very old and established firms. This is similar to Morocco where large firms continue to grow steadily after entry—a pattern which is associated with strong political connections to the country's establishment however and not necessarily linked to firms' productivity. The fact that most of new firms are small, likely entered into market by necessity instead of real entrepreneurship, could be contributing to overall low productivity growth as it drains resources to unproductive investment and results in high exit rate of infant firms.

**Figure 29. Net job creation by firm age and size in Brazil and selected countries (2013)**

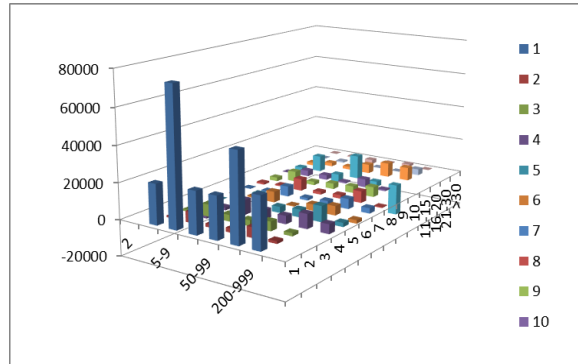
Brazil



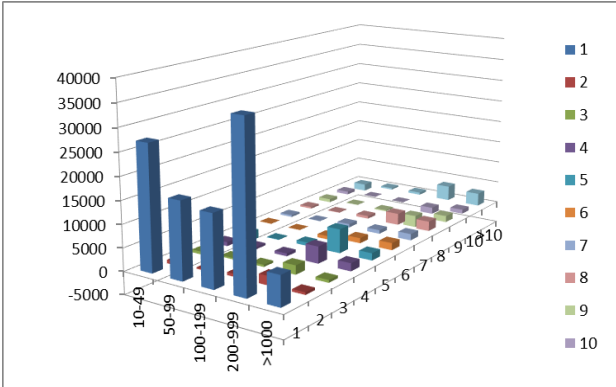
Germany



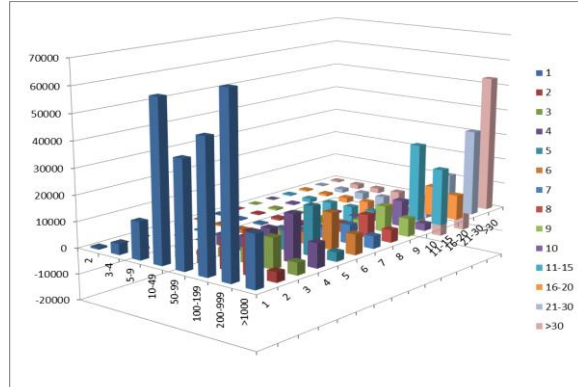
Czech Republic



Chile



Morocco



Source Brazil: Silva, J., Maciente A., and Gukovas R. (2015). "Employment growth, skill use and labor productivity in Brazil." World Bank, mimeo.

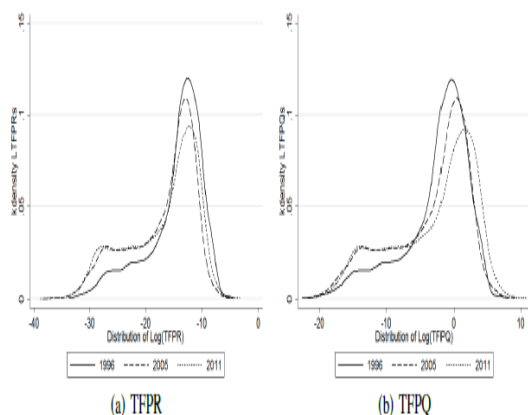
Source Germany, Chile, Czech Republic and Morocco: Hallward-Driemeier and Reyes (2014).

## Large TFP dispersion suggests presence of misallocation of resources

32. **TFP dispersion is high and asymmetric in manufacturing with a fat tail on lower TFP, suggesting the existence of barriers to exit and competition.**level (Figure 30). There are two facts that suggest the presence of misallocation of resources at the firm level. Firstly, the more disperse TFP, the greater can be the misallocation. This is because high dispersion implies that some firms are more able to produce output with the same amount of inputs. Secondly, the median is greater than the average implies that TFP distribution is asymmetric. The distribution of the logarithm of TFP in manufacturing sector for 1996, 2005 and 2011 shows that dispersion is relatively high in each time period (Figure 30). Furthermore, the figure shows that the distribution becomes more dispersed through time, with more firms dropping into the low TFP zone—that is suggesting that the problem is increasing over time. It is reasonable to assume that this large number of unproductive firms survive thanks to various uncompetitive practices, such as barriers to competition from other firms, privileged access to government contracts, access to subsidized credit, ad hoc tax exemptions and other financial incentives from public programs.

33. **Although the dispersion level is comparable to other LAC countries, there is a larger fat tail on lower TFP in Brazil relative to peers, again suggesting problems in the competitive environment.** An analysis of various measures of dispersion of total factor productivity (namely (a) the difference between the 90<sup>th</sup> and the 10<sup>th</sup> percentile, (b) the inter-quartile range and (c) the standard deviation, highlight that relative to other LAC countries), highlights that Brazil display higher productivity dispersion when looking at the difference between productivity of the 90<sup>th</sup> and the 10<sup>th</sup> percentile firms than the US, but lower than Colombia and at par with Mexico. However, the inter-quartile range in Brazil is the lowest among comparators suggesting the presence of fat tail on the lower TFP zone, consistent with the TFP dispersion (Figure 31).

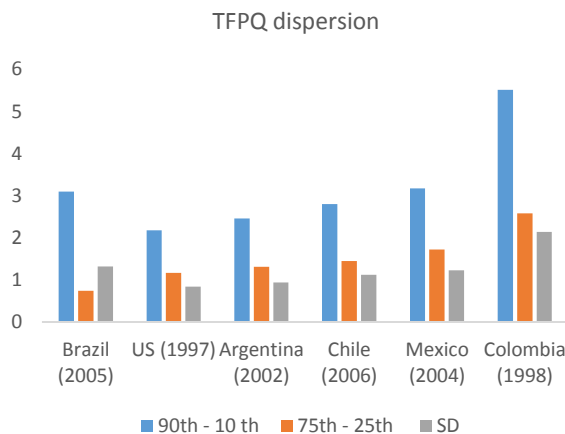
**Figure 30. TFP dispersion is high and asymmetric in manufacturing with a large mass in low TFP**



Note: This figure shows distribution of real TFP (TFPR) and nominal TFP (TFPQ).

Source: Vasconcelos (2017)

**Figure 31. But dispersion level is comparable to other LAC countries**



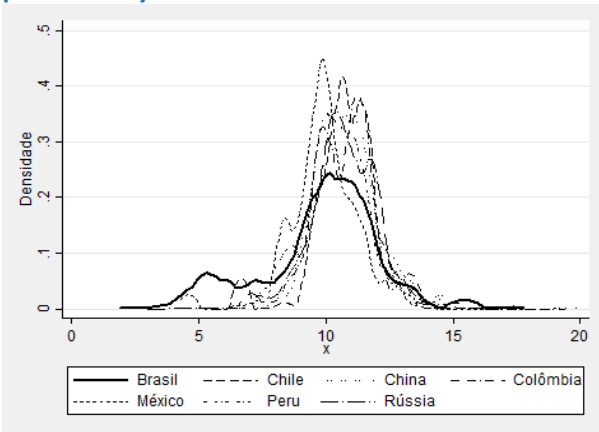
Source: Busso, Madrigal and Pages (2013)

34. **An international comparison of firms' productivity distributions confirms a strong concentration of low productivity companies and a lower concentration of firms with average productivity in Brazil compared to other countries.** Using Enterprise Survey data, Barbosa Filho and Correa (2017) show that the distribution of Brazilian companies has more "heavy" tails

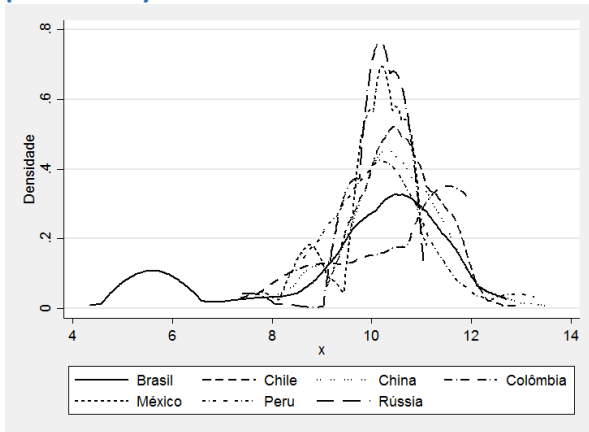


than other countries, especially in low productivity companies, but also in those with higher productivity, as shown by the peak in the upper tail of the sample density function (Figure 32). That is, the other countries have a more concentrated distribution of companies around average productivity. This fact seems to indicate that Brazil concentrates companies of low productivity in relation to similar countries. In addition, the dispersion of productivity presented in Brazil is the largest among the countries analyzed. The high dispersion observed in Brazil, associated with the concentration of companies with low productivity reduces the average productivity of the economy. The existence of some level of dispersion (heterogeneity) among firms is not only expected, but the result of mechanisms associated with the differentiation of product, market (geographic) and the selection process, in which companies evolve over time in a different way. However, the dispersions shown in Figure 30 are very large, indicating the existence of mechanisms which undermine competition and thereby enable low productivity firms to remain active, at the expense of higher productivity firms. Disaggregating the data at the sectoral level shows that the problem affects most sectors of the economy, albeit to different extents (Figure 32).

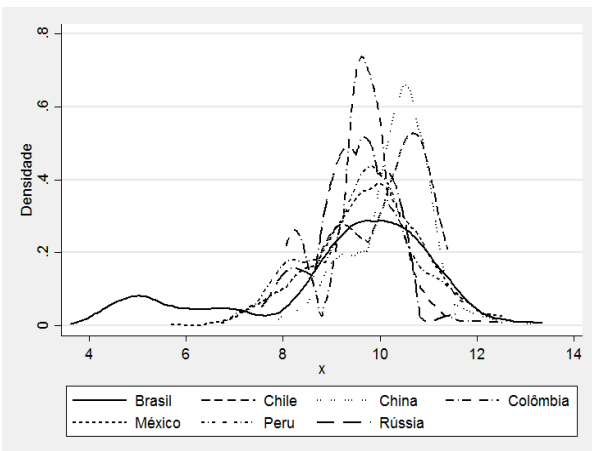
**Figure 32.a: Distribution of LN of labor productivity**



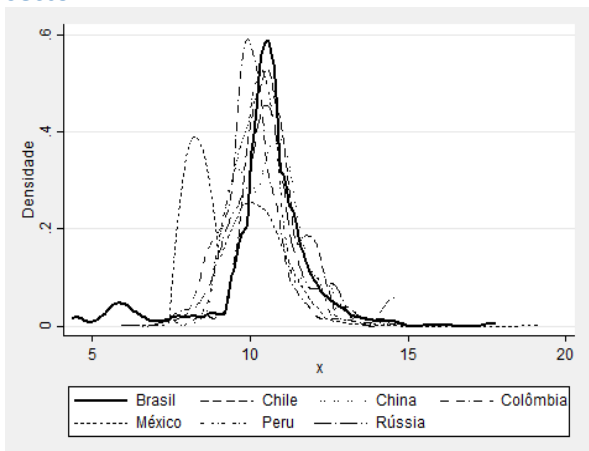
**Figure 32.b: Distribution of LN of labor productivity in the textile sector**



**Figure 32.c: Distribution of LN of labor productivity in the clothing sector**

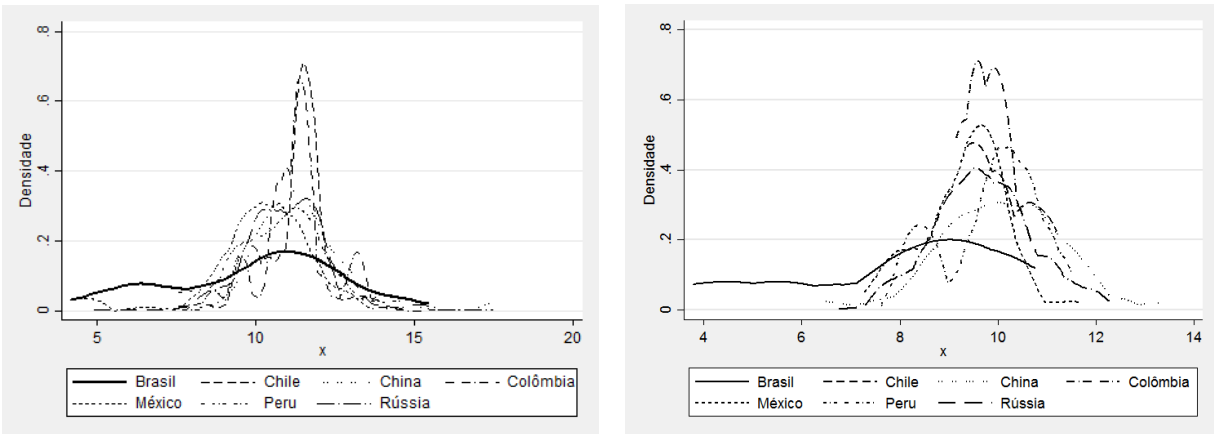


**Figure 32.d: Distribution of the LN of labor productivity in the machinery and metallurgy sector**



**Figure 32.e: Distribution of LN of labor productivity in the commerce sector**

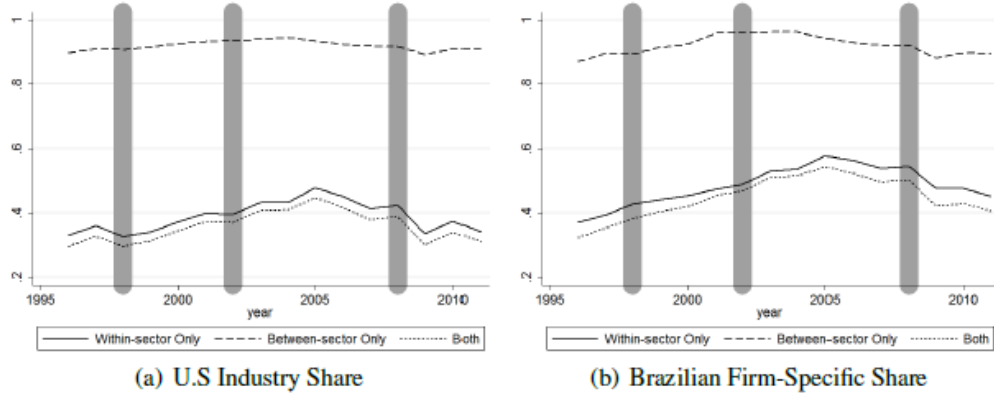
**Figure 32.f: Distribution of the LN of labor productivity in the hotel and restaurant sector**



Source: Barbosa Filho and Correa (2017), based on WBES data.

35. **The source of misallocation comes from within sector.** An analysis of the sources of misallocation at the firm level highlights that misallocation originates largely within-sector. Figure 33 shows the difference between the aggregate manufacturing product and the product implied by the efficient allocation using US industry shares and Brazil firm shares. When using US industry shares, it assumes that all firms within-sector have the same factor intensities of US industries and that any differences in factor expenditures reflect distortions. The line labeled “within-sector only” shows actual output divided the output if resources were allocated optimally within sector. The line labeled “between-sector only” shows the output ratio that could be attained if resources were allocated optimally across sector. And the line labeled “both” shows actual output divided by the output that could be attained if resources were allocated optimally across all firms. The dominant source of misallocation originates from within-sector as the ratio is lower than between-sector’s. In addition, the within-sector effect varies more over time than the between sector effect. In 2005, the year of lowest misallocation, the product is 44.7 percent farther from the potential output when using US industry share, and 54.3 percent when using Brazilian firms’ shares. This implies that an efficient allocation of inputs will double the aggregate output in 2005.

**Figure 33. Misallocation reflects the dynamic effect of the within-industry allocation**

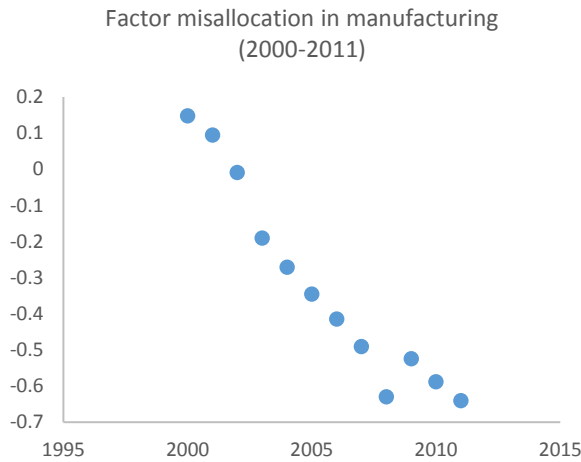


Note: Gray lines indicate global economic crisis. This figure shows the evolution of allocation efficiency over time. The line labeled *Within-Industry Only* shows actual output divided the output that could be attained if resources were allocated optimally within industry. The line labeled *Between-Industry Only* shows the ratio of the output that could be attained if resources were allocated optimally in each industry and across all firms, respectively. The line labeled *Both* shows actual output divided by the output that could be attained if resources were allocated across all firms.

Source: Vasconcelos (2015)

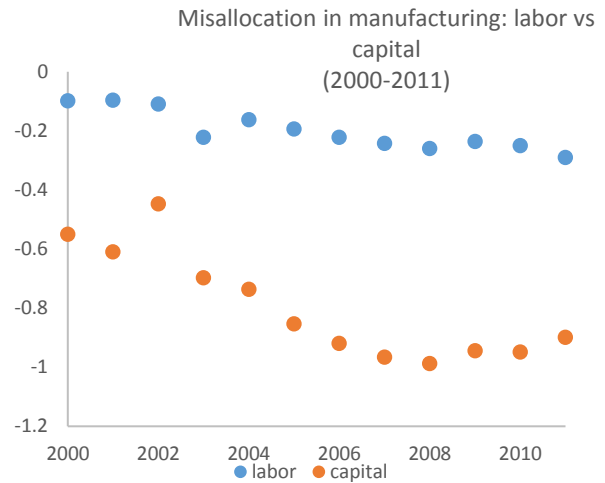
Note: Grey lines indicate three shocks which occurred during the period: the Asian financial crisis reduced the availability of capital in the Brazilian economy, which had a recent stabilization of inflation and a regime of fixed exchange rates; the second crisis was a domestic crisis in 2002 caused by uncertainties in the Brazilian political situation; the third was the sub-prime crisis of 2008-2009.

**Figure 34. Factor misallocation has been increasing over time**



Source: Vasconcelos (2017)

**Figure 35. Capital misallocation substantially larger than labor misallocation**

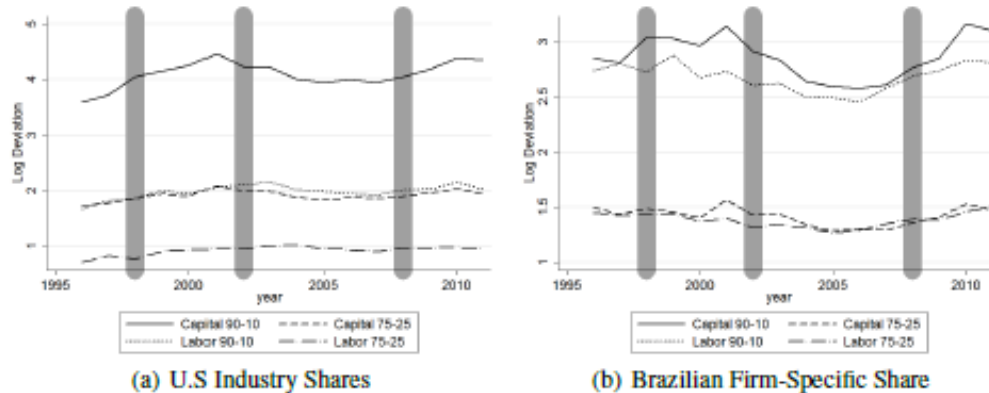


Source: Busso, Madrigal and Pages (2013)

**36. Misallocation has been increasing over time with capital misallocation substantially larger than labor misallocation.** The overall misallocation of factors of production in

manufacturing has increased greatly from 2000 to 2011 (Figure 34).<sup>11</sup> Furthermore, when decomposing misallocation into capital and labor misallocation, it shows that capital misallocation is three to five times larger than labor misallocation (Figure 35).<sup>12</sup> While the gap has been closing slowly since 2000, it remains substantial. The results is consistent with earlier findings. Figure 36 shows the dynamics of input wedges between 90<sup>th</sup> and 10<sup>th</sup> percentiles and between 75<sup>th</sup> and 25<sup>th</sup> percentiles of the respective distributions among firms for capital and for labor using US and Brazilian firm-specific shares . The dispersion, measured as ratios of 90<sup>th</sup> and 10<sup>th</sup> percentiles for example, is larger for capital than for labor, suggesting capital misallocation is larger in the Brazilian manufacturing sector. Although when using Brazilian firm specific shares, the difference between capital and labor dispersions is much smaller, the capital wedge is still larger than labor's. In line with the discussion in Section II (and Chapter 3), this pattern could be the result of policy distortions in the financial markets.

**Figure 36. Productivity wedge between 90<sup>th</sup> and 10<sup>th</sup> percentile firm is substantially larger for capital than for labor**



Note: Gray lines indicate global economic crisis. For each year, this figure shows a measure of dispersion of capital and labor wedges, the log deviations between the 90th and 10th percentiles and between the 75th and 25th percentiles of the respective distributions among firms in the sample, from 1996-2011. The capital and labor wedges for firm  $i$  are  $\frac{P_{it} Y_{it} / K_{it}}{P_{it} Y_{it} / K_{it}}$  and  $\frac{P_{it} Y_{it} / L_{it}}{P_{it} Y_{it} / L_{it}}$ , respectively.

Source: Vasconcelos (2017)

Note: Grey lines indicate three shocks which occurred during the period: the Asian financial crisis reduced the availability of capital in the Brazilian economy, which had a recent stabilization of inflation and a regime of fixed exchange rates; the second crisis was a domestic crisis in 2002 caused by uncertainties in the Brazilian political situation; the third was the sub-prime crisis of 2008-2009.

**37. Overall the analysis of firm dynamics signals the existence of significant market distortions.** The productivity distribution of Brazilian firms is characterized by large dispersion, with an unusually large lower tail—indicating that unproductive firms are able to survive in the market, presumably thanks to policies which support them. Within-firm productivity growth dominates over between-firm productivity dynamics, suggesting room for productivity growth

<sup>11</sup> The misallocation measure is the allocative component of the Olley Pakes (1996) decomposition. That is the difference in the output-weighted mean productivity (TFPF) and the average TFPR. When it is negative it means that technical efficiency (simple mean) is higher than aggregate productivity (weighted mean).

<sup>12</sup> Following Duranton et. al (2015) method for the decomposition.

through factor reallocation. There is also evidence of large within-firm capital (or credit) misallocation.

#### IV. Concluding Remarks

38. **This chapter highlights that the Brazilian economy is characterized by significant distortions which hamper productivity growth.** At the aggregate level, it is clear that Brazil's growth over the past two decades has been led by factor accumulation, notably labor, while productivity growth has been very weak. Structural shifts in employment from agriculture to services, which is a more productive sector, have positively contributed to overall labor productivity growth. This has been accompanied by a significant expansion in services which absorbed large part of the demographic increase and increased levels of employment and participation. The contribution of capital, as reflected in levels of investment, has also been limited.

39. **Most of the economy appears to be paralyzed, in stagnant productivity.** In terms of sectoral performance, agriculture productivity growth has been highest, but its level is still lower than other sectors, and given its relatively small share in the economy, its impact in overall productivity will be limited. Within the services sector, there has been a significant productivity growth in business services (notably financial services) and transport and telecommunications. There is a question as to whether the expansion in these sectors does not in fact reflect rents extraction resulting from limited competition. Nevertheless, what is also noteworthy is that the rest of the economy appears to be paralyzed, in stagnant productivity. Since the demographic boom is near exhausted then there is not likely to be space to continue this pattern of growth. Further, looking forward, it seems reasonable to expect slower sectoral reallocation (of labor from agriculture to services/manufacturing) given that the employment share in agriculture almost halved between 1996 and 2014. Hence it is urgent for Brazil to tackle the barriers to faster productivity growth.

40. **Firm-level analysis confirms the productivity problem, and highlights the existence of significant distortions that hamper the operation of Schumpeterian creative destruction.** Productivity distribution across firms is characterized by large TFP dispersion, especially among less productive firms, suggesting a lack of creative destruction. Within-firm productivity growth dominates over between-firm productivity dynamics, suggesting room for productivity growth through factor reallocation. And there is large within-sector TFP dispersion despite relatively little evidence labor misallocation, suggesting large capital (or credit) misallocation.

41. **The macro- and micro-level analyses suggest that low productivity growth results mainly from barriers to competition, including a highly-distorted policy environment and limited trade integration, as well as financial market distortions.** The findings of the analysis are consistent with the characteristics of Brazil's policy environment which undermine competition, instead of fostering it—thereby undermining the growth of more productive firms. The findings also seem to be associated with existing distortions in financial markets—which limit the level of investment and also distort the allocation to suboptimal projects, and possibly result in abnormal profits for the financial sector—and also by an environment which does not favor competition, resulting in the survival of low productivity firms at the expense of the growth of more productive ones. In addition, managerial quality, incentives to innovate, low quality of education, labor market programs incentivizing high job turnover, and an environment not

conducive to innovation and connectivity with the global economy all have played a role to further reduce productivity. The persistence of poorly-run firms is evidence of insufficient market competition, insufficient management training (education shortfalls), and inappropriate ownership structures (family-owned and managed firms are more poorly managed than family firms with an external CEO). All of these areas are susceptible to horizontal neutral policies across firms, in contrast to the prevalent non-neutral industrial policies utilized in Brazil. In the following chapters, specific productivity drivers – and associated policy levers – will be examined in greater detail.

## V. References

- Aghion P.; Bircan C. (2017). “The Middle Income Trap from a Schumpeterian Perspective”. Institute of Global Affairs research paper series 01/2017.
- Barbosa Filho, F. H. ; Correa, P. (2017). Distribuição de produtividade do trabalho entre as empresas e produtividade do trabalho agregada no Brasil. In: Regis Bonelli, Fernando Veloso e Armando Castelar Pinheiro. (Org.). *A Anatomia da Produtividade no Brasil*. 1ed. Rio de Janeiro: Elsevier, 2017, v. 1, p. 109-142.
- Barbosa Filho, F. and Veloso, F. (2016). “A Contribuição da Formalização para a Elevação da Produtividade do Trabalho no Brasil nos Anos 2000: Uma Análise Exploratória”. In: Barbosa Filho, F., Ulyseia, G. And Veloso, F (orgs.). *Causas e Consequências da Informalidade no Brasil*. Editora Elsevier, p. 303-325.
- Bastos, Paulo and Joana Silva. (2017). “The origins of high-growth firms: evidence from Brazil.” Mimeo, World Bank, Washington DC
- Bazzi, Samuel, Marc-Andreas Muendler and Lindsey Rickey. (2014). “Sources of Labor Productivity Changes in Brazil.” Mimeo, June.
- Caselli, Francesco. (2016). “The Latin American Efficiency Gap.” In *Understanding Latin America and the Caribbean’s Income Gap*, edited by J. Araujo, M. Clavijo, E. Vostroknutova, and K. Wacker. Washington, DC: World Bank.
- Cirera, Xavier; Maloney, William F.. 2017. *The Innovation Paradox : Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up*. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/28341> License: CC BY 3.0 IGO.”
- Dani Rodrik, 2016. "Premature deindustrialization," *Journal of Economic Growth*, Springer, vol. 21(1), pages 1-33, March.
- Dani Rodrik, 2013. "Unconditional Convergence in Manufacturing," *The Quarterly Journal of Economics*, Oxford University Press, vol. 128(1), pages 165-204.

De Vries, Gaaitzen J. (2014). "Productivity in a Distorted Market: The Case of Brazil's Retail Sector." *The Review of Income and Wealth* 60 (3): 499-524.

Easterly W., Levin R., 2001. "What have we learned from a decade of empirical research on growth? It's Not Factor Accumulation: Stylized Facts and Growth Models". *The World Bank Economic Review*, Volume 15, Issue 2, 1 August 2001, Pages 177–219, <https://doi.org/10.1093/wber/15.2.177>

Edmar Lisboa Bacha & Regis Bonelli, 2015. "Accounting for Brazil's Growth Experience – 1940-2002," Discussion Papers 0128, Instituto de Pesquisa Econômica Aplicada - IPEA.

Duranton, Gilles; Ghani, Ejaz; Grover, Arti Goswami; Kerr, William Robert. 2015. The misallocation of land and other factors of production in India (English). Policy Research working paper; no. WPS 7221. Washington, D.C. World Bank Group.

Ferreira, P.; Veloso, F. (2013), "O Desenvolvimento Econômico Brasileiro no Pós-Guerra", In: Veloso, F.; Ferreira, P.; Giambiagi, F.; Pessôa, S. (Orgs.). *Desenvolvimento Econômico: Uma Perspectiva Brasileira*. Rio de Janeiro: Campus/Elsevier, p. 129-165.

Ferreira, Pedro Cavalcanti & Pessôa, Samuel de Abreu & Veloso, Fernando A., 2011. "On the evolution of TFP in Latin America," FGV/EPGE Economics Working Papers (Ensaios Economicos da EPGE) 723, FGV/EPGE - Escola Brasileira de Economia e Finanças, Getulio Vargas Foundation (Brazil).

Haltiwanger, J.C., Jarmin, R.S., Miranda, J. (2013). "Who Creates Jobs? Small versus Large versus Young" *Review of Economics and Statistics*, Vol. 95, No. 2, Pages 347-361.

Hallward-Driemeier, M. and Reyes A. (2014). "Firm Dynamics and Job Creation: Are Gazelles Born or Made?" World Bank, mimeo.

Haskel J, Goodridge P, Pesole A, Dal Borgo Met al., 2011, *Productivity and growth in UK industries: an intangible investment approach*, Publisher: Imperial College Business School.

Lichtenberg, Frank R., 2014. "The impact of pharmaceutical innovation on longevity and medical expenditure in France, 2000–2009," *Economics & Human Biology*, Elsevier, vol. 13(C), pages 107-127.

Maciente, Aguinaldo, Joana Silva, and Renata Gukovas. 2015. "Employment Creation, Labor Productivity, and Firms' Dynamics." background paper for *Sustaining Employment and Wage Gains in Brazil*, World Bank, Washington, DC.

Margaret S. Mcmillan, Dani Rodrik. (2011) *Globalization, Structural Change and Productivity Growth*. NBER Working Paper No. 17143. Issued in June 2011

OECD, 2018: *Economic Survey of Brazil*. OECD, Paris.

Olley, G. S., and A. Pakes. 1996. The dynamics of productivity in the telecommunications equipment industry. *Econometrica* 64: 1263–1297.

Paul R. Krugman, (1994). “The Age of Diminished Expectations” MIT Press Cambridge.

Schiffbauer M., Sahnoun H., and Araujo J. (2016) “Structural Change in Latin America: Does the Allocation of Resources across Sectors, Products, and Technologies Explain the Region’s Slow Productivity Growth?” *Understanding the Income and Efficiency Gap in Latin America and the Caribbean* Published: March 2016 World Bank. Pages: 73 – 115

Vasconcelos, Rafael da Silva (2017). “Misallocation in the Brazilian Manufacturing Sector.”. *Brazilian Review of Econometrics*, Vol 37, No 2. Available at <http://dx.doi.org/10.12660/bre.v37n22017.61801>

Veloso, F., Matos, S.; Ferreira, P.; Coelho, B. (2017). “O Brasil Em Comparações Internacionais De Produtividade: Uma Análise Setorial”. In: Bonelli, R; Veloso, F., Pinheiro, A. (Orgs.). *Anatomia Da Produtividade No Brasil*. Rio De Janeiro: Elsevier, P. 63-107.

Veloso, F., Matos, S.; Ferreira, P.; Coelho, B. (2017). “O Brasil em Comparações Internacionais de Produtividade: Uma Análise Setorial”. In: Bonelli, R; Veloso, F., Pinheiro, A. (Orgs.). *Anatomia da Produtividade no Brasil*. Rio de Janeiro: Elsevier, p. 63-107.