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Working Paper

Structural changes in Brazilian employment (2002-2021)

JRC Working Papers Series on Labour, Education and Technology, No. 2023/01

Provided in Cooperation with:

Joint Research Centre (JRC), European Commission

Suggested Citation: Rodrigues-Silveira, Rodrigo (2023) : Structural changes in Brazilian employment (2002-2021), JRC Working Papers Series on Labour, Education and Technology, No. 2023/01, European Commission, Joint Research Centre (JRC), Seville

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JRC Technical Report

Structural Changes in Brazilian Employment (2002-2021)

JRC Working Papers Series on
Labour, Education and Technology
2023/01

Rodrigo Rodrigues-Silveira

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JRC132269

Seville: European Commission, 2023

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How to cite this report: Rodrigues-Silveira, R, *Structural Changes in Brazilian Employment (2002-2021)*, JRC Working Papers on Labour, Education and Technology 2023/01, European Commission, Seville, 2023, JRC132269.

Structural Changes in Brazilian Employment (2002-2021)

Rodrigo Rodrigues-Silveira (University of Salamanca)

Abstract

The current paper explores the structural changes in employment in Brazil during the period comprehended between 2002 and 2021, subdivided into three sub-periods: 2002-2014, sustained growth and expansion; 2015-2019, political and economic crises; and 2019-2021, the COVID-19 pandemics and its impacts on the labor market. It employs the “jobs approach” (Fernández-Macías 2012; CEA 1996; Wright and Dwyer 2003) to empirically assess the changes during the period considering wage as the fundamental measure of job quality. The Brazilian National Household Survey (PNAD), administered by the IBGE (Brazilian Statistical Office) since 1976, constitutes the core data source. According to the analysis, since the beginning of the 21st century, Brazil has experienced an upgrading in its employment structure. Even considering the macroeconomic and political crises starting in 2015, the advancements observed from 2002 to 2014 were not reverted.

Keywords: Brazilian Labor Market, Structural Change in Employment, Job Quality, Division of Labor

Joint Research Centre reference number: JRC132269

Related publications and reports:

Torrejón Pérez, S., Hurley, J., Fernández-Macías, E. and Staffa, E., Employment shifts in Europe from 1997 to 2021: from job upgrading to polarisation, JRC Working Papers on Labour, Education and Technology, European Commission, Seville, forthcoming.

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Executive summary

The present paper explores the structural changes in employment in Brazil during the period comprehended between 2002 and 2021, divided into three sub-periods. During the first interval (2002-2014), there was a recognizable pattern of mid-upgrading. The advancements are observed for both males and females, increased levels of education, all age groups, and both rural and urban. It was a time of higher formality in labor relations as well. There was a visible contraction in the participation of the less educated and the economy's informal sector. Unemployment was also drastically reduced.

From 2015 to 2019, the pattern changed towards middling. The leading associated factors were political instability and economic crisis. The white, young, rural residents and the formal employment were those who experienced most employment losses. Unemployment jumped to a two-digit level. The increase in the middle quintiles represented a partial drawback from the gains obtained in the preceding period.

During the COVID-19 years, the pattern of mid-upgrading reappeared. Nonetheless, the level of change was much lower, around 1%.

Despite the change from mid-upgrading to middling due to macroeconomic and political crises, the advancements observed from 2002 to 2014 were not reverted.

Policy implications

- During the period analyzed (2002-2021), intervals of economic growth combined with an increasingly educated workforce led to upgrading in the employment structure.
- Both political and economic cycles affect employment structure. Even in economic crisis contexts, policy decisions can enhance job quality or avoid further deterioration.
- COVID-19 had only marginal effects on the overall labor market structure. Macroeconomic and labor market policies were the significant drivers of change.

1 Introduction

There is a solid consensus on the role of labor markets as one of the major sources of welfare in contemporary societies both in developed and developing countries (Titmuss 1958; Castles 2008; Flora and Alber 1981; Powell and Barrientos 2004; Huber and Stephens 2005; Iversen 2005; Segura-Ubierno 2007; Riesco 2007; Ebbinghaus and Manow 2001; Rudra 2007; Haggard and Kaufman 2008; Pierson 2001; Wilensky 1975; Barrientos 2004; Barr 1998; Ashford 1986; Arts and Gelissen 2001; Briggs 2008; Esping-Andersen 1990; Gough and Wood 2004; Wood 2004; Rosanvallon 2000). The position of individuals in the employment structure, alongside institutions and redistributive policies, define their access to goods and services. Besides, better jobs also refer to a broader range of entitlements and social benefits. Therefore, the quality of work is vital to assess the levels of protection and security experienced by citizens of any particular society.

A core feature of employment structure in the long run is its volatility (although crises are able to accelerate this phenomenon). Economic or political crises, technological changes, and adopting new managerial practices alter previous equilibria and generate new trends in the overall organization of work. The literature (Wright and Dwyer 2003; Goos, Manning, and Salomons 2009; Bárány and Siegel 2018; Fernández-Macías 2012; Fernández-Macías and Hurley 2017; Henning and Eriksson 2021; Pérez and Vázquez 2021) identifies four significant patterns of labor market transformation. In the first, *polarization*, workers tend to either move to low-skilled, low-productivity sectors (especially personal services) or high-level services jobs requiring expert training, skills, and education. Traditional sectors placed in the middle, such as manufacturing, suffer from a steady reduction in their relative position in the labor market. The second, *upgrading*, manifests as a general movement toward higher-quality jobs. Taking into account that employment is the main source of welfare, an upgrade in labor quality could (although not necessarily it is always the case) enhance welfare, extending coverage of benefits to more people or promoting a better scenario in terms of working conditions. This phenomenon is usually related to multiple causes. Furthermore, the "paradox of development" shows that the increase in the level of education has been unequalizing at least in Latin America (composition effect, not return effect). The third, *middling*, can be conceived as the opposite of job polarization, and consists of the reduction or slower growth of the extremes. Finally, *downgrading* represents a displacement towards careers with lower qualifications and efficiency.

The present paper explores the changes observed in the Brazilian labor market in the last two decades (2002-2021). It employs the "jobs approach" (Fernández-Macías 2012; CEA 1996; Wright and Dwyer 2003) to empirically assess the changes during the period considering wage as the fundamental measure of job quality. The Brazilian National Household Survey (PNAD), administered by the IBGE (Brazilian Statistical Office) since 1976, constitutes the core data source.¹ During most of this period, especially in the Workers' Party (PT, in its Portuguese acronym) administrations (2003-2015), Brazil experienced constant reductions in inequality and sustained economic growth (Barros, Cury, and Ulyssea 2009; Paes de Barros, Franco, and Mendonça 2007; Néri 2007; Arretche 2018; Cardoso 2022). The political crisis ending in the impeachment of President Dilma Rousseff in 2015, and the economic downfall experienced in the aftermath, triggered unemployment and deepened the already ongoing process of deindustrialization.

Our goal is to determine if the social and economic gains have been converted into more systemic transformations in the labor market and how the recent turmoil affected the employment structure, that is, the distribution of workers into jobs. In general terms, the results show a mid-upgrading during the period comprehended between 2002 and 2014. Such development was possible due to sustained economic growth, technological improvements in production, and increased education among

¹ Due to compatibility reasons, we selected only those surveys collected after 2001. In 2002 the PNAD Survey adopted occupation and activity classifications compatible with ISCO-88 and ISIC rev. 4. These codings are still used for all the series and allow full comparability.

workers. Nonetheless, in the next sub-period (2014-2019), political and economic crises led to higher unemployment and a more marked employment growth in mid-paid jobs, a pattern also observed during the COVID-19 years (although in the last sub-period the growth was slightly more biased towards best-paid jobs).

This paper is structured in six sections. This introduction is followed by a brief narrative about the evolution of the Brazilian economy since 2002. The third section describes in detail the core concepts, data, and methodology used in the analyses. The fourth part explores the general changes in employment for all workers from 2002 to 2019 and decomposes them into selected dimensions. The COVID-19 impacts were also considered separately (2019-2021) to shed some light on the impact of the pandemics on employment. The fifth part performs regression analysis to determine the changes in the regression-based conditional probabilities for belonging to a given job quality group. The last section draws some conclusions based on the observed results.

2 Employment dynamics in Brazil

The analysis of structural changes in employment in Brazil using the approach proposed in the present paper is still in its beginnings. Despite the limited number of works on the matter, it was possible to map some key contributions employing the same methodology or similar variations to explore and understand the changes in the employment structure in the country. Most of these studies focus on the effects of labor market transformations on income inequality (Machado 2017; Figueirêdo, Silva Netto Junior, and Porto Junior 2007; Carvalhaes et al. 2014). Nonetheless, they provide valuable hints to contextualize the results presented in the following sections.

The interpretations of the changes observed between 2002 and 2021 are varied and often contradictory. Some studies, such as the ones from Machado (2017, 16) and Figueiredo et al. (2007), for instance, find supporting evidence for polarization in the labor market between 2000 and 2010 in Brazil. Both papers attribute the expansion of the service sector in both extremes of the income distribution as responsible for this pattern. They echo a previous study covering the 1990s (Cardoso Jr 1999, 7), which argued that the expansion of the tertiary was the result of a combination of three significant factors: the rapid urbanization, deindustrialization due to the neoliberal reforms in the national economy, and the downgrading in agriculture. This scenario, more consistent with upgrading than polarization, is also identified by other researchers, such as Baltar (2020), who emphasizes an upgrading or mid-upgrading from the period between 2002 and 2014. According to the author, some polarization was only observed from 2014 to 2019 when a series of political and economic crises hit Brazil (Baltar 2020, 6).

Carvalhaes et al. (2014) employ the same methodology adopted in the current study (Fernández-Macías 2012; CEA 1996; Wright and Dwyer 2003) to assess income inequality from 2002 to 2012. As already mentioned, their purpose was not to understand changes in employment structure but to use the method as a measure of how income inequality changed over time. Their results are, in part, coherent with the patterns observed in the current study. They found an upgrading from 2002 to 2008 and a mid-upgrading from 2008 to 2012. Nonetheless, from 2002-2021, the trend was one of upgrading. The study of Prates et al. (2013) for the São Paulo Metropolitan Region reinforces this interpretation. Using census data from 1991, 2000, and 2010, they found polarization between 1991 and 2000 and a mid-upgrading between 2000 and 2010.

Baltar (2020) also employed a similar strategy to the “jobs approach” to understand the changes in the Brazilian labor market from 2014 to 2019. Her methodology combines 3-digit occupation, the position in the occupation (formal, informal, unemployed, private or public), and the primary activity groups with a total of 3123 combinations. According to her results, domestic services and informal

retail and hired workers are primarily concentrated in the first quintile (Q1), while the public servants and skilled employees with formal contracts dominate the fifth quintile (Q5) (Baltar 2020, 12). Structurally, the changes during the period show a polarization, with the growth of informality, both in Q1 and Q5.

Results in these types of studies are very sensitive to the exact period covered, and to most methodological decisions (such as the variables selected as proxies of job quality, the categories used as units of analysis, or the level of detail of the info on occupations and sectors, among others). However, most of them confirm the results obtained in the present research. The broad patterns of upgrading or mid-upgrading during the first sub-period (2002-2014) are consistent. Nonetheless, they accuse polarization between 2014 and 2019, while our results provide evidence supporting a middling pattern. The differences can be due to methodological choices, including variables treated here as exogenous (informality) being included in job quality measurement, as in Baltar (2020), for instance.

The causes identifying pattern changes during the period are also similar: first, economic growth with the development of social institutions and policies and, later, economic and political crises that led to changes in the labor market structure. In the next section, I will provide a more detailed account of the economic and political context covering the period under scrutiny (2002-2021). This brief introduction will help to contextualize and facilitate the understanding of significant trends and transformations in Brazilian employment in recent years.

3 Brazil: from Inclusive Growth to Economic Turmoil (2002-2021)

The 21st century started with hope in Brazil. In the 1990s, despite many significant crises, the country had controlled inflation and started a promising path towards the consolidation of democracy. Fernando Henrique Cardoso, who governed the country between 1995 and 2002, promoted significant fiscal and social reforms, generating the conditions for sustained growth in the following years. In his two administrations (2003-2006, 2007-2010), Lula kept the policies, initially adopted by Cardoso, of sustained increases in the minimum wage in real terms and controlled inflation. He also vindicated the eradication of hunger and the reduction of extreme poverty. On top of that, external conditions were favorable. During the 2000s, most Latin American countries experienced sustained economic growth due to the increase in the prices of commodities. China replaced the EU (as a block), or the United States as a single country, as the major international trade partner. Oil and mining revenues enhanced the finances and allowed for an expansion in social expenditure. Based on previously adopted and smaller scale Conditional Cash Transfer policies, the *Bolsa Familia* conditional cash transfer program was created in 2003 and represented an important step forward in the fight against poverty in the country.

The unemployment rate dropped from 12.3% in 2003 to 6.7% in 2010 (figure 1). The GDP raised from R\$ 2.9 to R\$ 3.9 Billion. The minimum wage, on the other hand, increased from R\$ 674 to R\$ 1,052, both in real terms. The Gini coefficient dropped from 0.589 to 0.542. These numbers were kept stable also during most part of the Dilma Rousseff's first term (2011-2014). The unemployment kept falling. Nonetheless, trends started to change during this period. GDP growth became stagnant since 2014 and did not return until 2021. The unemployment rate was the most affected, changing from 6.8% in 2014 to 13.5% in 2021 (or 12.1% in 2019, to avoid possible COVID effects).

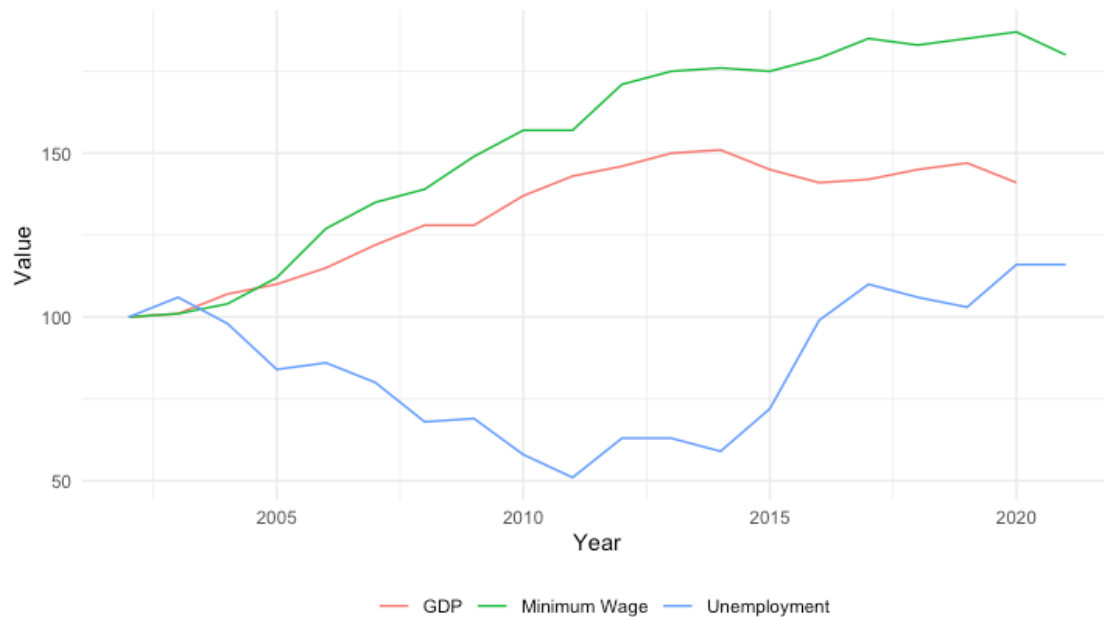
The key question remains: how these recent trends have affected the employment structure? First of all, most previously existing inequalities persist. Although the changes observed between 2002 and 2014 reduced asymmetries, these improvements were marginal when compared to long term patterns. A historical review of the labor market shows a consistent process of deindustrialization and transition to both low-skilled and high-skilled services (Pochmann 2020). The same study also indicates

that the trend of reduction in informality between 1986 and 2014 was reverted in the last years. In 1980, informality represented 14% of the workforce, a number that grew to 19.9% in 2018. Gender gaps are also clearly observed. Men get better positions and earn more than women (Cotrim, Teixeira, and Proni 2020). Some low-paid sectors, such as domestic services, are also highly feminine, which deepens the gender gap (IBGE 2018). The same occurs for urban/rural residents, white/non-white individuals, and the more/less educated (Silveira and Siqueira 2021; Fernandes 2021; Génot 2020).

Figure 1: Brazil: Selected Macroeconomic and Labor Indicators (2002-2021).

Brazil: Selected Macroeconomic Indicators (2002-2021)

Real GDP, Real Minimum Wage, and Unemployment Rate (2002=100)



Sources: IBGE, IpeaData, and the World Bank.

Despite all that, the net wage gap between some of these groups seems to have reduced during the period. In 2002, men earned 42% more than women. In 2014, it was 32%; in 2019, 23% and, in 2021, this proportion dropped to only 21% more. The upgrade was also observed in the levels of education. In 2002, workers with a university degree were 13% of the workforce. In 2014, they became 22% and 29% in 2021. Those in high school also grew significantly: from 37% to 47% in 2014 and 49% in 2021. These changes meant a drop from 49% to 21% of those with primary education or less.

Unfortunately, some figures remain almost unaltered. Women's participation share in the workforce was 41.3% in 2002 and 43.7% in 2012—the same for the income differences and employment levels between white and non-white. In 2012, a white individual earned on average 1.75 times more than a non-white, and in 2021 this figure was 1.74. Regarding unemployment, non-whites stand as 1.5 times more likely to be unemployed than whites. These figures are consistent over the sub-periods under scrutiny here.

These labor indicators (especially unemployment and minimum wage) indicate some improvements in the labor market. Some critical indicators have shown clear enhancements. Nonetheless, not all dimensions experienced amelioration. The racial divide and women's participation in the workforce still lag and have not been affected by the changes observed in other dimensions during the period. The most direct impact on the employment structure comes from the increase in the qualification of the workforce in general. This led to the expansion of skilled jobs in higher quintiles as well as the incorporation of technology in traditional sectors such as agriculture. These number are also key to understand the upgrading or middling patterns observed between 2002 and 2014 and why people

with lower education or blacks were one of the most affected groups by the crisis in the 2014-2019 sub-period.

4 Data and Methods

4.1 Data

The present paper employs the largest household survey held in Brazil since 1976 by the Brazilian Statistical Office (IBGE), the National Household Sample Survey (PNAD). From 1976 to 2015, it was held annually and, since 2016, replaced by a continuous version, collected each month and quarter. This general-purpose survey represents the second larger data-gathering effort in the country after the decennial census. It would be comparable to the European Social Survey or, more precisely, to the American Community Survey. Nevertheless, although not specific to labor markets, it includes various questions on employment structure, informality, income, contracts, and job characteristics.

The period selected for analysis comprehends the years between 2002 and 2021 and three sub-periods: 2002-2014, 2015-2019, and 2019-2021. This election responds to both theoretical and empirical reasons. Theoretically, they correspond to different cycles in Brazilian society: inclusive growth, political turmoil, and the COVID-19 pandemic. Empirically, PNAD suffered a significant methodological reorganization from annual surveys (2002-2015) to monthly data collection (2012-today). Although the classifications adopted for occupations and activities are fully compatible with ISCO-88 and ISIC rev.4 (at two digit-level) for the whole period, the number of jobs varies significantly between the two versions of the inquiry. Therefore, we use annual data for 2002-2014 and quarterly data on the continuous PNAD for the rest (2015, 2019, and 2021).²

Occupations are coded using the Brazilian Classification for Occupations (CBO), and activities employ the second version of the Brazilian Classification of Economic Activities (CNAE). These coding systems are still in use today and, thus, allow for full comparability of results. Besides, the coding is the same for the entire period between 2002 and 2021, with no changes or revisions. The methodological changes that support the sub-perioditization in 2014-2015 are due to new sampling and periodicity of the PNAD, i.e., the transition from annual to quarter surveys and the expansion of the sample. In terms of coverage, the PNAD is representative at the subnational state and metropolitan region levels. This territorial detail enables the spatial decomposition of the results.

Table 1 presents the number of observations (the size of the sample) and jobs for each year and period. The total differs, as can be observed.³ The first interval, 2002 to 2014, shows a yearly average of 150 thousand observations and 1,124 jobs. Due to the change from annual to quarterly surveys, these numbers increase to more than 220 thousand records and 2,000 jobs in the next sub-period (2015-2019). These figures changed only slightly during the COVID-19 (2019-2021) phase.

² We employed the fourth quarter of the year. We also tested for other quarters to check for robustness, and the results did not change significantly.

³ The numbers in table 1 represent only the number of observations, i.e., the size of the sample or the quantity of questionnaires collected by the survey. The total figures for workers will be considered later, in the analysis of the results.

Table 1: PNAD Survey Data.

Period	Year	Obs.	Jobs
2002-2014	2002	151,802	1,124
	2014	159,334	
2015-2019	2015	233,004	2,044
	2019	222,089	
2019-2021	2019	222,498	2,011
	2021	186,669	

Source: IBGE, PNAD.

There are still some methodological remarks to be made. These samples include only registers of workers containing data on the sector of economic activity, occupation, and wage. Observations with missing cases were dismissed. Jobs without correspondence either at the beginning or end of each period were discarded. In any case, their number is low and not capable of affecting the analysis. In order to avoid generating a bias in the analysis, the size (in terms of the number of workers) and the distribution of median wages of these records were checked. They represent less than 0.3% of the total employment for each period, and their wage distribution is similar to the overall samples. The use of imputation was also considered as an alternative to their deletion, but the results would not change.

4.2 Key concepts and their measurement

This section defines the fundamental concepts employed during the analysis for assessing structural changes in employment. According to the “jobs approach”, a **job** corresponds to a specific occupation performed in a concrete economic sector, in this case measured at the two-digit level (Fernández-Macías 2012, 10). The combination of sectors and occupations are considered key to understand major differences in wages and status occupied by workers. For instance, a clerk in the public service in Brazil earns more, enjoys higher stability and social esteem compared to a colleague in the private sector (Kalleberg and Berg 1987; Hartmann et al. 2019). Median wages are used as proxies for **job quality**. It is relatively trivial to assume that better salaries often are related to better qualifications and work conditions. Besides, wage also correlates positively with other job quality indicators. Jobs are classified according to equal-sized groups - in our case, **quintiles** of occupied individuals in the first year of each period under analysis. Once categorized, the changes in the number of people employed in each quintile are examined and compared. Therefore, these employment quality levels constitute the dependent variable under scrutiny in this study.⁴

Additionally, the research includes a set of control variables that allows the decomposition of results according to salient demographic and social processes influencing employment.

Labor informality corresponds to the absence of formal contracts or the level of protection granted by formal jobs such as social security, unemployment, and health benefits. In Brazil, not contributing to Social Security is a valuable proxy for informal work since this is an essential requirement for

⁴ There is more than one method for identifying job quality using groups. We will explore some of them in the methodology section and describe general patterns of change.

eligibility in most social policies related to employment. Our dataset includes formal jobs as a dummy (1 for formal and 0 for informal).

Education attainment, on the other hand, indicates the formal training workers receive. It is a measure of human capital and a proxy for skills. We included three levels: primary school (up to eight years of schooling), high school (eight to twelve years), and university. According to our data sources (described below), in 2021, 22.4% of the Brazilian workforce fall into the first category, 48.9% in the second, and 28.7% in the third. It is clear that the higher the level of education, the higher the possibility of a given worker being located in the upper quintiles. Nonetheless, we are interested in how these proportions change over time. If an upgrade is observed, we expect that the intensity of the association between income and education to be reduced or, at least, that the training requirements for entering the job market will increase.

The type of residence, particularly in **urban** areas, matters for the access to higher-quality jobs. Most positions in the highest quintiles are concentrated in large cities and relate to science, complex services (finance, information technology, or legal, for instance), public administration, and management tasks. Nonetheless, Brazil has experienced a wave of public infrastructure investments and a general modernization of agricultural regions. The result could be an upgrade of jobs both in agriculture and in rural areas.

Sex is another fundamental explanation for individual insertion in the labor market. Women are less paid and have limited opportunities to advance in their careers. Besides these characteristics, most services related to the care and domestic work are predominantly female-based (IBGE 2018). These are low-paid jobs with restricted formal protection. For instance, in Brazil, in 2015, domestic workers were guaranteed the right to social security, minimum wage, unemployment benefits, and contributory pensions (Law nº150, 2015). Supposedly, we could assume that women would be in a higher proportion in the lower quintiles compared to their weight in the overall population.

Age also influences how people enter the labor market. We include here three age tiers: young (up to 29 years old), middle-aged (30 to 49), and experienced (50 or more) workers. They represent different cycles in work life: entrance, career development, and consolidation. The goal is to determine if any given phase behaves differently from the general trend observed for the entire country.

Racism comprises maybe the most critical factor behind social stratification in Brazil. The country's four centuries' history of slavery left deep scars in the social tissue. Unfortunately, **skin color** is a strong predictor of poverty, low levels of education, and low-paid jobs. White citizens are preferred over black and brown in almost all aspects of social life. The inclusion of a dummy indicating whether the worker is white or not helps to clarify if the changes are equally distributed or racially biased.

Finally, we include flags for two economic sectors: **agriculture**, and **manufacturing**. More broadly, Brazil and Latin America have experienced some economic transformations called "the commodity consensus" by the Argentinian sociologist Maristella Svampa (2013). The term refers to the process, observed in almost all countries in the region, of re-primarization of exports (with the corresponding deindustrialization of the labor market) and the adoption of means-tested social protection policies. The purpose here is to examine this argument from the perspective of jobs.

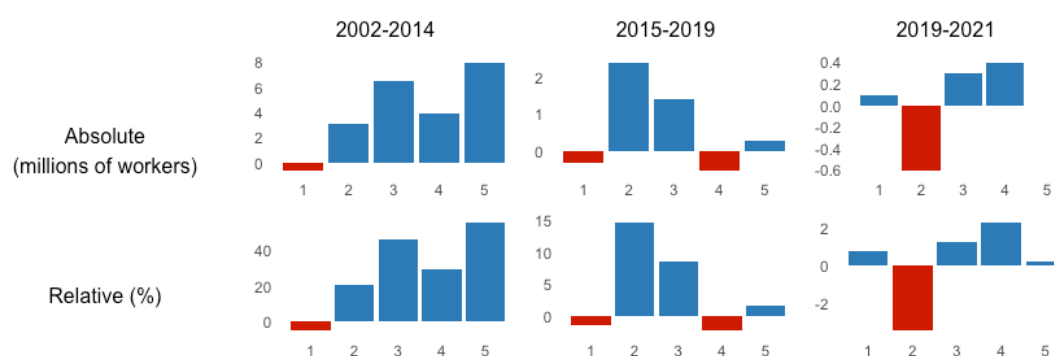
5 Trends in Employment Change (2002-2021)

5.1 General trends

The period between 2002 and 2021 follows a path coherent with the one expected by the social, economic, and political transformations mentioned above. During the first sub-period (2002-2014), the labor market has experienced mid-upgrading since lower quintiles either reduced or have grown at a smaller pace (figure 2). While Q1 reduced 521,443 jobs (a relative decrease of 4.7%), Q3 and Q5 increased 7.7 million each (approx. 40.8% and 54.7%, respectively). Q4 and Q2 also demonstrated improvements, with 4.1 million (30.7%) and 1.8 million (16.5%).

The pattern changes in the second sub-period (2015-2019). Although Q5 is still growing and the first quintile continues to reduce participation, the increase was more substantial in the middle of the distribution. This represents a change in the pattern from mid-upgrading to “middling” (as opposed to polarization). Even though Q1 reduced 646,486 jobs (-4% compared to 2015), Q2 and Q3 concentrated most job increases, with 2.6 million (15.3%) and 936,645 (4.6%), respectively. Q5 continued to grow but at a lower level, with 425,934 new individuals employed (2.4%). Q4 has only a minor reduction of 128,321 (-0.7%).

Figure 2: Employment change by quintiles, 2002-2021.



Source: IBGE, PNAD.

The last sub-period (2019-2021) corresponding to the COVID-19 years barely changed this new trend. The data employed, as mentioned before, corresponds to the fourth quarter. Therefore, it captures the direct effects of COVID-19 in 2020 and the potential consequences or realignments observed in 2021. The pattern of “middling” or mid-upgrading continued, but the levels of change are just noticeable. Here we must stress that, for the first time, the second quintile has experienced a decrease. This is the only structural difference from previous years, and one of the reasons why, in this case, it makes even more sense to talk about mid-upgrading, given that employment growth is slightly more biased towards high-quality jobs. Nonetheless, the size of the change is too small to represent a major shift. The third and fourth groups represent the highest increases, with 407,040 (1.8%) and 231,795 (1.2%). Lastly, Q5 improvement was minimal at 71,377 (0.4%).

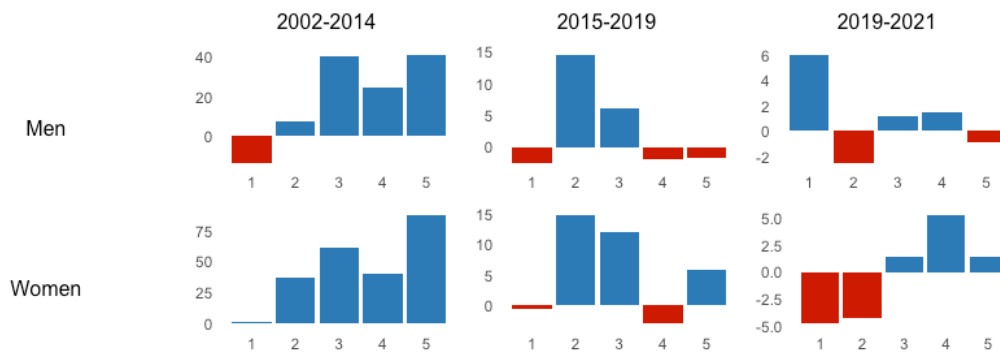
These patterns are in line with the general political and economic cycles observed in Brazil during this period. Between 2002 and 2014, growth was accompanied by investment in infrastructure, social policies stimulating consumption, laws regulating the informal labor market, and increased commerce and high-level services, especially in information technologies and telecommunications. The second period (2015-2019) continued the reduction in lower-quality jobs, despite the economic crisis and political turmoil, but the improvement in the upper quintiles diminished. Finally, the COVID-19 years (2019-2021) deviate slightly from the path set in 2015.

In the next sections, the same focus will be decomposed according to selected social dimensions. The goal is to shed some light on the drivers promoting the patterns of change described above.

5.2 Employment Change by Sex

When the results are decomposed by sex, they reveal similar trajectories for men and women most of the time. In the first period, workers of both sexes experienced a clear upgrading. Female participation in the fifth quintile grew by 82%, double that of men. Professionals in administrative services and education outstand as the major occupational increases. In the second, there was middling, with women reducing their participation in the fourth quintile while growing in the fifth, mostly on wholesale and retail trade and support administrative occupations in education. During the COVID-19 years, we observe a divergent pattern between sexes. While men are on a path of downgrading, women keep a mid-upgrading pattern. Some of these changes could be attributed to the fact that traditional obstacles to incorporating women into the labor market are being replaced with more flexible alternatives.

Figure 3: Relative Changes in Quintiles by Sex (2002-2021).



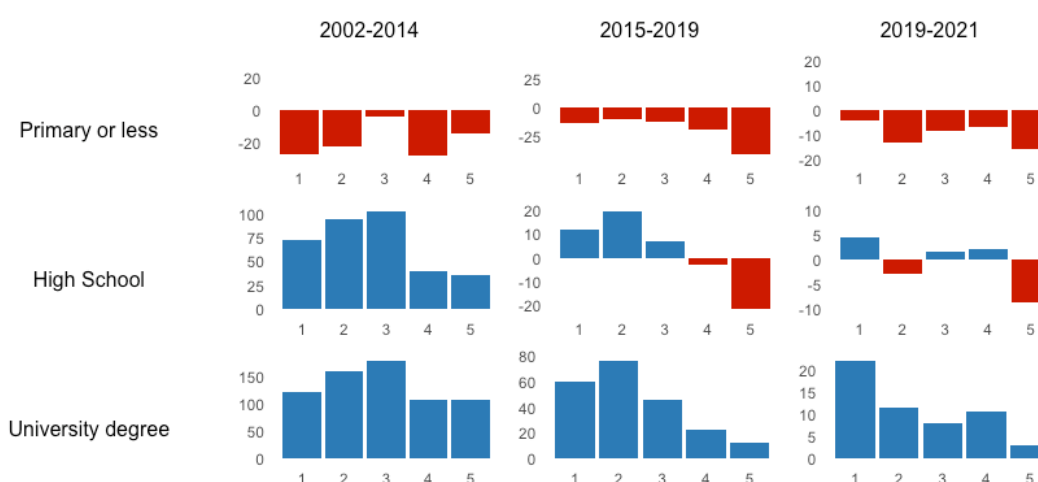
Source: IBGE, PNAD.

5.3 Employment change by education

Employment shifts by education show that there is an improvement in all quintiles and periods. The proportion of people with only primary school or less drops consistently over time in all quintiles, especially in the higher ones from 2015 to 2021. In Q5, for instance, the relative variation of this group fell by approximately 40% between 2015 and 2019. The proportion of workers with high-school degrees increases, especially in lower quintiles, and drops in the fifth in the two last sub-periods. Such improvement reveals, on the other hand, a more qualified workforce. Nonetheless, on the other, it also represents a retreat of some part of the less educated from the market. This change reflects the rise in the levels of education experienced since the beginning of the 21st century.

The perception of betterment in schooling is also reinforced by the incorporation of people with university degrees especially in the lower quintiles, suggesting a downgrading pattern of the more educated since 2015. However, we also need to take this expansion of workers with a university degree with some salt. Since the 1990s, there has been a considerable (and scarcely controlled) expansion of private universities with questionable quality targeting low-middle class or poor students. Many graduates could not find a job in their fields and had to settle for less in the service sector.

Figure 4: Relative Changes in Quintiles by Educational Attainment (2002-2021).

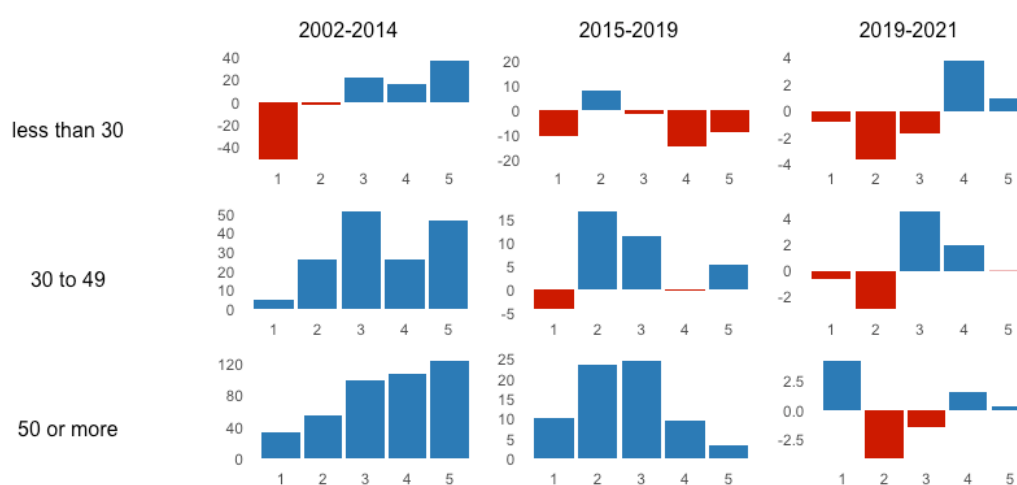


Source: IBGE, PNAD.

5.4 Employment change by age

Regarding age groups, there is a clear upgrade for all during the first period (2002-2014). This improvement was particularly felt for the oldest cohort, which grew around 120% in the fifth quintile during this interval. Those in the middle (30 to 49 years old) also increased substantially, especially in Q3 and Q5. The general trend shows how younger cohorts increase in the higher quintiles while older workers move to the upper quintiles. Between 2015 and 2019, the young lost ground on all quintiles but the second. They are the ones that were hardest hit by the crisis and the growing unemployment. The other age groups follow the general pattern of middling. The COVID-19 period shows three patterns: an upgrading for the young, mid-upgrading for those between 30 and 49, and downgrading of individuals 50 years or older.

Figure 5: Relative Changes in Quintiles by Age Group (2002-2021).

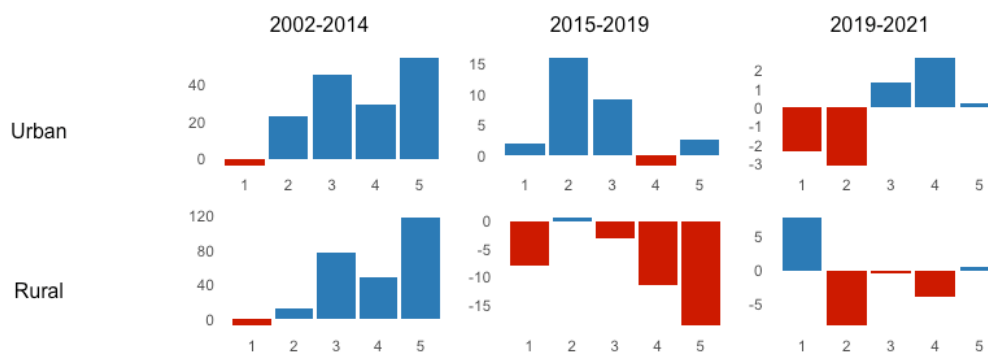


Source: IBGE, PNAD.

5.5 The urban/rural divide

The place of residence follows the general pattern for the first sub-period. It is worth mentioning, though, that rural employment growth almost doubled compared to urban, and it is even more concentrated in the distribution extremes. Nonetheless, there is a decoupling in the following years. The urban labor market seems to be experiencing a “middling” or even a mid-downgrading from 2015 to 2019, while rural employment decreases severely in almost all quintiles. Although this pattern had a high cost in terms of net employment losses, rural labor appears to behave as a middling by the collapse in both Q1 and Q5. This is due to the fact that rural employment is much more volatile and elastic to the business/political cycle. The COVID-19 period reproduces the same behavior, with rural employment only recovering in Q1. There was also a hollowing out of the two bottom quintiles of urban jobs. Therefore, the COVID-19 crisis negatively impacted upon those urban workers with lower wages. That is, those occupied in low-skilled services, such as personal services, and working in sectors such as retail trade, leisure, etc. That is, the type of activities that require human contact, and thus were limited or forcefully closed (while those in rural areas tend to be more occupied in the primary sector -in broad terms-).

Figure 6: Relative Changes in Quintiles by Place of Residence (2002-2021).

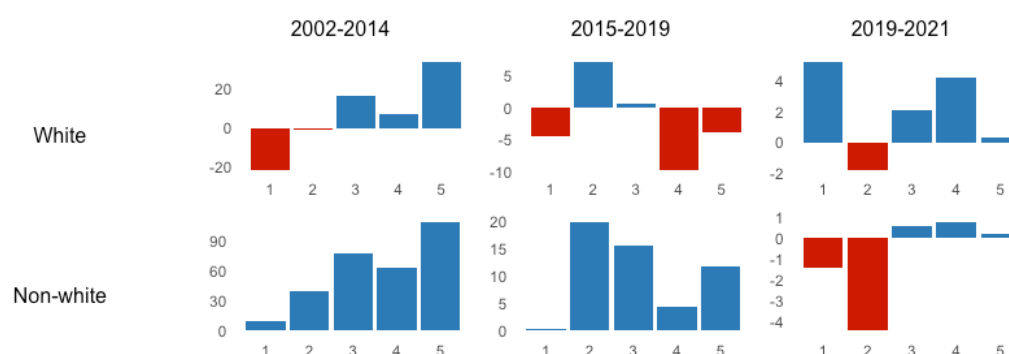


Source: IBGE, PNAD.

5.6 Employment change by skin color

Skin color is a strong predictor of a given individual’s income and position in the Brazilian labor market. Being black or brown decreases the chance of a worker having a formal job in the city requiring higher skills, usually at the highest quintiles. Figure 7 reveals a considerable upgrading for both white and non-whites between 2002 and 2014. The reduction on the “racial” bias in the labor market must be strongly highlighted. Nonetheless, the numbers were exceptionally high for non-whites. For instance, they doubled their participation in the fifth quintile. In the second sub-period, whites reduce their participation in most quintiles, while non-whites follow a pattern of mid-upgrading or even some degree of polarization, with employment increasing in all quintiles but Q1. During COVID-19 years, whites recovered, and non-whites lost participation in the lower quintiles, probably because they transitioned from employment to unemployment, inactivity or retirement. The expansion of public mandatory education and policies of job formalization can account as the main causes of the improvement observed by non-whites, especially during the first sub-period. The increase in unemployment and the growth in informality during the second period affected mostly non-white, particularly present in Q1 and Q2, where jobs are more prone to be informal or only partially regulated by the state.

Figure 7: Relative Changes in Quintiles by Skin Color (2002-2021).

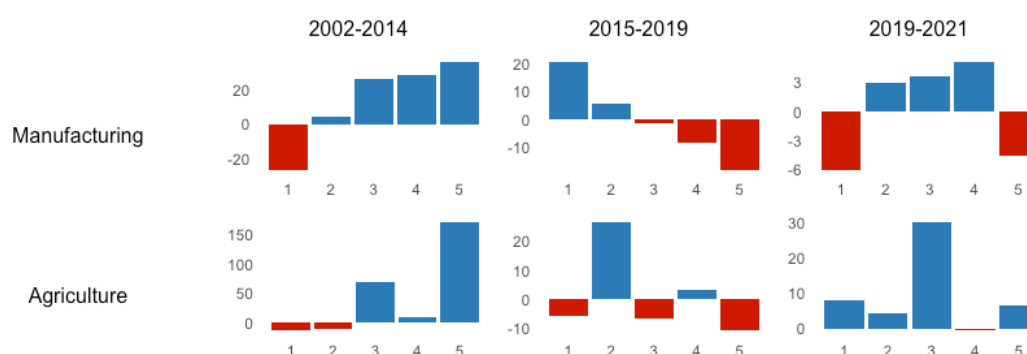


Source: IBGE, PNAD.

5.7 Employment change by broad sector: agriculture and manufacturing

Despite the pattern mentioned above of deindustrialization and the expansion of export-oriented agriculture, 2002-2014 reveals an upgrading in both sectors. Agriculture was particularly benefited, with a substantial increase in quintile five of about 150%. For manufacturing, the most salient change was the reduction of 36% of those workers in the sector located in Q1. The next sub-period meant a minor reduction in jobs in manufacturing and a noticeable decrease in agriculture, especially in the third, but also the first and fifth quintiles. COVID years promoted a polarizing recovery in agricultural jobs and a middling for manufacturing.

Figure 8: Relative Changes in Quintiles by Sector (2002-2021).



Source: IBGE, PNAD.

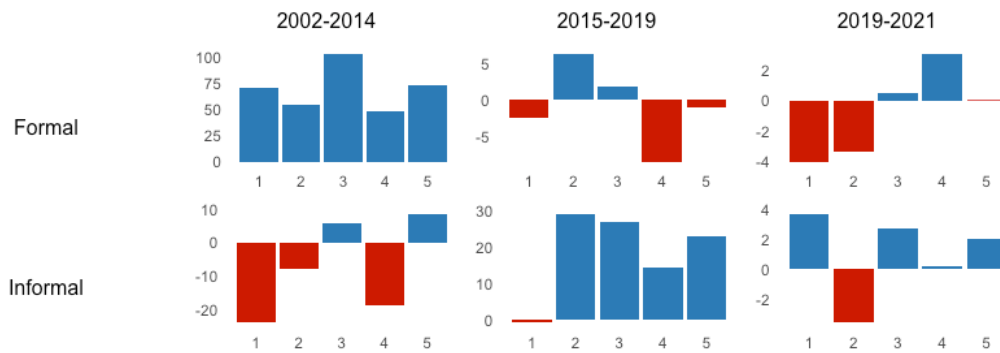
5.8 Employment change by type of employment: informality

Finally, informality was reduced, and formality increased from 2002 to 2014. The fact that formal positions more than doubled for almost all quintiles captures the effects of those labor market policies aimed at more surveillance of employers and establishing incentives to increase the number of formal contracts. Informality only increased in the third and fifth quintiles, but slightly. From 2015 to 2019, informality regained ground for two main reasons. The first was the economic crisis and the rise of

unemployment. When formal jobs are unavailable, people work in unregulated personal services, street market trade, and other low-quality positions. The second cause was the liberalizing labor market reform promoted in 2017. COVID-19 years are less clear. There is a slight upgrading for formal positions, but informality continued increasing in most quintiles.

In summary, there was a general upgrading during the entire period, but it was particularly intense in the first sub-period. Both sexes experienced enhancements in their positions, with a slight advantage for women. The same can be said about all age groups. Non-white workers also were the most benefited. Their incorporation grew in almost all quintiles. The increase in workforce education favored the incorporation of people with higher skills in all quintiles, with the contraction of workers with only primary education mainly felt in Q1 and Q2.

Figure 9: Relative Changes in Quintiles by Informality (2002-2021).



Source: IBGE, PNAD.

Nonetheless, the results were not so uniform when other socio-demographic groups were considered. Urban residents were the most benefited from the upgrading. This was not the case for rural residents. Despite their betterment observed in the first sub-period, this group experienced downgrading after 2014. Although workers in manufacturing and agriculture initially upgraded as well, a noticeable share of the improvements was lost after 2014. Finally, there was a formality reduction and informality growth from 2015 to 2021, even after the initial increase in formal jobs.

6 The determinants of belonging to better paid jobs

The next step of the analysis is determining the effects of these multiple socio-demographic characteristics on the conditional probabilities of belonging to each quintile. Since the dependent variable is measured as an ordinal scale, ordered probit models are employed:

$$Qt = \beta X_i + Year + \epsilon$$

Where X_i represents the intervening variables, $Year$ are the fixed effects for each year, and ϵ measures the error. For 2014, 29 years old or less, the dummies and primary education are used as reference categories for the year, age, and educational attainment.

Table 2: OProbit Regression Coefficients

	Occupation Quintiles (ref. category: Q5)				
	2002	2014	2015	2019	Pooled
	(1)	(2)	(3)	(4)	(5)
Sex - Male	0.729*** (0.006)	0.618*** (0.006)	0.481*** (0.005)	0.452*** (0.005)	0.547*** (0.003)
Age - 30 to 49	0.123*** (0.006)	0.008 (0.006)	0.154*** (0.005)	0.177*** (0.006)	0.123*** (0.003)
Age - 50 or more	0.025*** (0.009)	-0.016** (0.008)	0.128*** (0.007)	0.163*** (0.007)	0.093*** (0.004)
Education - High School	0.668*** (0.007)	0.499*** (0.007)	0.554*** (0.006)	0.518*** (0.006)	0.554*** (0.003)
Education - University	1.692*** (0.010)	1.585*** (0.009)	1.804*** (0.008)	1.691*** (0.008)	1.711*** (0.004)
Residence: Urban	0.826*** (0.009)	0.715*** (0.009)	0.743*** (0.006)	0.773*** (0.006)	0.769*** (0.004)
Formal Employment	0.483*** (0.006)	0.440*** (0.006)	0.439*** (0.005)	0.368*** (0.005)	0.427*** (0.003)
Skin Color: White	0.124*** (0.006)	0.140*** (0.006)	0.077*** (0.005)	0.083*** (0.005)	0.102*** (0.003)
2002					0.078*** (0.004)
2015					-0.230*** (0.004)
2019					-0.303*** (0.004)
Observations	151,802	159,334	233,004	222,089	766,229

Notes: ***Significant at the 1 percent level.

**Significant at the 5 percent level.

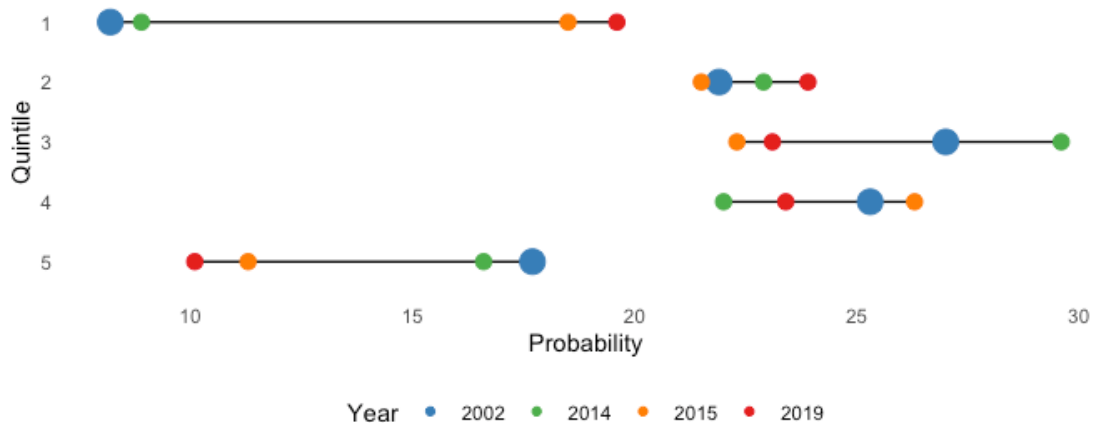
*Significant at the 10 percent level.

Source: IBGE, PNAD.

The results are those expected (table 2). Being a white male, middle-aged, with higher education, living in urban areas, and inserted into the formal labor market increases the probability of this person to be included into the higher quintiles. Besides, since education and income are highly correlated (especially in Brazil), having a university degree reveals the strongest effect on the position in job-wage groups. When fixed effects for years are included (in the pooled model), coefficients for 2015 and 2019, compared to 2014, are lower than expected due to economic and political crises and increased unemployment. This is another way to see that the previous process of upgrading was stopped after 2014.

The conditional probabilities for the average worker show a pattern of change coherent with the findings introduced so far (figure 10). There is upgrading from 2002 to 2014, then a middling in the next period. The probabilities for belonging to quintiles 1 and 2 are lower, and those for Q3, Q4, and Q5 are higher in 2014 compared to 2002. During the second sub-period, it is possible to observe a retreat: a reduction in the chances of being in the higher quintiles and an increase in the lower. For the entire period, most changes in the odds appear in Q2 and Q3.

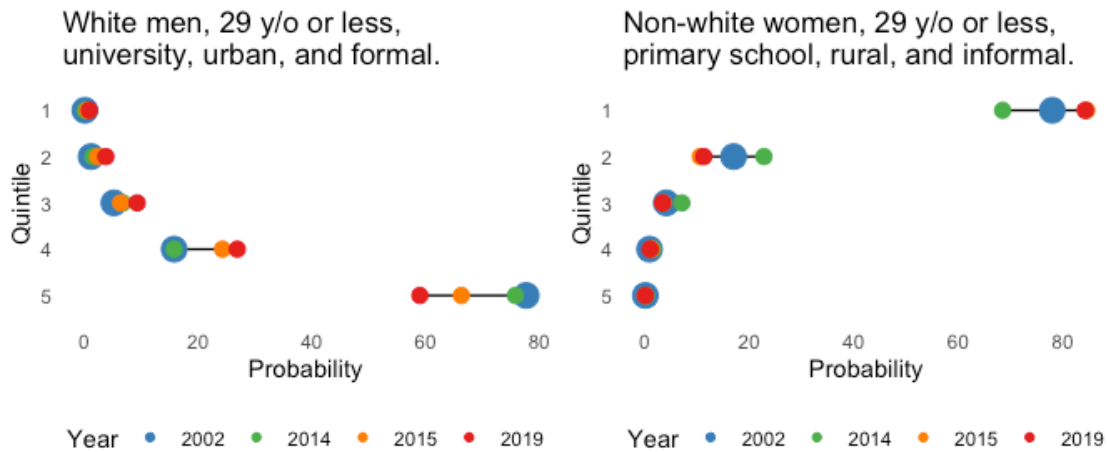
Figure 10: Conditional Probabilities by Year (for an average worker).



Source: IBGE, PNAD.

Figure 11 examines how two profiles of workers with very different individual characteristics changed over time. Although some changes can be observed, the overall structure of privilege is not altered. In 2014, a young white man with a university degree living in an urban area and the formal sector reduced his probability of belonging to lower quintiles and increased almost 20% his chance of fitting into the highest group. Besides, his odds of belonging to Q1 or Q2 are always lower than 0.5% and 4%, respectively. The opposite occurs with a young, non-white woman with primary education, living in rural areas, and informality. She will probably end up in Q1 or Q2 (a 92.5% probability of falling in one of the two in 2002 and 87.3% in 2014). There is some reduction in Q1 and an improvement in Q3 in 2014. Nonetheless, it was not sufficient to significantly change the underlying structural pattern.

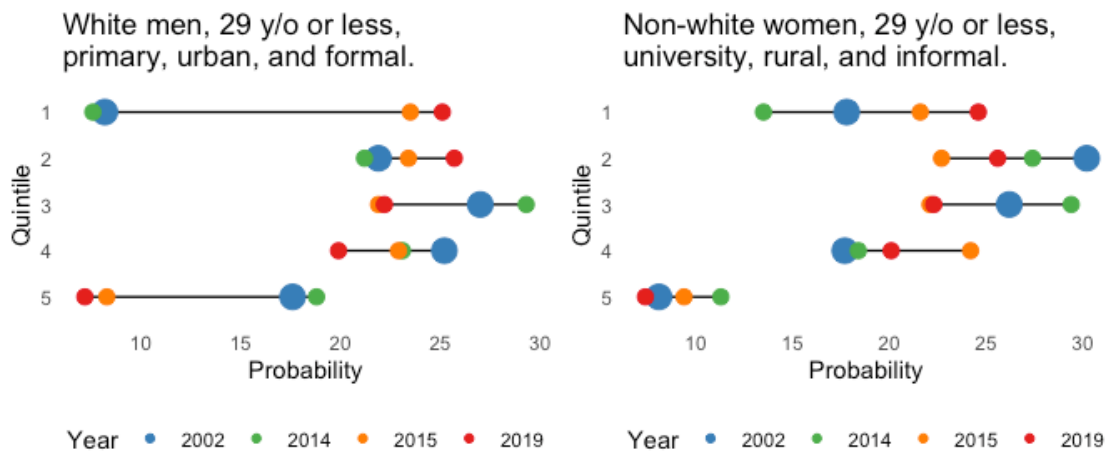
Figure 11: Conditional Probabilities by Year: Different Profiles of Workers.



Source: IBGE, PNAD.

The role of education is crucial in understanding the distribution of probabilities among quintiles. Figure 12 reproduces the same individuals with only inverted education levels. The young men have primary education, and the woman obtained a university degree. The changes are evident when compared to the previous figure. Both move to the center, with lower probabilities in Q1 and Q5 and higher in Q2 to Q4. When changes during the time are considered, the patterns differ by sex. In 2014, the odds for men were reduced in the lower quintiles and increased in the higher ones. For women, on the other hand, probability only rises in Q3. The numbers for 2015 and 2019 are around those observed for 2002.

Figure 12: Conditional Probabilities by Year: Different Profiles of Workers.



Source: IBGE, PNAD.

7 Final remarks

The present paper explores the structural changes in employment in Brazil during the period comprehended between 2002 and 2021. This broader period was divided into three sub-periods. The first, 2002-2014, deals with the period of economic growth and sustained job protection policies. The

second, 2015-2019, analyzed the impact of the recent economic and political turmoil that started in 2015 and is still ongoing. Finally, the third, 2019-2021, dig into the effects of the COVID-19 pandemic on employment.

As initially assumed, these economic and political cycles seem to impact employment structure. During the first sub-period, there is a recognizable pattern of mid-upgrading. There is an improvement in job quality for both males and females, all age groups, rural and urban residents and individuals with higher levels of education. It was a time of higher formality in labor relations as well. There was a visible contraction in the participation of the less educated and the economy's informal sector.

From 2015 to 2019, the pattern changed towards middling, with a sustained reduction in the first quintile and an increase in Q2 and Q3. Nonetheless, the white, young, rural residents and the formal employment were negatively affected. The increase in the middle quintiles represented a partial drawback from the gains obtained in the preceding period.

During the COVID-19 years, 2019-2021, there was again a pattern of mid-upgrading. That is, a similar pattern than in the previous period, but with employment growth being more biased towards high-paid jobs. Nonetheless, the level of change was much lower, around 1%. There was a minor upgrading for the women and a downgrading for men. Workers with university degrees kept increasing their participation in all quintiles, while the other groups receded or grew in only small proportions (high school). The crisis also damaged rural and black employees.

Despite the change from mid-upgrading to middling and then mid-upgrading again due to macroeconomic and political crises, the advancements observed from 2002 to 2014 were not fully reverted. For this reason, we can conclude that, since the beginning of the 21st century, Brazil has experienced a process of job upgrading in its employment structure.

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List of abbreviations and definitions

EU	European Union
IBGE	Brazilian Statistical Office
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification
PNAD	Brazilian National Household Survey
PT	Workers' Party

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Appendix

1. Measuring job quality

The measurement of job quality implies some challenges. The commonly adopted method firstly ranks all jobs according to their median wages and then splits them into five equal groups of workers. Therefore, the results would be ordinal categories containing all jobs totaling 20% of the engaged workforce. Then, it replies with the same quintile assignment of a given job for the subsequent years. This strategy is based on two fundamental assumptions. First, jobs are sufficiently small (in terms of the total number of workers occupied in each) to enable a division into relatively equal-shared groups. Huge jobs would make such partake unpractical, with some groups much more prominent than others. Second, jobs are reasonably stable in their positions, i. e., they do not change their ranks from one time slice to another. Since the literature focuses on the comparison among the number of workers within each quintile, changes in ranks for individual jobs should not pose a problem to the analysis if sub-periods are kept relatively small (10-15 years at most).

The current section evaluates these two assumptions empirically and compares the classification of jobs using alternative criteria not reliant on these theoretical claims. It allocates jobs using the same method proposed by the literature (Wright and Dwyer 2003; Fernández-Macías 2012), but, instead of keeping quintiles fixed for all the period, the method employed assigns jobs to quintiles in the first and the final years of each period. This procedure allows to assess the magnitude of change in the ranks during the period and test the underlying assumption of stability.

It must be also stressed that this procedure solely represents a methodological test for the consistency of the assumptions and the techniques employed. Such close exam is especially salient when it comes to countries with labor market structures considerably different from those developed economies that served as the empirical groundings for creating the method. The purpose, therefore, is to assess whether and how results would be eventually affected by a choice in operationalization.

On the other hand, our dataset contains a significant number of very large jobs (some with approx. 10% of the workforce). In total, there are 32 jobs with more than a million occupied and represent around 47% of the total occupied workforce (Table 3). If one or more eventually falls in the threshold between two groups, a quintile would end up with 15% while another could reach 27%, as occurred in 2002. Nonetheless, this problem seems to be reduced in the following years which present only minor differences among quintiles.

Table 3: Largest Jobs By Average No. of Workers (thousands).

Job	Sector	Sector Group	Occ.	Occupation Group	Workers
4852	G	Wholesale and retail trade; repair of motor vehicles and motorcycles	5	Service Workers and Shop and Market Sales Workers	8,689.9
5352	H	Transportation and storage	5	Service Workers and Shop and Market Sales Workers	6,458.1
9551	S	Other service activities	5	Service Workers and Shop and Market Sales Workers	6,142.3

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Job	Sector	Sector Group	Occ.	Occupation Group	Workers
4571	G	Wholesale and retail trade; repair of motor vehicles and motorcycles	7	Craft and Related Trades Workers	5,963.9
9791	T	Domestic services	9	Elementary Occupations	4,569.8
0161	A	Agriculture, forestry and fishing	6	Skilled Agricultural and Fishery Workers	4,006.7
8523	P	Education	2	Professionals	3,790.7
0162	A	Agriculture, forestry and fishing	6	Skilled Agricultural and Fishery Workers	3,546.0
4171	F	Construction	7	Craft and Related Trades Workers	2,834.7
4983	H	Transportation and storage	8	Plant and Machine Operators and Assemblers	2,779.0
6078	J	Information and communication	7	Craft and Related Trades Workers	2,677.2
5551	I	Accommodation and food service activities	5	Service Workers and Shop and Market Sales Workers	2,414.9
8023	N	Administrative and support service activities	2	Professionals	2,337.0
9651	S	Other service activities	5	Service Workers and Shop and Market Sales Workers	2,322.2
0192	A	Agriculture, forestry and fishing	9	Elementary Occupations	1,836.8
5652	I	Accommodation and food service activities	5	Service Workers and Shop and Market Sales Workers	1,630.6
9351	R	Arts, entertainment and recreation	5	Service Workers and Shop and Market Sales Workers	1,609.1
7451	M	Professional, scientific and technical activities	5	Service Workers and Shop and Market Sales Workers	1,590.1
4193	F	Construction	9	Elementary Occupations	1,544.8
8632	Q	Human health and social work activities	3	Technicians and Associate Professionals	1,468.9
5651	I	Accommodation and food service activities	5	Service Workers and Shop and Market Sales Workers	1,391.3
8033	N	Administrative and support service activities	3	Technicians and Associate Professionals	1,367.3
1876	C	Manufacturing	7	Craft and Related Trades Workers	1,337.4
8622	Q	Human health and social work activities	2	Professionals	1,312.3

Job	Sector	Sector Group	Occ.	Occupation Group	Workers
4572	G	Wholesale and retail trade; repair of motor vehicles and motorcycles	7	Craft and Related Trades Workers	1,260.0
9753	T	Domestic services	5	Service Workers and Shop and Market Sales Workers	1,158.9
5091	H	Transportation and storage	9	Elementary Occupations	1,106.7
7551	M	Professional, scientific and technical activities	5	Service Workers and Shop and Market Sales Workers	1,095.8
7441	M	Professional, scientific and technical activities	4	Clerks	1,083.0
4371	F	Construction	7	Craft and Related Trades Workers	1,045.1
7541	M	Professional, scientific and technical activities	4	Clerks	1,010.4
5351	H	Transportation and storage	5	Service Workers and Shop and Market Sales Workers	1,005.8

Source: IBGE, PNAD.

¿Do jobs change quintiles over time (violation of the second assumption)? Figure 2 contains the chord diagrams for the change of jobs between wage quintiles from the initial to the end year of each period. As we can observe, there is much movement between quintiles. As already mentioned, the methodology is the same as proposed by the literature, with only one difference: quintiles are defined separately for both the initial and final years of the sub-period. Firstly, although a large proportion of jobs stay in the same quintile, there are a lot of ups and downs. Secondly, some quintiles change more, especially Q2 and Q3, compared to Q1 (after 2014), Q4, and Q5. Finally, non-adjacent quintile changes are less substantial but still noticeable.

Does it make a difference in measuring job quality in capturing structural changes in employment? The results shown in figure 13 suggest that further analysis should be performed to determine the causes of this unexpected behavior. Although keeping the survey methodology constant for each sub-period, maybe changes in coding practices or data collection methods could explain these results. The division of big jobs into more fine-grained categories, could avoid sudden changes in the number of workers falling into different but contiguous quintiles. Extreme changes (Q1 to Q5 or vice-versa) are the ones that challenge the most. Nonetheless, they seem to be marginal. Quintile migration usually happens among adjacent groups and, probably, due to the large size of some jobs, as mentioned above.

The methodology also does not account for within-quintile variation. Although this is not the goal or focus of the analysis, within-quintile variations can reveal different degrees of heterogeneity not just among quintiles, but inside them as well. In Brazil, belonging to Q1 usually refers to minimum wage jobs. The median wage distribution is concentrated chiefly around this value. Conversely, wages in Q5 spread widely between professionals, managers, legislators, and other skilled occupations. Measuring the changes in wage spread within quintiles and over time could provide a more sophisticated and complete picture of the employment structure, incorporating inequality into the analysis.

Figure 14 represents the worker density by quintile for each year covered in the study period (2002-2021). Since each quintile represents around 20% of the workforce, this chart is valuable for measuring the observed wage variation within quintiles. In most years, a general pattern appears: the higher the

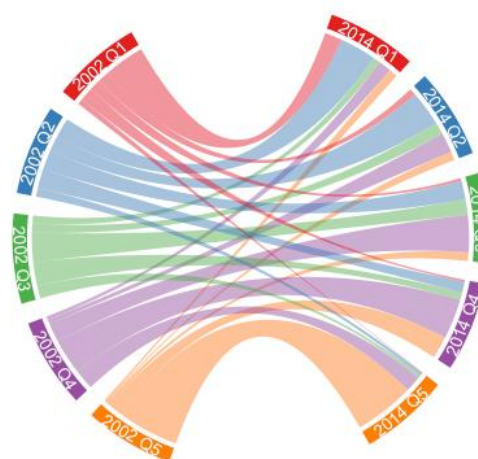
quintile, the larger the spread. Concretely, this means that the majority of the workforce is concentrated in those wages that pay less and the distance to the other occupational groups increases when the median wage increases.

There are two other aspects worth noticing. Firstly, density peaks at the beginning or end of each quintile also reinforce the idea of large jobs situated at the frontier between quintiles. Secondly, the comparison of median wages using constant 2021 Brazilian Reals (BRL) reveals the movements in purchasing power over time. A clear improvement between 2002 and 2014 was kept relatively stable until 2019. Nonetheless, the effects of the COVID-19 crisis, and the Bolsonaro administration more broadly, almost reverted entirely from the gains observed in the previous periods.

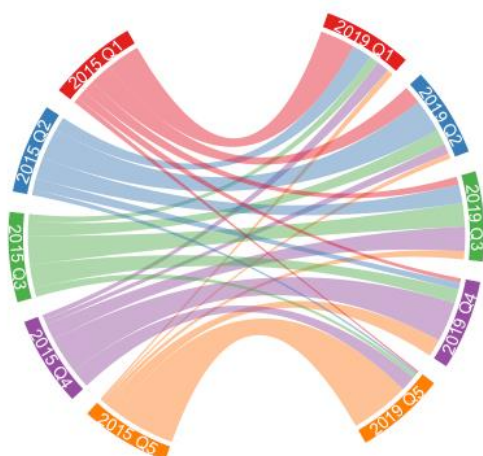
Figure 13: Migration within each period between empl. quintiles sorted by job median wages.
2002 - 2014

JOB STABILITY?

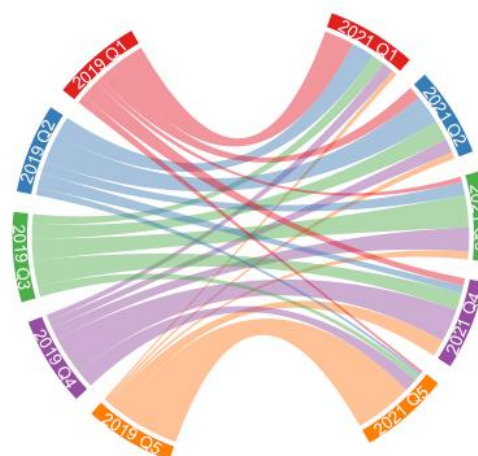
Between-Quantile Job Migration for Selected Periods



2015 - 2019

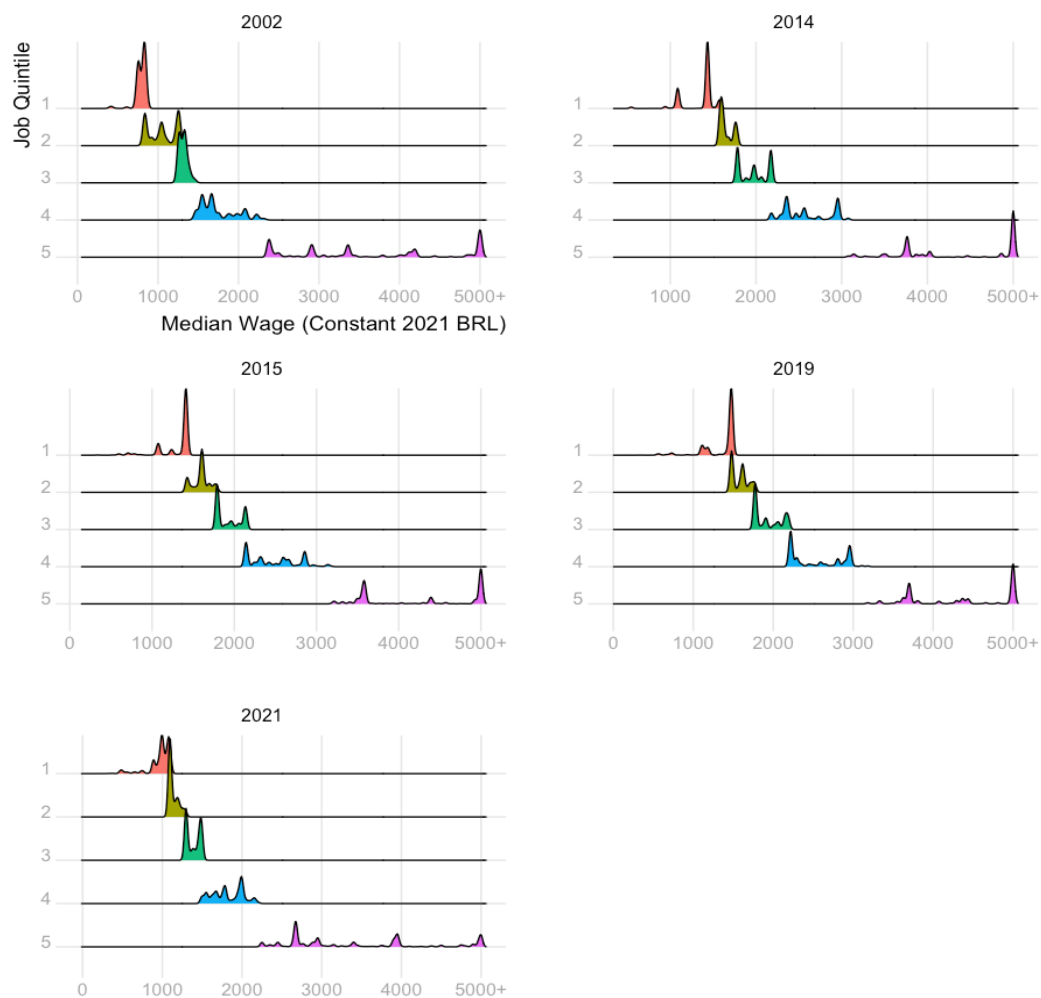


2019 - 2021



Source: IBGE, PNAD.

Figure 14: Worker Density by Quintile and Job Median Wage (2002-2021).



Source: IBGE, PNAD.

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