
ECONOMIC GROWTH AND CONVERGENCE IN THE VERY LONG-RUN:
THE CASE OF EMERGING ECONOMIES WITH A FOCUS ON BRAZIL
Natalia Izelli Doré

Doctoral Thesis in Economics

Supervised by
Aurora A. C. Teixeira

2022

To Davi and Raul.

Biographical Note

Natalia Izelli Doré was born on June 1st, 1987. She lived in her hometown in Maringá (Brazil) until 2017, after which she moved to Porto (Portugal). In 2012, she had concluded a Civil Engineering undergraduate course and a post-graduation in Project Management in Brazilian universities. In 2018, she enrolled in the Doctoral Program in Economics at the School of Economics and Management (FEP) at the University of Porto.

During her PhD path, she was awarded two CEF.UP (Center of Economics and Finance of University of Porto) research grants, first in a project assisted by Prof. Rosa Forte (2020), then by Ana Isabel Sá (2022). Furthermore, two out of four essays from her thesis have been accepted to be published in indexed journals.

Acknowledgments

I would like to express my warmest thanks and sincere gratitude to my advisor Prof. Aurora Teixeira, who made this path as smooth as possible. Her patience, motivation, insightful comments, criticisms, and knowledge carried me through all the research and writing stages of this thesis. I could not have imagined having a better advisor and mentor for my PhD study.

Besides my advisor, this acknowledgment extends to my PhD colleagues Catarina Peralta, Eduardo Martins, Jorge Saraiva, José Verónico, and Pedro Gil, for helping and effectively assisting me in these last four years. A special note of gratitude is devoted to Catarina and Eduardo, to have become my beloved friends beyond the academy. I genuinely believe that it would be much harder to conclude this journey without them.

I must express my deep thankfulness to my parents, Cida and Maurício, for giving me birth in the first place and spiritually supporting me throughout my life. My brother, Maurício, for all the high-level talks and intellectual discussions that lead me to this PhD journey. And last but not least, I would like to thank my husband Marco for all his kindness, affection, patience, and dedication. A large part of who I am today is due to his partnership.

Abstract

This doctoral thesis contains four essays on economic growth and real convergence of a relatively unexplored context, that of the Emerging Economies (EEs), focusing on the case of Brazil and embracing an overlooked very long-time span (over 100 years). The analyses encompass a diversity of methodological approaches, including bibliometric techniques, descriptive/ narrative review, and econometric time series methods.

In the first essay, a bibliometric review systematically quantifies the empirical studies published on economic growth from 1991 to 2020. The main findings entail the need to encourage more scientific attention devoted to a neglected group of EEs – the Latin American and the Caribbean – and redirect the empirical growth agenda to analyze the key determinants of economic growth in the very long run (more than 100 years).

The second essay provides a narrative review of Brazil's economic growth and real convergence from a very long-run perspective (1822-2019), organized by periods and sets of determinants. This historical economic analysis made it possible to identify some critical factors underlying the Brazilian backwardness: macroeconomic instability, deficient human capital formation, and poor institutional conditions.

To complement the previous descriptive analysis, the third essay empirically discusses the joint impact of some critical determinants on economic growth in Brazil between 1822 to 2019. Through cointegration analysis and Granger causality tests, evidence suggests that years of schooling (human capital) have a positive and long-lasting impact on Brazil's economic growth. Moreover, institutional quality promotes growth indirectly by fostering human capital accumulation, and the increase in living standards induces pro-industry structural change. Finally, there is solid evidence that, in the period 1930-2019, industrialization, measured by the weight of industry in terms of value-added,

is growth-enhancing.

Whereas the third essay debates the absolute Brazilian economic performance, the fourth essay assesses the relative growth (real convergence) of Brazil towards other 6 Latin American (LA6) countries, Portugal, and the United States (US), from 1822 to 2019. The extended unit root test results favor the very long-run real convergence of Brazil towards LA6 and Portugal, but not towards the US. Moreover, the estimation results of Markov Regime-Switching models involving two regimes (real convergence and real divergence) suggest that higher human capital stocks promote Brazil's real convergence towards the other LA6 countries. In contrast, the transition to more democratic political systems (institutional quality) fosters Brazil's catching up with LA6 and the US when the country is in a real convergence regime.

JEL Classification Codes: N10; N16; O40; O43; O47; O54.

Keywords: Economic growth, convergence, emerging economies, Brazil, very long run, human capital, structural change, institutions.

Resumo

Esta tese é composta por quatro ensaios sobre crescimento económico e real convergência num contexto pouco explorado, das Economias Emergentes (EEs), com foco no Brasil, e abrangendo uma janela temporal pouco explorada de muito longo prazo (mais de 100 anos). As análises abrangem uma diversidade de metodologias, incluindo técnicas bibliométricas, revisão narrativa/ descritiva, e métodos econométrico de séries temporais.

No primeiro ensaio, uma sistemática revisão bibliométrica quantifica os estudos empíricos sobre crescimento económico publicados de 1991 até 2020. Nos principais achados estão a necessidade de incentivar uma maior atenção científica ao grupo de EEs negligenciadas – América Latina e Caribe – e redirecionar a agenda empírica sobre crescimento económico a fim de analisar os determinantes chave para o crescimento económico de muito longo prazo.

O segundo ensaio fornece uma revisão narrativa do crescimento económico e real convergência do Brasil em uma perspetiva de muito longo prazo (1822-2019), organizada por períodos e grupo de determinantes. Com essa análise histórico-económica, foi possível identificar alguns fatores críticos subjacentes ao atraso brasileiro: instabilidade macroeconómica, deficiência na formação de capital humano, e as pobres condições institucionais.

A fim de complementar a prévia análise descritiva, o terceiro ensaio empiricamente discute o impacto conjunto de alguns determinantes críticos do crescimento económico do Brasil entre 1822 e 2019. Através de análise de cointegração e testes de causalidade de Granger, o ensaio mostra que os anos de escolaridade (capital humano) têm um impacto positivo e duradouro no crescimento económico do Brasil. Para além disso,

qualidade institucional promove crescimento indiretamente ao estimular a acumulação de capital humano, e o aumento do padrão de vida induz mudanças estruturais pró-indústria. Finalmente, há uma sólida evidência de que, no período 1930-2019, a industrialização, medida pelo peso da indústria em termos de valor agregado, é gerador de crescimento.

Enquanto o terceiro ensaio debate a performance económica brasileira absoluta, o quarto ensaio acede ao crescimento relativo (real convergência) do Brasil face a outros seis países da América Latina (AL6), Portugal, e os Estados Unidos (EU), de 1822 até 2019. Os resultados dos testes de raiz unitária estendidos favorecem a real convergência de muito longo prazo do Brasil face à AM6 e Portugal, mas não face aos EU. Além disso, os resultados das estimações dos modelos *Markov Regime-Switching* envolvendo dois regimes (real convergência e real divergência), sugerem que um maior estoque de capital humano promove a real convergência do Brasil face aos países AM6. Em contrapartida, a transição para um sistema político mais democrático (qualidade institucional) fomenta o *catching-up* do Brasil com os AM6 e os EU quando o país está num regime de real convergência.

Classificação JEL: N10; N16; O40; O43; O47; O54.

Palavras-chave: Crescimento económico, convergência, economias emergentes, Brasil, capital humano, mudança estrutural, instituições.

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Chapter 1

Introduction

From a scientific point of view, an analysis of a very long period would support comprehending the factors underlying a country's economic growth and the catching up (or falling behind) processes. According to Maddison (1995), the more we "zoom in" the lens from the past, the more we have forecasting instruments for years ahead. In like manner, the information based on these accounts provides valuable guidelines for governments to implement their policies and foster sustainable economic growth (Bergheim, 2008).

Despite several studies on economic growth and convergence that have adopted a very long-run perspective (over 100 years), most of them analyzed developed countries (e.g., Lai, 2001; Berry & Okulicz-kozaryn, 2007; Kirchner, 2012; Foldvari et al., 2013; Forte & Magazzino, 2016; Esteve & Tamarit, 2018). To the best of our knowledge, the same research attention was not devoted to the EEs. However, studying such countries is relevant since their specific characteristics, most notably high levels of poverty and inequality (Amar et al., 2020), economic vulnerability (Saccone & Deaglio, 2020), inefficient manufacturing basis (Wang et al., 2020), and political instability (Vianna & Mollick, 2018), are likely to imply the existence of drivers of economic growth and convergence which are distinct from those related to developed countries.

The present thesis aims at filling in these research gaps by analyzing the EEs context. Specifically, the goal is to contribute to economic growth and real convergence literature

by analyzing one of the largest EEs, Brazil. Since the country has presented significant challenges in promoting a robust and sustainable economic performance throughout its history (Arbache & Sarquis, 2018), we shed light on three critical determinants of the Brazilian economic path: human capital, structural change, and institutional quality. Indeed, if economic performance has deep historical roots, we aim to propose a scope for a policy to be applied in Brazil to boost its sustainable growth and real convergence.

A set of four essays is developed to respond to such endeavor: 1) a bibliometric study to examine and document several aspects in the empirical literature related to growth; 2) a descriptive/ historical review of Brazil's economic growth and real convergence since its independence from Portugal (1822) up to 2019; 3) an empirical analysis of the joint impact of human capital, structural change, and institutional quality on the Brazilian growth between 1822 and 2019; and 4) an empirical exercise to investigate the effect of human capital and institutional quality on the catching up (or falling behind) process of Brazil towards other six Latin American EEs, Portugal and the United States (US).

The bibliometric technique is increasingly used to explore and map disposable information in specific fields, providing useful insights for academics and professionals' future scientific research (Castro e Silva & Teixeira, 2011). Based on 1735 articles devoted to empirical studies on economic growth, published in journals indexed in the Web of Science between 1991 and 2020, Essay 1 (Chapter 2) conducts a bibliometric exercise to examine and categorize the published studies according to the country(is) (block or region) investigated, time span, main determinant(s) explaining growth, and type of methodologies applied to analyze the data. Five main results are worth highlighting: (i) the share of empirical articles on economic growth show a clear upward trend; (ii) among all the groups of countries considered, the EEs, have received the most scientific attention; (iii) the economic growth processes of the Latin American and the Caribbean EEs have observed little scientific attention; (iv) the very long-run studies comprise a residual share among the empirical literature on growth; (v) the extant empirical studies on economic growth have addressed mainly the impact of 'Macroeconomic conditions.'

In Essay 2 (Chapter 3), we reconstruct the economic history of Brazil from a very long-run perspective (1822-2019). On the one hand, this qualitative analysis indicates that

structural changes observed in the middle of the 20th century were crucial in promoting the country's growth and real convergence with technologically advanced countries. On the other hand, poor institutional conditions and deficient human capital formation have emerged since imperial times as critical factors underlying Brazil's inability to establish robust and sustainable economic growth.

Resorting to cointegration analysis and Granger (non)causality tests, Essay 3 (Chapter 4) seeks to investigate three main hypotheses: (H1) the process of structural change associated with industrialization is likely to foster Brazil's very long-run economic growth; (H2) human capital improvements are likely to foster Brazil's very long-run economic growth; and (H3) high-quality institutions are likely to foster Brazil's very long-run economic growth. Based on annual frequency data from 1822 to 2019, the study achieves three main results: 1) human capital has a long-lasting, positive impact on Brazil's economic growth; 2) structural change favoring industry (proxied by the weight of secondary sector value-added) promotes Brazil's economic growth from the 1930s onwards suggesting that in this period industrial changes towards more advanced and sophisticated manufacturing basis tend to boost economic growth; 3) institutional quality stands as a critical factor in economic growth indirectly by fostering human capital accumulation.

Finally, Essay 4 (Chapter 5) considers the same extensive time frame of previous essays (1822-2019) to entail a comparative analysis using unit root tests and Markov Regime-Switching (MS) models of Brazil's economic performance in three different scenarios (i) towards other LA6 EEs; (ii) towards a developed country, its *alma matter* Portugal; and (iii) towards the commonly regarded technological frontier country, the US. After considering possible structural breaks, we found evidence of Brazilian real convergence (tendency to narrow the per capita income gap) towards the LA6 EEs and Portugal, but not the US. The estimated MS models, involving two different regimes, real convergence and real non-convergence/ divergence, capture human capital's positive effect in promoting Brazil's real convergence to other LA6 EEs. Institutional quality emerges as growth-enhancing when Brazil is in a real convergence regime.

Chapter 2

Empirical Literature on Economic Growth, 1991-2020: Uncovering Extant Gaps and Avenues for Future Research

[Doré, N.I. and Teixeira, A.A.C. (2021). *Empirical literature on economic growth, 1991-2020: Uncovering extant gaps and avenues for future research*. Global Journal of Emerging Market Economies. <https://doi.org/10.1177/09749101211061626>.]

2.1 Introduction

Explaining the wealth of a nation is one of the oldest debates in the economic growth literature while genuine progress in this research agenda seems hard to achieve (Chu et al., 2020; Durlauf et al., 2005). The proper understanding of the factors that have contributed to the economic growth of a country is essential to the design of successful government policies addressed at increasing growth in the long run (Bergheim, 2008; IMF, 2018). Many authors share this perspective as echoes from the past play a key role in forecasting the future (Maddison, 1995; Spolaore & Wacziarg, 2013).

Since the beginning of the 1990s, the interest in economic growth determinants has increased sharply (Ekanayake & Moslares, 2020; Teixeira & Queirós, 2016), and the literature on the subject is considered quite extensive (Abosedra et al., 2020). According to Bruns and Ioannidis (2020), empirical research takes a large share in this literature as the debate on the factors to achieve sustainable economic growth persists (Urbano et al., 2019). The economic growth researchers have constantly addressed the problem empirically, often combining historical analyses with relevant theoretical models (Diebolt & Hagemann, 2019; Durlauf et al., 2005).

The availability of data is generally a problem for empirical studies on growth, which is one of the reasons explaining the plethora of econometric literature focused on the period after 1960, when data are more easily available for a larger group of countries (Durlauf et al., 2005; Goldberg, 2020).

The years following 1960 also coincided with unprecedented growth rates of some emerging economies (EEs),¹ countries transitioning from underdevelopment but still observing low-to-middle per capita income levels,² namely the Latin American countries (Durlauf et al., 2005; Hofman & Valderrama, 2021). Since then, EEs have made a large contribution to the global economy (Bown & Crowley, 2014; Gruss et al., 2020), corresponding in 2019, to more than 35% (and approximately 65%) of the world's GDP (population).³

The study of EEs is scientifically relevant since this group of countries presents specific features, such as high levels of poverty and inequality (Amar et al., 2020), economic vulnerability (Saccone & Deaglio, 2020), and an inefficient manufacturing basis (Wang et al., 2020). These aspects are likely to imply the existence of distinct drivers of economic growth compared to more developed countries (Tridico, 2007).

¹ We often encounter the terms “Emerging Economies” and “Emerging Markets” to illustrate the same group of countries. Albeit, the terms “market” and “economies” do not always have the same definition, although they have been adopted by scholars and researchers when referring to emerging countries in quite the same fashion. Notwithstanding, the term ‘emerging markets’ is more often used by global financial companies and institutions (Saccone, 2017).

² The term “emerging economies” was first introduced in 1981 by Antoine Van Agtmael of the World Bank (Saccone & Deaglio, 2020; Tridico, 2007). The definition of the concept is still not consensual (O’Sullivan & Sheffrin, 2003; Saccone, 2017). Combining different sources, namely Duttagupta and Narita (2017), Saccone (2017), IMF (2020), and Wang et al. (2020), we obtained a list of 62 EEs (see Appendix 1).

³ Authors’ calculation based on the World Bank database.

The EEs have garnered greater scientific attention since 2000 (Jorgenson & Vu, 2016) after the Asian crisis (1997-1998) and the dot-com collapse (2000-2001), when this group of countries surpassed the growth rate of advanced economies (IMF, 2018). Mostly due to rapid growth in China, the Asian economies observed increased growth performance compared to other EEs, including Latin America (Darku & Yeboah, 2018). However, the slower economic growth of the latter region does not seem to have received sufficient scientific attention, in which some authors contend that the growth literature regarding this group has been quite scarce (Martin & Vazquez, 2015; Barrios et al., 2019; Hofman & Valderrama, 2021).

Given doubts regarding the scientific attention economic growth scholars have devoted to the case of EEs, in particular, the potential discrepancies between Asian and Latin American EEs, it seems useful to take a thorough account of this stream of literature. Although there are a few recent meta-analysis studies addressing economic growth, these contributions have focused on specific determinants, namely financial development (Bijlsma et al., 2018), remittances (Cazachevici et al., 2020), and parallel economy effects (Afonso et al., 2020). To date, and to the best of our knowledge, a comprehensive, quantitative-base literature survey in economic growth has yet to be conducted.

Bibliometric techniques, as one of the quantitative approaches bring objectivity and formalism to the analysis while using powerful dynamics to trace a scientific discipline, map the evolution of a field of study, the emergence of a new topic, and find expert authors and prestigious articles within a research area, among others. They do so in a manner that reduces the level of bias usually associated to qualitative approaches (Castro e Silva & Teixeira, 2012).

Through the lens of long-run economic growth literature, we intend to answer four main questions, which may be considered research gaps: (1) What is the evolution of empirical economic growth research over time? (2) Are the EEs understudied in comparison to developed countries? (3) Did the Latin American EEs receive the same scientific attention as the Asians EEs? (4) Is there any specific pattern in the empirical economic growth literature devoted to EEs in terms of period analyzed, methodology of analysis, and main economic growth determinants?

To answer these questions and fill the literature gaps, we have examined

quantitatively empirical studies on economic growth. We gathered 4,302 articles published between 1991 and 2020 in journals indexed in Web of Science (WoS) in the scientific area of economics and conducted a detailed analysis of the 1,735 relevant empirical articles.

After this Introduction, the essay is structured as follows. The following section provides a literature review on the determinants of economic growth, and a systematic state of the art of qualitative and quantitative articles on the topic. In the next section, we describe the bibliometric methodology used. This is followed by the result section that includes the block of countries analyzed, time frame of the data, type of methodology, and determinant(s) examined. Finally, the last section presents the conclusions and highlights avenues for future research.

2.2 Literature review

2.2.1 Categorizing the main determinants of economic growth

The empirical literature on economic growth is quite extensive, and these studies have suggested many variables as effective determinants of growth (Bruns & Ioannidis, 2020). This is not to say that growth theories have no place in this purpose (Moral-benito, 2012). Rather, growth econometrics have emerged in light of theoretical principles, just as empirical studies have boosted the demand for future theories (Durlauf et al., 2005).

In practice, Durlauf et al. (2005) found 145 potential determinants for a country's economic growth. Moral-benito (2012) acknowledges the existence of more than 140 possible growth determinants as proposed by Durlauf et al. (2005), although his final empirical findings suggested 34 explanatory variables. Departing from similar approaches, i.e., the Bayesian model, Sala-i-martin et al. (2004) and Bruns & Ioannidis (2020) analyzed 67 and 37 determinants, respectively.

Since the evidence encompasses a large set of determinants, for the purposes of the

bibliometric exercise, and based on the relevant literature, we divided and organized all the potential explanatory variables into 7 main groups: 1) Human capital; 2) Labor and demographic conditions; 3) Technology, innovation, and structural change; 4) Macroeconomic conditions; 5) International trade and FDI; 6) Natural resources and geography; and 7) Institutional conditions.

According to Romer (1990), the more educated the labor force, the more productive and innovative the country, leading to higher rates of economic growth in the long run. Some of the empirical literature, namely Mankiw et al. (1992), and Barro (2001), have found strong evidence of positive effect of human capital on economic growth. Particularly, empirical researchers have used many variables to measure the human capital stock, such as education, intelligence, health, nutrition, and work experience, among others (e.g.: Garza-Rodriguez & Almeida-Velasco, 2020; Ogundari & Awokuse, 2018). In the 1990s, Mankiw, Romer and Weil extended the Solow (1956) neoclassical growth model to accommodate the impact of human capital, recognizing that the aforementioned variables are essential elements of economic growth (Jones & Vollrath, 2013).

Strictly linked to human capital, labor and demographic patterns can affect economic prosperity in several ways, such as the working-age structure, labor share, population growth, fertility and mortality rate, urbanization, poverty, and immigration (Cruz & Ahmed, 2018). For instance, according to Munir & Shahid (2021), a decrease in the fertility and mortality rate and an increase in the working-age population has the potential to boost the labor force, hence achieving high levels of economic growth. In the same line, urbanization is a necessary condition for a country to reach, at least, the middle-income level and sustain growth (Cruz & Ahmed, 2018).

However, immigration has contrasting impacts on the landscape of the host country, depending on the extent to which the residents and immigrants complement or replace each other (AboElsoud et al., 2020). According to the neoclassical growth model and the augmented Solow growth model, immigrant inflows increase the host country's population and dilute the capital, which means a decrease in the long-run economic growth per capita (Kang & Kim, 2018). In contrast, a positive effect is observed if immigrants transport some kind of human capital, complementing the host country's

residents, thereby enhancing per capita output through higher wages (AboElsoud et al., 2020).

Law et al. (2020) advocate that continuous research and innovation are primary catalysts of productivity and economic growth. This dynamic relationship can be traced back to Schumpeter (1939) and the endogenous growth model developed by (Romer, 1986). Aghion & Howitt (1992) also highlighted the link between innovation and growth based on Schumpeter's model and concluded that technological progress is the exclusive promoter of growth. The concepts of technology, innovation, and structural change are also supported by influential empirical studies as potential and prominent drivers of economic growth (Olczyk & Kordalska, 2018; Vu, 2017).

Since the industrial revolution, industrialization has been an indicator of modernization as well as a key engine of economic growth (Zheng & Walsh, 2019). If a country presents sequential structural changes in its economy, it means a set of changes in the composition of productive factors towards more sophisticated goods with a high share of added value, which is expressed as a sharp rise in output growth (Olczyk & Kordalska, 2018).

Governments and central banks are key players in promoting economic growth through their fiscal and monetary policies (Bondarchuk & Raboshuk, 2020). Back to Keynes, countries can invest in these interventions to accelerate economic growth (Nawaz & Khawaja, 2018). Government actions may include non-distortionary taxation and productive expenditures, that influence positively the marginal product of capital, improve incentives to investments, and thus boost growth (Benos, 2009). Likewise, central banks influence the economy of a country through several factors, such as money supply, inflation targeting policies, credit facilities, and exchange rate control of the national currency (Bondarchuk & Raboshuk, 2020). These instruments are important tools to boost the economy, and some empirical studies have shown a positive and long-run relationship between these monetary instruments and economic growth (Akalpler & Duhok, 2018).

Since the 1990s, the flows of capital between nations rose sharply, especially in the context of developing/peripheral economies the use of some international resources have been crucial to finance their growth (Alencar et al., 2019). Foreign Direct Investment

(FDI) benefits the host countries' output through new capital investment, technology transfer, integration in global economic networks, development of human capital and skills, and boosting competitiveness (Chanegriha et al., 2020). Even though there is extensive empirical research on the FDI-growth relationship, the main direction of such causality is not clear yet (Khalid & Marasco, 2019).

The economic integration of countries also relies on international trade and remittance from emigrants (Singh, 2015). First, international trade is a key factor to achieve rapid economic growth, especially for the least developed countries (LDC), since it can bring innovation and advance technology diffusion in the host country (Zheng & Walsh, 2019). This is emphasized in the economic theory on trade openness, which indicates several channels that may lead to high rates of economic growth, e.g., foreign exchange provided by export revenues, which in some cases are crucial domestic savings (Çevik et al., 2019).

Despite the positive effect shown in empirical studies on international trade, the effects of remittance have found contradicting conclusions (Sobiech, 2019). The countries that benefit the most from remittances are those with less developed financial systems, since they provide an alternative way to finance entrepreneurs and their investments, hence promoting growth (Nepal et al., 2020).

After the energy crises of 1974 and 1981, the relationship between economic growth and energy/electricity consumption attracted the attention of the researchers in the field (Zheng & Walsh, 2019). The economies that are heavily dependent on energy use are constantly struggling to find solutions, based on sustainable natural resources, to overcome environmental pressure from the global policy community (Martinico-perez et al., 2018). One of the limiting factors for the economic prosperity of a country is the finite supply of natural resources, and its pronounced environmental degradation for energy distribution and consumption (Martinico-perez et al., 2018; Petrović-Randelović et al., 2020). Nonetheless, natural gas consumption seems positively correlated with GDP growth, which suggests a helpful alternative for sustainable economic development (Alam et al., 2017).

The last group of determinants is essential to economic performance and influences the role system: institutions. The term 'institution' includes the organization and systems

of a particular society or group, including their traditions and customs, which matter greatly in achieving economic growth (Alexiou et al., 2019; Cavusoglu, 2012). In order to deliver long-lasting economic benefits to society it is of the utmost importance to have strong and efficient institutions (Olaniyi & Oladeji, 2021). The quality of these institutions is measured, for instance, by the enforcement of property rights, constraints on the actions of powerful groups, equal opportunities, and control of corruption, among others (Pereira & Luiz, 2020). Nawaz & Khawaja (2018) and (Olaniyi & Oladeji, 2021) use fiscal policy and financial development, respectively, to illustrate that the positive effect of these determinants on economic growth is only possible conditional on the quality of institutions.

2.2.2 Literature reviews addressing economic growth determinants: An overview

Economic growth determinants have been the focus of a considerable number of high-quality reviews/overviews (e.g., Škare & Hasić, 2016; Nagarajan et al., 2017; Burke et al., 2018; Stanley et al., 2018; Urbano et al., 2019; Afonso et al., 2020; Badassa et al., 2020; Cazachevici et al., 2020; Colagrossi et al., 2020; Rickman & Wang, 2020). Literature reviews can be categorized into two main groups (see Snyder, 2019): (i) narrative (Table 2.1) and (ii) systematic (Table 2.2).

The narrative/qualitative reviews encompass critical discussions of the empirical literature on the impact of one or a few given factors on countries' economic growth. Such literature reviews address, for example, education (Sianesi & Van Reenen, 2003), taxes (Mabugu & Simbanegavi, 2015; Rickman & Wang, 2020), FDI (Forte & Moura, 2013), electricity (Burke et al., 2018), and corporate governance (Škare & Hasić, 2016). In many cases, instead of a broad country overview, the qualitative discussions focus on one specific country or group of similar economies, namely the United Kingdom and OECD (Sianesi & Van Reenen, 2003), Africa (Škare & Hasić, 2016), and the United States (Rickman & Wang, 2020), in order to highlight one main determinant or identify the most appropriate factor for explaining the economic growth of the countries studied.

Regarding the systematic/quantitative literature reviews, the most common approach is the ‘meta-analysis.’ The extant meta-analysis studies address the seven groups of determinants mentioned previously: 1) human capital (Benos & Zotou, 2014; Churchill et al., 2017); 2) labor and demographic conditions (Neves et al., 2016); 3) technology, innovation and structural change (Stanley et al., 2018); 4) macroeconomic conditions (Churchill & Yew, 2017); 5) international trade and FDI (Cazachevici et al., 2020; Gunby et al., 2017); 6) natural resources and geography (Havranek et al., 2016); and 7) institutional conditions (Afonso et al., 2020; Colagrossi et al., 2020).

Based on the results of different reviews, we can conclude that they are generally aligned with each other. In the first group of determinants, for example, education is defined as an important and significant factor to enhance growth by increasing productivity, mentioned in both the narrative (Sianesi & Van Reenen, 2003) and meta-analysis (Benos & Zotou, 2014) reviews.

The qualitative and quantitative reviews are also aligned regarding the impact of FDI. In a narrative study, Forte and Moura (2013) claimed that it was not possible to precisely determine the impact (negative or positive) of FDI on economic growth since it is strictly dependent on the host country’s domestic characteristics. Indeed, in their meta-analysis regression, Gunby et al. (2017) found a statistically insignificant impact of FDI on China’s growth and concluded that the results can be replicated only to other countries with similar development features.

In general terms, the large group of institutional conditions also find consensus in the literature. Even though the meta-analysis by Colagrossi et al. (2020), and the narrative studies by De Haan et al. (2006) and Škare & Hasić (2016) identify different determinants (democracy, economic freedom, and corporate governance, respectively), all of them found arguments in favor of the positive effect of solid institutions on economic growth.

Within the systematic review and differently from the meta-analysis, the bibliometric approach rests on trends and the main features used to study certain topics. Although bibliometric techniques capture the patterns and evolution of a scientific research field, their contribution regarding economic growth is limited to a few studies (Badassa et al., 2020; Nagarajan et al., 2017; Urbano et al., 2019). For instance, Nagarajan et al. (2017) analyzed 144 studies retrieved from Scopus between 1975 and 2013, addressing the

impact of population ageing on economic growth. They identified the emergent topics associated with this literature, the scientific importance of chief mechanisms involved in the relationship, and categorized the studies by methodological approach, covering regions and/or countries. Their results suggest the need for empirical studies on the subject in developing and least developed countries.

Urbano et al. (2019) and Badassa et al. (2020) are another two important bibliometric studies evaluating, respectively, entrepreneurship trends and the impact of sustainable transport infrastructure on economic growth. Both studies used the WoS database and analyzed around 80 published papers, the former from 1992 to 2016, and the latter from 2000 to 2019. These comprehensive bibliometric studies provided a broad overview of the respective field and potential gaps for future research.

Even though many economic growth determinants have been critically (qualitative and quantitatively) analyzed, the relevant studies have provided generally an overview of one factor, sometimes in specific periods of time, and with respect to one particular country or group of economies (BRICS, advanced economies, developing countries, etc.). A discussion embracing a larger group of determinants over a wider timespan and focusing on a larger and more diversified sample of countries has not yet been accomplished.

Table 2.1. Narrative literature reviews on economic growth determinants

Group of growth determinant	Growth determinant	Author(s)	Title	Main results
1) Human capital	Education	Sianesi & Van Reenen (2003)	The returns to education: Macroeconomics	Direct effect (++) <i>note: it varies with the countries' level of development.</i> Indirect effect (++) <i>note: through physical investments, technology transfer and fertility.</i>
4) Macroeconomic conditions	Government expenditure	Immen & Kuehnel (2009)	Productive government expenditure and economic growth	Direct effect (++) Indirect effect (+) <i>note: through investment incentives (financing).</i>
	Taxes and expenditure reforms	Mabugu & Simbanegavi (2015)	Tax and expenditure reforms in Africa: An overview	Africa (++) <i>note: above certain level can decline growth</i>
	Fiscal policy	Rickman & Wang (2020)	US state and local fiscal policy and economic activity: Do we know more now?	Not a major driver of US economic growth
5) International trade and FDI	FDI	Forte & Moura (2013)	The effects of foreign direct investment on the host country's economic growth: Theory and empirical evidence	(+ or -) <i>note: it is dependent on the domestic characteristics of host country and the investments.</i>
6) Natural resources and geography	Transport infrastructure investment	Crafts (2009)	Transport infrastructure investment: Implications for growth and productivity	(++) <i>note: it is neglected if it is financed by taxes on income.</i>
	Energy use	Stern (2011)	The role of energy in economic growth	(++)
	Electricity	Burke <i>et al.</i> (2018)	The impact of electricity on economic development: A macroeconomic perspective	(++)
7) Institutional conditions	Economic freedom	De Haan <i>et al.</i> (2006)	Market-oriented institutions and policies and economic growth: A critical survey	(+) <i>note: it depends on legitimacy of the government, independent legal system, protection of property rights, and competition</i>
	Corporate Governance	Škare & Hasić (2016)	Corporate governance, firm performance, and economic growth – theoretical analysis	(+)

Note. (++): positive effect, statistically significant or medium to high effect; (+): positive effect, not statistically significant or small to very small effect; (-): negative effect, not statistically significant or small to very small effect.

Table 2.2. Systematic literature reviews on economic growth determinants

Meta-analysis					
Group of GD	GD	Author(s)	Title	TD	RTS Main results
1) Human capital	Education	Benos and Zotou (2014)	Education and Economic Growth: A Meta-Regression Analysis	57 studies with 989 estimates	(1989-2011) (++)
	Government expenditure on education	Churchill <i>et al.</i> (2017)	Government education expenditures and economic growth: a meta-analysis	29 studies with 237 estimates	(1983-2013) Developed countries (++) LDC (+)
2) Labor and demographic conditions	Inequality	Neves <i>et al.</i> (2016)	A Meta-Analytic Reassessment of the Effects of Inequality on Growth	28 studies with 49 estimates	(1994-2014) (--) [negative effect more pronounced in LDC than in developed countries; wealth inequality is more pernicious than income inequality]
3) Technology, innovation and structural change	ICT	Stanley <i>et al.</i> (2018)	Does ICT generate economic growth? A meta-analysis regression	59 studies with 466 estimates	(1980-2013) Developed countries (++) [more significant from computing] Developing countries (++) [more significant from cell]
4) Macroeconomic conditions	Government transfers	Churchill and Yew (2017)	Are government transfers harmful to economic growth? A meta-analysis	23 studies with 149 estimates	(1985-2013) Developed countries (--) LDC (-) [the higher the level of social security, the lower the savings, hence the more pronounced negative effect on economic growth.]
5) International trade and FDI	FDI	Gunby <i>et al.</i> (2017)	Did FDI Really Cause Chinese Economic Growth? A meta-analysis	37 studies with 280 estimates	(2001-2015) (+) [transplanting the Chinese style policies that favor FDI to other developing countries will likely have little impact on their growth]
	Remittance	Cazachevici <i>et al.</i> (2020)	Remittances and economic growth: A meta-analysis	95 studies with 538 estimates	(2000-2018) (+) [the effect is larger in Asia than in Africa]
6) Natural resources and geography	Natural resources abundance	Havranek <i>et al.</i> (2016)	Natural Resources and Economic Growth: A meta-analysis	43 studies with 605 estimates	(1995-2013) Negligible (+ or -)
	Parallel economy	Afonso <i>et al.</i> (2020)	The non-observed economy and economic growth: A meta-analysis	15 studies with 133 estimates	(1996-2017) (-) [less pernicious in developed countries]
7) Institutional conditions	Democracy	Colagrossi <i>et al.</i> (2020)	Does democracy cause growth? A meta-analysis (of 2000 regressions)	188 studies with 2047 estimates	(1983-2019) (++)

Note: GD: Growth determinant; TD: Type of document; RTS: Research time-span; (++): positive effect, statistically significant or medium to high effect; (+): positive effect, not statistically significant or small to very small effect; (--) negative effect, statistically significant or medium to high effect; (-): negative effect, not statistically significant or small to very small effect.

Table 2.2. Systematic literature reviews on economic growth determinants (continued)

Bibliometric surveys						
Group of GD	GD	Author(s)	Title	DS (AA)	RTS	Main results
2) Labor and demographic conditions ageing	Population ageing	Nagarajan <i>et al.</i> (2017)	The impact of population ageing on economic growth: A bibliometric survey	Scopus (144)	(1975-2013)	There are few studies on the subject in developing countries and non on LDC.
6) Natural resources and geography	Sustainable transport infrastructure	Badassa <i>et al.</i> (2020)	Sustainable Transport Infrastructure and Economic Returns: A Bibliometric and Visualization Analysis	WoS (77)	(2000-2019)	There is a need for more work on transport sustainability, its effect on issues about metrics that assess sustainability, and economic indicators.
7) Institutional conditions	Entrepreneurship	Urbano <i>et al.</i> (2019)	Twenty-five years of research on institutions, entrepreneurship, and economic growth: what has been learned?	WoS (81)	(1992-2016)	There is a positive effect of entrepreneurship on economic growth.

Note: GD: Growth determinant; DS (AA): Data source (number of analyzed articles); RTS: Research time-span.

2.3 Methodological considerations

To appraise the evolution of the empirical literature on economic growth with a focus on EEs, we scrutinized its several dimensions – countries analyzed, the period of analysis, methodologies employed, and main economic growth determinants – and have resorted to a systematic literature review using bibliometric techniques.

Generally, bibliometric studies are based on three main sources of data: Scopus Sci Verse (Elsevier), Clarivate Analytics' Web of Science (WoS), and Google Scholar (GS). WoS along with Scopus, are the most used scholar citation database for field delineation (Comerio & Strozzi, 2019). Both sources have better performance than GS, since the latter is inundated by inconsistencies, multiple copies with inadequate information (incorrect title, author, volume number), which is less frequently updated (Nagarajan et al., 2017). According to Li et al. (2018), WoS is the world's leading analytical platform and is increasingly regarded as a scientific instrument across several knowledge domains. As the most traditional indexing platform worldwide (Marchiori et al., 2021) and the oldest citation resource (Nagarajan et al., 2017), we opted for WoS as our bibliographic database in this study.

In terms of search algorithm (Figure 2.1), we used specific keywords (AK="economic growth") and limited the search to articles written in English. Then, we refined the search to the field of Economics. This systematic search yielded 4,302 articles published between 1991 and 31st July 2020.

In a second stage, we downloaded all the relevant information concerning the articles, i.e., title, authors, citations, source, year of publication, abstract, etc., and analyzed each abstract to select the relevant studies (in some cases, it was necessary to read the introduction and other sections of the papers).

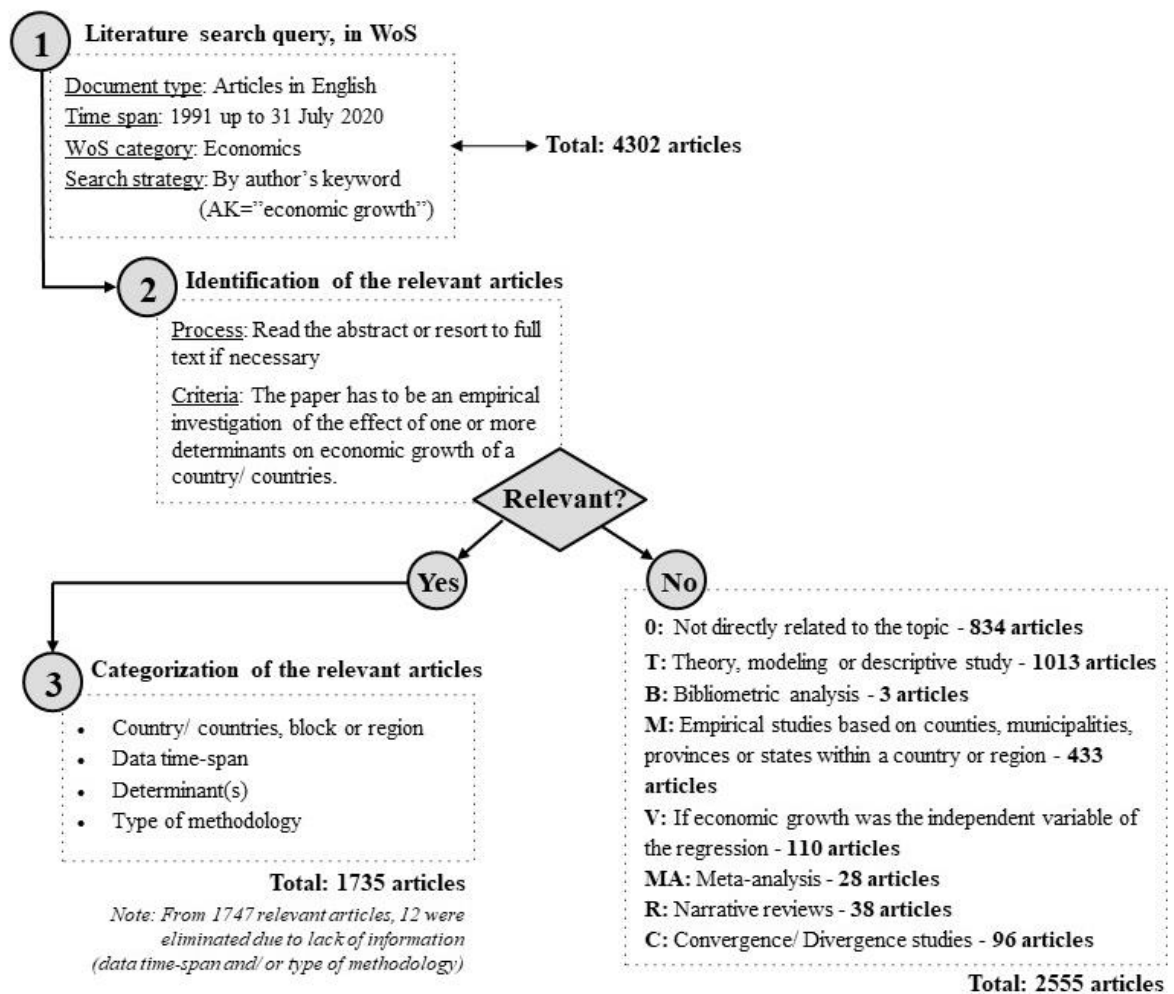


Figure 2.1. Main steps of the systematic review process

Source: Authors' elaboration.

After reading and classifying each paper regarding their relevance, we excluded from the subsequent analysis the theoretical and review-related papers, empirical studies based on municipalities, counties, provinces or states within a country or region, articles in which economic growth was not the variable to be explained (being instead an explanatory variable), studies dealing with convergence/divergence issues, and the papers that were not directly related to economic growth. Consequently, 2,555 articles were excluded. In addition, due to a lack of information needed to categorize the studies, 12 more were eliminated.

Table 2.3. Categories sub-groups

Country/ block/ region^{1,2}
Developed Countries
Developing Countries
Least Developed Countries (LDC)
Emerging Economies (EEs)
Block of Countries - Asia
Block of Countries – Latin America and The Caribbean
Block of Countries - Europe
Block of Countries – Middle East and North Africa (MENA)
Block of Countries - Africa
Block of Countries - OECD
Block of Countries - Diverse
Period of analysis
Less than 10 years
Between 11 and 30 years
Between 31 and 100 years
More than 100 years
Methodologies for data analysis
Cross-section
Static Panel data (FE, RE)
Dynamic Panel data (GMM, GMM-sys)
Time series (VAR, ARDL, VEC)
Other
Determinant(s) of economic growth (see Section 2)
Human capital (education, health, ageing)
Labor and demographic conditions (inequality, migration, income distribution)
Technology, innovation and structural change (ICT, R&D, deindustrialization)
Macroeconomic conditions (fiscal policy, government transfers, public debt)
International trade and FDI (FDI, exports and imports, trade openness, remittance)
Natural resources and geography (energy consumption, infrastructure)
Institutional conditions (corruption, democracy, economic freedom, reforms)

Note. ¹ – We used the 2020 classifications from the IMF, World Bank, and United Nations. The final classification of countries by level of development is presented in Appendix 2. ²- ‘Block of Countries’ corresponds to studies that analyzed more than one country with different levels of development.

The remaining (1,735) articles were examined and categorized according to the country(ies) (block or region) of analysis, the starting and ending year of the period analyzed, the main determinant(s) explaining economic growth, and the type of methodology applied to analyze the data. Specifically, each given category was composed of several sub-categories as shown in Table 2.3.

2.4 Mapping the empirical economic growth literature: Main results

2.4.1 Evolution of the empirical literature on economic growth

The empirical articles on the economic growth of countries, published in sources indexed in the WoS, significantly increased since 1991 and reached almost half of the total studies (48.9%) in the growth-related literature in the last five years. As shown in Figure 2.2, from 1991 to 1995, the number of empirical articles had a small place in the literature (13.5%), summing only seven publications out of 52. Since then, the pattern has risen consistently, with a sharp increase from the first (1991-1995) to the second period (1996-2000), when publications grew nearly five times, and after that, doubling every five years.

The evolution of the ratio of empirical articles on countries' economic growth in total articles published on economic growth shows a positive pattern throughout the period analyzed (Figure 2.2), which to some extent can be associated with the availability of data and advancements in computing power (Backhouse & Cherrier, 2017).

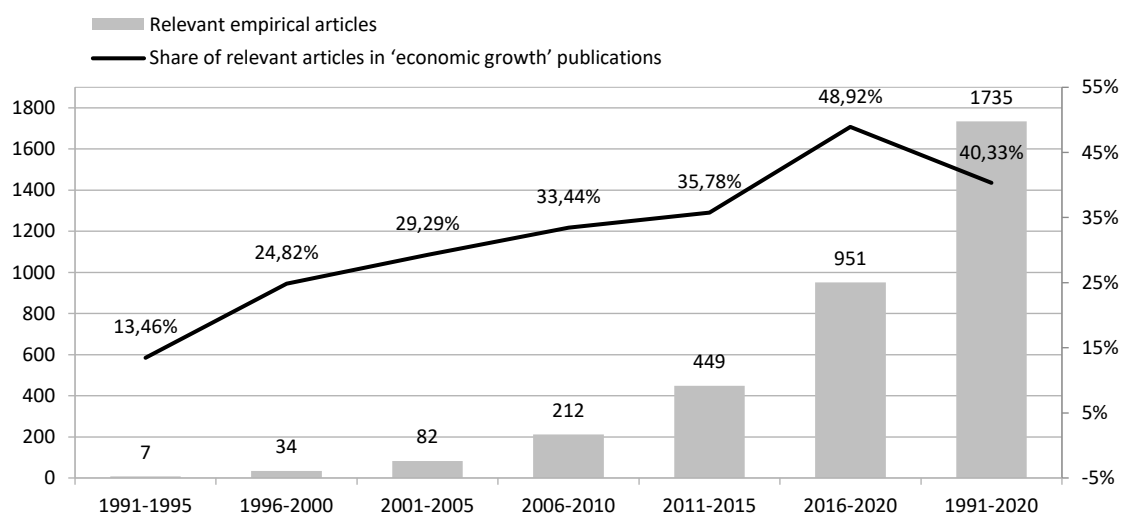


Figure 2.2. Evolution of empirical journal articles on economic growth, 1991-2020

Source: Authors' computation based on data from the WoS, 31 July 2020.

2.4.2 Countries analyzed: Evolution of the relative shares

Analyzing the distribution of relevant economic growth research by group of countries over time (Figure 2.3), it is possible to observe that as the number of publications increases, the attention given to each block of economies remains almost unchanged, with some specific notes. First, in the first period (1991-1995), only Developed countries (29%), Developing countries (14%), the Asians (14%), OECD economies (14%), and a block of diverse countries (29%) were studied. Secondly, studies focusing on Developed countries decreased from the first (1991-1995) to the second period (1996-2000), dropping from 29% to only 6%, thus leading to more diversified country research.

As can be seen in Figure 2.3, the distribution of publications over the entire period is favorable to studies that focus on a diverse group of countries (28%), followed by the EEs (23%), and the Developed countries (12%). These findings reveal the relevance and greater attention devoted to EEs, at least within economic growth literature, compared to studies on more advanced economies in the same field. Moreover, if we consider that most OECD and European countries belong to the group of Developed economies, and that most of the Latin American, Caribbean, Asian and MENA countries are classified as EEs, the distribution of both groups in the related literature is 30% (EEs) and 25% (developed countries), supporting the claim above.

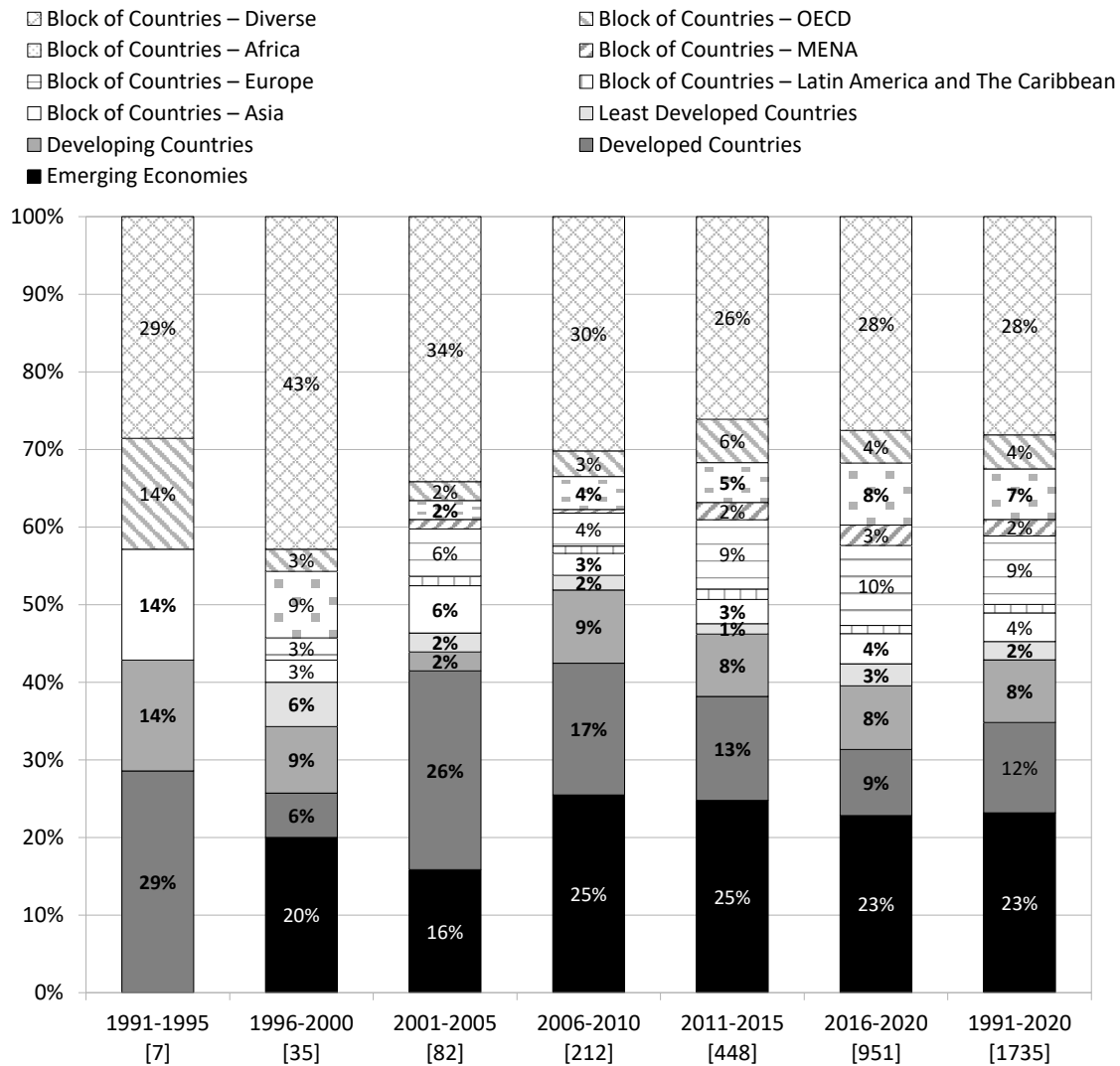


Figure 2.3. The distribution (%) of 1735 relevant articles by group of countries

Source: Authors' computation based on data from the WoS, 31 July 2020.

Apart from the second period (1996-2000), when the block of European countries filled 43% of total articles (Figure 2.4), the geographic area that attracted much attention among the EEs was Asia, which achieved 34% of the total research over the period under analysis. Furthermore, as can be seen in Figure 2.4, the sharp growth observed in the Asian studies since 2001 was not followed by research on Latin America and the Caribbean, which observed a decrease in their relative contribution to the literature, from 31% in the third period (2001-2005), to a negligible share of only 4% in the last five years.

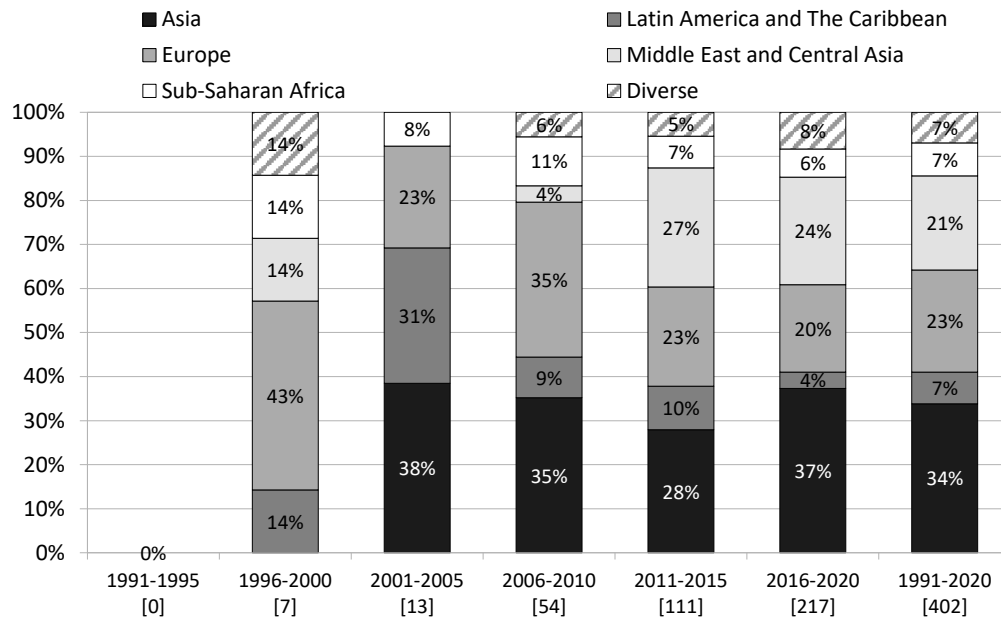


Figure 2.4. The distribution (%) of 402 articles on EEs by geographic area

Source: Authors' computation based on data from the WoS, 31 July 2020.

Of a total 402 articles on EEs, the group of Latin American and Caribbean countries accounts for only 29 publications, losing ground to Sub-Saharan Africa, the Middle East and Central Asia, and Europe, which correspond to 30, 86, and 93 publications, respectively, between 1991 and 2020. Such evidence confirms that Latin America and the Caribbean have not received sufficient scientific attention in the growth literature, as stated by Barrios et al. (2019), Hofman & Valderrama (2021), and Martin & Vazquez (2015).

2.4.3 Period of analysis

We mapped the 1,735 studies by period of analysis grouping them into four categories (cf. Table 2.3): 1) less than 10 years; 2) between 11 and 30 years; 3) between 31 and 100 years; and 4) more than 100 years.

There is a predominance of studies (more than 80% of the total) that involved analyses spanning between 11 and 100 years (Figure 2.5). Most of the studies within this period (93%) have as their start year of analysis as 1960 or later. Studies covering more

than 100 years are scarce, accounting for only 39 (2% of the total) articles (reaching a peak of 5% in the fourth period, 2006-2011). The relatively small share of very long-run studies might be in part explained by the lack of or difficulty in finding relevant data. Supporting this assumption, we noted that the Developed countries have the largest share of very long-run analyses, encompassing 22 of 39 articles (56%) that involve periods with more than 100 years.

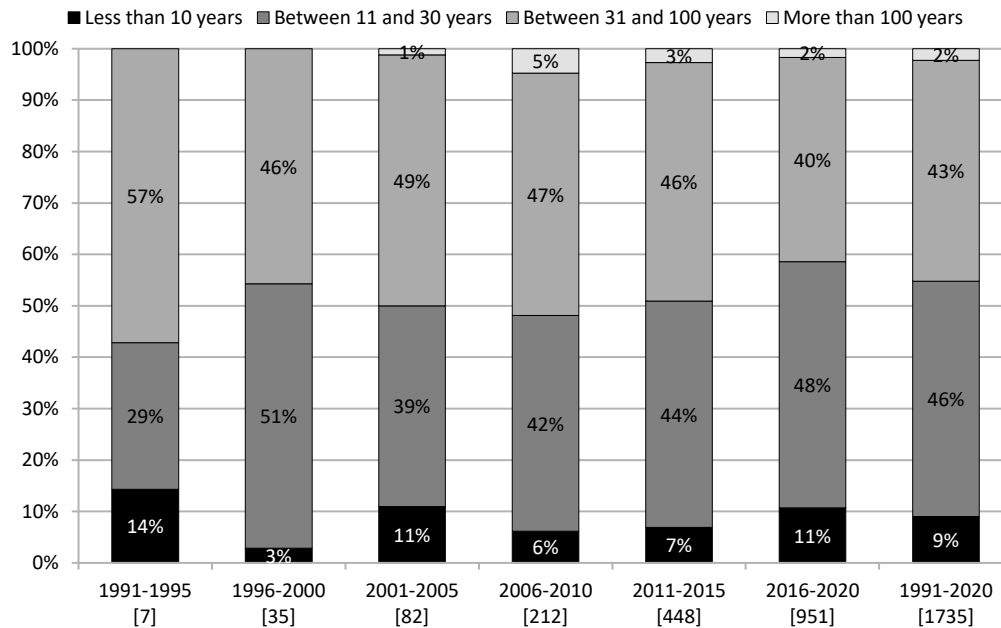


Figure 2.5. The evolution of articles by period of analysis

Source: Authors' computation based on data from the WoS, 31 July 2020.

Across blocks of countries (Figure 2.6), studies between 11- and 30- years and between 31- and 100-years account for 80% or more of the total studies. In the case of studies focusing on European or MENA countries, there is a higher representativeness of shorter span studies, involving up to 30 years (making up 84% and 94% of the corresponding total, respectively).

Regarding the studies that focused on EEs (402 articles), slightly more than half (52%) involved a period between 31- and 100- years. The very long-run analysis (more than 100 years) represents only 1% of the total. For EEs, 1,875 was the oldest starting year (in a South African study), and the longest period of analysis observed in an

Indonesian investigation was 128 years, from 1880 to 2008.

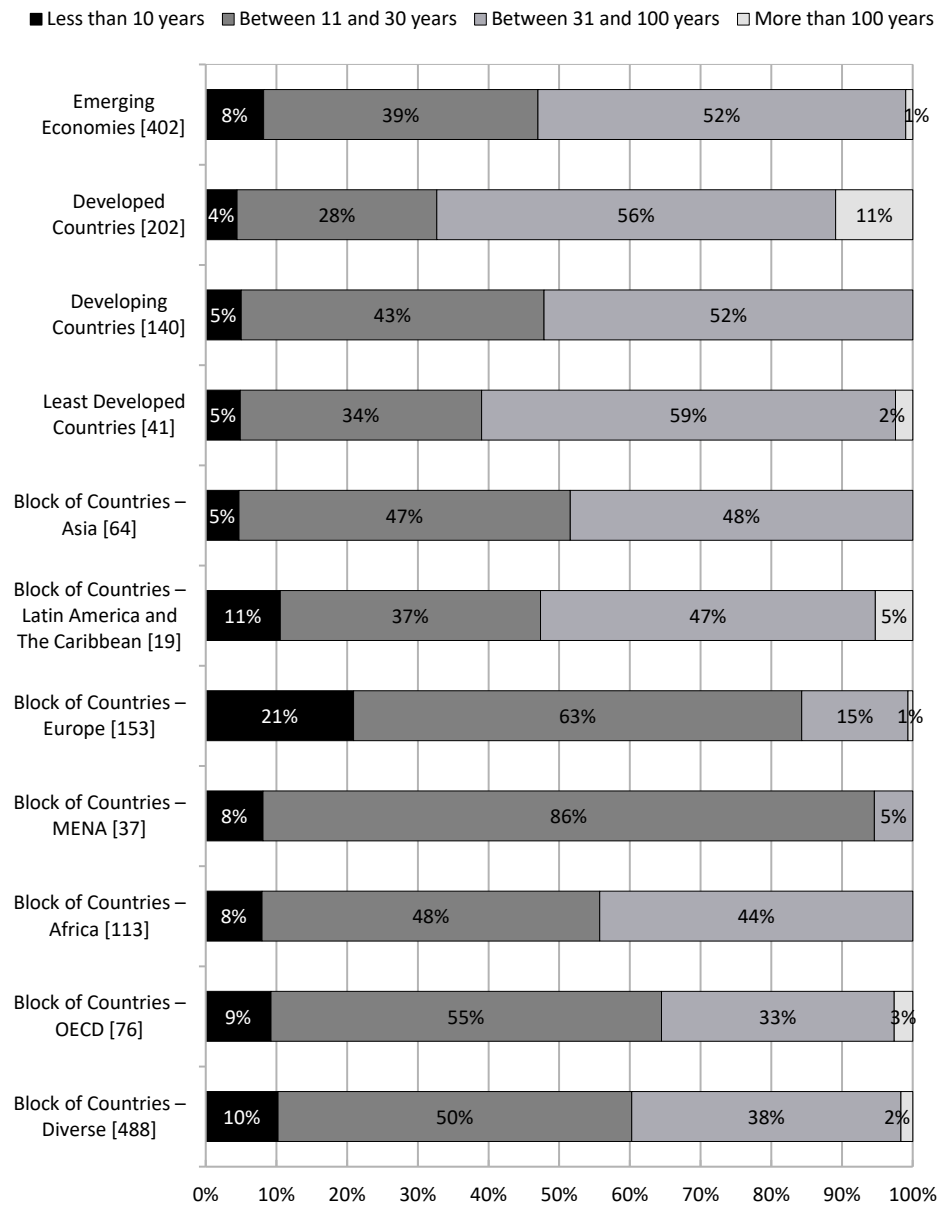


Figure 2.6. The distribution (%) of 1735 relevant articles by group of countries and period of analysis

Source: Authors' computation based on data from the WoS, 31 July 2020.

Analyzing the period of analysis of the articles focusing on the EEs by geographical area (Figure 2.7), we found that while European EEs have a share of 16% (15 articles) in a timeframe with less than 10 years and no articles with more than 100 years, Latin America and the Caribbean have a share of 7% (4 articles) that analyze more than 100

years, but no articles with less than 10 years. Indeed, the latter is the only block of countries among the EEs that has no published study analyzing less than 10 years.

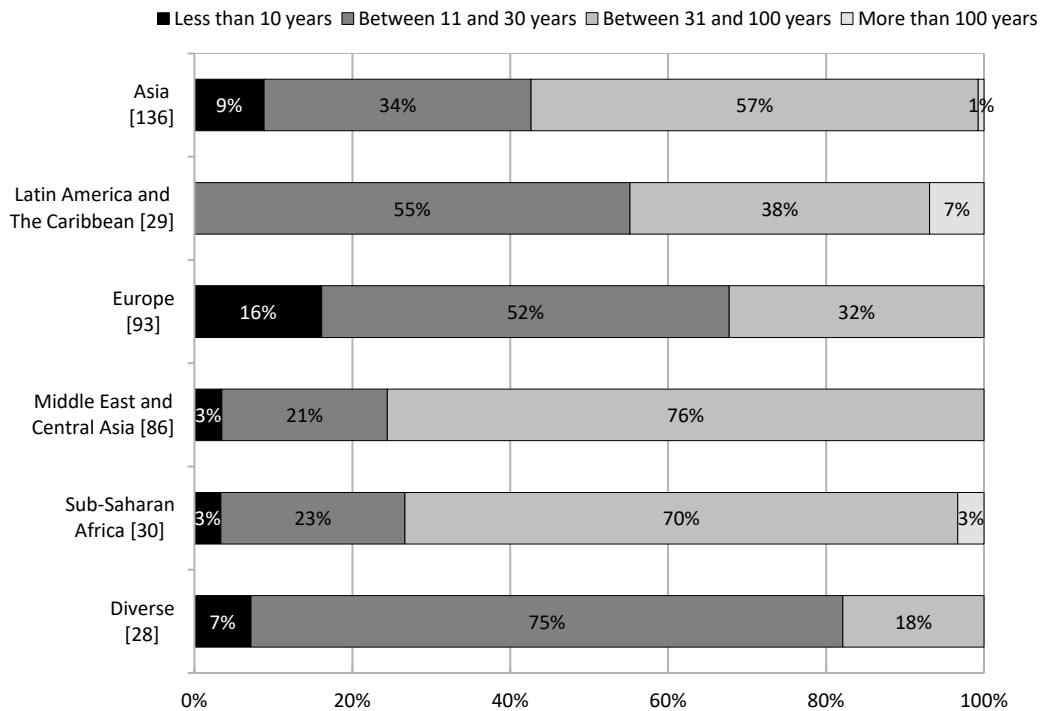


Figure 2.7. The distribution (%) of 402 articles on EEs by geographic area and period of analysis

Source: Authors' computation based on data from the WoS, 31 July 2020.

2.4.4 Data analysis methodologies

To understand the methodological approaches and considering that some publications contain more than one data analysis method, we considered each methodology applied as one analysis. We therefore mapped 1764 analyses/observations in our sample of 1,735 relevant articles.

As we can see in Figure 2.8, over the whole period (1991-2020), the most used methodology was time series (39%), followed by panel data (dynamic, 31%, and static, 16%), other methods (9%), and cross-section (6%).

The evolution of studies presented a substantial change from the first (1991-1995) to the third period (2001-2005). First, there were no dynamic panel data analyses in the first five years. Second, the cross-section method (the least used in the sample) achieved a

peak of 28% in the second period (1996-2000), dropping each five years to reach only 4% into the methodology distribution in the last five years.

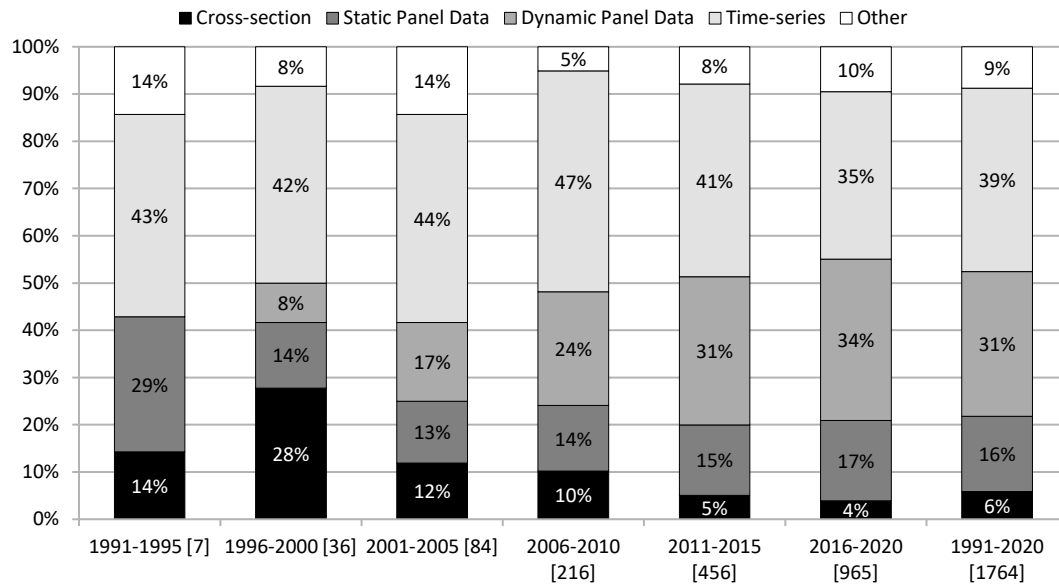


Figure 2.8. The distribution (%) of 1764 ‘methodology analyses’ by type of data analysis methodology

Source: Authors’ computation based on data from the WoS, 31 July 2020.

In terms of block of countries (Figure 2.9), we found that time-series analyses have the major share among EEs (79%), Developed countries (67%), Developing countries (45%), and LDC (78%), whereas for the remaining group of economies the methodology used most often was dynamic panel data. Interestingly, the studies focusing on EEs and Developed countries used all the different types of methodology except for the cross-sectional. On the other hand, for the studies focusing on Latin America and the Caribbean countries, the share of cross-sectional regressions was 16%, presenting some diversity across type of data analysis methodology and block of countries.

Regarding the EEs (Figure 2.10), the dominance of time series analyses is clear (Asia, 82%; Latin America and the Caribbean, 93%; Europe, 73%; Middle East and Central Asia, 92%; and Sub-Saharan Africa, 93%), except for the group of studies of diversified countries (18%), where dynamic panel data accounted for more than half of the analyses (54%).

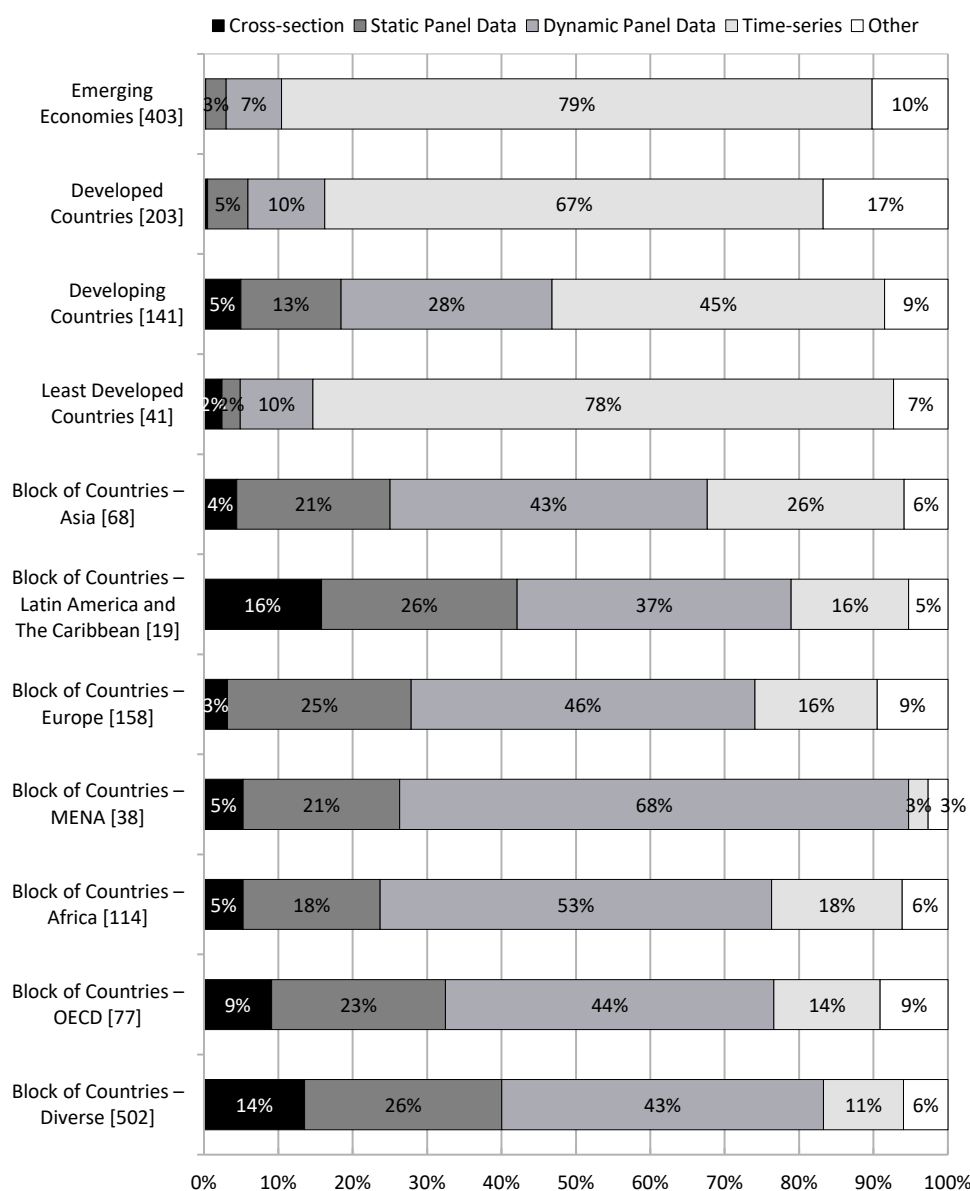


Figure 2.9. The evolution of studies according to the type of data analysis methodology and by group of countries

Source: Authors' computation based on data from the WoS, 31 July 2020.

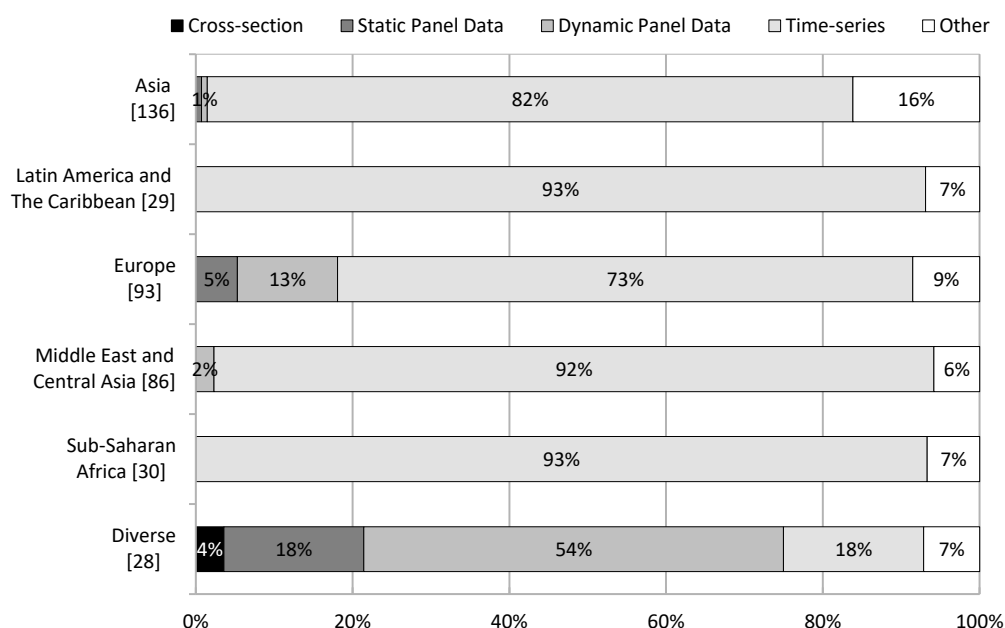


Figure 2.10. The distribution (%) of 403 EE's 'methodology analyses' by geographic area and type of data analysis methodology

Source: Authors' computation based on the WoS, 31 July 2020.

2.4.5 Main determinants of economic growth

A given study often analyzes more than one economic growth determinant. In fact, out of the 1,735 articles analyzed, 384 articles included two or more economic growth determinants. Thus, we have 2,269 observations (determinants-studies).

Since 1996, the evolution of economic growth determinants has been quite homogeneous, as can be seen in Figure 2.11. The group of determinants 'Macroeconomic conditions' has always dominated the literature even though its share dropped from 63% in the first period (1991-1995) to 34% in the last five years (2016-2020). The second most analyzed group of determinants is 'International trade and FDI', which for the same period observes a variation in its share from 38% to 22%. The 'Natural resources and geography' is the third most analyzed group (16%) over the period of study, followed by 'Institutional conditions' (9%), 'Labor and demographic conditions' (7%), 'Human capital' (6%), and 'Technology, innovation and structural change' (6%).

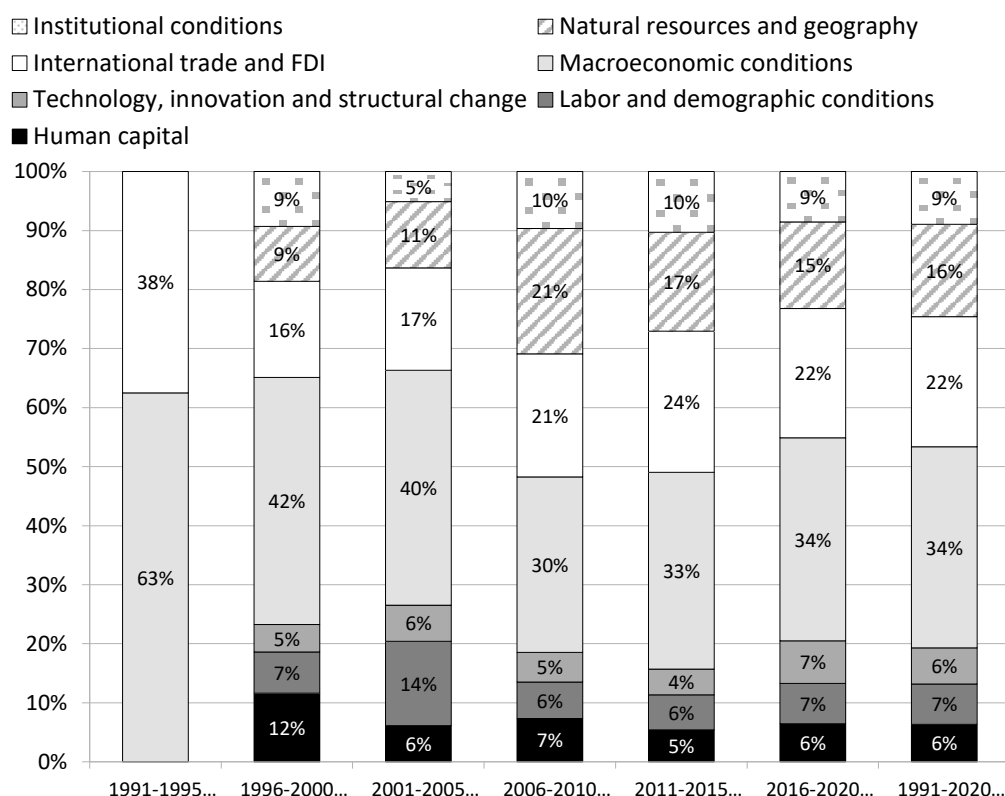


Figure 2.11. The distribution (%) of 2269 ‘determinant analyses’ by group of determinants

Source: Authors’ computation based on data from the WoS, 31 July 2020.

The distribution of economic growth determinants in terms of group of countries is slightly more heterogeneous than previous analyses (see Figure 2.12). ‘Macroeconomic conditions’ is not the dominant determinant among the LDC, Asian, Latin American, Caribbean, and African countries, being replaced by ‘International trade and FDI’. In the case of the MENA countries, ‘Macroeconomic conditions’ divides its scientific attention with ‘Institutional conditions’, each one with 27% of the total analyses.

In the case of EEs, which encompass 554 of 2269 observations (24% of the total), they present a dynamic distribution among groups of determinants similar to the total sample average, where the groups of ‘Macroeconomic conditions’ (34%), ‘International trade and FDI’ (25%), and ‘Natural resources and geography’ (19%) represent almost 80% of the total observations/analyses. Determinants related to ‘Institutional conditions’ (4%), ‘Labor and demographic conditions’ (5%), ‘Human capital’ (6%), and

‘Technology, innovation and structural change’ (6%) are the least studied.

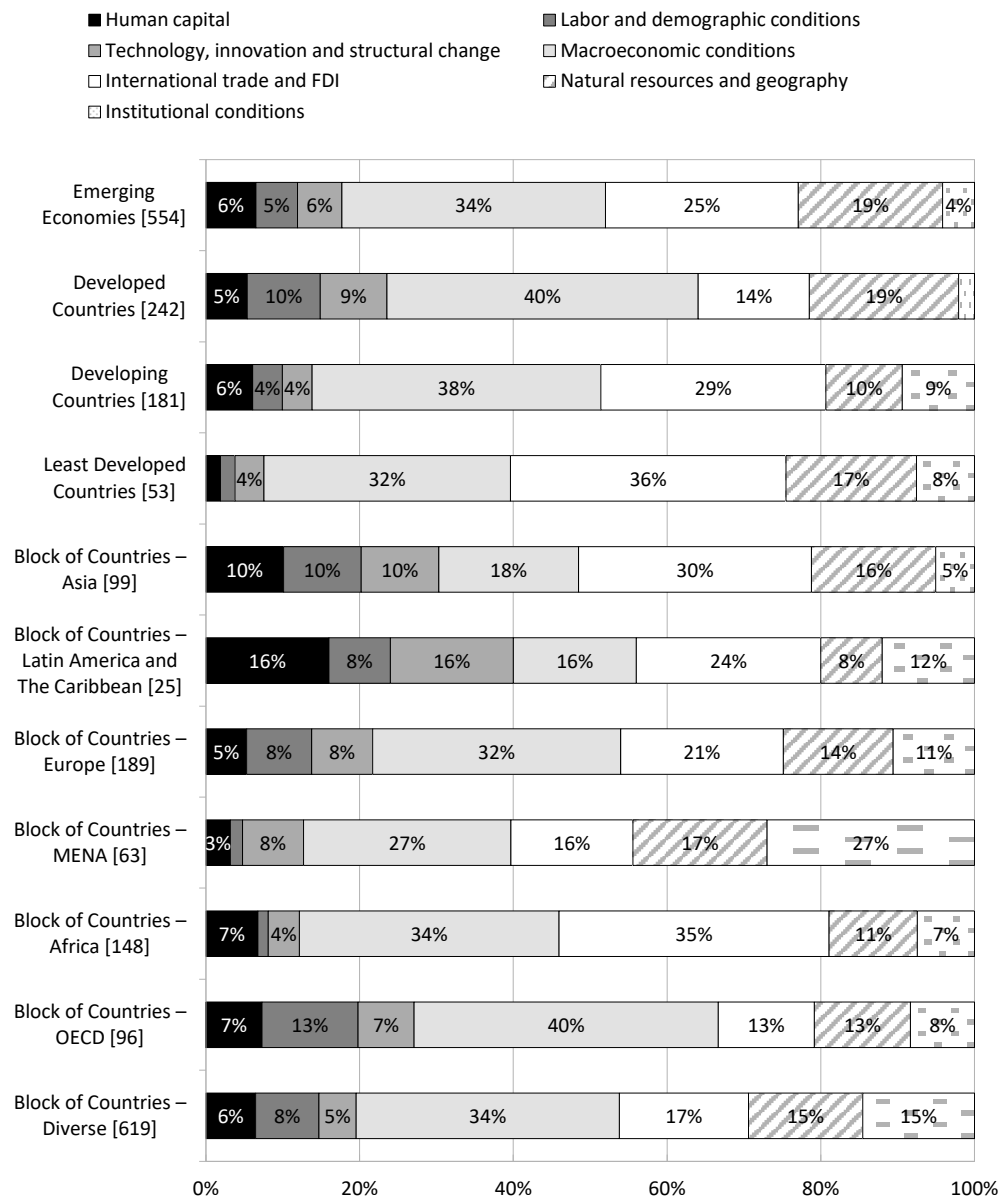


Figure 2.12. The distribution (%) of 2269 ‘determinant analyses’ by group of countries and group of determinants

Source: Authors’ computation based on data from the WoS, 31 July 2020.

Detailing a bit further the determinants analyzed in studies focusing on EEs and Developed countries (Table 2.4), the same scientific attention was given to each determinant in both group of countries. Apart from exchange change and public debt (Developed countries), the common determinants, namely energy consumption, financial

development, FDI, military expenditure, exports, government expenditure, CO2 emissions, tourism, and human capital, account for more than 30% of the corresponding total in both groups of countries.

Table 2.4: The 10 most-studied determinants for EEs and Developed Countries

Emerging Economies (EEs)		Developed Countries (DC)	
Single determinant	Share in EEs' analysis	Single determinant	Share in DC' analysis
Energy consumption ⁴	8.3%	Energy consumption ⁴	7.9%
Financial development ²	6.0%	Military expenditure ²	5.0%
FDI ³	5.8%	Financial development ²	3.7%
Military expenditure ²	3.6%	Public debt ²	2.9%
Exports ³	3.3%	Government expenditure ²	2.5%
Human capital ¹	2.9%	Exports ³	2.5%
CO2 emissions ⁴	2.7%	Tourism ³	2.5%
Tourism ³	2.4%	CO2 emissions ⁴	2.5%
Exchange rate ²	2.2%	FDI ³	1.7%
Government expenditure ²	2.2%	Human capital ¹	1.7%

Note. These determinants belong to the following group of determinants: ¹- 'Human capital'; ² 'Macroeconomic conditions'; ³ – 'International trade and FDI'; ⁴- 'Natural resources and geography'. Bold represents common determinants.

If we focus on the EE analyses by geographic area (Figure 2.13), 'Macroeconomic conditions' remains the most-studied group of determinants – Asia (34%); Latin America and the Caribbean (38%); Europe (30%); Middle East and Central Asia (38%); and Sub-Saharan Africa (44%), except for the block of diverse countries, where the group 'International trade and FDI' accounts for 34% of the total analyses.

Among the studies that focus on the Asian countries (192 observations), 'Macroeconomic conditions' (34%) is the most analyzed group, followed by 'Natural resources and geography' (23%), 'International trade and FDI' (19%), 'Labor and demographic conditions' (8%), 'Human capital' and 'Technology, innovation and structural change' (6% each), and 'Institutional conditions' (4%).

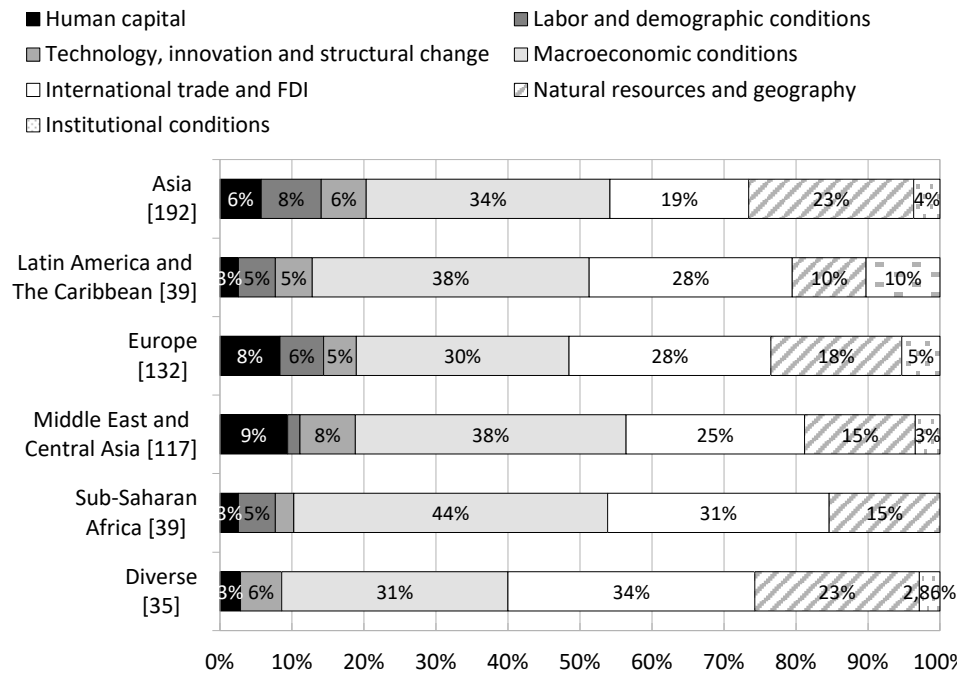


Figure 2.13. Main groups of determinants (% total) in the case of EEs by geographic area

Source: Authors' computation based on data from the WoS, 31 July 2020.

2.5 Discussion and concluding remarks: Main gaps and avenues for further research

The discussion around economic growth and its proposed determinants has been a continuous and significant academic endeavor (Law et al., 2020). Motivated by this ongoing debate and the doubts related to the scientific attention devoted by to the case of EEs, this essay presents a systematic/quantitative bibliometric review that explores the empirical studies published on economic growth.

Based on 1735 relevant empirical articles published in Economic journals indexed in WoS, from 1991 to 2020, we obtained five main results: 1) greater scientific attention has been devoted to EEs compared to more advanced economies; 2) within EEs, the sharp growth observed since 2001 in Asian-related studies does not follow a similar pattern in the case of research on Latin America and the Caribbean, which observed a decrease in

their relative contribution to the empirical growth literature; 3) very long-run empirical studies, covering more than 100 years, are scarce, accounting for only 2% of the total, being even scarcer in the case of EEs (1% of the total); 4) for all the relevant empirical articles, the most widely used methodology of analysis was time series (39%), most particularly in the case of EEs (79%); 5) globally, the ‘Macroeconomic conditions’ is the most often analyzed group of determinants, whereas ‘Human capital’, ‘Technology, innovation and structural change’, ‘Labor and demographic conditions’ and ‘Institutional conditions’ are rather neglected; these latter determinants are also somewhat overlooked in empirical articles devoted to EEs, where the main focus falls on ‘Macroeconomic conditions’ (mainly financial development) and ‘International trade and FDI’ (mainly FDI).

Answering the first main question, *What is the evolution of the empirical economic growth-related research over time?* We concluded that from the first (1991-1995) to the second period (1996-2000) analyzed, the publications grew nearly five times, and after that, it doubled every five years, reaching almost half of the total studies (48.9%) in the growth-related literature in the last period (2016-2020). This evolution and recent greater share of empirical growth studies probably reflects the availability of data and advancements in computing power as pointed out by Backhouse & Cherrier (2017).

Regarding the second question, *Are the EEs understudied in the empirical economic growth literature in comparison to developed countries?* We found that EEs have not been understudied, quite the opposite. The distribution of publications over time showed a larger share of empirical studies devoted to EEs (23%) compared to Developed countries (12%). Even when we extended the analysis to consider the block of the Asian, Latin American, Caribbean, and MENA countries as EEs, and the block of OECD and European countries as Developed countries, the share remains more favorable to the former (30%) than the latter (25%). Such an evolution reflects the increasing scientific attention devoted to the EEs from the early 2000s onwards and it is likely to be related to the massive change in the world economy since then. The balance shifted from the advanced economies to the EEs, specially boosted by the expressive growth of China and India (Gruss et al., 2020; Jorgenson & Vu, 2016).

In what concerns the third question, *Did the Latin American EEs receive the same*

scientific attention as the Asian EEs? Our analysis shows that a significant number of studies has been dedicated to Asia (136 articles out of 402). This is likely to reflect the importance of these countries, especially China and India, in the world economy since 2000, as mentioned previously. We further discovered that the EEs from Latin American and the Caribbean are understudied not only when compared to the Asian EEs but to most of the others, encompassing only 7% of the total empirical articles devoted to EEs.

Finally, concerning the fourth research question, *Is there any specific pattern in the empirical economic growth literature devoted to EEs in terms of period analyzed, methodology of analysis, and main economic growth determinants?* The quantitative analysis suggested a gap in the very long-run studies (only 1% of the total EEs studies), as well as an expressive choice for time-series analysis (almost 80% of the total EEs studies). Regarding the main economic growth determinant analyzed, ‘Macroeconomic conditions’ and ‘International trade and FDI’ dominate the EE growth literature, accounting for more than 50% among all groups of countries.

Focusing on the EE studies, we can conclude that Latin America and the Caribbean also present a gap in the very long-run research (7%), although their share is far more representative than the average EEs (1%). The time-series analyses are responsible for almost all of the studies (93%), and ‘Macroeconomic conditions’ remains the main growth determinant examined within this group of countries (38%). Moreover, although the share of ‘Institution conditions’ (10%) is slightly above that of the global average (9%), given the institutional constraints faced by this group of countries (together with those of Africa), (S. G. Hall & Ahmad, 2014; Martin & Vazquez, 2015; Nistor et al., 2018; Vianna & Mollick, 2018), further empirical evidence of the influence of institutional quality on the economic growth of Latin America and the Caribbean is essential at this stage.

The results point to the scientific relevance of EEs within the economic growth literature. However, it is not possible to identify a right direction for the related research, whether this is due to their sharp rise in the world economy (especially boosted by the growth of China and India), or if their impressive growth rates reflect the positive results of previous studies, hence, the adoption of proper policies by their governments. In practice, our study encourages investment in this type of research, mainly in the neglected

group of EEs, Latin America and the Caribbean, since the evidence gathered is likely to help governments devise proper economic policies to overcome backwardness and boost sustainable economic growth. Likewise, with respect to the features that most define these economies, such as poverty and inequality (Santos & Villatoro, 2018; Vacaflores, 2018), inefficient manufacturing basis (Krasil'Shchikov, 2015; Peña-Vinces et al., 2019), and poor institutional conditions (Nistor et al., 2018; Vianna & Mollick, 2018), the present bibliometric analysis shows an urgent need for empirical studies on the matter.

From our bibliometric analysis, it was possible to obtain an overall view of the state of the art and the research trajectory of the empirical growth-related literature. In fact, this systematic literature review encompasses three main contributions, at the theoretical, empirical, and methodological levels. First, at the theoretical level, although a reasonable number of quality reviews have addressed the topic of economic growth (Afonso et al., 2020; Badassa et al., 2020; Burke et al., 2018; Cazachevici et al., 2020; Colagrossi et al., 2020; Nagarajan et al., 2017; Rickman & Wang, 2020; Škare & Hasić, 2016; Urbano et al., 2019), their critical discussion (narrative/qualitative or systematic/quantitative) has focused on the impact of one or only a few growth determinants, as well as being centered on one specific country or a group of similar economies. Therefore, this essay adds a novel and up-to-date systematic/quantitative survey to the economic growth reviews, embracing all countries, determinants, and time-span studies. Second, at the empirical level, it suggests the empirical growth-agenda needs to be redirected in future research. Indeed, the mapping of the relevant studies has highlighted, for instance, the scarcity of empirical studies on the economic growth of the Latin American and Caribbean EEs, the overall lack of very long-run studies (more than 100 years), and the relatively neglected determinants related to 'Institutional conditions', 'Human capital', 'Labor and demographic conditions' (8%), and 'Technology, innovation and structural change'. Third, at the methodological level, to the best of our knowledge, this is the first bibliometric survey to explore and map the available empirical information on the economic growth of countries in general, and that of EEs in particular, embracing almost 1800 published articles in journals of the scientific field of economics indexed in WoS. Summing up, the systematic literature review performed drew some attention on the existing empirical literature on economic growth and provided a comprehensive panorama of potential avenues for future research in the field.

Chapter 3

Brazil's economic growth and real di(convergence) from a very long-term perspective (1822-2019): An historical appraisal

[Doré, N.I. and Teixeira, A.A.C. (2022). *Brazil's economic growth and real div (convergence) from a very long-term perspective (1822-2019): An historical appraisal*. Brazilian Journal of Political Economy. (to be published)]

3.1 Introduction

A former Portuguese colony, Brazil is the largest country in Latin America as well as one of the largest in the world in terms of territorial size and population. Records of the Gross Domestic Product (GDP) place Brazil in the eightieth position in the world ranking (IMF, 2018), even though its per capita level differs substantially. In 2018, Brazil occupied the 80th position in terms of GDP per capita based on Purchasing Power Parity

(PPP) rates, far from some of its continental neighbors, such as Chile (56th), Mexico (63rd), and Argentina (64th). The scenario is even worse when compared with the benchmark United States (10th), or its *alma matter* Portugal (42nd).

The picture of the country that emerges not only underscores its precarious position regarding per capita income, but also some rather inconsistent periods of economic growth. Despite the ability for high growth rates (from 1960 to 1980, the real GDP grew on average by 7.5% annually), Brazil has faced significant challenges in its efforts to promote robust and sustainable growth, and its long-term economic performance has been disappointing (Arbache & Sarquis, 2018).

The ups and downs of Brazil's economic growth has garnered substantial scientific attention from economists, and a set of quantitative studies have analyzed some of the key determinants of Brazilian economic performance, such as inflation (e.g., Araújo et al., 2018), balance-of-payment constraints (e.g., Alencar & Strachman, 2014; Lélis et al., 2018; Vieira & Holland, 2010), financial and trade liberalization (e.g., Bresser-Pereira et al., 2020), structural change (e.g., Oreiro et al., 2018), and political instability (e.g., Campos et al., 2020). Although these analyses are highly relevant and provide insights to better understanding Brazilian backwardness, they focus mainly on relatively short and contemporary periods (except for Campos et al., 2020, who embraced a very long time span), which means that these studies place particular emphasis on explaining deceleration/acceleration events, but have missed a great deal of potential information provided by much longer periods.

Additionally, qualitative, descriptive accounts of Brazil's economic history are available mainly in book format (e.g., Abreu, 2014; Bresser-Pereira, 2017; Furtado, 1987; Hudson, 1997). These studies generally focus on a structural perspective, attributing Brazil's laggardness to an unstable balance of payment, the high weight of commodities in the export basket, and the detrimental, premature deindustrialization process after the 1980s.

Even though these studies occasionally agree on some determinants that have hindered Brazilian economic performance (e.g., premature deindustrialization; balance-of-payment constraints), others present divergent conclusions (e.g., Carvalho & Carvalho (2019) vs. Araújo et al. (2018), or Alencar et al. (2018) vs. de Jesus et al., 2018)). The

disagreements are hard to disentangle, and the mixed results require delving even further into Brazil's economic history.

To date and to the best of our knowledge, the studies addressing Brazilian performance have overlooked some critical factors underlying the economic growth of emerging economies (EE), such as the role of human capital formation (Wang et al., 2020), and their institutional conditions (Vianna & Mollick, 2018).

Another overlooked issue is whether Brazil has managed to achieve or is in the process of achieving real convergence with the developed countries. Most of the literature on real convergence has focused on the processes of real convergence within the country (e.g., Dapena et al., 2017; Ferreira, 2000; Lima & Notini, 2010). The present study focuses on Brazil's real convergence regarding other Latin American countries, and more developed countries, such as Portugal, the UK, and the US, measured by real GDP per capita, retrieved from Maddison Project Database (2020).

In this essay, we aim to fill these gaps in the literature by providing a structured qualitative/ narrative review of Brazil's economic growth from a very long-run perspective (1822-2019), highlighting the critical factors underlying its economic performance, summarized by periods (adapting Maddison's (1992, 2000) proposal)⁴ - The Empire (1822-1889); The Oligarchic Republic (1889-1930); The developmentalist era (1930-1980); The Crisis period (1980-1990); and The Neoliberalism phase (1990-2019)⁵ - and sets of growth determinants (cf. Bruns & Ioannidis, 2020, and Sala-i-Martin et al., 2004) - Macroeconomic (in)stability; International trade; Resources and dynamic capabilities (human capital, research and development, and innovation); Sectoral specialization patterns/structural change; and Institutions (law, culture, politics, transparency). Furthermore, the lack of studies providing a very long-term perspective of Brazil's real convergence, vis-à-vis technologically advanced countries, is likely to enrich the debate.

⁴ Even though the discovery of Brazil in 1500 (up to 1822) constitutes an important part of Brazilian history as Portuguese colony, the per capita growth in this phase was low and in line with the rest of the world (Maddison, 2001). Thus, we dismiss this phase.

⁵ The period 1980 onward could be considered the Neoliberalism phase. However, since some authors (e.g., de Medeiros & Trebat, 2021; Saad-Filho, 2020) contend that from 1980 and 1990 Brazil experience a decade-long transition with external debt crisis, and it was in the 1990s onward that liberal policies and denationalization actually began we decided to split 1980-2019 into two distinct phases: the Crisis period (1980-1990), and the Neoliberalism phase (1990-2019).

From a scientific point of view, an analysis of a very long-run time span should provide insights into understanding the factors underlying Brazilian economic growth and its catch-up (or falling behind) processes. According to Maddison (1995), the more we “zoom in” the lens on the past, the more we have instruments to forecast for years ahead. In a similar manner, the information retrieved from these accounts provide valuable guidelines for governments to implement their policies and foster effective economic growth (Bergheim, 2008).

The essay is structured as follows. Section 2 discusses Brazil’s economic evolution, divided into five periods. Section 3 concludes, presenting the main findings of this descriptive, very long-run account, and addressing potential avenues for future research.

3.2 The long-term economic development of Brazil: A descriptive account

3.2.1 The Empire (1822-2019)

Not only was the year of 1822 a significant landmark in Brazilian history, with the declaration of independence, but the 1820s also brought a period of **low economic growth** to an end in most of the world (Maddison, 2001). While the advance of technology and higher economic growth rates were achieved after the 1820s in some countries, such as the UK and US, the Brazilian per capita income did not increase significantly (Maddison, 2001). We found a modest per capita annual rate of 0.35% from 1822 to 1889. The small advance in the real GDP in this period (1.96%) was accompanied by a population growth of 1.61%, meaning near stagnation in per capita terms (Figure 3.1).

The end of the colonial era also brought independence in strategic economic sectors, since Brazil was able to create its banking system and to have its own currency

(Maddison, 1992). These new amenities helped the Brazilian government to adopt a strategy to pay off debt and finance expenditure: money printing. In a book about Brazil's economic growth, Furtado (1987) contends that this mechanism led to the duplication of the country's available currency in the first decade after independence. Consequently, and according to Leff (1972), the imperial era was a period of chronic inflation.

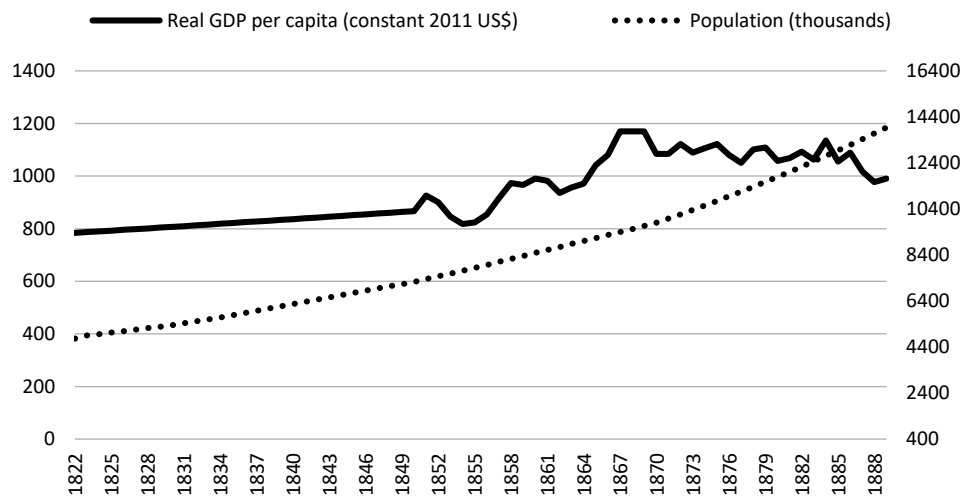


Figure 3.1. Real GDP per capita (left axis) and population (right axis), 1822-1889⁶

Brazil's nonviolent independence did not mean without damaging the colony's wealth. Since 1808, Portugal was forced by Britain to allow Brazil to trade with the rest of the world, and the former country was in no position to obstruct this arrangement due to its large debt to the English nation. Independence in 1822 came with a treaty that Brazil would assume a 1.4 million pounds sterling of debt owed to Britain and an indemnity totaling 600.000 pounds sterling owed to the Portuguese crown (Hudson, 1997). Thus, the Empire era started with the first period of Brazilian foreign debt, which comprehends the years following independence until a funding loan in 1931 (Abreu, 2006).

Although the debt to Britain was large due to the financial compensation paid for independence, the spread of the Brazilian central government and non-government loans also refers to the need to develop infrastructure, railway, and port facilities, in order to

⁶ All the figures in the present essay which depict the GDP per capita and population were constructed by the authors based on data from the Maddison Project Database (2020). Some missing values were retrieved from (Coatsworth, 1978), 1822-1849, and from World Bank Database, 2015-2019. Additionally, the figures containing the convergence ratios consider 9 Latin American countries, notably Argentina, Bolivia, Chile, Colombia, Cuba, Mexico, Peru, Uruguay, and Venezuela.

improve the transportation of Brazil's primary goods. With the close links to Great Britain, Brazil was obligated to certain trade agreements since 1810, which favored the former country with an import tariff of only 15% *ad valorem* (a tax of 24% was applied to goods from the rest of the world, and 16% to Portuguese products). Considering this limitation, the government faced financial difficulties until the end of the agreement in 1844, when Brazil was able to raise the general tariff level, at least for manufactured goods (Furtado, 1987).

Even though the government did not require large inputs to sustain its daily activity, the main instrument to finance these expenditures was import tariffs, which justified the adoption of protectionist policies. These policies were implemented after 1840 and helped stimulate domestic manufacturing and boost the linkage between export growth and industrialization (Leff, 1972).

In the absence of a significant merchant class in Brazil, agriculture was the principal avenue for economic development in the nineteenth century (Leff, 1972). The agricultural landlords took advantage of abundant Brazilian natural resources and the slave labor force to boost their production. The country's crops were concentrated on coffee in the Southeast, and sugar and cotton in the Northeast (Furtado, 1987).

Indeed, the imperial period mostly favored the domestic agricultural sector, which may explain the low levels of per capita growth compared to the world standard (Maddison, 2000). This backwardness may be explained by a lack of significant changes in the traditional plantation economy during this period or considerable improvements in manufacturing activities (Fishlow, 1980). In the same vein, Leff (1972) attributes the Brazilian meager performance in nineteenth century to the low rate of technical progress, and the low level of technology. Also justifying the relative underdevelopment is Brazil's late industrialization; in contrast to other advanced nations, namely the US, that observed the emergence of the industrialization process in the XVIII - XIX centuries (Clark et al., 2008), Brazil only experienced the capitalist industrial revolution between 1930 and 1980 (Baer, 1978; Fonseca & Salomão, 2017).

If a country does not experience a certain level of complexity in its manufacturing sector and relative technological autonomy, resting its development on the domestic market is not a sustainable option. Therefore, the only alternative is to explore

international trade (Furtado, 1987). In the first decade of the imperial period, the sugar crops from the Northeast were the export leaders, followed by cotton and coffee, the latter representing only 18% of the total export revenue (Furtado, 1987). According to Hudson (1997), there was a sharp rise in coffee production in the following decades, and its share in exports increased from 50% in 1841-50 to 59.5% in 1871-80, which put Brazil in a near monopoly position on the world coffee market (Maddison, 1992).

In contrast with the vast natural resource such as land, the labor shortage was a constraint to landowners and farmers. Slavery had been abolished in most countries all over the world, and Brazil was being pressured to end slave labor as well, a decision which came into force in 1888. The resulting lack of labor made the government advance with legislation to encourage immigration in 1870, which benefited production and landowners (Hudson, 1997).

Although most of immigrants came from European countries (from 1820 to 1890, 876,980 people emigrated to Brazil, 87% were from the Catholic countries of Portugal, Spain, and Italy), they constituted mostly illiterate and unskilled labor (Zanella et al., 2003). This, together with African slavery explains Brazil's meager human capital stock. According to Leff (1972), given the schooling system's poor conditions and the effect of rapid population growth, in 1877, only 7% of the cohort aged between 7 and 11 years had been enrolled in primary school.

The structure of Brazil's political and administrative system during the imperial period was properly established after the 1824 Constitution, where four powers – the executive, the legislative, the judicial, and the moderating power – were the nation's organizational drivers (Zanella et al., 2003). Another important feature of the Brazilian Constitution was the adoption of Catholicism as the religion of the Empire. Such a strong imposition had consequences both for the government, where non-Catholics were not eligible for employment, and for society, because the policies to boost immigration labor favored mostly Catholic countries, as mentioned previously. Furthermore, throughout Brazilian history, the rural landowners/rural elite oligarchies were a driving force behind this complex arrangement. They were more than just the country's dominate class, they were part of the government, even if indirectly.

This first period of the independence era was marked by low economic growth in

Brazil. The records on the standard of living are also low in comparison to countries like the US and the UK (in 1889, Brazil's GDP per capita represented less than 20% of the GDP per capita of the UK). Indeed, the Brazilian economy lagged the English-speaking nations from 1822 to 1889. Furthermore, as can be seen in Figure 3.2, Brazil diverged from some other countries within Latin America in real terms after the 1830s.

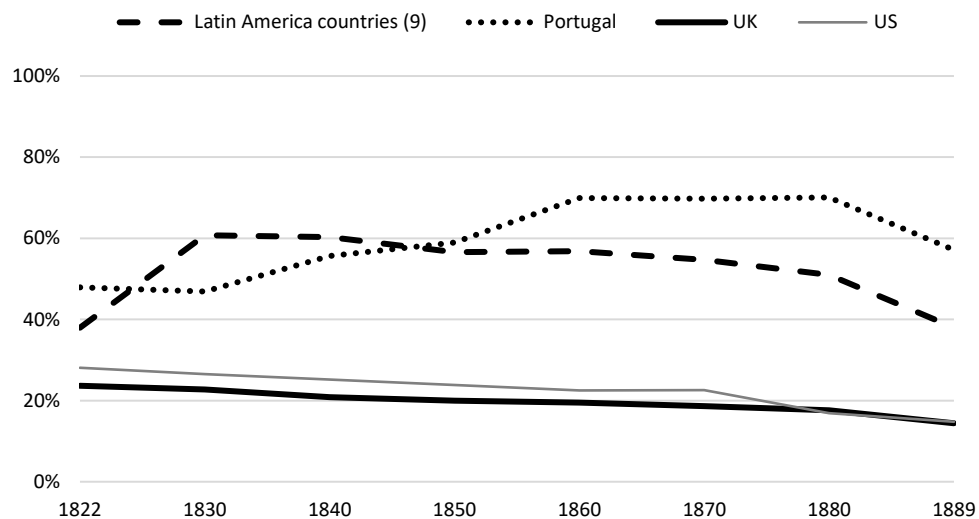


Figure 3.2. Evolution of Brazil's real convergence indicator, 1822-1889

3.2.2 The Oligarchic Republic (1889-1930)

During most of the nineteenth century, the Brazilian economy developed at relatively low rates. However, at the end of the monarchy, the proclamation of the Republic in 1889 breathed new life into Brazil, which embarked on a path of rapid economic growth (Figure 3.2). The oligarchic republic period was marked by an annual GDP growth rate of 2.92%, also followed by a sharp rise in population (2.17%) due to mass immigration. In per capita terms, the rate recorded in this period, 0.76%, surpassed the Empire era.

Coupled with the arrival of European immigrants and the abolition of slavery, the new paid labor class prompted a sharp rise in the emission of paper currency, which until then had been mostly printed to pay government debts (Furtado, 1987). In hindsight, the country experienced long-term inflation even at the end of nineteenth century. In the same vein, inflation disrupted the normal mechanism of the exchange rate, which fell faster in

this period and helped to boost even further the domestic price of coffee, hence stimulating production (Maddison, 1992).

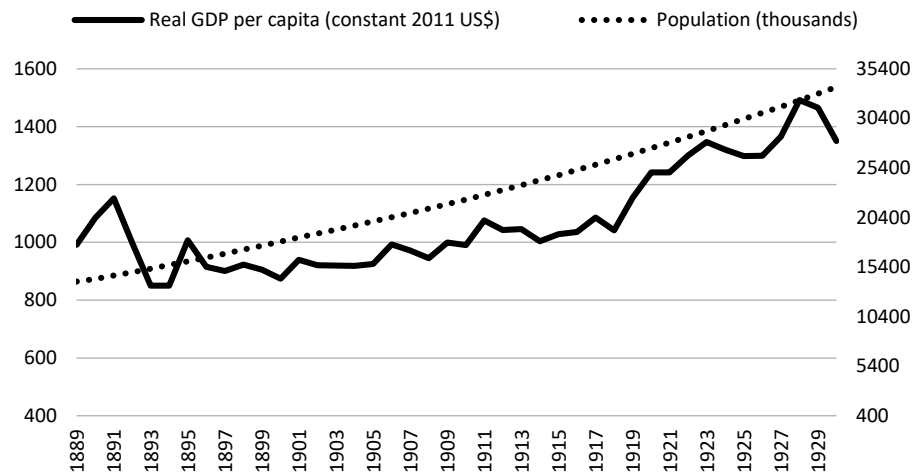


Figure 3.2. Real GDP per capita (left axis) and population (right axis), 1889-1930

In the first period of the Republic, Brazil bolstered its primary goods exports, such as rubber, sugar, tobacco, and cotton, and was responsible for 75% of the world's coffee production. However, as competition rose, prices fell constantly, forcing the government to devalue the Brazilian currency. According to Leff (1969), the *mil réis* depreciated 80% against the pound sterling between 1889-1920. Therefore, when the price of imported goods rose, the Brazilian government faced lower consumption and less revenue from import taxes (Hudson, 1997).

From 1898 to 1902, under the policies of the new Minister of the Treasury, Joaquim Murinho, the Brazilian economy drafted a deflationary plan that reduced money supply, pushed prices down, doubled the export value, thus reducing pressure on the balance of payments. Equally important, the funding loan of 1898 and the gold standard established in 1900 marked a recovery in the external balance and restored the trust of foreign investors (Furtado, 1987).

The following years were prosperous, and many commercial banks were founded, which helped to boost credit, therefore favoring both rural producers and factory owners. The coffee sector benefited from the credit facilities and was able to broaden its supply due to the land and labor surplus available throughout the country. However, demand did not follow the trend in supply, and coffee surplus contributed to raising the price of

commodities. The elite producers, based chiefly in the state of São Paulo, led a convention in 1906 (known as *Convenção de Taubaté*) to establish a policy of coffee “valorization”, which faced some resistance from the federal government. Regardless, however, the power of coffee growers was reinforced until 1930 (Furtado, 1987).

The Brazilian market, set by Britain as its main trade partner in the nineteenth century, started to attract the interest of another English-speaking nation, the United States. Hudson (1997) states that, in 1926, 50% of all products were exported to the US, and by the 1920s, 35% of total Brazilian foreign debt was in US dollars.

As the human capital increased, Brazil also became more urbanized and, though far from satisfactory, more educated (Hudson, 1997; Leff, 1969). From 12.4% in 1889, the percentage of the cohort aged 7-11 years enrolled in schools rose to 39% in 1930. Secondary schools (aged 11-17 years) and higher education (aged 18-21 years) were introduced late in Brazil, and according to the records in 1930, 1.7% and 0.063%, respectively, were enrolled in these levels of schooling (Leff, 1969).

Associated with the difficulty in accessing foreign industrialized products and the transition to a period of credit facilities, the manufacturing sector experienced economic expansion and an embryo of what would come to be called the “Import Substitution Industry” (ISI) emerged in the middle of the twentieth century (Furtado, 1987). Indeed, Fishlow (1980) highlights the rapid growth of the manufacturing sector, especially textiles, between 1906 and 1912.

According to Leff (1969), rather than damaging the commodity exports, the protectionist policies applied in Brazil in 1900, mainly the high tariff rates, and the barriers to importation between 1905 and 1908, helped to boost both industrial development and coffee production, in essence suggesting that they were complementary and mutually supported.

The Brazilian republic was a regime born of a coup d’état rather than accidentally. The military forces assumed moderate power until the new constitution was passed in 1891, when the imperial regime was totally dissolved. The rural elite oligarchies gained the official command of the political system, thus reinforcing their power at state level (Hudson, 1997).

In this new organizational system, authority was no longer centralized in federal

terms, but rather the states gained politic and financial autonomy (Furtado, 1987). The first republic is well known for the “*Voto de Cabresto*” (Vote Corraling) or “*Coronelismo*” (Colonelism), the highest form of corruption in this period, rooted in illegal arrangements among the political power and the oligarchic elites (Biason, 2019). Moreover, many divergences in interests resulted in political instability since the imperial era, and economic pressure on the salaried middle class, which led to social disorder and military uprising. The civil war in the Southern State of Rio Grande do Sul (1893-95), the Armed Revolt in Rio de Janeiro (1891, 1893-94), and the “*Canudos*” war in the Northeast state of Bahia (1896-97), underscored Brazilian instability at the end of the nineteenth century (Furtado, 1987).

Even though the Brazilian economy performed better in the oligarchic republic than in the previous period, in real terms, its GDP per capita represented less than 20% of the GDP per capita of the English-speaking nations (Figure 3.3). The dynamics of the new regime were not sufficient to recover and to catch-up with either the UK or the US, nor with Portugal and some other Latin American countries.

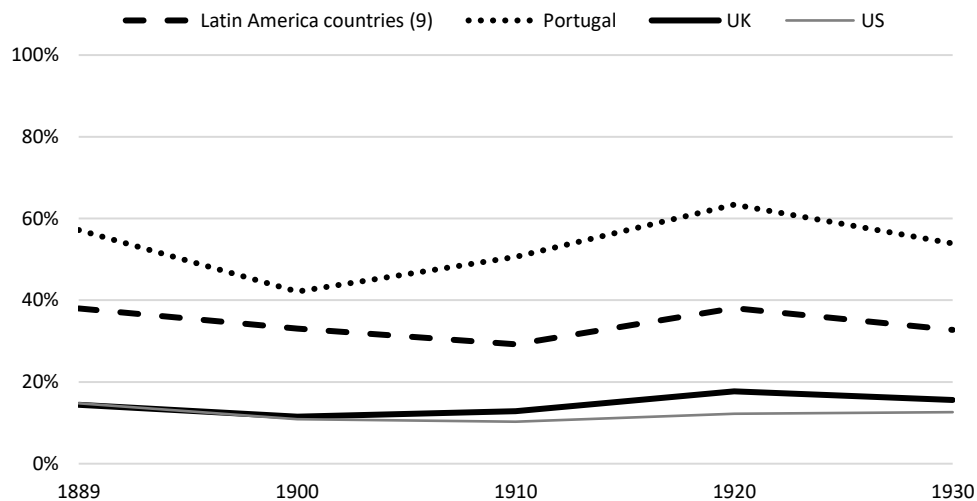


Figure 3.3. Evolution of Brazil's real convergence indicator, 1889-1930

3.2.3 The Developmentalist era (1930-1980)

The period that succeeded the Great Depression was a milestone in the history of Brazilian development. This period is widely studied due to Brazil's extraordinary

economic performance (Figure 3.4), recording a GDP per capita growth rate of 3.69%. In the developmentalist era, as it is commonly known, Brazil reached GDP growth never seen before (6.32% annually compounded rate), and an average population growth of 2.63%.

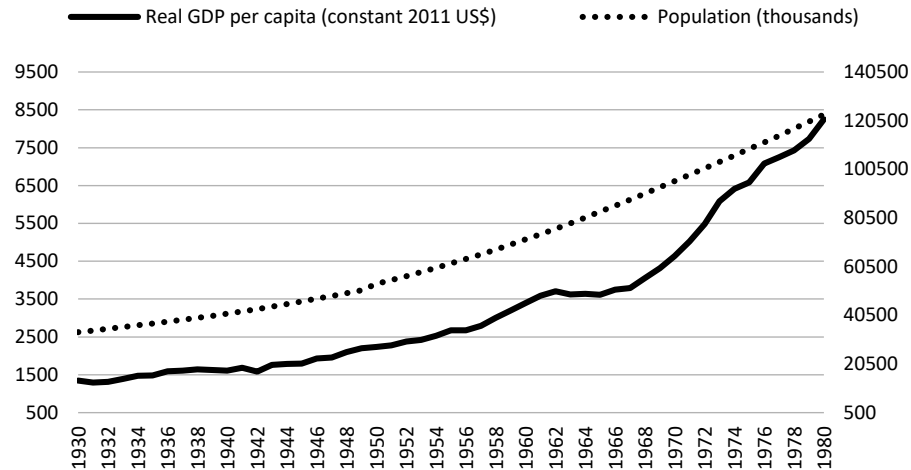


Figure 3.4. Real GDP per capita (left axis) and population (right axis), 1930-1980

Marquetti et al. (2019) highlight two sub-periods of significant economic boom: 1) 1955-1960, GDP per capita growth of 4.91%, with a rapid industrialization process, a Plan of Goals coordinated by the state, and investments from national and foreign capital; and 2) 1968-1973, GDP per capita growth of 8.48%, accompanying an international boom associated with fiscal and monetary policies under the military dictatorship in Brazil.

According to Fishlow (1980), the Brazilian “miracle”, as the second economic boom became widely known, was also linked to distinct strategies adopted after the military coup of 1964: 1) more integration with international markets; 2) greater centralized fiscal capacity; 3) monetary correction; 4) institutional reforms; and 5) structure of subsidies.

Nassif, Morandi, et al. (2020) stress that the leverage of the budding heavy industries, resulting in the growth of labor productivity, and the subsequent economic growth boom were a result of several protectionists policies adopted under the second term of Getulio Vargas’ government (1950-1954), and Juscelino Kubitschek’s administration (1956-1960). Bresser-Pereira (2020), notwithstanding, argues sustain that the policy's success of Brazil in this period was due less to policy’s protectionist character and more to the fact that policymakers used intuitively import taxes and/or the multiple exchange systems

to neutralize the Dutch disease, which were fundamental for industrialization and rapid growth over these fifty years (1930-1980).

The period of rapid economic growth also gave rise to a rapid inflationary process. From the mid-1950s onward, there was a period of accelerating inflation. According to Marquetti et al. (2019), such an inflationary process is associated with balance-of-payment constraints and the consequence devaluation of the exchange rate. They also argue that most of the developing countries, especially in Latin America, had a history of medium to high inflation rates until the early 1990s.

Since the mid-1960s, the export volume increased about 10%, which helped to lead a balance surplus in 1965 and 1966. When some foreign capital started to dry up in the same period, it provoked ongoing balance of payment crises, and accounts for a balance deficit of 2.3% in GDP, between 1971-73 (Fishlow, 1980). In like manner, the external debt registered at 10% of the GDP in 1967 and 17% (US\$14.9 million) in 1973. After this year, the external indebtedness continued to rise and reached even higher rates. Brazil recorded an external debt of US\$55.8 million in 1980.

The labor class became more empowered during this period, seeking a better future as the population continued to grow beyond the capability of the state to improve the educational system. Therefore, the literacy rate was low in comparison to other Latin American countries, and even lower than the level of the fast-growing Asian countries (Maddison, 2000). Although this may be true, illiteracy generally decreased more than 60% among the population aged between 10 and 29 years from 1950 to 1976.

Although the coffee cycle (1850-1930) was an important and relevant factor in the Brazilian economy, its export receipts stagnated after 1953, given way to the changes that were about to come. From 1932-39, Brazil's manufacturing sector grew more than 10%, and by 1939, it employed about 9.5% of the labor force (Fishlow, 1980). According to Mateo (2018), the industry share in Brazilian GDP during the developmentalist era went from 25% to 44%, whereas agriculture fell 10% in the same period. The power of the domestic market also helped to boost the Brazilian industry, where capital goods were supplied some 61% by locals, especially from 1947-49 (Leff, 1969).

After the Great Depression, the productive structure of the Latin American countries had changed, having the policies applied contributed to this pattern. After the 1950s, they

experienced very progressive arrangements greatly influenced by the structuralist economists of that time, such as the Argentine Raul Prebisch and the Brazilian Celso Furtado, who contributed to establishing the ISI strategy from that period until the 1980s.

According to Arestis & Baltar (2019), the ISI period (1950-1980) was a landmark in the Brazilian economy, with high growth rates and a diversified manufacturing industry. The ISI strategy, as the name suggests, involved policies aimed at increasing the demand for domestic products, raising the import tariffs, and subsidizing new industries to meet this demand, as well as helping to boost exports of manufactured goods rather than of commodities and primary products (Nassif, Morandi, et al., 2020). Actually, these and other “protectionist” policies (e.g., export subsidies) were intuitively adopted by policymakers in a way to neutralize the Dutch disease (a common problem faced mainly by exporter of commodities countries, such as Brazil) to guarantee equal conditions of competition to the manufacturing companies (Bresser-Pereira, 2021).

Apparently a well-succeeded strategy, the ISI policies had some peculiarities in Brazil, such as the presence of foreign direct investment (FDI) mostly from multinational enterprises. In contrast with other EE that adopted similar policies (e.g., Singapore, China), the openness to FDI inflows was not based on technology transfers or even research and development arrangements. The lack of selectivity in the multinational enterprises and, to some extent, the heavy protectionist policies created some imperfections in the ISI strategy (Nassif, Morandi, et al., 2020). In the same vein, Cabral et al. (2017) claim this model was incapable of propelling technological progress and delivering a mature, efficient national innovation system.

Brazilian development in this period, like in several Latin American countries, was supported by resources from developed countries, through long-term foreign loans, under flexible international interest rates (Nassif, Morandi, et al., 2020). In such a context, international shocks had a direct effect on the country’s economy, which in fact occurred between 1979 and 1982 (the international interest rate shock). Consequently, foreign interest rates rose so sharply that the loans became almost unpayable, leading to a profoundly severe crisis in the 1980s (the external debt crisis) that affected many of the Latin American countries, including Brazil (Carvalho & Carvalho, 2019).

It is not only the high rates of economic growth that reflect the extraordinary

performance of Brazilian development after the Great Depression, but also the real convergence, as shown in Figure 3.5. In the previous period, these rates were either stagnated or decreasing, differently from the developmentalist era. After 1940 and mostly due to the industrialization process, Brazil's growth converged to the more highly developed countries such as the US and the UK. The sharp convergence with other Latin American countries after the 1970s may be related not only to this performance but also to the oil shock crises, especially in Mexico.

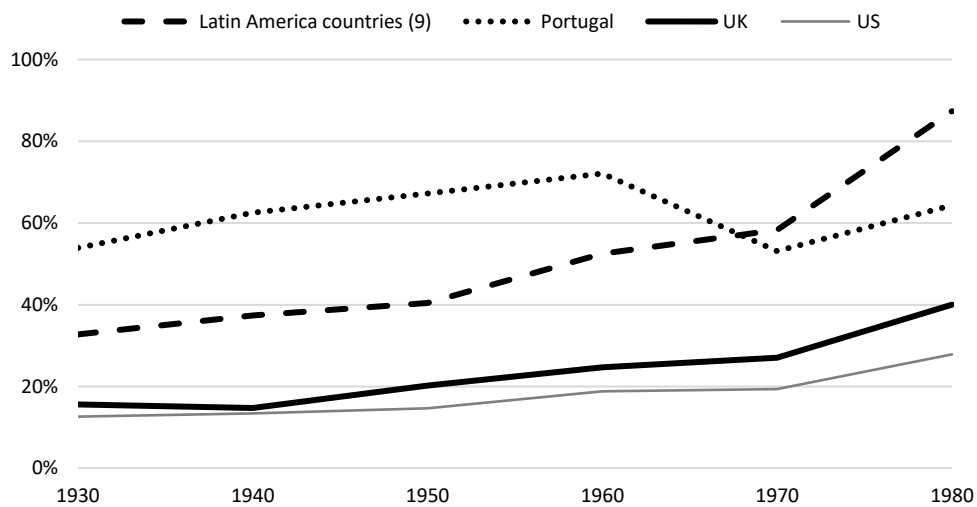


Figure 3.5. Evolution of Brazil's real convergence indicator, 1930-1980

3.2.4 The Crisis period (1980-1990)

The buoyancy of the developmentalist period started losing steam in the 1980s, in a period set by transition and austerity (de Medeiros & Trebat, 2021). The 1980s was marked by the end of the accelerated growth process and the start of a crisis decade due to external debt, and high and inertial inflation regime (Bresser-Pereira, 2021; Feijo & Lamônica, 2019). Indeed, this decade (1980-1990) is widely known as the “lost decade”, where the per capita decreased 0.50% on average, and population and GDP rates increased almost as much as in imperial period (1.58% and 2.08%, respectively) – Figure 3.6.

The high inflation rates observed between 1981 and 1994 can be explained, according to several authors, by the theory of inertial inflation (Arida & Lara-Resende, 1985;

Bresser-Pereira & Nakano, 1987; Simonsen, 1988). The latter sustains that extensive use of indexation had created a feedback mechanism so strong that supply shocks, such as the oil-price surges, automatically carried over into permanent increases in the level of inflation (i.e, inflation is inertial), rendering monetary and fiscal policies ineffective as the inertia rendered inflation unresponsive to demand (Cati et al., 1999). In fact, this was especially true in Brazil in the beginning of the 1980s.

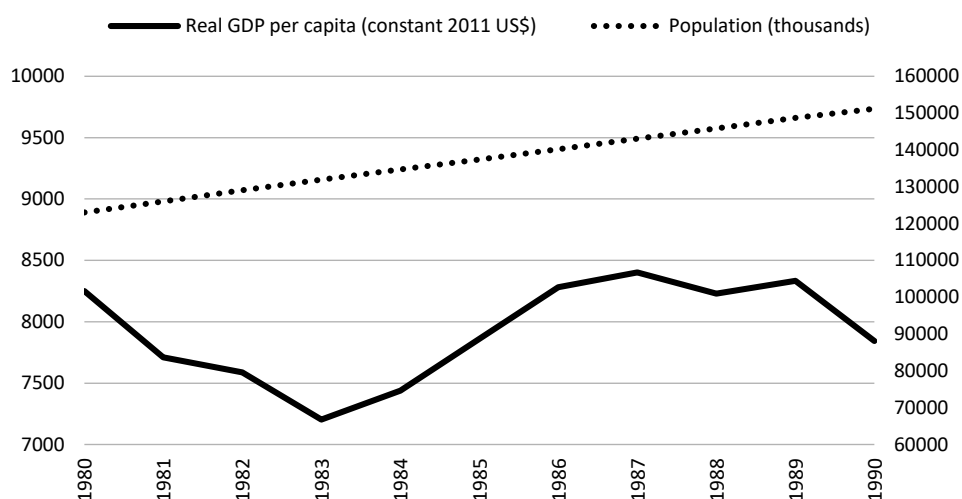


Figure 3.6. Real GDP per capita (left axis) and population (right axis), 1980-1990

Hudson (1997) argues that, during the 1970s and 1980s, the system of primary and secondary schools was restructured, and the colleges and universities rapidly expanded attending nearly all states with federal universities, which results with the sharp increase in graduate study.

Over this decade (1980-1990), the productive sectors went through significant change. Agriculture and industry suffered, respectively, a reduction of about 10-7% and 45-32% in their share of GDP, whereas the service sector went from 45% in 1980, to 60% in Brazilian GDP added value in 1990 (Lourenço & Cardoso, 2018), chiefly associated with low productivity and low-skilled labor (Nassif, Morandi, et al., 2020). These numbers evidence the deindustrialization process that Brazil was exposed to from 1980 onwards, and even though this is still not consensual, it could be pointed out as one of the real causes of economic stagnation in this period (Marquetti et al., 2019).

The 1980s was a period of recovery from military rule and the shift to democratic governance in Latin America as a whole.⁷ After resumed a democratic regime in 1985, the new federal constitution (that is in force until today), drawn up in 1988, established the supreme and fundamental laws of the Brazilian state.

The period of foreign debt crisis, and chronic hyperinflation brought economic stagnation to Latin America in general. Therefore, the real convergence/divergence graph (Figure 3.7) accurately illustrates this fact. On the other hand, Portugal, the UK, and the US seem to follow the same trend, which Brazil was diverging from.

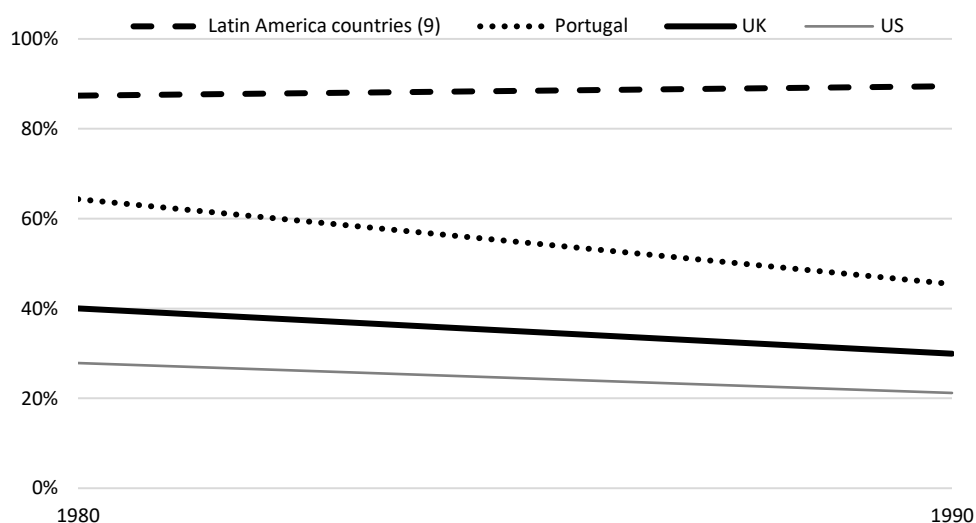


Figure 3.7. Evolution of Brazil's real convergence indicator, 1980-1990

3.2.5 The Neoliberalism phase (1990-2019)

From the beginning of the 21st century, the recovery from stagnant times seemed to be evident (Figure 3.8), at least until 2014, when economic crises, political events and corruption scandals changed the sharp trend of growth (Padula & Albuquerque, 2018). On average, between 1990 and 2019, the GDP per capita growth rate was 2.07%. Even though recording a meagre level, in a sub-period (2003-2010) ruled by the left-wing party, *Partido dos Trabalhadores* (PT; Workers' Party) under the presidency of Luis Inácio Lula da Silva, Brazilian performance showed an average annual rate of GDP per capita growth

⁷ The military dictatorship in Brazil lasted from 1964 to 1985.

of 4.63%.

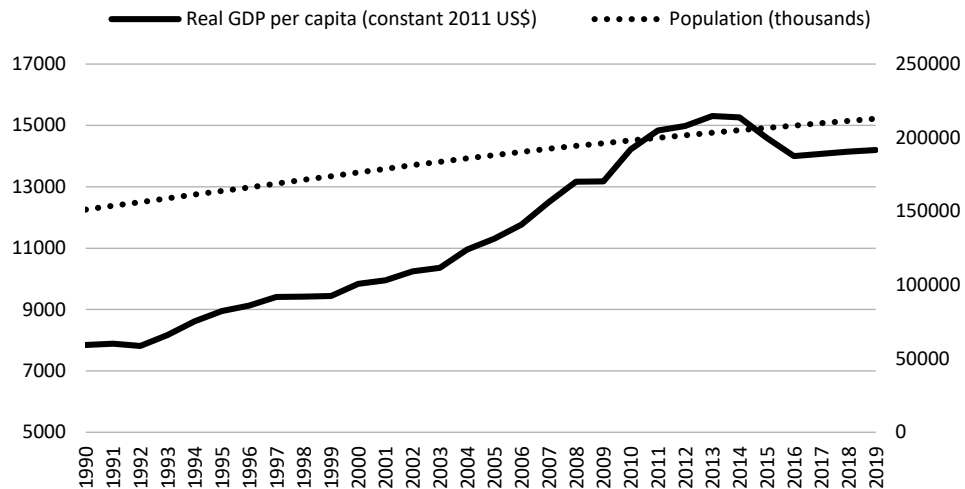


Figure 3.8. Real GDP per capita (left axis) and population (right axis), 1990-2019

The 1990s was marked by the start of liberalization process, as well as a period of deregulation governed by the Brady Plan and the Washington Consensus (Bresser-Pereira, 2021; Feijo & Lamônica, 2019). These economic policies were the drivers behind the neoliberalism agenda, which led Brazil to reduce the state's role in economic activity, consequently decreasing public investment and the capacity to keep the industrial infrastructure updated (Arestis & Baltar, 2019).

The end of the 20th century sets the adoption of a very orthodox arrangement of monetary, fiscal, and exchange rate policies (Araújo et al., 2018). After 1999, a set of measures was created to guide economic policies in the country. The three main policies of the plan, better known as the “Macroeconomic Tripod”, are: an inflation-targeting regime; a floating exchange rate; and targeting primary fiscal surpluses (Nassif, Feijó, et al., 2020). These new policy arrangements, or New Macroeconomic Consensus (NMC), has been managed in a very stringent and orthodox manner, according to Nassif, Feijó, et al. (2020).

Apparently due to the Macroeconomic Tripod regime adopted in 1999 and the Real Plan in 1994,⁸ the inflation rate during the last few decades achieved low levels (6.26%,

⁸ The Real Plan (Plano real) established the creation and adoption of a new currency, the Brazilian Real. In fact, this plan was crucial to zeroing the memory of the system and breaking down the inertia in the inflation process (Arida & Lara-Resende, 1985).

on average). Nevertheless, this was not possible without some costs to society. Bresser-Pereira (2015) warned of some perverse effects caused by the Macroeconomic Tripod regime, like the high levels of the interest rate, the overvaluation of the exchange rate, and the increasing current account deficits. In like manner, Nassif, Feijó, et al. (2020) state that the inflation-targeting regime (one of the “three legs” of the Macroeconomic Tripod regime), has jeopardized the sustainable, long-term economic growth in Brazil.

For a better understanding of the Macroeconomic Tripod, Nassif, Feijó, et al. (2020) distinguish three phases, following the establishment of the regime in 1999: 1) up to 2005, the responsible agents learned how to manage the very tight monetary and fiscal policy arrangements; 2) the second phase (2006-2011) was marked by more flexibility regarding those policies, a gradual reduction in the interest rate, and low levels of inflation; and 3) in the last phase, which started in 2012, inflation rose again, and the government was unable to properly coordinate the monetary and fiscal policies.

After 2002, a new wave of state intervention took place in Brazil driven by the PT Party, which lasted until 2015. The respectable economic results of the first two terms (2003-2010) were mostly boosted by the 185% increase in the international commodity prices, the main Brazilian export product (Spolador & Roe, 2013). Exports went back to being the key player of the economic growth engine in the country, expanded 115% between 2000 and 2005, prompted chiefly by the growing Chinese market (Cabral et al., 2017).

From 2003 and 2010, Brazil experienced the effective overvaluation of the exchange rate, which contributed to substitution between national and import inputs in the domestic market (Magacho et al., 2018). Furthermore, the 2008 financial crisis and the collapse of the commodities bubble helped to depress the export sector and slow down investments (Bresser-Pereira, 2015). Some would note that the Brazilian export basket is excessively specialized in natural resources products (which increased 50% between 2000 and 2014) and, as a developing country, tends to suffer from external shocks and chronic overvaluation of the exchange rate (Bresser-Pereira, 2015; Feijo & Lamônica, 2019).

Despite the adoption of similar monetary and fiscal policies as the previous period, the twenty-first century started with the strong administration of distributive policies. The government’s main idea was that Brazil had become a mass consumer society, and

spending on education, health and social welfare programs fostered consumerism. These programs were able to lift almost 30 million people from poverty, to increase the real minimum wage, and the per capita household income (Bresser-Pereira, 2015). In addition, unemployment declined and the growing participation in the formal labor market contributed to increasing the GDP per capita around 30% and 50%, in the last decade (Nassif, Morandi, et al., 2020).

Hudson (1997) argues that, in 1990, 19% of the total population below the age of fifteen was illiterate, which apparently could be explained by changes in spending, shifted from primary education towards colleges and universities. In 1993, the high school system totaled 893 institutions, and in 1995, expenditures on universities were twice those of basic education (Hudson, 1997). From 2000 to 2009, Brazil had one of the largest increases in education expenditure, which resulted in the better quality of education (Haddad et al., 2017).

According to data from the IPEA, in 1999 the average years of schooling was 3.8 for adults aged over 25 years. In 2014, the same age group had attended almost 8 years of schooling, on average. The massive support for advanced studies was also the rule in this period, and from 2000 and 2019, the number of private and public higher education institutions increased from 1180 to 2608 (IBGE, 2001, 2020).

The premature deindustrialization and “servicification” after the 1980s had its echoes in the present period and the share of the manufacturing sector in GDP continued to fall, achieving only 10% in 2015 (Arbache & Sarquis, 2018). On the other hand, Oreiro et al. (2018) highlight the increased level of capacity utilization and investment share from 2003 onward, proposing there was some acceleration and contribution to the Brazilian economy. The positive impact spread mostly in the agricultural and mining sectors, leaving behind the most technologically advanced sectors, hence increasing even further the technological gap between Brazil and, for instance, the US (Oreiro et al., 2018).

The last thirty years are marked by diversified arrangements in the political arena. After the return of democracy in 1985, some of the best-known right-wing parties alternated in the Brazilian presidency until 2002, when a former union leader, Luis Inácio Lula da Silva, was elected for the PT, a left-wing party struggling for power since 1980 (Onbaşı, 2020). Lula ruled the country for eight years (two complete mandates) and was

followed by another PT politician, Dilma Rouseff. Rouseff did not finish her second term in office, and after an impeachment process in 2016, she was replaced by the vice-president, Michel Temer, returning the country's "power" to a right-wing party. Temer ruled the country from 2017 to 2018, when new elections voted the far right-wing and former military officer, Jair Bolsonaro, into executive office.

A traditional problem that has long afflicted Brazil, corruption scandals have involved several authorities and large companies (Jucá et al., 2016). For instance, in 1992, the sitting president Fernando Collor was charged and impeached after several accusations of massive corruption (Fleischer, 1997). Many other corruption scandals were investigated, or rather uncovered in the 1990s. One of the reasons was the lack of effective monitoring and independent agencies to fight against bribery, tax fraud, or other illegal operations within public administration (Fleischer, 1997).

During the PT administration, Brazil implemented new laws and regulations, and made efforts to uphold the independence of judicial institutions to fight against corruption (Onbaşı, 2020). However, the measures applied were not sufficient, and an old, deeply rooted trait of the Brazilian political economy (close collaboration between private companies and political leaders) came to light and revealed significant corruption scandals that would destabilize even further the political institutions in Brazil (May et al., 2019).

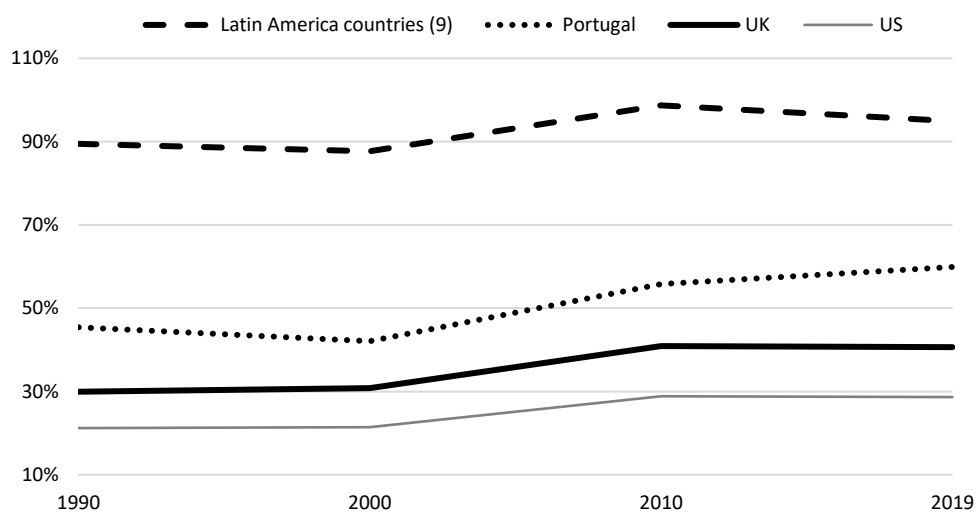


Figure 3.9. Evolution of Brazil's real convergence indicator, 1990-2019

In the 21st century, the Brazilian economy reaped the benefits of the commodity boom and the flush of foreign capital investments, improving the standard of living of the population, at least until 2014, when several institutional instabilities arose. With inflation under control, it was possible to maintain the external accounts balanced. A more open country along with the overvaluation of the national currency meant imports were boosted, dragging the deindustrialization process down even further. Moreover, low-skilled services took precedence and dampened the possibility of a path to a more modernized, technological, and industrialized country, as can be seen in the real convergence indicator (Figure 3.9), especially from 2000 to 2010.

3.3 Conclusion

The aim of this essay was to zoom in the lens on the past and to provide a structured narrative review of some critical factors (e.g., inflation, human capital formation, institutional instability) that have bolstered or weakened Brazilian economic growth over a very long-run (1822-2019), as well as provide support to understand the process of real (div)convergence.

The transition to the group of developed countries is a long-run process (Nassif, Morandi, et al., 2020), and, in the past 200 years, Brazil seems to have more periods of falling behind than catching up with the most advanced countries, such as the UK and the US, or even its *alma mater* Portugal. It was only in the middle of the 20th century that Brazil started to present a positive, rapid trend of real convergence, more precisely from 1950 to 1980. Nevertheless, the lack of a sustainable growth path, which means long periods of fast growth, is one of the difficulties of Brazil in closing the per capita income gap with developed countries.

From our long-run analysis through the lens of Brazilian history, it was possible to pinpoint some determinants often related to its economic performance.

Macroeconomic instability forced the government to apply several policies to re-

establish the balance of the public accounts, such as the adoption of a new currency, the *Real*, in 1994, after four previously unsuccessful changes, and the ‘Macroeconomic Tripod’ policies, in 1999. *Inflation* has followed a controlled path but between the developmentalist and Neoliberalism period, when the government misgoverned its monetary policies in a completely undisciplined manner, and the country was unable to curb the inertial inflation process, achieving chronic levels (e.g., 2737% in 1990). Far from satisfactory, the ‘Macroeconomic Tripod’ policies and other monetary arrangements brought confidence and economic growth in the first years of the 21st century. Indeed, the chief result is the acknowledgement that the government and central bank’s fiscal and monetary actions, respectively, must be planned for the long-term in a more coordinated manner bearing in mind the mistakes and successes of the past.

Regarding **International trade**, we can highlight two determinants: *Import tariffs* and *degree of openness*. Both variables reflect the country’s openness to external markets. Throughout Brazil’s independent history, the average value of the tariffs imposed on foreign products decreased sequentially, while the degree of openness increased, although not substantially until this century. The protectionist policies were always applied to contain import consumption and boost industry within the country. To some extent and along with the neutralization of the Dutch disease, it helped to diversify the manufacturing industry and raise the exports of more value-added products. One of the imperfections of these policies is that they prevented the transfer of technology and advanced research and development arrangements from more developed economies, which became even harder to compete with.

With respect to one of the features that most defined the EE, deficient **human capital** formation (Wang et al., 2020), Brazil has invested in the ability to promote quantitatively and qualitatively better, more comprehensive education to its citizens. The progress made after the developmentalist period, probably associated with some affirmative policies in this domain, was the most significant in Brazilian history, when the *illiteracy rate* dropped to nearly one fourth of the total population aged 15 years and above. On the other hand, in 2018, Brazil had an illiteracy rate of 6.77%, far more than other similar EE, such as Argentina (1%), China (3.16%), Mexico (4.62%), Russia (0.27%), and Uruguay (1.3%) (World Bank Database). These numbers highlight the backwardness of Brazilian human capital formation, and governments’ inability to improve the educational system,

also neglected in the economic debate regarding its importance in promoting economic growth in Brazil.

Few **structural changes** can be identified throughout these 200 years. The abundant Brazilian natural resources such as land always contributed to boost the primary sector of the economy, being the focus of the oligarchic elites. This abundance, along with the slave labor force until 1888, inhibited the agricultural landlords from properly investing in technology, training, and more automatic systems to increase productivity. The manufacturing activities started to grow substantially only after 1905, when some barriers to importation helped to boost industrial development (Leff, 1969). Some other assertive policies and investments propelled the manufacturing sector in Brazil during the developmentalist phase, thereby contributed to it being considered one of the most dynamic economies in the world (Porsse & Marquetti, 2014). Even though *Employment in the Primary Sector* (percentage of total employment) has been decreasing over time, the premature deindustrialization process and “servicification” observed after the 1980s could be associated with the country’s difficulty to converge to the technologically advanced countries and achieve a higher level of development (Arbache & Sarquis, 2018; Oreiro et al., 2018).

The poor condition of Brazilian **institutions** can be observed especially in the instability of its *Political Regimes*. The variable plays a key role in the economy and could deliver long-lasting benefits if the country had strong and efficient institutions (Olaniyi & Oladeji, 2021). Just like other EE, Brazil performed very poorly in the sector and its independent history is beset by political imbalances and crises, such as coups d’état (1889, 1964), impeachments (1992, Fernando Collor; 2015, Dilma Rousseff), and dictatorship regimes (1930-1934, Getúlio Vargas; 1937-1945, Getúlio Vargas; 1964-1985, military government). Along with constant political instability, Brazil suffers from deep-rooted *Corruption* issues. Since colonial times, corruption has emerged as a result of a political life of very low moral stature and assumes different aspects and meanings. Between 1822 and 1930, the illicit activities lay in the political systems, from 1930 until the end of the military period (1985), corruption was associated to social phenomena, and finally, after the return to democracy, it became systemic and governed the way institutions operated, distorting their public credibility (Biason, 2019).

The overall picture of the Brazilian economic performance is far from satisfactory and one of the possible causes can be easily associate to the instability of formal (*Political Regimes, Corruption*) and informal (*Customs, Religion*) institutions of the country throughout its history. As mentioned by Bernardelli & Michellon (2018), it is of the utmost importance to relate economic growth to cultural factors, language, religion, and customs, since many facts indicate their direct and significant influence on people's way of life and the development processes of countries. Considering this, for the Brazilian case we can observe a constant decline in the affiliated Catholic members throughout history, especially the more dogmatic and fundamentalistic players inside the government.

The discussion on economic growth and its proposed determinants has been a continuous and significant academic endeavor (Law et al., 2020). This essay has attempted to summarize Brazil's economic growth from a very long-run perspective (1822-2019), in a structured qualitative and narrative review that encompasses three main contributions, at the theoretical, empirical, and policy levels. First, at the theoretical level, although the literature is rich in high-quality quantitative papers analyzing Brazilian economic performance, as well as some long-view descriptive accounts in book format, this study proposes a novel and encompassing framework of Brazil's economic history, highlighting key factors of its absolute and relative performance since independence, organized by periods and sets of determinants. Second, at the empirical level, it explores and assembles substantial information, as well as high-quality analyses and a comprehensive panorama of the evolution of the key determinants. Finally, at the policy level, this essay intended to offer some guiding lines, highlighting government policies to promote robust and sustainable economic growth, especially around neglected but urgent determinants: institutional conditions and human capital formation.

Complementing the descriptive analysis performed with a quantitative, causality approach of the determining factors which underlie the performance of the Brazilian economy would undoubtedly constitute a challenging and important avenue for further research.

Chapter 4

The role of human capital, structural change, and institutional quality on Brazil's economic growth over the last two hundred years (1822-2019)

4.1 Introduction

The empirical literature on economic growth that analyzes more fundamental factors, rooted in the very long run, contributes to devising more assertive policies that target robust and sustainable economic growth (Bergheim, 2008; Spolaore & Wacziarg, 2013).

The interest in analyzing economic growth determinants is far from new (Teixeira & Queirós, 2016), and the literature on the topic is quite extensive (Abosedra et al., 2020). Moreover, researchers have realized the importance of very long-run research as reflected by its substantial expansion in recent years (Cioni et al., 2020; Spolaore & Wacziarg,

2013). Notwithstanding, the extant literature has primarily focused on specific developed countries, such as Australia (e.g., Foster, 2016; Kirchner, 2012), Belgium (e.g., Nieuwerburgh et al., 2006), France (e.g., Facchini & Melki, 2013), Italy (e.g., Cavicchioli & Pistroesi, 2016; Forte & Magazzino, 2016; Pistroesi & Rinaldi, 2012), Spain (e.g., Balaguer et al., 2014; Esteve & Tamarit, 2018), Sweden (e.g., Ljungberg & Nilsson, 2009), The Netherlands (e.g., Foldvari et al., 2013), the United Kingdom (e.g., Lai, 2001; Škare, 2014), and the United States (e.g., Berry & Okulicz-kozaryn, 2008).

Furthermore, the very long-run literature available has focused on the growth determinants that have been, in most cases, analyzed in an isolated manner. Among the most frequently mentioned determinants, we find the macroeconomic conditions, namely government expenditure (e.g., Cavicchioli & Pistroesi, 2016; Facchini & Melki, 2013; Forte & Magazzino, 2016), military spending (e.g., Lai, 2001), financial market development (e.g., Nieuwerburgh et al., 2006), inflation (e.g., Škare, 2014), and public debt (e.g., Esteve & Tamarit, 2018). Apparently, some critical factors associated with economic growth have been relatively neglected in the related literature, such as human capital (e.g., Ljungberg & Nilsson, 2009) and institutional conditions (e.g., Kirchner, 2012), or even overlooked as in the case of structural change and technology innovation.

The study of human capital, institutional conditions, and structural change as drivers of sustainable economic growth is especially relevant for the EEs since this group of countries presents specific characteristics (e.g., high levels of poverty and inequality (Amar et al., 2020); inefficient manufacturing basis (Wang et al., 2020); corruption and political instability (Vianna & Mollick, 2018)), which are likely to imply the resounding failure of control over those aspects throughout their development history. Thus, by estimating the direct impact of these three variables over the very long run, we can assess how and to what extent such impacts have contributed to overcoming the backwardness of an EE.

Brazil is one of the largest EEs, but it is also one of the most unequal countries in the world (in terms of income, according to the GINI index). Furthermore, it has the worst literacy rate among the South American EEs (World Bank database, 2018), exhibits high levels of corruption (according to the Corruption Perception Index, 2020), and has unstable political institutions (Campos et al., 2020). Putting the Brazilian case into

perspective is an interesting option because although the ability to grow at high rates in given periods of its history (from 1960 to 1980, the Brazilian real GDP grew on average 7.5% per annum), the country has faced significant challenges in promoting a robust and sustainable economic performance in the very long run (Arbache & Sarquis, 2018).

Despite the existence of several high-quality studies on the empirics of Brazil's economic growth (e.g., Araújo et al., 2018; Campos et al., 2020; de Mendonça & Cacicedo, 2015; Mele, 2019; Oreiro et al., 2018; Rocha & Souza, 2018; Veríssimo & Xavier, 2014), they have focused on relatively short and contemporaneous periods. One exception is Campos et al. (2020) who embraced a very long-run time frame (1870-2003), focusing on the role of political institutions. They did not, however, analyze the most recent period of history (the 21st century), nor did they intersect institutions with other variables, namely human capital and structural change.

Studies that embraced more distant horizons of the Brazilian economy involve descriptive/qualitative accounts (e.g., Abreu, 2014; Furtado, 1987; Hudson, 1997), suggesting a myriad of growth inhibiting factors (e.g., premature deindustrialization process, balance-of-payment constraints, human capital formation deficiency), but they have failed to uncover the relative impact of each of them. Moreover, this literature has not addressed the joint impact of critical factors strongly associated with the development of EEs, namely structural change, institutional conditions, and human capital (Nistor et al., 2018; Vianna & Mollick, 2018; Wang et al., 2020).

This study aims to fill these literature gaps by conducting a quantitative, empirical analysis of the impact of structural change, institutional conditions, and human capital on Brazil's economic growth over a very large time span. To achieve such an endeavor, we employ time series methods, such as cointegration and Granger causality, using annual frequency data on Brazil from 1822 to 2019.

The essay is structured as follows. Section 2 reviews the relevant empirical literature on growth in the very long run in general, and Brazilian performance in particular. It further describes a brief theoretical framework of the determinants considered in the study and their impact on economic growth. Section 3 defines and discusses the data and methodology. In Section 4, we present and discuss the empirical results. Finally, Section 5 concludes and highlights the main contributions and limitations of the study.

4.2 Literature review on very long run economic growth

4.2.1 An overview of the main studies on very long-run economic growth

The empirical debate on the determinants of very long-run economic growth is still limited to a few studies (Appendix 3). Among the 19 quantitative studies we found, the majority (14) focus on developed countries, while four studies address the EEs (Argentina, Brazil, and South Africa), and one has analyzed a less developed country (Mozambique).

Two studies have analyzed the drivers of Australia's economic growth. Foster (2016) associates the country with a 'growth miracle' due to a very long-term (1904-2008) innovation process in the energy sector, and Kirchner's (2012) results suggest a positive long-run relationship (1902-2008) between legislative outputs and the level of real GDP per capita.

Based on Italian (Cavicchioli & Pistoresi, 2016; Forte & Magazzino, 2016) and French (Facchini & Melki, 2013) time-series data, several authors examined the interaction between government expenditure and economic growth and found evidence for a positive relationship between these variables. On the contrary, military spending is analyzed with UK data (Lai, 2001) and the results point to a direct and negative impact on economic output.

Esteve & Tamarit (2018) showed that an increase in the public debt-to-GDP ratio is associated with a decline in Spain's growth (1851-2013). Nieuwerburgh et al.'s (2006) study assessed the role of finance for growth in Belgium (1830-2000) and found significant evidence of the positive, long-term contribution of stock market development to growth. Škare (2014) addressed the link between inflation, unemployment, and output (the 'golden triangle' model) in the UK over the period from 1851 to 2011, and the empirical outcomes validate the golden triangle model.

Among the very long-run studies on international trade, Italy (Pistoresi & Rinaldi, 2012) and Spain (Balaguer et al., 2014) were the object of analysis between 1863 to 2004,

and 1900-2012, respectively. Both studies' results support the idea that an increasingly more open economy prompts economic efficiency.⁹

The impact of migration on growth was studied by Foldvari et al. (2013) for The Netherlands, and the impact of climate by Berry & Okulicz-kozaryn (2008), for the USA. The former study found that the mass migration during the Dutch 'Golden Age' (1580-1670), and the 80 years' war had a direct and positive long-run impact on the Dutch GDP per capita after 1700.¹⁰ Although the El Niño–Southern Oscillation (ENSO) is a potent source of climatic variability, the results of the latter study found no causality effect of ENSO shock on economic growth in the USA (1894-1999).

Human capital is a long-term investment, thus, the causation relationship between education and economic growth has to be analyzed as a historical process over a very large time frame (Ljungberg & Nilsson, 2009). To the best of our knowledge, Sweden is the only country in which scholars have associated education with economic growth in the very long run (1870-2000). Using a time-series approach, Ljungberg & Nilsson (2009) concluded that human capital accumulation was a positive driving factor behind economic performance in Sweden over the period in analysis, mainly due to primary education investments since the latter part of the nineteenth century.¹¹

Apart from Fedderke et al. (2006) study, which is centered on the causality effects of investments in infrastructure on South Africa's growth (1875-2001), the studies focusing on EEs (Campos et al., 2020; Campos et al., 2012; Campos & Karanasos, 2008) and LDCs (Pereira & Luiz, 2020) have stressed the role of institutional conditions and their impact on economic growth. For instance, Pereira and Luiz (2020) investigate the contribution of political and economic institutions to economic progress in Mozambique (1900-2005), measured by political liberties and property rights, respectively. The authors found that the improvement of these institutions have ensured peace and prosperity, and have, thus,

⁹ Although long-run relationship was observed between imports and exports, and real GDP, no causality was observed during and between wars (1914-1950) in Italy (Pistoresi & Rinaldi, 2012). In the Spanish case, Balaguer et al. (2014) found no causality during the inward oriented growth period (1900-1958), characterized by economic isolation, industrial backwardness, and limited foreign trade.

¹⁰ The immigrants were essentially wealthy entrepreneurs, highly schooled and skilled laborers, thus brought high-valued added activities to Dutch republic (Foldvari et al., 2013).

¹¹ The authors also stress the importance of continuous growth of human capital. They observed an economic slowdown in the 1970s and the 1980s and associated it with slowdown of human capital accumulation due to upper secondary and tertiary school in the preceded years.

fostered economic development.

Regarding studies on Argentina, Campos and Karanasos (2008), and Campos et al. (2012) use the same timeframe (1896-2000) and analyze the impact of formal and informal political instability on the country's economic performance. Although Campos et al. (2012) have investigated this impact within a finance-growth nexus framework, the results are in line with Campos and Karanasos's (2008) findings, i.e., informal political instability has a long-lasting, direct, and statistically significant negative impact on growth, whereas formal political instability has a negative and indirect impact through volatility. In Campos et al. (2020), the Brazilian case is analyzed within a similar timeframe (1870-2003) as the former studies. The results show the presence of direct and indirect (through volatility) effects of formal and informal political instability on Brazil's economic growth.

In this overview of the very long-run empirical literature, several aspects are worth highlighting: 1) the majority of studies focus on developed countries, and their chief concern regards the impact of macroeconomic conditions (government expenditure, public debt, financial development, and inflation) on economic growth; 2) the role of structural change and technology innovation have been neglected in this literature; 3) education has to be an ongoing investment in all its levels (primary, secondary, tertiary, and vocational), which should therefore be analyzed as a historical process over the very long run; 4) the studies encompassing EEs mainly address the issue of institutional conditions using the same proxies (formal and informal political instability).

4.2.2 An overview of the empirical studies on the economic growth process of Brazil

The economic growth literature includes several studies that analyze the Brazilian case, with high-quality empirical evidence (Appendix 4). These empirical studies have discussed the impact of one or several growth determinants over more recent decades.

Regarding the role of macroeconomic conditions and their effect on Brazilian economic performance, five main factors arise, most notably: aggregate demand (e.g.,

Alencar et al., 2018; de Jesus et al., 2018; Oreiro et al., 2012), monetary policy (e.g., Araújo et al., 2018; dos Santos et al., 2015; Libânio, 2010; Oreiro et al., 2011), financial system (e.g., Nyasha & Odhiambo, 2017; Paula & Pires, 2012; Rocha & Souza, 2018; Stefani, 2007), and government expenditure (e.g., de Mendonça & Cacicedo, 2015; Gadelha, 2011).

The concern about Brazil's excessive dependency on commodities exports is addressed by Arbache and Sarquis (2018), and Veríssimo and Xavier (2014, 2013), who agree that the strong concentration of Brazilian exports in commodities has undermined economic growth.

The impact of tourism and energy consumption on growth have also been studied, respectively, by Brida et al. (2011), and Mele (2019). The former study found no evidence to support the causality effects of tourism on economic growth in Brazil; however, the latter study showed the existence of causality between energy consumption and per capita GDP, albeit without indicating the exact direction.

From a Keynesian-Structuralist perspective, Oreiro et al. (2018) tested the hypothesis that the slowdown in growth between 1980 and 2012 was due to Brazil's premature deindustrialization. The combined effect of reducing the share of the manufacturing industry in GDP and the low investment rate resulted in a strong and negative impact on the labor productivity growth rate, therefore, on economic growth.

The institutional conditions were evaluated by Campos et al. (2020) encompassing the period from 1870 to 2003. The study concluded that formal and informal political instability directly and indirectly (via the conditional volatility of growth) affected Brazilian economic growth negatively.

4.2.3 The impact of structural change, human capital, and institutional conditions on Brazil's long-term economic growth: Main hypotheses to be tested

The process of change from the primary sector to more dynamic and sophisticated industries, as well as innovation and technological progress in productivity activities, are

recognized as one of the main determinants of a country's long-run economic growth (Aghion & Howitt, 1992; De La Escosura, 2007; Teixeira & Queirós, 2016). This type of effort and resource reallocation is recognized as the process of structural change (Erumban et al., 2019).

If we trace back the works of Joseph Schumpeter or Willian Lewis, we find theoretical evidence and strong arguments to support the relevance of structural change to achieve a higher level of development. According to Schumpeter (1939, 1954), an economy cannot develop without structural change, and the adoption of constant innovation and technology are primary catalysts of productivity, hence prominent drivers of economic growth. Lewis (1954), in turn, claims that the movement from agriculture to manufacturing is at the heart of economic development and growth. Consequently, since capital and labor are supposed to shift from less productive sectors to more productive ones, overall productivity and economic growth is bolstered.

Baumol (1967) was the first to develop a comprehensive model examining the relationship between structural change and economic growth in an unbalanced growth model. Subsequently, Aghion and Howitt (1992), Lucas (1988), and Romer (1986) also analyzed this dynamic relationship through endogenous growth models and concluded that technical or productive progress are exclusive engines of long-run economic growth.

Empirically, the more industrialized regions reveal higher economic development than the mainly agricultural ones (Teixeira & Queirós, 2016). According to Zheng and Walsh (2019), industrialization is an indicator of modernization, and the developing and less developed countries must achieve higher levels of technology diffusion in order to catch up with the frontier economies. Some Asian economies (e.g., South Korea, Taiwan) have successfully achieved high levels of development due to structural change since their economies shifted towards the production of more specialized and sophisticated goods with a high share of value added (Olczyk & Kordalska, 2018).

Regarding the Brazilian economy, instead of putting efforts into diversifying its manufacturing basket or moving its production from mainly commodities to (high-tech) industry, the country has experienced profound, premature deindustrialization since the 1980s (Bresser-Pereira, 2012; Feijo & Lamônica, 2019; Nassif, Morandi, et al., 2020). Oreiro et al. (2018) empirically highlighted the sharp decline in the share of the

manufacturing industry in GDP in Brazil from the beginning of the 1980s, and the strong, negative impact of these dynamics on growth, leading the country to a “semi-stagnation” phase.

Based on the above, we conjecture that:

H1: The process of structural change associated with industrialization is likely to foster Brazil’s very long-run economic growth.

The stock and quality of human capital is closely associated with innovation and structural change in a society (Diebolt & Hippe, 2019; Romer, 1990). Education, intelligence, research activities, and health are some of the many dimensions through which one can measure human capital stock (Garza-Rodriguez & Almeida-Velasco, 2020). Human capital accumulation is one of the most critical determinants of sustainable economic growth, especially for developing countries and EEs (Tridico, 2007).

Romer (1986) and Lucas (1988) included human capital (through education) in their new endogenous growth model and recognized it as an essential element for economic growth. Furthermore, Barro (2001) and Mankiw et al. (1992) found strong empirical evidence of the positive effect of human capital (measured by the percentage of the working age population that was in secondary school, and the years of schooling, respectively) on economic growth.

It is widely acknowledged that education positively affects growth by raising the quality of labor, thereby providing the necessary and sufficient knowledge and skills that citizens need to improve their standard of living (Garza-Rodriguez & Almeida-Velasco, 2020; Ljungberg & Nilsson, 2009). Furthermore, education stimulates creativity and innovation, as well as facilitates the absorption of new ideas and technologies developed by advanced countries (Nelson & Phelps, 1966). Altogether, investments in human capital formation seem to spur long-term growth, and this relationship is an important policy agenda for EEs and developing countries (Habib et al., 2019).

Based on the above, we conjecture that:

H2: Human capital improvements are likely to foster Brazil’s very long-run economic growth.

According to North (1991), institutions are the incentive structure of an economy, and the evolution of this structure can drive an economy to grow, stagnate, or decline. The term ‘institution’ includes the organization and system of a particular society or a group, including their customs and traditions (Alexiou et al., 2019; Cavusoglu, 2012). Notwithstanding, there is still an on-going debate around what are institutions exactly and how they can be measured (Bruinshoofd, 2016). Some authors have applied diversified proxies to measure institutional quality, using namely formal and informal political instability (e.g., Barro, 1991; Campos et al., 2012; Campos et al., 2020), corruption (e.g., Iqbal & Daly, 2014; Mauro, 1995), democracy (e.g., Acemoglu et al., 2001; Mathonnat & Minea, 2019), and political and property rights (e.g., Pereira & Luiz, 2020). Accordingly, political instability (i.e., coups and revolutions, legislative effectiveness, number of constitutional changes) is expected to affect the behavior of voters and of authorities, which can influence economic decisions, as well as diminish property rights security, and increase uncertainties, thus stimulating activities that are detrimental to economic performance (Campos et al., 2012; Campos et al., 2020). In the same vein, corruption depresses growth and development by leading investors to make relatively unproductive decisions, worsening poverty and income inequality, and jeopardizing democratic states (Iqbal & Daly, 2014). The effects of political rights control and democratic stability may be positive and promote growth due to some constraints imposed on political leaders that limit the implementation of distorted public policies (Mathonnat & Minea, 2019). In addition, the enforcement of property rights over physical capital, patents, and profits reduces transaction costs and rent-seeking behavior and encourages investments, all of which boost growth (Alexiou et al., 2019; Pereira & Luiz, 2020).

Institutions also affect the economic performance of a country indirectly through interconnections with human capital (Dias & Tebaldi, 2012). The increased quality and stability of institutions encourages the productive employment of workers through a well-functioning and informative labor market, thus fostering technology and output growth (Dias & Tebaldi, 2012; Rogers, 2008). This is because high-quality institutions ensure that human capital is guided towards its most productive uses (Zhou, 2018). From the viewpoint of EEs, the education upgrade is contingent on the level of institutional quality, such as the policies aimed at boosting human capital, which should be promoted with better institutions (Dias & Tebaldi, 2012; Zhou, 2018).

Based on the above, we conjecture that:

H3: High-quality institutions are likely to foster Brazil's very long-run economic growth.

4.3 Methodology

4.3.1 Model specification and selection of the estimation technique

The main goal of this study is to evaluate the extent to which, in the very long run, that is, from 1822 to 2019, human capital, structural change, and institutional quality contributed to Brazil's economic growth. Given this purpose, the cointegration econometric techniques applied to the time series data seems to be the appropriate methodology to employ (Granger, 1981; Johansen, 1988).

4.3.2 Description of the variable proxies and data sources

4.3.2.1 Economic growth

The Maddison Project Database (2020) provides the Brazilian real GDP per capita (constant 2011 US\$) from 1800 to 2018, covering the whole period we are focusing on with just a small number of missing values (1822-1849, 2019). We have employed this series in our research and filled in the missing figures using data collected from Coatsworth (1978) for 1822-1849, and the World Bank (WB) database for the most recent period.

Coatsworth (1978) suggested an average annual growth rate of GDP per capita of 0.36% between 1800 and 1860 in Brazil. Therefore, using the data for 1850 from Maddison, we extended the series back to 1822 based on this annual growth rate. To complete the figure for 2019 we have used the WB Database.

The real GDP per capita evolution since 1822 clearly presents an upward trend (Figure 4.1). During most of the nineteenth century, the per capita annual rate was remarkably stagnant (0.2% on average), at least until the proclamation of the Republic, in 1889. Under the new regime, Brazil embarked on a path of rapid economic growth, particularly from 1950 to 1980, when the country reached a GDP per capita growth rate of 4.4%, on average. The pattern of accelerated economic performance expired in the following 20 years and was reestablished during the first decade of the 21st century.

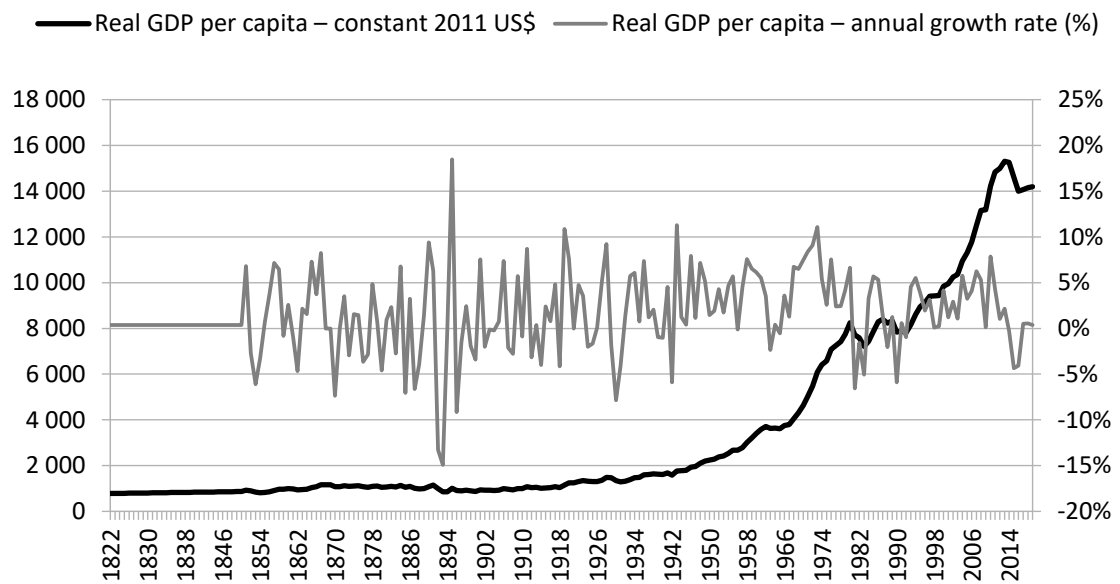


Figure 4.1. Real GDP per capita, in constant 2011 US\$ (left axis) and annual growth rate % (right axis), Brazil, 1822-2019

Source: Authors' elaboration based on data from Maddison Project Database (2020), Coatsworth (1978), and WB Database.

4.3.2.2 Human capital

Several proxies of human capital can be found in the literature, among which the most common are school enrollment ratios (e.g., Barro, 1991; Batten & Vo, 2009; Mankiw et al., 1992), adult literacy rates (e.g., Rehman et al., 2015), and average years of schooling (e.g., Barro, 2001; Ljungberg & Nilsson, 2009; Niquito et al., 2018). For this study, the chosen measure of human capital was based on the availability of data, since it encompasses a very long-time window (1822-2019).

The ‘average years of schooling’ (population aged 15 to 64) was gathered from Barro and Lee (2015), and Lee and Lee (2016), provided for periods of 5 years, from 1870 to 2010.¹² The authors also have projections that we used to complete the data until 2019. The years in between were obtained by linear interpolation. From 1822 to 1869, we used backward interpolation based on the average growth rate between 1870 to 1918. As can be seen in Figure 4.2, the years that followed the “developmentalist” period (1930-1980) were marked by outstanding evolution in the average years of schooling, which rose from 3 years in 1980 to 8 years in 2010.

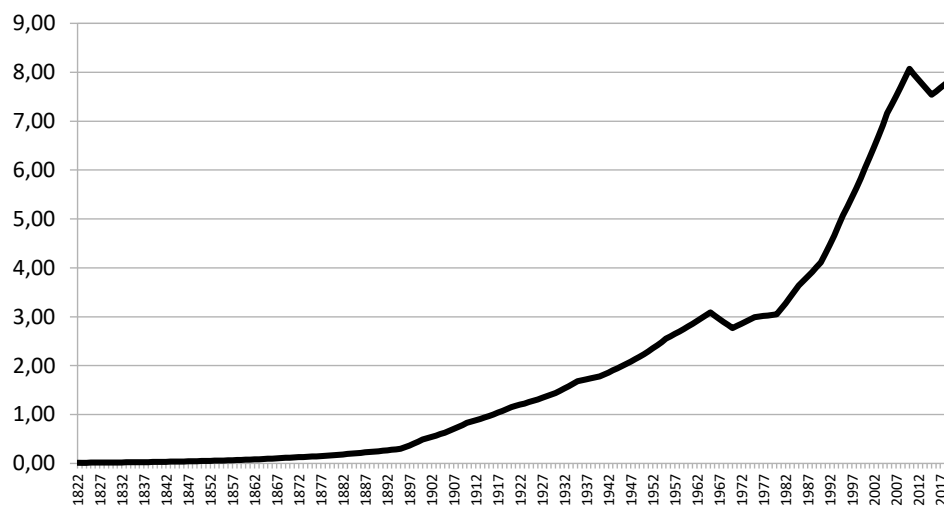


Figure 4.2. Average years of schooling, population aged 15-64, Brazil, 1822-2019

Source: Authors’ elaboration based on data from Barro and Lee (2015) and Lee and Lee (2016).

4.3.2.3 Structural change

According to Olczyk and Kordalska (2018), the changes in the structure of an economy are often measured in terms of employment or value added. To use the employment composition data (i.e., the weight of working age population in the primary, secondary, and tertiary sectors) and its evolution over the period under analysis (1822-2019), we resorted to and combined several datasets. To construct the time series, we gathered the number of persons engaged in each sector, and then divided it by the sum of total persons engaged in the primary, secondary, and tertiary sectors.

¹² Data is easily retrieved in the authors’ website, <http://www.barrolee.com>, last accessed April 2021.

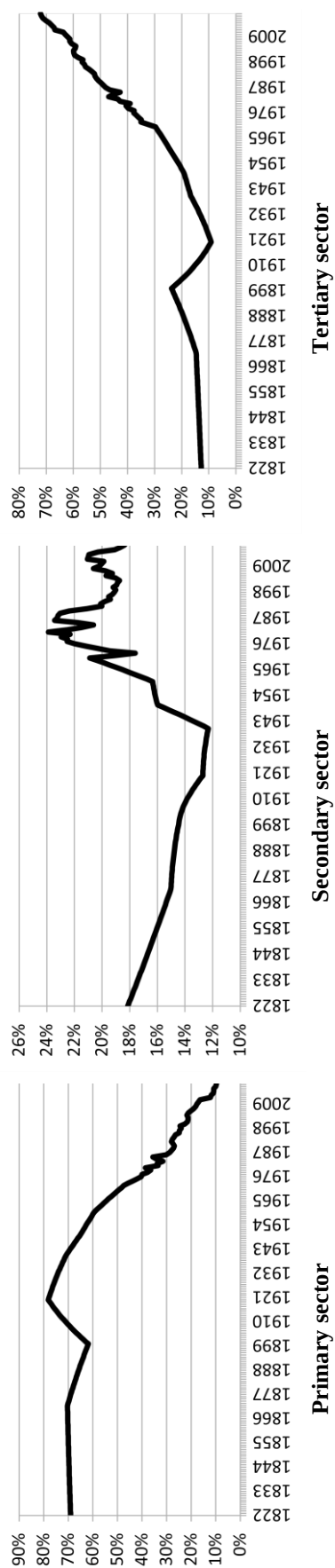


Figure 4.3. Employment in the primary, secondary, and tertiary sectors (% of total persons engaged), Brazil, 1822-2019

Source: Authors' elaboration based on data from PWT 10.0, IBGE, and ILO.

The Penn World Table (PWT) version 10.0 provides the annual number of persons engaged in each sector, from 1950 to 2011. To complete the missing values, we used two additional sources: the Brazilian Institute of Geography and Statistics (IBGE), which covers the years of 1872, 1900, 1920, 1940, 1950, 1960, 1970, and 1980; and the International Labour Organization Database (ILO), with data from 1981 to 2019 (1991, 1994, 2000, and 2010 were missing).

First, we used linear interpolation to fill the missing values in the IBGE datasets, from 1872 to 1950. We used the annual growth rate derived from the previous computation to complete the PWT series back to 1872. From 1822 to 1871, we applied backward interpolation based on the average growth rate between 1872 and 1922. The most recent period (2012 to 2019) was filled based on the computation of the annual growth rate of persons engaged in productive activities from ILO, thus applying the PWT series from 2012 onwards.

The trends depicted in Figure 4.3 show that structural change was negligible until the 1920s. The transition from an agrarian, rural society to an industrialized one only started after the 1940s, when assertive policies and investments propelled the manufacturing sector, at least until the 1980s (Arestis & Baltar, 2019; Nassif, Morandi, et al., 2020). Brazil's premature deindustrialization and "servicification" occurred from 1980 onwards, chiefly associated with low productivity and low-skilled labor (Nassif, Morandi, et al., 2020). Some authors (e.g., Marquetti et al., 2019) have suggested that the deindustrialization process can be highlighted as one of the real causes of economic stagnation after the 1980s.

4.3.2.4 Institutional quality

Eicher and Röhn (2007) argued that the term 'institutions' is not only hard to define, but rather complex to measure, which implies a major challenge when using this variable. To assess the impact of institutional quality on Brazilian economic growth, we have opted to perform a political measure (Figure 4.4), the Polity Score, due to the availability of data over very long time periods.

The polity score variable captures a political form of institutional quality by subtracting the autocracy variable score from the democracy variable score (Cavusoglu,

2012). The most democratic and efficient governments/institutions are linked to higher polity scores, whose scale ranges from +10 (strongly democratic) and -10 (strongly autocratic). This specific data was retrieved from the Polity5 Project¹³ and, for the Brazilian case, covers the period from 1824 to 2018. As no substantial institutional changes emerged from 1822 to 1824 (2018 to 2019), we assumed that the score for 1824 (2018) also applied to the years 1823 and 1822 (2019).

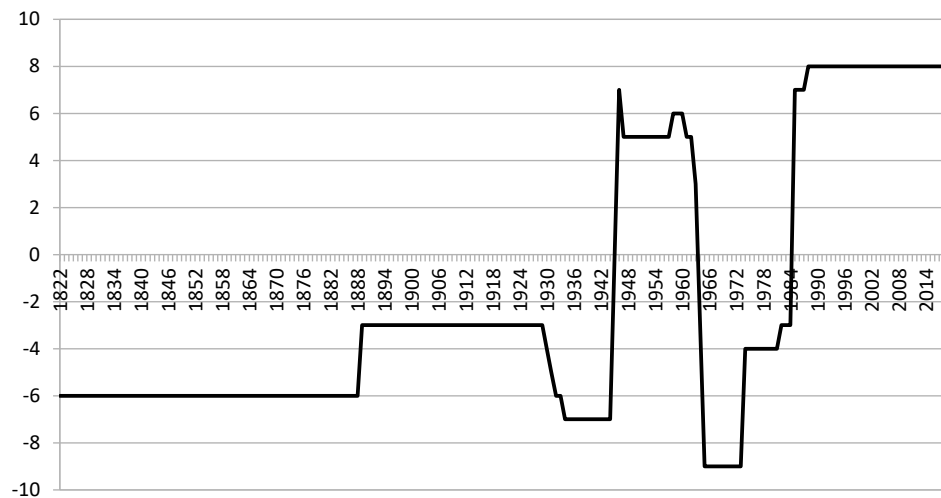


Figure 4.4. Polity Score, Brazil, 1822-2019

Source: Authors' elaboration based on Polity5 Project.

The descriptive statistics for the relevant variables are presented in Table 4.1 showing that the average Brazilian real GDP per capita during the period of analysis was one fourth of the maximum value, considered very low when compared to the potential that the country had already reached. The mean of human capital, measured by the average years of schooling of the population aged 15 to 64 years old, is another strikingly low value of only 2. This implies that in Brazil, from 1822 and 2019, individuals studied only an average of 2 years. The structural change proxies reveal a high share of individuals engaged in the primary sector (57.8%), and a low share of individuals employed in the secondary sector (16.6%). This figure illustrates the late industrial revolution in Brazil, that began around 1940 (Fonseca & Salomão, 2017), the premature deindustrialization after the 1980s (Nassif, Morandi, et al., 2020), and the commodity export-oriented regime more recently (Cabral et al., 2017). With respect to institutions, the Polity Score average,

¹³ In <http://www.systemicpeace.org/inscrdata.html>, last accessed in April 2021.

-1.909, implies that Brazil has experienced a more autocratic political system than a democratic system throughout its history as an independent nation.

Table 4.1. Summary of the descriptive statistics of the relevant variables and source of data

Variable	Description	Source of data	Mean	Min	Max
Real GDP per capita	Gross domestic product at constant 2011 prices per inhabitant (in dollars)	Maddison Project 2020; Coatsworth (1978); World Bank	3495.701	784.009	15306
Human capital	Average years of schooling, population aged 15 to 64, both sexes	Barro and Lee (2015) Lee and Lee (2016)	2.047	0.025	8.17
Structural change	Employment in primary sector as % of total persons engaged	PWT 10.0; IBGE; ILO	0.578	0.096	0.781
	Employment in secondary sector as % of total persons engaged		0.166	0.123	0.239
	Employment in tertiary sector as % of total persons engaged		0.256	0.091	0.721
Institutional quality	Polity Score	Polity5 Project	-1.909	-9	8

Source: Authors' elaboration

4.4 Empirical results

4.4.1 Unit root tests

The unit root test is the first step when using time-series data to avoid spurious regressions in economic modeling (Engle & Granger, 1987). The method centers on the stationarity (absence of unit root) and non-stationarity (presence of unit root) analysis of the relevant time-series variables (Inwood & Stengos, 1991). Therefore, we begin the empirical analysis by performing the two most widely used conventional tests, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, to check for the presence of unit roots of each selected variable. In addition, we also employed the Kwiatkowski-Phillips-Schmidt-Shin' (KPSS) Zivot and Andrews' (1992). The former, which is a test of the null hypothesis of stationarity against the alternative of a unit root, has been attractive as a useful counterpoint to the ADF test (Hansen, 2020). In turn, the latter

ensure reliable and accurate results by providing a robust unit root test in the presence of structural break.

Apart from ‘employment in the secondary sector’ and the ‘polity score’, all the remaining variables in levels present a clear upward or downward trend. Thus, for these variables, we included a constant and a time trend in the tests. The results in Table 4.2 reveal that all variables are non-stationarity in levels.

Table 4.2. Unit root/ stationary tests of the series under study

Variable	ADF test (p-value)	PP test (p-value)	KPSS test	Zivot-Andrews [break date]
Level				
Real GDP per capita	-1.219 (0.907)	-1.172 (0.916)	2.37***	-3.425 [1909]
Human capital	-1.028 (0.940)	-0.171 (0.992)	1.53***	-2.927 [1896]
Structural change (SC) – Secondary sector	-1.074 (0.725)	-1.024 (0.744)	2.36***	-4.146 [1941]
Structural change (SC) – Tertiary sector	-1.940 (0.634)	-0.713 (0.972)	0.74***	-3.279 [1918]
Institutional quality	-2.614* (0.090)	-2.393 (0.144)	2.10***	-4.053 [1974]
First Difference				
Real GDP per capita	-9.304*** (0.000)	-11.934*** (0.000)	0.117	-12.790*** [1981]
Human capital	-4.042*** (0.001)	-6.719*** (0.001)	0.129*	-5.627*** [1981]
Structural change – Secondary sector	-8.831*** (0.000)	-10.360*** (0.000)	0.175**	-11.286*** [1982]
Structural change – Tertiary sector	-2.970** (0.038)	-6.719** (0.038)	0.183**	-5.621*** [1921]
Institutional quality	-8.966*** (0.000)	-11.568*** (0.000)	0.028	-11.805*** [1974]

Note. *** (**) [*] statistically significant at 1% (5%) [10%]; all variables are in logarithms; apart from structural change – secondary sector and institutional quality, the variables in levels include a trend; for each variable the lag-length selection in ADF, PP, and KPSS test was based on the information criteria provided in *varsoc* command (STATA).

Source: Authors’ computation using STATA 15.1.

The same procedure was applied to the first differences in the aftermath, and the results were consistent between the ADF, PP, and the Zivot-Andrews tests, with all variables being stationary in the first differences. Hence, we can conclude that the

variables are integrated of order 1, i.e., $I(1)$.¹⁴ From these findings, we can assume that the series can have one or more stationary linear combinations, and that the variables have a stable long-term relationship among them (cointegrated in the long run).

4.4.2 Vector Error Correction Model (VECM)

The hypothesis of a long-term relationship between the relevant variables can be assessed using cointegration tests, such as the Johansen test (Johansen, 1988), to calculate the effective number of cointegrating vectors. Table 4.3 reports the cointegration test results of the two models proposed depending on the proxy used for ‘structural change’ (Model 1: the weight of the secondary sector; and Model 2: the weight of the secondary and tertiary sectors).

Table 4.3. Johansen cointegration test with the variable

	Number of cointegrating vectors (r)	Trace statistics	5% critical value
Model 1	None	64.7427*	53.12
	At most 1	30.5235	34.91
Model 2	None	103.5529*	76.07
	At most 1	51.6005	53.12

Note. Trace test is a Johansen cointegration test for the null hypothesis that, among real GDP per capita ($\ln$), human capital ($\ln$), structural change ($\ln$) [model 2 uses 2 proxies] and institutional quality ($\ln$), there are r linearly independent cointegration relations, that is, the 4 [5] variables share 4 [5]- r stochastic tendencies; * represents the rejection of the null hypothesis that among the 4 [5] variables there are r linearly independent cointegration relations (compared to the alternative that there are $r+1$ linearly independent cointegration relations) at a 5% significance level.

Source: Authors’ computation using STATA 15.1.

For the period of analysis (1822-2019) and all the relations associated with Models 1 and 2, the sequential testing procedure indicates one cointegrating relationship among the variables. Indeed, the trace statistic rejects the null hypothesis of no cointegration ($H_0: r = 0$) in all the models, whereas it fails to reject the null hypothesis of at most one

¹⁴ If x_t and y_t are both stationary in the first difference, represented by the notation $I(1)$, then it is generally true that the linear combination between variables will also be $I(1)$. For more discussion see, for example, (Engle & Granger, 1987).

cointegrating vector ($H_0: r \leq 1$) at 5% statistical significance.

Since we have identified the existence of one cointegrating equation for each model, we can say that there is a stable equilibrium relationship. Therefore, the parameters of the vector error correction models (VECM) can be estimated by constraining the real GDP per capita which is taken as normalized to 1.

Table 4.4. Long-term relations of growth, human capital, structural change and institutional quality, Brazil, 1822-2019

		VECM 1	VECM 2
Human capital (HC)		0.437*** (0.068)	0.372*** (0.062)
Structural change (SC)	Secondary sector	3.043*** (0.513)	4.010*** (0.942)
	Tertiary sector		0.372 (0.420)
Institutional quality (IQ)		0.164 (0.147)	0.166 (0.152)
Lags		3	4
Number of cointegrating vectors		1	1
Cointegration vector		Restricted constant	Restricted constant
Jarque-Bera test (overall) ⁽¹⁾		45.405 (0.000)	33.288 (0.000)
Lagrange-multiplier test ⁽²⁾		24.052 (0.088)	26.059 (0.404)
Eigenvalue stability condition ⁽³⁾		0.181	0.350

Notes. All variables are in logarithms; The number of lags was established according to the Schwarz's Bayesian information criterion (SIC); All cointegrating vectors include a constant and a trend. (1) H_0 : the disturbances in the VECM are normally distributed; (2) H_0 : no autocorrelation at lag order; (3) the cointegrating equations are stationary when the estimated root is not close to 1.

Source: Authors' computation using STATA 15.1.

To test whether the VECMs associated with the cointegration relationships are well specified, we rely on complementary tests, namely the Jarque-Bera, Lagrange multiplier, and the Eigenvalue stability condition (see Table 4.4). Although the overall Jarque-Bera statistics reject the null hypothesis that the disturbances in the models are normally distributed, we can continue to assume that the models present an overall goodness of fit since the parameters specified presented high statistical significance (Juselius, 2006). In particular, we have assumed that these results only cause a small divergence in the

standard deviation values, but not in the overall feature of the models, as can be seen from checking other diagnostic results. According to the Lagrange multiplier test, we cannot reject the null hypothesis of no autocorrelation in the residuals for the two models. Regarding the Eigenvalue stability condition, most of the estimated roots are not close to 1, suggesting that the predicted cointegrating equations are stationary, being, thus, well specified.

Additionally, to ensure the goodness of fit of the estimated VECM models, a further diagnostic and stability tests were conducted, namely the cumulative sum of recursive residuals (CUSUM), and the cumulative sum of squares of recursive residuals (CUSUMsq). These stability tests confirm that the parameter estimates in the models are robust, i.e., all residuals lie within 95% significance interval indicating no instability (see Appendix 5).¹⁵

According to the results (Table 4.4), human capital and structural change (proxied by the weight of the secondary sector) are positively correlated with Brazilian economic growth in the very long run at 1% level of significance. At the same time, the coefficients for institutional quality (proxied by Polity Score) have presented no significance in both models.

Even though the results obtained provide a picture of the very long-run association between the selected series for the Brazilian economy from 1822 to 2019, we could not explicitly infer the existence and direction of causality between the variables. For this purpose, and in line with similar studies (e.g., Balaguer et al., 2014; Foldvari et al., 2013; Mele, 2019; Pereira & Luiz, 2020), we proceeded with a causality test introduced by (Granger, 1969).

¹⁵ In STATA 15.1, where the estimations were performed, the CUSUM command (*estat sbcusum*) also provides a test for structural breaks due to changes in regression coefficients over time. The t-statistic results from all models failed to reject the null hypothesis of no structural break. The Bai and Perron's (1998) test for multiple structural breaks was also applied to support the aforementioned results (see Appendix 6).

4.4.3 Granger causality test

The concept of Granger causality is rooted in the basic principle that only the past can have causal influence on the future and makes sense only for purely non-deterministic processes (Neusser, 2016). When restricted to cointegration among the series, the Granger causality shows whether changes in one series are systematically followed by changes in another series, which can be observed in one or both directions (Ljungberg & Nilsson, 2009; Teixeira & Loureiro, 2019).

Considering that the results from the cointegration tests are similar across the three models, we opted to test for the absence of Granger causality by estimating the following vector autoregressive model (VAR):

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \alpha_y \\ \alpha_x \end{bmatrix} + \begin{bmatrix} \beta_{y,1} & \dots & \beta_{y,p} \\ \beta_{x,1} & \dots & \beta_{x,p} \end{bmatrix} \cdot \begin{bmatrix} Y_{t-1} \\ \dots \\ Y_{t-p} \end{bmatrix} + \begin{bmatrix} \gamma_{y,1} & \dots & \gamma_{y,p} \\ \gamma_{x,1} & \dots & \gamma_{x,p} \end{bmatrix} \cdot \begin{bmatrix} X_{t-1} \\ \dots \\ X_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{y,t} \\ \varepsilon_{x,t} \end{bmatrix} \quad (1)$$

where Y_t represents the real GDP per capita; X_t stands for the proxy for human capital, structural change, and institutional quality in each VAR and testing procedures; and ε_t are the error terms.

To test for causality in this system of equations, there can be alternative causal relations for each pair of series (e.g., structural change does not Granger cause real GDP per capita) if all $\gamma_y = 0$, which is the null hypothesis. By the same token, real GDP per capita does not Granger cause structural change if all $\gamma_x = 0$. In each case, if the underlying null hypothesis is rejected, evidence of Granger causality is found.

The results (see Table 4.5) revealed that in the very long run (1822-2019), human capital is the only determinant that Granger causes Brazil's economic growth. Moreover, we found that Granger causality runs from institutional quality to human capital, and from real GDP per capita to structural change. According to our hypotheses in Section 4.2 and the outcomes obtained, we can conclude that H2 (*Human capital improvements are likely to foster Brazil's very long-run economic growth*) is validated, whereas H1 (*The structural change process associated with industrialization is likely to foster Brazil's very long-run economic growth*) and H3 (*High-quality institutions are likely to foster Brazil's very long-run economic growth*) cannot be validated.

Table 4.5. Granger (non-) causality tests, Brazil, 1822-2019

Null hypothesis	Model 1
Structural change <i>does not</i> Granger cause Economic growth	1.969 (0.374)
Human capital <i>does not</i> Granger cause Economic growth	6.287** (0.043)
Institutional quality <i>does not</i> Granger cause Economic growth	3.562 (0.168)
Economic growth <i>does not</i> Granger cause Structural change	6.553** (0.038)
Economic growth <i>does not</i> Granger cause Human capital	4.028 (0.133)
Economic growth <i>does not</i> Granger cause Institutional quality	1.902 (0.386)
Structural change <i>does not</i> Granger cause Human capital	2.111 (0.348)
Structural change <i>does not</i> Granger cause Institutional quality	2.526 (0.283)
Human capital <i>does not</i> Granger cause Structural change	1.470 (0.480)
Human capital <i>does not</i> Granger cause Institutional quality	0.558 (0.756)
Institutional quality <i>does not</i> Granger cause Structural change	2.728 (0.256)
Institutional quality <i>does not</i> Granger cause Human capital	5.508* (0.064)

Notes. (**) [*] statistically significant at (5%) [10%]; All variables are in logarithms; The number of lags was established according to the Schwarz's Bayesian information criterion (SIC); The re-estimated VAR involves the set of endogenous variables with p lags plus a constant; Wald test chi-square are displayed with p-values in brackets.

Source: Authors' computation using STATA 15.1.

These results highlight the critical importance of human capital as an essential element of sustainable economic growth, especially for developing countries and EEs, such as Brazil (Nistor et al., 2018; Tridico, 2007). For instance, improving human capital, namely by raising the average years of schooling, would boost the quality of the labor force and sustain the development of more advanced, sophisticated skills, while also stimulating creativity and the absorption of imported technologies, thereby significantly affecting productivity and economic growth (Nelson & Phelps, 1966; Romer, 1990; Teixeira & Queirós, 2016).

This positive, direct impact of education on growth has been examined in other studies on Brazil, e.g., Lau et al. (1993) and Niquito et al. (2018), although they focused on the Brazilian states between 1970 and 1980, and the Brazilian municipalities for 2010, respectively. In a descriptive manner, Sandoval (2012) provides valuable information

favoring the hypothesis under which human capital is the most effective way to bolster future growth in Brazil, although it is dependent on quality education that strengthens cognitive skills.

Regarding the direct causality between structural change and economic growth, our results are not aligned with the findings in the literature (e.g., Marquetti, 2002; Nassif, Morandi, et al., 2020b; Oreiro et al., 2018; Oreiro & Feijó, 2010), which cover more recent, shorter times periods. Using a descriptive analysis, Marquetti (2002) and Oreiro and Feijó (2010) linked the premature deindustrialization process from 1980 onward to harmful effects on economic growth. By applying a multivariate analysis, Oreiro et al. (2018) suggested that the growth slowdown in Brazil between 1980 and 2012 was due to the decrease in the manufacturing share in GDP. Nassif, Morandi, et al. (2020) revealed that the heavy industrialization process from 1950 to 1979 was the most important component to explain productivity growth in that period, whereas in the period between 1980 and 2011, sharp deindustrialization was responsible for long-term economic stagnation.

Considering the larger time window analyzed, 1822-2019, we failed to find sufficient evidence for the direct impact of structural change on Brazil's economic growth. Interestingly, though, our results showed evidence that in the very long run, the causality is reversed, that is, increases in real GDP per capita seem to promote structural change processes favoring the industrial (and to lesser extent, the services) sector. This outcome suggests that in the case of Brazil, in the last 200 hundred years, economic progress intensified the allocation and shift of resources, namely human resources, from the primary sector into the industrial sector.

On account of Brazil's large domestic market (one of the major countries in the world, in terms of population size), our findings are sustained by the fact that as economic progress improves the standard of living and the purchasing power of households, there are certain changes in demand that favor more complex products and services, contributing to structural changes associated with industrialization (Oreiro et al., 2018; Teixeira & Queirós, 2016).

Institutional quality (proxied by the polity score) emerged as an important growth determinant in Brazil's very long-term growth, but indirectly, via human capital

accumulation. As Acemoglu et al. (2004) highlighted, more democratic institutions tend to encourage investments in human capital, which leads to an increase in GDP per capita. Campos et al. (2020), Cavalcanti et al., (2008), and Nakabashi et al. (2013) are high-quality studies that defend institutions as a powerful tool for Brazilian development. However, Niquito et al. (2018), in their study referring to Brazilian municipalities, is the only one that supports the idea that human capital is a consequence of institutional quality, comprising thus an important channel through which institutions prompt economic growth in Brazil.

4.4.4 Robustness check

The contradicting results from the present essay and other studies on structural change-growth in the Brazilian context may arise some questions regarding the validity of our results. To help solving this issue we carry the same previous cointegration and Granger causality analysis using a different proxy for structural changes, namely the ‘value added of sectors (% GDP)’¹⁶, *ceteris paribus*. As data for the variable is only available from 1900 on, and since the majority of studies on this regard analyze the Brazilian structural changes after the industrialization boom of the 1930s, the robustness check encompasses the time window between 1930 and 2019.

As can be seen in Appendix 7, the cointegration analysis provide results aligned to Table 4.4, at least in the Model VECM1. That is, the long-term relations of growth, human capital, structural change (proxied by the secondary sector) and institutional quality is similar regarding the measure of the secondary sector (% employed in the sector, or value added as % of GDP). On the other hand, the Granger (non-)causality test (Appendix 8) has outcomes worth highlighting. Although the causality direction from institutional quality to human capital, and from human capital to economic growth are also observed in the robust check exercise, new causality effects emerged. At 1% significance, the test failed to reject the Granger non-causality of structural change to economic growth, and economic growth to human capital. Not surprisingly, the former is aligned with the bulk

¹⁶ The time series was retrieved from IBGE (1990) – (1930-1989), and IPEA Database – (1990-2019).

of literature and to what is expected from structural change-growth relationship. Overall, the robustness check has presented solid evidence that, in the period from 1930 to 2019, industrialization, measured by the weight of industry in terms of value-added, is growth enhancing.

4.5 Conclusion

The researchers on economic growth have adopted more distant horizons because the analysis of more fundamental factors, rooted in the very long-run perspective, provides more valuable guidelines for governments to implement strategic policies and foster sustainable growth (Bergheim, 2008; Cioni et al., 2020).

Even though studying more peripheral economies may spur a new understanding of their backwardness, the empirical research on very long-time growth has been chiefly dedicated to developed countries. Furthermore, the literature has neglected or paid little attention to some critical growth determinants, such as human capital, institutional conditions, and structural change.

To overcome these gaps, the present study brings an EE, Brazil, into perspective and conducts a quantitative, empirical analysis of the joint impact of human capital, structural change, and institutional quality on economic growth over an extensive time span. Based on annual frequency data on Brazil from 1822 to 2019, we employed cointegration and Granger (non)causality econometric techniques to achieve our goals.

Considering a period of analysis of almost two hundred years (1822-2019), the study achieves three main results: 1) human capital has a long-lasting, positive impact on Brazil's economic growth; 2) structural change favoring industry (proxied by the weight of secondary sector value-added) promotes Brazil's economic growth from the 1930s onwards suggesting that in this period industrial changes towards more advanced and sophisticated manufacturing basis tend to boost economic growth; 3) institutional quality stands as a critical factor in economic growth indirectly by fostering human capital accumulation.

The results obtained contribute to the extant literature by offering evidence that the effects of education on growth have to be analyzed as a historical process (Ljungberg & Nilsson, 2009). Furthermore, human capital accumulation is one of the most critical factors in promoting sustainable economic performance, especially for developing countries and EEs (Tridico, 2007). The results also highlight the relevance of institutional quality in boosting economic growth through human capital improvements, since more democratic institutions guide human capital toward the most productive uses (Zhou, 2018), encourage more investments in education (Mathonnat & Minea, 2019), and stimulate the production of ideas by protecting intellectual property rights (Faria et al., 2016).

Meanwhile, our outcomes contribute to the Brazilian structural change-economic growth literature by adding a new perspective of such a relationship. When using the share of employment in the secondary sector, we fail to find a significant causality effect running from industrialization to economic growth in Brazil between 1822 and 2019. We uncovered that a sharp increase in the standard of living of Brazilian households leads to changes on domestic consumption towards more advanced and sophisticated products fostering the allocation of resources from agriculture to industry. Additionally, we encounter a significant and positive effect of structural change on economic growth from the 1930s onwards when structural change is measured by changes in the secondary sector's value-added weight.

Overall, our results have several important policy implications. First, the Brazilian public authorities should aim to reduce the high school dropout rate by investing in quality education. Additionally, policymakers should concentrate on reforms to encourage school attendance and accessibility as well as create new schools. Finally, well-functioning institutions, in this case, more democratic regimes, should be central to the debate as they are key factors in generating an environment that fosters better quality education and, ultimately, economic growth.

Despite its novel contribution, this study presents noticeable limitations. First, although we selected the variables carefully, continuous time series were unavailable. This meant we had to gather some of the missing data from distinct sources and resort to linear and backward interpolation. Such techniques do not affect the long-run properties

that were being tested, but they can lead to size distortion (Ghysels & Miller, 2014). Second, the proxy for human capital used in this study, ‘average years of schooling’, is recognized as an inaccurate measure due to its lack of information about sources of learning other than schooling, and the lack of information about the quality of education. Correcting for the quality of education is likely to increase the explanatory power of human capital on economic growth (Teixeira & Queirós, 2016). Nevertheless, such limitations stand as interesting potential avenues for further research.

Chapter 5

Do human capital and institutional quality contribute to Brazil's long term real convergence/ divergence process? A Markov Regime-Switching Autoregressive approach

5.1 Introduction

Real convergence is the process whereby lower-income economies' GDP per capita levels catch up with those of higher-income economies (Del Hoyo et al., 2017). The literature on real convergence began to be widely discussed in the 1980s. Its many concepts (e.g., absolute, sigma, and beta convergence) have been developed to explain the economic growth of countries or regions (Soukiazis & Cravo, 2008; Vojinović & Oplotnik, 2008). A recent IMF report (IMF, 2021) suggests that economic divergence across countries is a significant concern, implying that the topic still holds a relevant place

in the macroeconomic agenda.

The empirical studies on real convergence encompass, in general, the analysis of a large sample of countries (e.g., Barro, 1991; Bernard & Durlauf, 1995; Caballero, 2019; Cartone et al., 2021; Cuñado, 2011; De La Fuente, 1997; Mankiw et al., 1992; Popov & Jomo, 2018; Tsionas, 2000). Although these analyses are of high scientific relevance, they missed a great deal in explaining the convergence experience by individual economies since the understanding of the fundamental determinants of catching up (or falling behind) is improved by looking at a specific country's performance over a long period (Lains, 2003; Tóth, 2019).

The studies devoted to examining the catching-up process of a country compared to leading and/ or similar economies in an isolated fashion are scarce. The few existing contributions mainly encompass the analysis of emergent economies (EEs) from Eastern Europe and Asia (e.g., Barro, 2016; Lee, 2016; Lee, 2017; Matkowski et al., 2016; Miron et al., 2009; Ozturk et al., 2013; Tóth, 2019), and some developed countries (e.g., Aguiar & Figueiredo, 1999; Amaral, 1998; Kokkinen et al., 2007; Lee, 2016; Micallef, 2020; Papaconstantinou et al., 2013). Broadly resorting to a general framework of cross-country growth regression, these studies focus on validating the beta-convergence hypothesis (i.e., less developed countries grow faster than their more developed peers). For instance, the Asian EEs (China and South Korea) have presented significant real convergence toward the USA from 1960 to 2010. In contrast, the Eastern Europe EEs (Hungary, Romania, and Turkey) have shown unsatisfactory economic performance to reach their peers or the European mean, respectively, between 2000-2017, 1999-2007, and 1950-2010. Apparently, the heterogeneity of the EEs on different continents regarding economic structures and development models (Wu & Pan, 2021) urges for real convergence studies addressing particular countries within this group, namely the overlooked context of Latin America (herein addressed as LA).

Although LA EEs have grown enormously during part of their development history, they nevertheless presented unstable, short, and interrupted periods of catching up (Lee, 2020). There are shreds of evidence regarding the determinants of this catching up and falling behind. For instance, Rodrik (2011) claims that the LA countries had performed better when they applied unorthodox policies (1930-1970) than when they turned

orthodox after the 1990s. The author also attributes the disappointing performance of these countries in the mid-2000s to insufficient macroeconomic and institutional reforms. A UN (2005) report further emphasizes the inability of LA to improve their social capabilities, making them fall behind in the level of development.

As one of the LA EEs, Brazil has shown interruptions and exhaustion of catching up periods (Albuquerque, 2019). Although the country has recorded periods of high growth rates, especially between 1960 and 1980, it has not yet moved towards a sustainable convergence path, implying the inability to close the per capita income gap with developed countries (Arbache & Sarquis, 2018). In particular, the trajectory of Brazilian growth vis-à-vis the USA from 1822 to 2019 has oscillated around 20%, with a sharp divergence pattern until the beginning of the last Century followed by several interruptions of convergence since then. This underlines Brazil's inability to either achieve stable growth trajectories or reduce the gap with more developed economies. To the best of our knowledge, the potential determinants that explain Brazil's catching up and falling behind process have not been studied, thus scientifically relevant to be addressed.

Since the convergence to the group of advanced economies is a long-run process (Nassif, Morandi, et al., 2020), its empirical illustration requires a long-time data series (Aguiar & Figueiredo, 1999; Lains, 2003; Miron et al., 2009). Therefore, from a scientific point of view, a complementary analysis to the real convergence investigation is added to detect what factors could explain Brazil's (div)convergence path for a very long period, from 1822 to 2019.

We intend to contribute to the empirical real convergence literature by adding an analysis of one sole country, Brazil, in three different scenarios: (i) towards a group of economies that share a similar colonization process (former colonies of Spain and Portugal), persistent macroeconomic instability, abundant natural resources, unequal income distribution and early independence relative to other developing regions, i.e., other LA economies; (ii) towards a developed country, its *alma matter* Portugal, since it may spur an understanding of the scars from the colonization process and the role of institutions in Brazilian growth process; and (iii) towards the commonly regarded technological frontier country, the United States (US).

The study is organized as follows. Section 2 reviews the relevant literature, and the methodology and data are detailed in Section 3. Section 4 discusses the results. Finally, the conclusions in Section 5 put forward the study's main contributions, limitations, and policy implications.

5.2 Literature review on the determinants of countries' real convergence

5.2.1. Theoretical framework

Sustaining rapid and long periods of economic growth is a complicated process requiring various crucial inputs, such as infrastructure, human resources, economic stimulus, and strong institutions (Popov & Jomo, 2018). One of the major tasks of economists is to identify which of these factors are the engine or the brake of a country's growth and distinguish those associated with the real convergence processes (Iancu, 2009; S. Li, 1997).

Aggregate demand (e.g., Alencar et al., 2018; de Jesus et al., 2018; Oreiro et al., 2012), financial system (e.g., Nyasha & Odhiambo, 2017; Rocha & Souza, 2018; Stefani, 2007), government expenditure (e.g., de Mendonça & Cacicedo, 2015; Gadelha, 2011), institutions (e.g., Campos et al., 2020), monetary policy (e.g., Araújo et al., 2018; dos Santos et al., 2015; Libânio, 2010), and tourism (e.g., Brida et al., 2011) compose the extensive set of factors that have been targeted as key explanations for Brazil's economic growth. The same scientific attention was not guided towards Brazil's real convergence and its determinants. Previous literature on the subject tends to focus on the convergence process within Brazil (e.g., Dapena et al., 2017; de Almeida et al., 2021; Ferreira, 2000; Lima & Notini, 2010; Penna & Linhares, 2013). Although of high relevance, these studies miss a great deal in analyzing and discussing potential explanatory factors associated with real convergence/ divergence of Brazil towards other economies. As apparently is the

case, urgent growth and convergence determinants, namely institutional quality and human capital formation, have been neglected in the literature above, thereby constituting a challenging avenue to be addressed.

According to Abramovitz (1986), a country's potential for rapid growth is strong when technologically backward but socially advanced. The author suggests that the catch-up process depends on a country's "social capability" to absorb foreign technologies and adapt them to their needs. Indeed, one of the hypotheses predicted by the theoretical models on growth is that the catching-up process is driven by the potential of lagging countries to absorb ideas and knowledge from the technology frontier, thus attaining higher productivity growth rates (De La Fuente, 1997; Rodrik, 2011; Verspagen, 1991). Although this may be true, the capacity to adapt these imported technologies and innovate is only possible through highly qualified human resources (Nelson & Phelps, 1966) and adequate institutions (Manca, 2010).

Many authors consider human capital accumulation the main driver of sustained growth (e.g., Barro, 2001; Lucas, 1988; Mankiw et al., 1992; Nelson & Phelps, 1966; Romer, 1986), as well as a critical factor in explaining the process of real convergence among different economies (Abramovitz, 1986; Nelson & Phelps, 1966; Soukiazis & Cravo, 2008). Zhang et al. (2019) have provided strong evidence on the substantial impact of human capital on growth and that real convergence is pronouncedly conditional on this latter variable.

As suggested by Nelson and Phelps (1966), human capital is not an ordinary input into the production process but a primary source of innovation and convergence, such that the level of education speeds technology diffusion and facilitates the catch-up in total factor productivity. According to their model, the advance in the productivity level depends upon the educational attainment and the gap between the theoretical level of technology (technology frontier) and the current level of productivity $((T_t - A_t)/A_t)$. In algebraic terms:

$$\frac{\dot{A}_t}{A_t} = \Phi(h) \left[\frac{T_t - A_t}{A_t} \right], \Phi(0) = 0, \Phi'(h) > 0 \quad (2)$$

where $\Phi(h)$ is a function of the educational attainment. As the model implies, the increased educational attainment fosters the path of technology diffusion in the long run.

Although human capital is necessary for sustained growth, due to the complementarity among the different growth determinants, no one single factor can be a sufficient condition for catching up (Li, 1997). Rodrik (2002) urges the search for more fundamental or 'deep' determinants of economic performance and convergence, such as institutions. Some of the empirical literature, namely Acemoglu et al. (2001), Bruinshoofd (2016), Campos et al. (2020), Dias and Tebaldi (2012), and Nawaz and Khawaja (2018), have found a significant influence of institutional arrangements on shaping the sustained growth process.

It might be expected that institutional stability makes property rights more secure (Campos et al., 2020), curbs leakages, channels resources in the right direction (Nawaz & Khawaja, 2018), and facilitates the process of speeding up the diffusion of knowledge (Dias & Tebaldi, 2012). It should be noted that, since the catching-up process is essentially the technology adoption through learning, it depends on qualified institutions capable of facilitating and encouraging knowledge absorption (Li, 1997).

Through interconnections, human capital and institutional arrangements are indispensable factors that are complementary for catching up, especially for late development countries (Doré & Teixeira, 2021; Li, 1997). The 'social capability' from Abramovitz (1986) lies in this notion that the state of education embodied in a country and its existing institutions creates an adequate environment to absorb more advanced technologies, generating strong potentiality for the real convergence process. Thus, we conjecture that:

H1: Human capital promotes country's real convergence.

H2: Institutional quality promotes country's real convergence.

5.2.2. An overview of the empirical studies on real convergence analyses

The real convergence empirical illustration typically implies verifying two main hypotheses, the absolute (or unconditional) convergence and the conditional convergence, both relying on the notion that lower-income economies tend to grow faster than higher-income ones (Cartone et al., 2021; De La Fuente, 1997). The difference

between them is that the former accommodates the assumption that all economies have the same parameters and, therefore, the same steady-state positions, whereas the latter can only be verified once we consider a set of country-specific characteristics (Barro & Sala-i-martin, 1997; Del Hoyo et al., 2017).

In practice, to test these hypotheses, researchers have been using the concept of beta-convergence, which is usually assessed through the application of simple regressions considering (conditional convergence) or not (absolute convergence) a set of controlling variables (Popov & Jomo, 2018; Zarembova et al., 2012). On the one hand, a positive beta convergence in this regression suggests real divergence, whereas, on the other hand, a negative beta coefficient implies an inverse relationship between initial income levels and growth rates of income and thus, validates the convergence hypotheses (Del Hoyo et al., 2017).

There are at least two additional measures of real convergence commonly found in the growth literature: the sigma-convergence and the unit root tests (Lim & McAleer, 2004). The sigma-convergence analysis, calculated by standard deviation, is used to measure if the dispersion of real per capita GDP across economies tends to decrease (convergence) or increase (divergence) over time (Popov & Jomo, 2018; Quiroga, 2010). In a time-series framework, a third metric for real convergence determines whether a common deterministic and/ or stochastic trend exists between economies employing unit root tests (Bernard & Durlauf, 1995).

In general, the empirical debate around the catching-up processes has focused on examining the real convergence hypotheses within a large sample of economies, employing the beta-regression analysis (e.g., Barro, 1991; Caballero, 2019; Mankiw et al., 1992), unit root tests (e.g., Bernard & Durlauf, 1995; Greasley & Oxley, 1998; Tsionas, 2000), or others (e.g., Cartone et al., 2021). However, despite being high-quality studies and having contributed to the literature reporting evidence of real (di)convergence among countries or regions, these examples have missed a great deal in capturing the essential determinants that caused or undermined the catching-up process of an individual economy. In this spectrum, it seems challenging to propose targeting policies to prompt sustainable growth and hence, real convergence if the study was not looking exclusively at the experience of a single country (Lains, 2003).

Table 5.1. Empirical evidence on the determinants of countries' real convergence processes

	Country of reference	Countries towards which the reference country converge/diverge	Period	Method	Control variable(s)	Main results
EEs						
Sanz-Villarroya (2005)	Argentina	Australia	1875-2000	Unit root with structural breaks		1875-1899: convergence 1975-2000: divergence
		Canada				1875-1890: convergence 1936-2000: divergence
		OECD mean				1875-1913: convergence 1913-2000: divergence
Lee (2016)	South Korea	USA	1960-2010	Output per worker decomposition	Physical capital, human capital, productivity	Rapid catch-up of all components
		75 countries		Cross-country regressions	Investment, fertility, education, life expectancy, government consumption, rule of law, inflation, trade openness, democracy	Conditional beta-convergence
		USA		Accounting analysis		
Barro (2016)		89 countries	1960-2010	Cross-country regressions	Life expectancy, fertility rate, rule of law, democracy, investment, government consumption, terms of trade, education, openness ratio, inflation.	Conditional beta-convergence
		China	1870-2010		Education, democracy	
		28 countries				
Lee (2017)		83 countries	1960-2010	Cross-country regression	Investment, fertility, education, life expectancy, government consumption, rule of law, inflation, trade openness, democracy	Conditional beta-convergence
		USA		Growth accounting analysis		
Miron et al. (2009)	Romania	Bulgaria (BG) Czech Republic (CZ) Hungary (HU) Estonia (EE) Latvia (LV) Lithuania (LT) Poland (PL) EU16 mean	1999-2007	Euclidian distance		EE: divergence BG, CZ, HU, LV, LT, PL, Euro Zone (16): convergence
				Clusters		1999-2006: divergence 2007: convergence – cluster (BG, EE, LV, LT)
Ozturk et al. (2013)	Turkey	EU13 (members and mean)	1950-2010	Unit root, time series regression		Sweden: convergence The Netherlands: constant EU11: divergence
Matkowski et al. (2016)	Poland	EU15	1993-2015	Cross-country regression		Absolute beta- and sigma- convergence
Tóth (2019)	Hungary	EU27	2000-2017	Cross-country regression		Absolute beta-convergence

Table 5.1. Empirical evidence on the determinants of countries' real convergence processes (continued)

	Country of reference	Countries towards which the reference country converge/diverge	Period	Method	Control variable(s)	Main results
Developed countries						
Amaral (1998)	Portugal	26 countries	1850-1992	Cross-country regression		No evidence of absolute beta-convergence
		12 Developed countries		Graphic analysis; Growth accounting analysis		1850-1950: divergence 1950-1992: convergence
Aguiar and Figueiredo (1999)	Portugal	EU7	1870-1990	Convergence rate estimation; Graphic analysis		1870-1913: Divergence 1913-50: Null convergence 1950-73: Convergence 1973-90: Null convergence
				Time series regression	Infrastructure, human capital, trade openness	Conditional convergence
Kokkinen et al. (2007)	Finland	Sweden	1900-2000	Graphic analysis; Time series regression	Labor productivity in the secondary sector, hours worked in the non-secondary sector	1970-2000: convergence
		EU15				1920-1946: convergence
Papaconstantinou et al. (2013)	Greece	EU15	1996, 2006	Cross-section regression, Markov conditional bootstrap (MCB)	Government consumption, openness of the economy, FDI, inflation, corruption, bureaucracy	Absolute and conditional beta-convergence
Micallef (2020)	Malta	EU28	1995-2018	Cross-country regression; Growth accounting analysis		Absolute beta-convergence
		EU15				Absolute beta-divergence
		NMS ^a				Absolute beta-convergence

Note. ^a The New Member States (NMS) refers to: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia.

The real convergence analysis of an isolated country is still limited to a few studies (see Table 5.1). Among the 13 published works we found, the majority (8) have addressed the investigation of specific determinants related to the catching-up (or falling behind) process, either using controlling variables in the regression analyses (e.g., Aguiar & Figueiredo, 1999; Barro, 2016; Kokkinen et al., 2007; Papaconstantinou et al., 2013), through undertaking growth accounting exercises (e.g., Amaral, 1998; Micallef, 2020), or both (e.g., Lee, 2016; Lee, 2017).

As shown in Table 5.1, the most common way to capture the real convergence effect was the beta-(absolute or conditional) analysis through the regression technique. According to the EEs examples, the regressions presented the Asian EEs as the clear evidence of real convergence towards the technology frontier, the USA. From South Korea's analysis between 1960 to 2010, it was concluded that the catch-up experience could be attributed to the country's high investment rate, substantial human capital, high trade openness, maintenance of good institutions, and low inflation (Lee, 2016). Similarly, Barro (2016) and Lee (2017) concluded that the Chinese real convergence from 1960 to 2010 could be attributed to high investment rates, low fertility, improved life expectancy, and institutional quality.

The regression analysis regarding the European EEs showed the evidence for absolute convergence towards a group of other countries from the European Union. Poland's study lies on the estimation of absolute beta-convergence between the 11 Central and Eastern European (CEE) countries in which it is located and the old EU members (EU15) from 1993 to 2015, and the results validated the hypothesis (Matkowski et al., 2016). Tóth (2019) first confirmed Hungary's absolute beta-convergence (2000-2017) toward the European Union's GDP per capita average, then compared the country's situation to a set of clusters. Although the regressions showed evidence of real convergence, Matkowski et al. (2016) and Tóth (2019) highlight that, respectively, Poland's and Hungary's economic performance have been shown insufficient to reach the average income levels of EU15 and EU27 in the medium term.

Still, within the regressions framework depicted in Table 5.1, the developed countries have presented quite distinct results in what concerns the catching-up process among the most advanced countries in Europe. Greece (Papaconstantinou et al., 2013) and Malta (Micallef, 2020) were studied within the concepts of absolute and conditional beta-regressions using additional techniques, namely Markov conditional bootstrap and growth accounting, respectively. The Greek study, conducted with data of 1996 and 2006, has explicitly focused on the significant importance of diminishing the bureaucracy and corruption to prompt the growth of GDP per capita and real convergence with the EU15. The study focused on Malta, which covered the period 1995-2018, has presented different results depending on the countries Malta was being compared. For instance, concerning the EU28 and the New Member States (NMS) the absolute beta coefficient was negative

and statistically significant (evidencing real convergence), whereas the absolute beta-convergence towards the EU15 was not verified. Based on a growth accounting exercise, Micallef (2020) pinpointed Malta's higher labor utilization as the most important driver of real convergence since the mid-1990s.

Both Portugal (Aguiar & Figueiredo, 1999; Amaral, 1998) and Finland (Kokkinen et al., 2007) were studied through a very long-time window, 1850-1992, 1870-1990, and 1900-2000, respectively, which according to Lains (2003) and Barro (2016) is the optimal time frame when analyzing the real convergence process. Amaral (1998) explored the Portuguese GDP per capita patterns compared to other 26 countries and found no evidence of absolute beta-convergence. Additionally, using graphic analysis and growth accounting exercises, and comparing Portugal with 12 developed countries, Amaral (1998) concluded that the years that followed the Second World War were the most relevant to prompt the catching-up process due to physical and human capital accumulation. Aguiar and Figueiredo (1999) compared Portugal with only 7 developed countries resorting to distinct methodologies, the convergence rate estimation, graphical analysis, and time-series regression. Complementary to Amaral (1998), who highlighted the importance of physical and human capital, Aguiar and Figueiredo (1999) uncovered the high significance of trade openness to Portugal's real convergence process. Kokkinen et al. (2007), resorting to graphic analysis and time series regressions, assessed how the late Finnish industrialization led to the country's catching-up process in the 20th century vis-à-vis Sweden and the EU15. The authors found strong evidence of real convergence to the EU15 in the interwar period and to Sweden after the 1970s.

Apart from studies that resort to regression analysis, Miron et al. (2009), Ozturk et al. (2013), and Sanz-Villarroya (2005) embraced different methodological approaches to investigate the real convergence of some EEs. Sanz-Villarroya (2005) provided an estimate of when Argentina started to diverge from Australia (1975-2000), Canada (1936-2000), and the OECD average (1913-2000) by applying unit root tests with structural breaks. Using the same technique, Ozturk et al. (2013) investigated Turkey's real convergence towards the EU13 (each member and the mean), and the unit root hypothesis failed to reject the non-stationarity for EU13 mean and the other nine countries. In turn, as the results were insufficient to determine whether there is convergence among Turkey and the Netherlands, the UK, Finland, and Sweden, the authors resorted to a beta-

convergence estimation. A catching-up process was found only between Turkey and Sweden, from 1950 to 2010. In an attempt to test Romania's real convergence towards other Eastern European countries and the EU16 mean, Miron et al. (2009) resorted to the distances and clusters methodology and found that Romania was closer to Baltic countries, distanced from other neighboring countries, and even more distanced from the Euro Area.

In this overview of the empirical literature on real convergence of single countries, a set of aspects are worth to be highlighted: 1) most studies focus on beta convergence regressions in a cross-country panel dataset; 2) the LA EEs have been neglected in this literature; 3) although long time series is particularly useful for the estimation of convergence effects (Barro, 2016), the studies focused mainly on relatively short periods.

5.3 Methodology

5.3.1. Research questions and model specification

Detecting whether a lower-income economy's GDP per capita levels converge toward a higher-income country is relevant, especially for development economists (Quiroga, 2010; Verspagen, 1995). However, once economic (div)convergence is detected, the real reasons and mechanisms by which the catching up (or falling behind) process is on track can be diverse and should be scrutinized (Quiroga, 2010). Thus, the present study proposes investigating how human capital and institutional quality have contributed to the Brazilian real convergence path towards six EEs LA countries,¹⁷ Portugal, and the

¹⁷ According the classification proposed by Doré & Teixeira (2021), there are 17 countries classified as EEs within LA and the Caribbean (see Appendix 9). Excluding the Caribbean countries, we have 14 countries (Argentina; Brazil; Chile; Colombia; Costa Rica; Ecuador; El Salvador; Guatemala; Mexico; Panamá; Paraguay; Peru; Uruguay; Venezuela). Data for the GDP per capita in earlier periods is missing for Costa Rica, Ecuador, El Salvador, Guatemala, Panamá, and Paraguay, which apart from Panamá are countries systematically poorer than Brazil. Thus, for the analysis we considered the LA EEs with available data for the whole period of analysis (1822-2019): Argentina, Chile, Colombia, Mexico, Peru, and Uruguay. Although data on the GDP per capita was available for Venezuela until 2018, given the recent turmoil experienced by this country we decided to exclude it from the analysis.

US, over the very long-run, that is, from 1822 to 2019.

We intend to dig into the Brazilian real convergence process through two distinct approaches to achieve our goal. First, we describe the relative GDP per capita evolution of Brazil/six LA countries (by mean), Brazil/Portugal, and Brazil/the US. Second, we deploy and extend the time series method of Bernard and Durlauf (1995) to test for Brazilian real convergence towards LA, Portugal, and the US. Furthermore, a Markov Regime-Switching Autoregressive (MS-AR) approach is used to test how human capital and institutional quality contribute to catching up or falling behind.

5.3.2. Data sources and main variable proxies

According to Hall and Jones (1999), when a study deals with long-run analysis, using levels is the most appropriate way to operationalize economic growth. Our data set includes the real GDP per capita (constant 2011 US\$) time series estimated by the Maddison Project Database (2020), which offers data from 1800 to 2018. Some missing values for Argentina (1822-1849, 1851-1859, 1861-1869, 1871-1874), Colombia (1822-1849, 1851-1859, 1861-1869), Mexico (1822-1849, 1851-1859, 1861-1869, 1871-1889, 1891-1894), and Uruguay (1822-1849, 1851-1859, 1861-1869) were completed by linear interpolation. The missing figures for the Brazilian time series (1822-1849) were collected from Coatsworth (1978). We resort to the World Bank (WB) database to extend the data to 2019 for all countries.

Figure 5.1 shows that Brazil and the average of six LA countries have presented a similar path throughout the period, including a meager growth until the 1950s and a sharp upward trend afterward. Portugal and the US, the developed nations, have recorded a greater level of development than the EEs in the study, albeit the former only surpassed the LA countries after the 1970s. For our study, the corresponding variable under analysis (i.e., real convergence proxy) is represented by the ratio between Brazil's real GDP per capita and each block/ country.

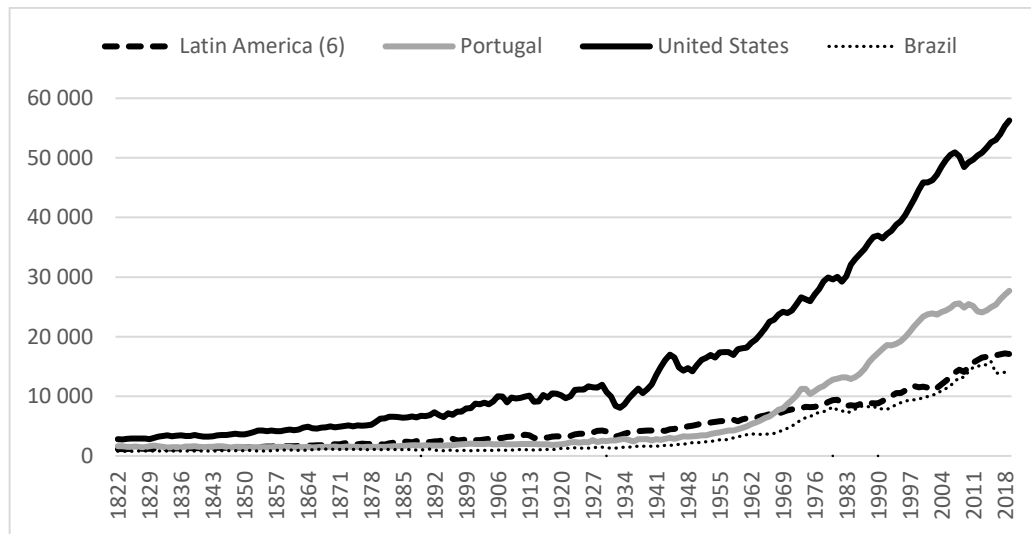


Figure 5.1. Real GDP per capita, in constant 2011 US\$, Brazil, LA6, Portugal, the US, 1822-2019

Source: Authors' computation based on data from Maddison Project Database 2020, Coatsworth (1978), and WB Database.

There are a set of alternative metrics in the literature to measure human capital, e.g., school enrollment ratio (Barro, 1991; Mankiw et al., 1992), adult literacy rate (Rehman et al., 2015; Vergolino et al., 2004), and average years of schooling (Barro, 2001). We intend to explore this growth determinant in a very long-run window (1822-2019), so the appropriate proxy was chosen due to data availability. The ‘average years of schooling’ (population aged 15 to 64) is far from a perfect measure of human capital, mainly due to a lack of information about the quality of education (Teixeira & Queirós, 2016). However, the ‘adult literacy rates’ and ‘school enrollment ratios’ seem to have some deficiencies highlighted in theoretical models, putting the ‘average years of schooling’ as the most popular and most used specification of human capital (Wössmann, 2003). The proxy used in the present study was gathered from Barro and Lee (2015) and Lee and Lee (2016), which is provided by five years intervals from 1870 to 2040.¹⁸ The years in between were taken by linear interpolation, whereas from 1822 to 1869, the data was obtained by backward interpolation.

¹⁸ Data is easily retrieved in the authors’ website, <http://www.barrolee.com>, last accessed January 2022.

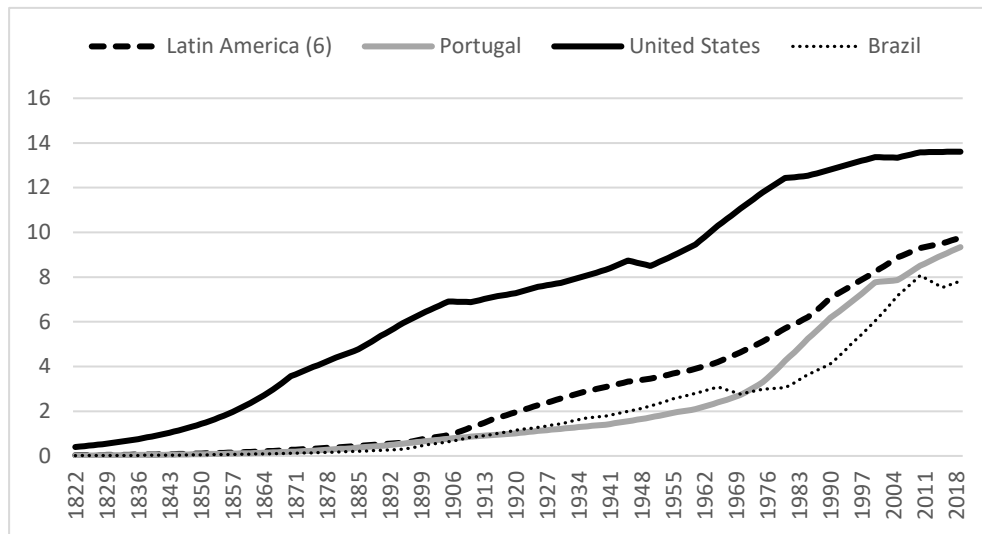


Figure 5.2. Average years of schooling, population aged 15-64, Brazil, LA6, Portugal, the US, 1822-2019

Source: Authors' computation based on data from Barro and Lee (2015) and Lee and Lee (2016).

Unlike the US, which since the 19th Century has recorded a superb evolution in terms of years of schooling of their citizens, Brazil, LA6, and Portugal have been struggling to achieve high levels of schooling, embarking on a significant upward trend only after the 1970s, 1910s, and 1960s, respectively (see Figure 5.2). Even so, during the whole period under analysis, the US citizens have the double years of schooling (population aged 15-64), on average, of all countries, at least until the end of the last century.

There is an intense and ongoing debate in the literature around the appropriate way of measuring 'institutional quality' (Bruinshoofd, 2016). The most common proxies used are political instability, corruption, democracy, and political and property rights (Doré & Teixeira, 2021). In the present study, we opted to assess the impact of institutional quality on Brazil's real convergence by the Polity Score, which captures the degree to which a country is considered more democratic (+10) or more autocratic (-10). The data for all countries under analysis were retrieved from Polity5 Project,¹⁹ and the series covers the entire period until 2018. The missing figures for Argentina (1822-1824), Brazil (1822-1824), Colombia (1822-831), and Uruguay (1822-1829) were obtained in Spruk (2016). For the missing figures for 2019, we opted to use the exact value of 2018.

¹⁹ In <http://www.systemicpeace.org/inscrdata.html>, last accessed January 2022.

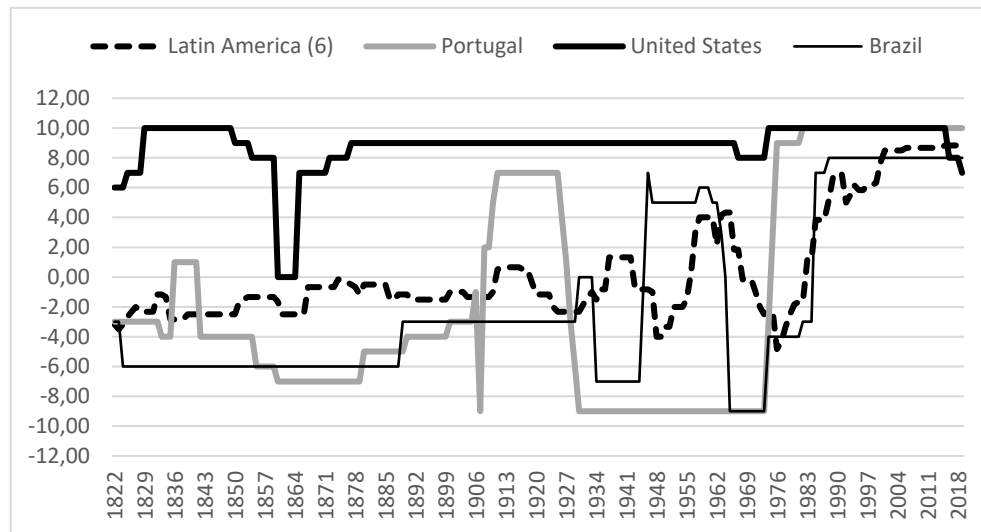


Figure 5.3. Polity Score, Brazil, LA (6), Portugal, the US, 1822-2019

Source: Authors' computation based on data from Polity5 Project.

Apart from a short period in the middle of the 19th Century, the US has been a full democracy, while the other countries have been oscillating between autocratic and democratic governments (see Figure 5.3). From 1945 onwards, Brazil became a more democratic country, although between 1964 and 1985, it was interrupted when a dictatorship regime was established. The LA countries struggled with military coups during similar periods as Brazil, recovering into democratic states afterward. Portugal presented a more autocratic than democratic pattern until 1912 and during most of the 20th Century. It was only after the revolution of 1974 that the country became a fully democratic state.

5.3.3. Selected methodological procedure and technique

Using a very long-time data available (1822-2019) for GDP per capita, the first procedure describes the evolution of the Brazilian standard of living relative to the selected economies. This technique attempts to frame the trajectory of Brazilian relative development throughout its history since independence (1822).

Various methods in the literature study real convergence, and the most common is to regress the average growth rate on the initial level of real per capita output using cross-

section data among a group of countries (Lim & McAleer, 2004; Tochkov, 2021). After identifying some weaknesses of cross-section tests, Bernard and Durlauf (1995, 1996) proposed an alternative unit root and cointegration framework to test for real convergence and catching up using long time-series data. The authors extended the use of unit root tests of single series to comparative series as well as they offered a formal definition of real convergence as a catching-up process, where I_t denotes the information set available at period t :

Definition: Countries i and j converge between dates t and $t + T$ if the (log) per capita output, y , deviation is expected to decrease. If $y_{i,t} > y_{j,t}$,

$$E(y_{i,t+T} - y_{j,t+T} | I_t) < y_{i,t} - y_{j,t} \quad (3)$$

According to Bernard and Durlauf (1995), one can assess the stationarity of comparative series using unit root tests by adopting the non-convergence as the null hypothesis. This definition is violated if the level of the comparative series is non-stationary, which consequently excludes the expectation for income gaps to narrow. If the unit root tests fail to reject non-stationarity, thus non-convergence cannot be rejected. On the other hand, if the tests reject non-stationarity, there is a tendency for the GDP per capita comparative series to narrow their gaps in the long-run (tendency toward catching up). In like manner, our initial step involves performing the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for a unit root in the comparative real GDP per capita series for each pair of countries, i.e., Brazil/LA6 countries, Brazil/Portugal, and Brazil/the US. We allow for possible structural breaks in the series for more robust test results, as proposed by Greasley and Oxley (1998).

Apart from finding evidence of real convergence, our study's novelty is to estimate the extent to which human capital and institutional quality influence the Brazilian catching up (or falling behind) process towards LA6, Portugal, and the US. This second step consists of performing an MS-AR model from Hamilton (1989), one of the literature's most popular nonlinear time-series models (Clements & Krolzig, 2003; Doğan & Bilgili, 2014). The key feature of this regime-switching class of model is that the parameters can change over time according to an underlying state process which could be a finite-state hidden Markov chain. Moreover, it allows the incorporation of nonlinear variables and is best suited to capture the effect of potential structural breaks (Rahman et

al., 2020). In this sense, we examine the nonlinear impact of human capital and institutional quality on the Brazilian process of real GDP convergence in two different – real convergence and real divergence - regimes over the period 1822 to 2019.

The MS model is particularly appropriate for examining the economic growth (in our case, the relative economic growth of Brazil towards LA6, Portugal, and the USA) in different regimes (Menla Ali & Dimitraki, 2014). Generally, the model is applied to differentiate the economic performance for periods of expansion and contraction. Adopting the concept to our case, we allow the model to take into account two different regimes ($s_t \in \{1,2\}$): real convergence (catching up) and real divergence (falling behind).

Clements and Krolzig (2003) have outlined three extensions to the basic framework for testing the asymmetries in MS(m)-AR(p) models, where m stands for the number of regimes/ states, and p is the lag length. The first extension, the MSI(m)-AR(p), is characterized by switching in the *intercept* rather than the *mean* as in the original model. In contrast with the latter, in which a shift in regime causes a once-and-for-all jump in the level of the observed time-series, the former implies a smooth transition in the process level after a regime shift. Differently from the original Hamilton model, the second extension proposes that the variance of the disturbance term depends on the regime, that is, the model MSIH(m)-AR(p) allows for heteroskedasticity. At last, the multivariate model MS(m)-VAR(p) allows for more than one state variable, where each variable responds to a specific state variable. That said, the appropriate model to be applied to our case is the MSIH(m)-AR(p), which is specified as follows:

$$Y_t = \mu_{s_t} + \beta_{s_t} \cdot HC_t + \delta_{s_t} \cdot IQ_t + \sum_{i=1}^p \gamma_i \cdot Y_{t-i} + \varepsilon_{s_t}, \quad \varepsilon_{s_t} \sim N(0, \sigma_{s_t}) \quad (4)$$

where t represents time; μ is the intercept term; p represents the number of lags in the autoregressive term; ε is the white noise with mean zero and variance σ_{s_t} ; and coefficients are shown through β, δ , and γ . The variables HC_t and IQ_t stand, respectively, for the proxy for Brazil's human capital and the proxy for Brazil's institutional quality. The Y_t represents the relative GDP per capita of the three pairs of countries (Brazil/LA, Brazil/Portugal, Brazil/the US), all in logarithm.²⁰ The estimation is conducted by

²⁰ The relative real GDP per capita is calculated by $(Y_t^{BR} - Y_t^i)$, where Y_t^{BR} stands for Brazil's real GDP per capita, and Y_t^i is the real GDP per capita for country i ($i = \text{LA; Portugal; the US}$).

maximum likelihood using the expectation-maximization algorithm described by Hamilton (1989).

In the MS models, it is assumed that the nonobservable state variable s_t is generated by the first order of the Markov chain, which is specified by the transition probabilities:

$$p_{ij} = \Pr (s_t = j \mid s_{t-1} = i), \quad \sum_{j=1}^m p_{ij} = 1 \quad \forall i, j \in \{1, \dots, m\} \quad (5)$$

Accordingly, as our case encompasses a two-regime model, there are two transition probabilities: $p_{12} = \Pr (\text{convergence in } t \mid \text{divergence in } t-1)$ and $p_{21} = \Pr (\text{divergence in } t \mid \text{convergence in } t-1)$. Thus, the current regime relies on the regime one period ago, and p_{ij} shows the probability of being in regime j following regime i .

5.3.4. Time frame of analysis and relevant phases

To delve into the Brazilian economy's real convergence process of the Brazilian economy *vis-à-vis* a group of 6 LA EEs, Portugal, and the US, we resort to the time-division proposed by Doré and Teixeira (2021): 1) The Empire period (1822-1889); 2) The Oligarchic Republic (1889-1930); 3) The developmentalist era (1930-1980); 4) The Crisis period (1980-1990); and 5) The Neoliberalism phase (1990-2019). Based on the graphic visualization, these phases can be grouped according to Brazilian real convergence regimes (more details in Figure 5.4, Section 5.4). For instance, phases 1 and 2 are set by periods of clear divergence (Regime 2), whereas from phase 3 on, i.e., after 1930, Brazil embarked on a real convergence path (Regime 1). It is worth highlighting that for the pair Brazil/ Portugal, the regimes are not clearly defined, thus, this two-regime division should be considered cautiously.

Starting from 1822, when Brazil conquered its independence from Portugal, the authors organized the Brazilian economic path according to some critical periods of its history. The Empire period covers the end of the colonial era (1822) until the proclamation of the Republic (1889) when a centralized monarchy regime led the country. The imperial regime was dissolved in 1889 after a military coup, and a republic was installed, dominated mainly by rural elite oligarchies. The Great Depression and the

Revolution of 1930 set the start of the most flourishing period of Brazilian economic performance. Even though had experienced a dictatorship regime between 1964 and 1985, the developmentalist era (1930-1980), as it is commonly known, was a prosperous period in Brazil marked by high growth rates. The apparent sustained growth path ended in the 1980s when the country embarked on a decade of profound economic crisis. From 1990 on, Brazil embarked in a path of economic liberalization and deregulation processes drove by the neoliberalism agenda imposed to the country by the Brady Plan and the Washington Consensus.

5.4 Empirical analysis

5.4.1. A brief account of the real convergence of the Brazilian economy from 1822 to 2019

In the Empire (1822-1889), Brazil presented a modest per capita annual rate of 0.35% and a clear divergent path (Regime 2) towards some other LA EEs and the US. In 1822, the standard of living of Brazilian citizens was 28% and 67% of those from the US and the average of other six LA countries, respectively (see Figure 5.4). At the end of the period (1889), probably due to the economic growth of Argentina (1.47%), Chile (1.78%), and Uruguay (1.07%), Brazil widened the gap between the average of the six LA countries and its relative GDP per capita fell from 67% to 40%. Concerning the frontier country, the US, Brazil lagged even further, and in 1889 Brazil's GDP per capita represented only 15% of the North American nation.

Apparently, the independence from Portugal (1822) brought more economic advantages to the ex-colony, at least until 1868. Between 1822 and 1868, Brazil narrowed the gap with Portugal increasing the relative income per capita from 48% to 78%. The following years were set by a depression in the Brazilian economy, contributing to the divergence pattern observed from 1870 to 1889.

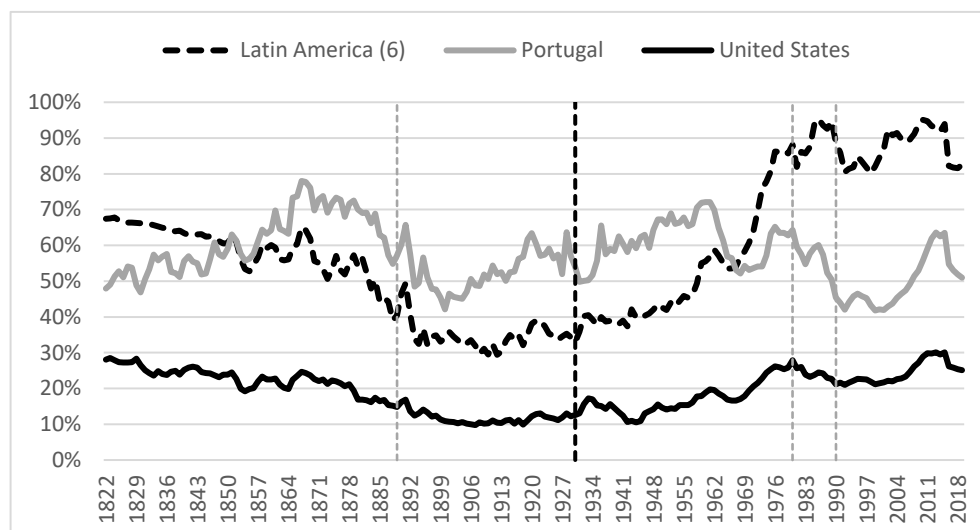


Figure 5.4. Real convergence, 1822-2019, Brazil's GDP per capita relative series

Source: Authors' computation based on data from Maddison Project Database 2020, Coatsworth (1978), and World Bank (WB) Database.

The end of the monarchy in 1889 gave birth to the Oligarchic Republic in Brazil after a military coup. The economic performance of the new regime (1889-1930) was not sufficient to present a real convergence path towards LA, Portugal, and the US. Accordingly, the Brazilian GDP per capita represented only 35%, 53%, and 12%, on average, of LA's, Portugal's, and the US' GDP per capita between 1889 and 1930.

Between 1930 and 1980 was the period of most economic success throughout Brazilian history, when the country shifted from regime 2 to 1. In the developmentalist era, as it is commonly known, Brazil recorded a GDP per capita growth rate of 3.69%, surpassing the mean of the other six LA countries (1.67%), Portugal (3.32%), and the US (2.06%).

Until 1970 the annual convergence rate of Brazil towards the average of the six LA countries was about 1.5%, and the standard of living of Brazilian citizens increased from 33% (1930) to 61% (1970) of LA's. During the decade that followed, the pace of convergence accelerated (3.8% a.a. on average), and there was a sharp catch-up path where Brazil could reach, at the end of the period, 88% of relative GDP per capita.

After World War II, Brazil experienced a real convergence path (Regime 1) towards the US. Limiting the relative GDP per capita to around 14% from 1930 to 1950, we can consider this subperiod null convergent. Although presenting a convergence path if

considering the entire period (1930-1980), the standard of living of Brazilian citizens was far from those observed by US citizens at the end of the developmentalist phase (28%).

With respect to Portugal, Brazil presented a smooth convergence path until the 1960s, when the former country started to experience high growth rates, even compared to other developed European countries, from 1961 to 1973 (Aguiar & Figueiredo, 1999). After 1970, the real convergence process regained power due to Brazilian economic performance, and in 1980 Brazil's GDP per capita was about 64% of Portugal's GDP per capita.

During the Crisis period (1980-1990), not only Brazil but other LA countries started to lose steam, facing a decade of transition and austerity (de Medeiros & Trebat, 2021). Apart from Chile and Colombia, all LA countries under analysis (including Brazil) presented negative growth rates during these years. Moreover, due to the similar economic path, one can observe real null convergence of Brazil towards the other six LA countries from 1980 to 1990.

Widely known as the "lost decade", between 1980 and 1990, the Brazilian economy shrank (GDP per capita decreased by 0.5%, on average), and the falling behind process took place, especially with those developed countries, namely Portugal and the US. Indeed, the decrease of relative Brazil's GDP per capita from these economies was 64% to 45% and 28% to 21%, respectively.

In the last and the most recent phase, neoliberalism (1990-2019), the Brazilian economic recovery seemed evident, especially between 2000 and 2015, when one can observe a catching-up process towards Portugal and the US. At the end of 2015, the standard of living in Brazil reached the highest level compared to the US, 30%, while compared to Portugal, the ratio was 64%. Some political events, economic crises, and institutional instabilities changed the positive economic trend in Brazil from 2015 on, which in Figure 5.4 can be observed by a clear divergence from all countries under analysis.

5.4.2. Real convergence or real divergence: evidence based on unit root tests with structural breaks

The ADF and PP tests are the standard approaches to examining the time series properties, which can place the convergence hypothesis in an explicitly unit root framework (Bernard & Durlauf, 1995; Greasley & Oxley, 1998). We first apply the non-stationary tests of the relative GDP per capita series (log), assuming no structural breaks.

As can be seen in Table 5.1, there is no tendency for Brazilian income gaps towards LA, Portugal, and the US to narrow over time, given the tests do not reject the null-hypothesis (i.e., the relative series are not stationary) considering a time trend in the relative series.

Table 5.1. Non-stationary tests of the relative GDP per capita series

Brazil vs	ADF (p-value)	PP (p-value)
LA6	-1.390 (0.864)	-1.356 (0.873)
Portugal	-3.009 (0.130)	-3.035 (0.123)
US	-1.606 (0.790)	-1.513 (0.825)

Note: All variables are in logarithm; the lag-length selection was based on the information criteria provided in *varsoc* command (STATA 17.1[®]).

Any breaks in the economic pattern of countries, some of which are transitory while others may have permanent effect, will have important implications for the existence of income convergence (Greasley & Oxley, 1998). One of the foremost critics of Bernard and Durlauf's (1995) approach is that they do not consider the possibility of discontinuities in the per capita GDP series. In light of this criticism, we then perform an extended ADF test (see Inwood & Stengos, 1991), allowing for the presence of breaks (intercept and trend) in the given relative series. Before proceeding, however, we opt to look for possible breaks through visual inspection (Figure 5.5).

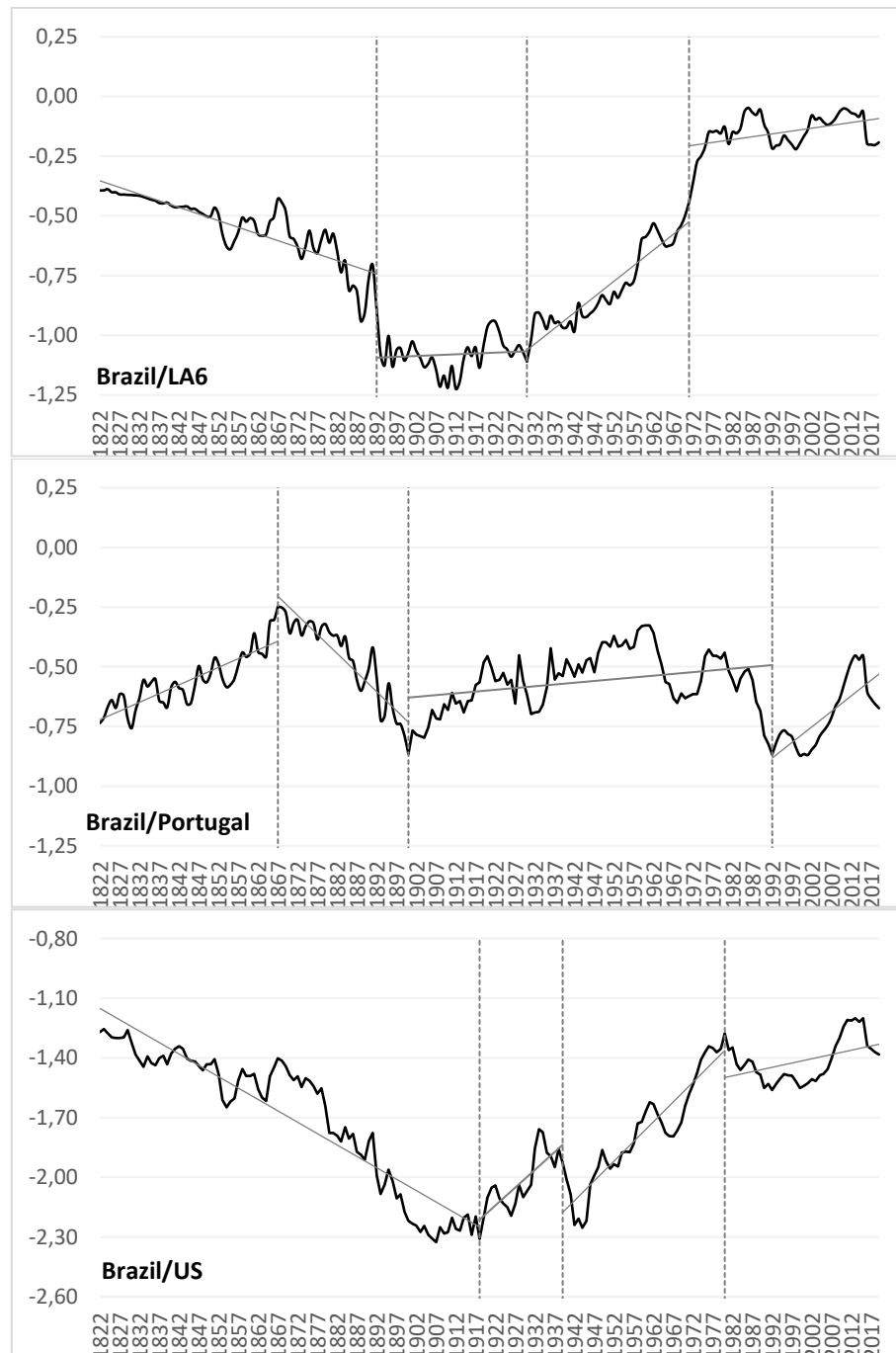


Figure 5.5. Actual and fitted (straight line) values, 1822-2019, Brazil's GDP per capita relative series (log)

Source: Authors' computation based on data from Maddison Project Database (2020), Coatsworth (1978), and World Bank (WB) Database.

According to Inwood and Stengos (1991), the correct identification of the structural breaks excludes the basis of non-stationarity and, therefore, its effect on the data. From Figure 5.5, we can depict some possible breaks in the relative series, namely 1892, 1930,

and 1971 for Brazil/LA, 1867, 1900, and 1992 for Brazil/Portugal, and 1918, 1939, and 1980 for Brazil/US. To check the validity of this exogenous approach, we use the methodology proposed by Bai and Perron (1998), which endogenously determines the number and timing of potential multiple structural changes.

Table 5.2. Potential break dates reported by visual analysis and Bai-Perron test

Brazil vs	Visual analysis			Bai-Perron		
LA6	1892	1930	1971	1884	1942	1971
Portugal	1867	1900	1992	1857	1886	1987
US	1918	1939	1980	1886	1931	1969

Source: Bai-Perron test – Authors’ computation using STATA 17.1®.

Table 5.2 reports the potential break dates identified by visual analysis and Bai and Perron's (1998) test. Both procedures concerning the breakpoints are substantially close to one another. We opted to assume the structural dates from Bai-Perron to proceed with the extended ADF test since visual inspection may be biased.

The results derived from the extended ADF tests (Table 5.3) indicate that Brazil and LA's relative GDP per capita series has become stationary after assuming three structural breaks, namely in 1884, 1942, and 1971. Although the critical values are not tabulated for this model, Inwood and Stengos (1991) have provided a 5% critical value of -5.1316 for a three-break model. Therefore, as our lagged variable (y_{t-1}) yields a test statistic of -5.86, we can reject the hypothesis of non-stationarity, favoring the catching-up process in the very long-run.

The effect of introducing each breakpoint can be separately analyzed and historically supported. Since 1822, Brazil has diverged from LA at an annual average speed of 0.47%. The break point of 1884 (five years before Brazil has implemented the Republic) indicates the beginning of a flat pattern that persisted until 1942, when the country embarked on the developmentalist era and started a process of catching up to other LA countries (at an annual average speed of 1.89%). The accelerating process of diminishing the GDP per capita gap was sustained up to 1971 when, probably due to some external (e.g., oil shock) and internal (e.g., external debt, hyperinflation) crises, Brazil started losing steam with

pronounced macroeconomic instability, notable until recent times.

Table 5.3. ADF test with structural breaks. Relative GDP per capita series

ADF: $\Delta y_t = a_0 + \beta \cdot y_{t-1} + a_1 \cdot t + a_2 \cdot duT_i + a_3 \cdot dtT_i + a_4 \cdot dT_i + \Delta y_{t-1} + \varepsilon_t$						
Variable	Brazil vs LA		Brazil vs Portugal		Brazil vs US	
	Parameter	t-statistic	Parameter	t-statistic	Parameter	t-statistic
Constant	2.007 (0.700)	2.87	-1.536 (1.846)	-0.83	1.809 (0.793)	2.28
y_{t-1}	-0.250 (0.043)	-5.86	-0.223 (0.043)	-5.20	-0.164 (0.036)	-4.52
t	-0.001 (0.000)	-3.02	0.001 (0.001)	0.76	-0.001 (0.000)	-2.52
duT_1	-0.102 (0.023)	-4.47	0.052 (0.029)	1.81	-0.072 (0.025)	-2.92
duT_2	0.006 (0.036)	0.18	-0.058 (0.049)	-1.19	0.006 (0.036)	0.17
duT_3	0.238 (0.053)	4.46	-0.190 (0.151)	-1.26	0.145 (0.052)	2.77
dtT_1	0.002 (0.001)	2.93	-0.002 (0.002)	-1.12	0.001 (0.001)	1.63
dtT_2	0.005 (0.001)	3.60	-0.000 (0.001)	-0.21	0.002 (0.001)	2.24
dtT_3	0.001 (0.001)	1.54	0.002 (0.001)	1.44	0.001 (0.001)	1.62
dT_1	0.042 (0.048)	0.86	0.051 (0.057)	0.90	0.024 (0.056)	0.43
dT_2	-0.033 (0.048)	-0.68	-0.015 (0.058)	-0.26	0.037 (0.057)	0.66
dT_3	0.040 (0.050)	0.80	-0.064 (0.055)	-1.17	0.028 (0.057)	0.49
Δy_{t-1}	0.103 (0.070)	1.47	0.063 (0.071)	0.89	0.202 (0.071)	2.82
R-squared	0.220		0.153		0.157	
LM (χ^2) AR[1]	3.556		0.081		0.435	
AIC	-636.33		-579.614		-573.615	

Note. The number below the coefficient estimates are standard errors. LM (χ^2) is a Lagrange Multiplier type test of serial correlation up to order 1. Dummies values for breaks defined as in Inwood and Stengos (1991), where $T_i(\text{BRvsLA})=1884, 1942, \text{ and } 1971$; $T_i(\text{BRvsPT})=1857, 1886, \text{ and } 1987$; and $T_i(\text{BRvsUS})=1886, 1931, \text{ and } 1969$.

Regarding the extended ADF results for Brazil-Portugal, we can observe that the structural break dates proposed by the Bai and Perron's (1998) test, namely 1857, 1886, and 1987, were sufficient to convert the relative GDP per capita series into a stationary series (i.e., for a test statistic of -5.20, we can reject the hypothesis of non-stationarity at 5% significance). Although the exact break dates are not historically supported, one may

speculate their significance on the Brazilian real convergence towards Portugal. Until the proclamation of the Republic (three years after the second break point), Brazil presented low levels of growth and a clear path of divergence towards other economies under study. What differentiates the Brazil-Portugal pattern, at least from 1822 to 1857, is probably Portugal's sudden deprivation of a centuries-old empire and the loss of substantial part of its revenues, which is reflected in the Brazilian catching up. The last break data, 1987, may also indicate some Portuguese economic achievement rather than Brazilian since, in 1986, the former country joined the European Union.

Different from the results for Brazil/LA and Brazil/Portugal, the introduction of structural breaks has not been able to eliminate the discontinuities in the relative GDP per capita series of Brazil/US. This is to say that, even considering some break points, Brazil has not been able to achieve a sustainable convergence path towards the US, at least considering the period under analysis (1822-2019). Furthermore, one can conclude that Brazilian citizens' relative standard of living towards US citizens has almost stagnated since 1822.

5.4.3. Explaining the sources of real convergence / divergence of Brazil vis-à-vis LA, Portugal, and the US: A Markov Regime-Switching Autoregressive (MS-AR) approach

5.4.3.1. Preliminary investigation

Before estimating the model, it is essential to conduct various diagnostic tests, such as lag length selection, nonlinearity test, and the unit root test. Although of great concern in time series models, the stationarity of the involved variables is not a critical point in Bayesian statistics, as the MS adopted in this study (Araújo et al., 2020). Thus, only the first two diagnostic tests are going to be applied.

First, the number of lags ($p=2$) was selected based on the Akaike information criterion (AIC) and the Schwarz information criterion (SBIC), applied to the three models (Model I: Brazil/LA, Model II: Brazil/Portugal; Model III: Brazil/US). Second, to check for nonlinear time series dependencies, we performed the BDS test (Brock et al., 1996),

which has been found to have power against a wide range of nonlinear alternatives (Chen et al., 2019). The results of the BDS test (see Table 5.4) from the residuals clearly show significant nonlinear dependencies (i.e., the null hypothesis of linearity is rejected in all models at the 1% significance level) and entail the application of the MS model.

Table 5.4. Nonlinearity BDS test from Brock et al. (1996)

Variable	m=2	m=3	m=4	m=5	m=6
Model I: Brazil/LA6	206.907***	525.824***	1612.992***	5611.309***	21780.412***
Model II: Brazil/Portugal	129.489***	187.835***	302.454***	506.570***	861.289***
Model II: Brazil/US	64.102***	145.875***	387.358***	1182.693***	3993.964***

Note. *** (**) [*] statistically significant at 1% (5%) [10%]; m indicates the maximum embedding dimension.

Source: Authors' computation using STATA 17.1®.

5.4.3.2. Regime Switching Model

Based on the previous diagnostics, the proposed regime-switching model is the Markov-Switching intercept heteroskedasticity with 2 Regimes ('Real convergence', Regime 1, and 'Real divergence', Regime 2) and 2 lags. Table 5.5 shows the results obtained from the MSIH(2)-VAR(2) models. In all models, Regimes 1 and 2 are characterized as real convergence (catching up) and real divergence (falling behind), respectively. For instance, Regime 1 (Real convergence) has the less negative value of the intercept term, $\mu_1^I = -0.641$, $\mu_1^{II} = -0.425$, and $\mu_1^{III} = -92.945$ (statistically significant at 1% and 5%), with higher volatility in Model I (Brazil/LA6) and Model II (Brazil/Portugal), $\sigma_1^I = 0.054$, $\sigma_1^{II} = 0.096$, and lower volatility in Model III (Brazil/US), $\sigma_1^{III} = 0.034$. It follows that Regime 2 (Real divergence) corresponds to a period when Brazil is less accurate in diminishing its real GDP gap towards the studied economies or even diverging, represented by the lower value of the intercept terms, $\mu_2^I = -0.646$, $\mu_2^{II} = -0.594$, and $\mu_2^{III} = -93.040$, and value of variance of, $\sigma_2^I = 0.005$, $\sigma_2^{II} = 0.045$, and $\sigma_2^{III} = 0.071$. These outcomes imply that the real divergence process of Brazil towards the LA6 countries and Portugal is less volatile than the real convergence process. On the other hand, when Brazil is studied towards the frontier country, the US, the divergence process is more volatile than the convergence one.

In the case of Model I (Brazil/LA6) and III (Brazil/US), the transition probabilities

indicate that either the process of catching up (Regime 1) or falling behind (Regime 2) has strong stability since p_{11} and p_{22} are both close to one. In Model II (Brazil/Portugal), the divergence process is more persistent than the convergence one, $p_{11} < p_{22}$. For instance, given that we are in regime 1, $p_{11}^I = 0.988$, $p_{11}^{II} = 0.587$, and $p_{11}^{III} = 0.964$ represents the probability of 98.8%, 58.7%, and 96.4% chance (respectively) of remaining in Regime 1 (catching up). Also, given that we are in regime 2, $p_{22}^I = 0.977$, $p_{22}^{II} = 0.966$, and $p_{22}^{III} = 0.954$ represents the probability of 97.7%, 96.6%, and 95.4% chance (respectively) of remaining in Regime 2 (falling behind). This reveals that, for the pairs Brazil/LA6 and Brazil/US, there is more probability of staying on the same path (converging or diverging) than reversing to the other way around. On the other hand, when observing the pair Brazil/Portugal, the path of convergence seems to be easily reversed, whereas the path of divergence has strong stability.

Considering the regression parameters, the results reveal to be different according to the pair of countries in question. In Model I (Brazil/LA6), a positive effect of human capital is observed regardless Brazil is on the path of convergence or divergence towards the LA6 countries. At the same time, while the impact of institutional quality on convergence in Regime 1 (catching up) is positive, this impact turns out to be negative in Regime 2 (falling behind). The findings evidence the relevance of improving human capital in diminishing the real GDP per capita gap. Moreover, the level of democracy has a stimulating effect on real convergence only if Brazil is experiencing a catching up towards other LA6 countries (Regime 1).

Under the framework of Model II (Brazil/Portugal), there is no evidence of a causal relationship between human capital and the real convergence process. Apart from the autoregressive (ar[1]) term, the institutional quality is the only parameter statistically significant at 5%, but only under Regime 2 (falling behind). To that end, when Brazil is on a path of real divergence towards Portugal, an increase in level of democracy could enhance the Brazilian catching up in the very long run.

Table 5.5. Estimated MSIH(2)-AR(2) models

	Model I (Brazil/LA6)	Model II (Brazil/PT)	Model III (Brazil/US)
<i>Regime 1 (Real convergence/ catching up)</i>			
Intercept (μ_1)	-0.641*** (0.224)	-0.425*** (0.106)	-92.945** (37.139)
β_1 [HC_br]	0.154** (0.074)	-0.030 (0.048)	-0.755*** (0.163)
δ_1 [IQ_br]	0.021* (0.013)	-0.017 (0.052)	0.025** (0.011)
σ_1	0.054	0.096	0.034
<i>Regime 2 (Real divergence/ falling behind)</i>			
Intercept (μ_2)	-0.646*** (0.222)	-0.594*** (0.005)	-93.040** (37.135)
β_2 [HC_br]	0.149** (0.074)	-0.061 (0.041)	-0.773*** (0.163)
δ_2 [IQ_br]	-0.019** (0.009)	0.026** (0.013)	0.033 (0.038)
σ_2	0.005	0.045	0.071
γ_{t-1} [AR(1) GDPpcBR/GDPpc ⁱ]	1.028*** (0.071)	1.036*** (0.082)	1.089*** (0.047)
γ_{t-2} [AR(2) GDPpcBR/GDPpc ⁱ]	-0.042 (0.071)	-0.100 (0.082)	-0.089 (0.047)
P ₁₁	0.988	0.587	0.964
P ₂₁	0.023	0.034	0.046
P ₁₂	0.012	0.413	0.036
P ₂₂	0.977	0.966	0.954
AIC	-3.441	-2.966	-3.000
LogLike	355.754	302.704	306.024

Note. *** (**) [*] statistically significant at 1% (5%) [10%]; the number below the coefficient estimates are standard errors; 1 and 2 in subscripts indicate the Regimes of convergence and divergence, respectively.

The set of parameters estimated under Model III (Brazil/US) is statistically significant at 5%, except for the institutional quality and the autoregressive term (ar[2]) in Regime 2 (Real divergence/ falling behind). Human capital negatively impacts the real convergence process, regardless of the regime. This relationship is the opposite of what was found in Model I (Brazil/LA6), a result more aligned with theoretical predictions and empirical literature (Abramovitz, 1986; Nelson & Phelps, 1966; Zhang et al., 2019). Regarding the institutional quality, the impact is positive and statistically significant as presented in Model I, Regime 1 (catching up), albeit irrelevant in Regime 2 (falling behind).

With the various aspects of our empirical investigation considered, some features

emerge and are worth highlighting. The two independent variables, human capital (proxy by the ‘average years of schooling’) and institutional quality (proxy by the Polity Score), differently impact the catching up (or falling behind) process depending on which (block of) country(ies) Brazil is compared with. Even though human capital was expected to promote the real convergence process (Abramovitz, 1986; Nelson & Phelps, 1966; Verspagen, 1991), this is only true for the pair Brazil/LA (Model I). When Brazil is compared to Portugal (Model II), this relationship is not statistically significant, or when we compare Brazilian’s economic growth with that of the US (Model III), human capital significantly harms Brazil’s comparative performance. Thus, the effects of human capital on convergence are more complex than initially recognized (Zhang et al., 2019).

The negative and neutral impact on the comparative growth performance of Brazil towards the US and Portugal, respectively, can be associated with at least two features underlying the former country: (i) the late education takeoff and type of educational investments; and (ii) the high levels of poverty and inequality. First, as shown in Figure 5.2, while the US citizens have achieved the highest level of education (almost 14 years of schooling, on average), the Brazilians are still on a path to completing the secondary education (8 years of schooling, on average). To compensate for this lagged position, the spending on education in Brazil has been directed to increase the number of schools and schools’ infrastructures rather than the quality of the education system (Rocha et al., 2017; Sandoval, 2012), which can partially at least explain the inefficiency of increasing levels of human capital in promoting the catching-up process towards more developed countries (e.g., Portugal) or even explain the divergence from the technological frontier country, the US. Indeed, if the quality of teaching does not proportionally follow the construction of more schools, the students languish in poor schools and do not acquire skills that benefit the economy (Sandoval, 2012).

Second, some critical factors defining most LA EEs like Brazil, namely high levels of poverty and inequality,²¹ may generate adverse effects of human capital on growth and real convergence. At the same time that human capital improvements are expected to contribute to alleviating poverty and lowering inequality (Ferreira et al., 2010; Litschig & Morrison, 2013; Sotomayor, 2019), the latter are, in turn, correlate with highly uneven

²¹ In the appendices, Appendix 10 illustrate, with data from 2006-2019, how some these social characteristics bring closer Brazil and its peers LA EEs.

access to education. Enrollment in tertiary education tends to increase with a family's consumption level, especially in Brazil (Kang, 2017; Menezes-Filho & Vasconcellos, 2007; Wjuniski, 2013). Since wealthier families provide better-quality secondary education for their children, they are more likely to enter prestigious and highly competitive public universities. On the other hand, children from poorer families rarely have any options rather than to go to private universities of dubious quality, which they can ill afford (Menezes-Filho & Vasconcellos, 2007). This process can generate a vicious cycle, where poverty leads to a flawed educational system, amplifying wage differentials by skills and accelerating inequality, thereby preventing the country from converging in real GDP per capita to more developed ones. That said, we can conclude that hypothesis H1 (*Human capital promotes country's real convergence*) is only validated when Brazil is compared to the other LA6 EEs.

The institutional quality's results differ depending on the regime. For the pair Brazil/LA6, the institutional quality (proxied by Polity Score) shows a positive effect on periods of convergence (Regime 1) still, it hampers Brazil's catch-up to LA6 in per capita income if the country is experiencing a non-convergence/ divergence regime (Regime 2). This behavior might be aligned with the argumentation by Barro (1996), who suggests that more democracy enhances growth at low levels of political freedom but act contrarily when a moderate level of freedom has already been attained, an argument in favor of a nonlinear relationship between institutional quality and economic growth/ convergence. By the same token, Barro (2016), Lee (2016), and Lee (2017) found strong evidence of the inverted U-shaped relationship between real convergence and political freedom.

As the bulk of the growth-related literature suggests, a positive effect of institutional quality on the real convergence of Brazil vi-à-vis Portugal and the US is observed. However, the coefficient is not significant in the catching-up phase for Brazil/Portugal (Regime 1, Model II) and the falling behind phase for Brazil/US (Regime 2, Model III). In the light of the economic history, more democracy was necessary to promote catching-up as far as Brazil was experiencing more (less) convergence towards the US (Portugal). One plausible reason for the neutrality effect of institutional quality on convergence in one out of two regimes is the heterogeneity of societies in developing and EEs. Bresser-Pereira (1993) argues that only some sort of cooperation among social classes and sectors of society would be able to assure the necessary governability of the regime. Therefore,

in countries with high levels of poverty and inequality, such as LA EEs in general, and Brazil in particular, even after establishing more democratic regimes, the constitution, stability, and appropriate reforms proposed by it to enhance economic development and convergence may be more challenging to negotiate and achieve (Lisboa & Latif, 2013).

Based on the above results, we can conclude that hypothesis H2 (*Institutional quality promotes country's real convergence*) is validated when Brazil is compared to other LA6 EEs, Portugal, and the US, conditional on the path convergence/ regime that it is being experienced.

5.5 Conclusion

Some classical theories in economics suggest that less developed countries are expected to narrow the per capita income gap with the world's frontiers over time (Arbache & Sarquis, 2018; Del Hoyo et al., 2017). Not surprisingly, empirical studies have extensively explored the real convergence process (Cuñado et al., 2007; Nahar & Inder, 2022). Albeit these studies are of high scientific relevance, they tend to focus on a large sample of countries, missing a great deal in capturing the fundamental determinants of individual economies in shaping the catching-up process (Lains, 2003; Młynarzewska-Borowiec, 2018; Tóth, 2019).

Based on an extended unit root approach, the present essay tests for Brazilian real convergence vis-à-vis six LA EEs, Portugal, and the US over a very long period 1822-2019. Such an approach leads us to conclude that, after considering structural breaks on the relative time series, Brazil has narrowed the gap towards other LA countries and Portugal, whereas the same phenomenon is not observed towards the US. From 1822 until 2019, Brazil diverged on real per capita terms from the technological frontier country.

Furthermore, to shed some light on the potential determinants explaining Brazil's catching up and falling behind, a Markov Regime-Switching (MS) model was estimated. The impact of human capital (proxied by the 'average years of schooling') and institutional quality (proxied by polity score) on Brazil's real convergence was

scrutinized. We found that such impact has important but distinct results, depending on the regime (real convergence/ divergence) and towards which economies Brazil is compared. On the one hand, human capital is positively associated with Brazil's real convergence process only when Brazil is compared to other LA6 EEs. On the other hand, there is a negative and neutral impact of human capital on the comparative growth performance of Brazil towards the US and Portugal, respectively. The uneven access to school and the lack of a qualified education system are possible explanations underlying the inability of human capital to promote Brazil's convergence towards more developed countries.

Regarding the results of institutional quality, we uncovered that its impact on the real convergence of Brazil is asymmetric according to the regimes. For the pair Brazil/LA6, it was found to have a positive (negative) impact on convergence (non-convergence/ divergence) periods, which can be due to the non-linear relationship between democracy and growth (Barro, 1996). For the pairs Brazil/Portugal (Brazil/US), a positive effect was found only on the divergence (convergence) regime, while neutral on the convergence (divergence) regime. The positive impact of institutional quality on real convergence is aligned with the literature (Li, 1997; McDonald, 2015), being justified by the expectation that qualified institutions are more capable of facilitating and incentivizing knowledge and technologies absorption from advanced economies (Abramovitz, 1986; De La Fuente, 1997). The neutral impact can be attributed to inequalitarian societies like EEs, Brazil in particular, which therefore generates fragmentation among citizens and increases the challenges of class coalition able to assure the necessary governability of a more democratic regime (Bértola & Williamson, 2017; Bourguignon & Verdier, 2000; Bresser-Pereira, 1993).

By developing this study, we contribute to the literature at three levels, theoretical, methodological, and empirically. At the theoretical level, this essay adds to the real convergence literature the analysis of one solely country, Brazil, in three different scenarios: (i) towards other LA EEs; (ii) towards a developed country, its *alma matter* Portugal; and (iii) towards the commonly regarded technological frontier country, the US. At the methodological level, to the best of our knowledge, this is the first study to employ and adapts the MS model to capture the dynamic relationship between human capital and institutional quality to the relative real GDP per capita, accounting for different

explanatory variables behavior according to the regime (convergence/ divergence). At the empirical level, this study offers new and challenging evidence of the nonlinear impact of human capital and institutional quality on real convergence process of Brazil vis-à-vis other LA6 EEs, Portugal, and the US.

Altogether, the set of evidence provides important policy implications. To promote real convergence, it is required specific guidelines regarding the economy that is being targeted. Brazilian experience suggests that the process of catching up to similar economies (e.g., other LA EEs) demands investments on school facilities to increase the population's educational attainment. However, suppose the government intends to redirect the policies to promote real convergence towards more developed economies (e.g., Portugal, and the US). In that case, the initiatives should combine schooling quantity with education quality. According to Wößmann and Hanushek (2007), two factors that positively influence student outcomes are teacher experience and measures of teacher achievements. The authors also highlight the extraordinary importance of getting the institutional structure right, as the full learning capability can be achieved if the institutional arrangements are efficient (Li, 1997).

Even though the present essay conveys some novel contributions, it nevertheless entails some limitations and outlines some avenues for future research. First, the metric of human capital used – average years of schooling – does not consider the educational quality. Therefore, adjusting the human capital proxy is likely to increase the power of the variable in explaining the relative economic growth (Teixeira & Queirós, 2016), even in different contexts. Second, EEs from other continents should be put in perspective, and the results compared to those related to LA EEs to corroborate our findings. Finally, as some of the bottlenecks of these economies seem to be high poverty and inequality levels, an appropriate alternative would be to add these variables to future real convergence studies.

Conclusion

“The longer you can look back, the farther you can look forward.”

(Winston Churchill, speech, March 1944)

Chapter by chapter, this four-essay thesis evolved from a systematic bibliometric exercise, through narrative review and more complex empirical analysis, all of which aimed at providing, in a sequential way, new insights into the literature on economic growth and real convergence of the EEs in general, and Brazil in particular.

The thesis starts (Essay 1) with an overall view of state of the art and the research trajectory of the empirical growth-related literature. Three significant contributions emerge: (i) it adds a novel and up-to-date systematic/ quantitative survey to the economic growth reviews, embracing all countries, determinants, and time-span studies; (ii) it is the first bibliometric survey to explore and map the available empirical information on the economic growth of countries; and (iii) it suggests that the empirical growth-agenda needs to be redirected in future research. As a matter of fact, the main results of the first essay support the next steps of this thesis, that is, the analysis of the neglected group of EEs, namely LA; the consideration of broader time horizons (the very long-run), embracing more than 100 years; and the exploration of some understudied determinants in the context of EEs, namely human capital, institutional conditions, and structural change.

The study of human capital, institutional conditions, and structural change as drivers of sustainable economic growth is especially relevant for the EEs since this group of countries presents specific features (e.g., poverty, inequality, institutional instability, inefficient manufacturing basis) which are likely to imply the resounding failure of control over those aspects throughout their development history.

A former Portuguese colony, Brazil is the largest country in LA and one of the largest in the world in terms of territorial size and population. According to the IMF (2018), the

country is one of the world's leading economies, placing Brazil in the eightieth position in the world ranking (records of the GDP). Such relevance in the world's context raised the interest to choose Brazil as the representative of EEs in general, and Latin American EEs in particular, thus digging a little deeper into its economic path from independence (1822) to recent times (2019) to enlighten the main drivers of its performance. The three essays that complete this thesis encompass such large time window (1822-2019).

Before proceeding to the empirical exercises, Essay 2 provides a qualitative/structured narrative review of some critical factors that have bolstered or weakened Brazil's economic growth and some support for understanding the process of real di(convergence). This essay encompasses three main contributions: (i) it proposes a novel and encompassing framework of Brazil's economic history, highlighting key factors of its absolute and relative performance since independence, organized by periods and sets of determinants; (ii) it explores and assembles substantial information, as well as a detailed analysis and a comprehensive panorama of the evolution of the key determinants; and (iii) it offers some guiding lines, highlighting government policies to promote robust and sustainable economic growth, especially around neglects but urgent determinants, namely institutional conditions and human capital formation.

Adding to the descriptive review, Essays 3 and 4 complement the analysis through more quantitative approaches, firstly focusing on the absolute growth, then centering on the relative growth of Brazil towards other LA EEs, Portugal, and the US.

Employing cointegration and Granger (non)causality econometric techniques, Essay 3 analyzes the joint impact of human capital (proxied by average years of schooling), institutional quality (proxied by the Polity Score), and structural change (proxied by employment and value-added (from the 1930s onwards) by sector as the percentage of total persons engaged/ value-added). The results obtained contribute to the extant literature by offering evidence that human capital is one of the most critical factors in promoting sustainable economic performance, especially for developing countries and EEs, such as Brazil. The results also highlight the relevance of institutional quality in boosting economic growth through human capital improvements. Meanwhile, our outcomes contribute to the Brazilian structural change-economic growth literature by adding a new perspective of such a relationship. When using the share of employment in

the secondary sector, we fail to find a significant causality effect running from industrialization to economic growth in Brazil between 1822 and 2019. We uncovered that a sharp increase in the standard of living of Brazilian households leads to changes on domestic consumption towards more advanced and sophisticated products fostering the allocation of resources from agriculture to industry. Additionally, we encounter a significant and positive effect of structural change on economic growth from the 1930s onwards when structural change is measured by changes in the secondary sector's value-added weight.

Finally, Essay 4 analyzes the Brazilian real convergence vis-à-vis six LA6 EEs, Portugal, and the US. Based on an extended unit root approach allowing for structural breaks of the relative time series, the essay found that Brazil has narrowed the gap towards other LA countries and Portugal, whereas the same phenomenon is not observed towards the US. From 1822 until 2019, Brazil diverged on real per capita terms from the technological frontier country. Furthermore, to shed some light on the potential impact of human capital and institutional quality explaining Brazil's catching up and falling behind, a Markov Regime-Switching (MS) model was estimated. Human capital was found to be positively associated with Brazil's real convergence process only when Brazil is compared to other LA6 EEs, whereas negatively and neutrally associated with the comparative growth performance of Brazil towards the US and Portugal, respectively. The uneven access to school and the lack of a qualified education system are possible explanations underlying the inability of human capital to promote Brazil's convergence towards more developed countries. Regarding the results of institutional quality, a non-linear relationship was found for the pair Brazil/LA6, whereas positive and neutral effects were observed in both pair Brazil/Portugal and Brazil/US. Even though the positive impact of institutional quality on real convergence is aligned with the literature, the neutral impact can be attributed to some specific features underlying the EEs, such as poverty and inequality, which contributes to the social fragmentation and further obstacles to promoting coalition crucial for more democratic regimes.

Altogether, the present thesis provides several important policy implications. First, Brazilian policymakers should concentrate on reforms to encourage school attendance and accessibility, as well as invest in school facilities. It is also essential to combine schooling quantity with educational quality. As a matter of fact, the entire learning

capability can only be achieved if the institutional arrangements are efficient. That said, our findings' second and critical implication is the well-functioning of institutions, which should be central to the debate as they generate the appropriate environment that fosters economic growth and real convergence. Third, specific to a large country such as Brazil, governments should consider the importance of the domestic market with caution. The structural changes promoted by industrialization are highly relevant in boosting Brazilian growth and the country should invest on a more technological and value-added manufacturing basis. At the same time, once there is an increase in the standard of living of Brazilian households, it would change the domestic consumption towards more advanced and sophisticated products, which in turn would induce pro-industry structural change.

Despite the fact that this thesis conveys some novel contributions, future studies could extend the current line of research. For instance, although we selected the variables carefully, continuous time series were unavailable. We had to gather some missing data from distinct sources and resort to linear and backward interpolation. Such techniques do not affect the long-run properties being tested, but they can lead to size distortion (Ghysels & Miller, 2014). Second, the human capital proxy used in this study, 'average years of schooling', is recognized as an inaccurate measure due to its lack of information about sources of learning other than schooling and the lack of information about the quality of education. Correcting for the quality of education is likely to increase the explanatory power of human capital on economic growth (Teixeira & Queirós, 2016). Third, EEs from other continents should be put in perspective, and the results compared to those related to LA EEs to corroborate the findings from Essay 4. Finally, as some of the bottlenecks of these economies seem to be high levels of poverty and inequality, an appropriate alternative would be to add these variables into future Brazilian growth and real convergence studies.

Appendices

Appendix 1: Emerging Economies by geographic area, and the corresponding GDP growth rate and GDP per capita growth rate by period (Constant 2010 US\$).

Country	Average GDP Growth (%)			Average GDP per capita Growth (%)		
	1980-2019	2000-2019	2010-2019	1980-2019	2000-2019	2010-2019
Asia	5,78	5,78	5,78	4,21	4,58	4,72
China	9,44	9,02	7,69	8,45	8,43	7,17
Indonesia	5,15	5,26	5,42	3,50	3,90	4,10
India	6,12	6,51	6,74	4,30	5,06	5,52
Malaysia	5,81	5,06	5,32	3,54	3,27	3,84
Philippines	3,93	5,47	6,4	1,74	3,65	4,74
Sri Lanka	4,92	5,13	5,26	3,91	4,32	4,42
Thailand	5,11	3,98	3,64	4,05	3,40	3,22
Europe	2,75	3,51	2,48	2,89	3,75	2,70
Albania	2,95	4,26	2,61	2,79	4,71	2,87
Belarus	3,04	4,53	1,81	3,36	4,84	1,86
Bosnia and Herzegovina	8,15	3,34	1,91	8,85	3,99	3,18
Bulgaria	1,81	3,63	2,33	2,42	4,48	2,99
Croatia	2,26	2,03	1	2,81	2,56	1,58
Hungary	2,27	2,63	2,76	2,49	2,87	3,02
Montenegro	2,63	3,12	2,83	2,53	2,98	2,77
North Macedonia	1,53	2,86	2,59	1,38	2,71	2,51
Poland	3,79	3,83	3,63	3,80	3,92	3,68
Romania	2,34	4,06	3,14	2,99	4,85	3,67
Russian Federation	0,86	3,7	1,92	0,89	3,73	1,65
Serbia	3,31	3,6	1,91	3,71	4,02	2,45
Turkey	4,47	4,91	5,85	2,76	3,38	4,20
Ukraine	-0,95	2,6	0,45	-0,33	3,46	1,35

Appendix 1: Emerging Economies by geographic area, and the corresponding GDP growth rate and GDP per capita growth rate by period (Constant 2010 US\$) (continued).

Country	Average GDP Growth (%)			Average GDP per capita Growth (%)		
	1980-2019	2000-2019	2010-2019	1980-2019	2000-2019	2010-2019
Latin America and The Caribbean	2,98	3,26	2,97	1,45	2,07	1,84
Argentina	1,91	1,97	1,37	0,66	0,92	0,32
Brazil	2,84	2,39	1,39	1,10	1,36	0,53
Chile	4,3	3,76	3,33	2,95	2,61	2,15
Colombia	3,47	3,81	3,72	1,81	2,50	2,51
Costa Rica	3,73	3,92	3,63	1,74	2,57	2,50
Dominican Republic	4,68	4,97	5,64	3,03	3,66	4,44
Ecuador	2,92	3,37	2,84	0,87	1,65	1,18
El Salvador	1,45	2,01	2,47	0,55	1,50	1,99
Guatemala	2,99	3,46	3,5	0,69	1,50	1,75
Jamaica	1,37	0,8	0,68	0,56	0,23	0,15
Mexico	2,5	2,09	2,69	0,83	0,72	1,40
Panama	4,91	5,9	6,19	2,86	4,03	4,39
Paraguay	3,69	3,37	4,38	1,58	1,84	3,00
Peru	3,28	4,77	4,49	1,65	3,62	3,23
Trinidad and Tobago	2,53	3,16	-0,14	1,86	2,65	-0,69
Uruguay	2,42	2,63	3,09	1,96	2,40	2,75
Venezuela, RB	1,71	3,04	1,15	-0,07	1,43	-0,25
Middle East and Central Asia	3,99	4,79	3,50	1,68	2,64	1,49
Algeria	2,74	3,29	2,69	0,62	1,55	0,68
Armenia	3,49	6,57	4,47	4,11	6,82	4,22
Azerbaijan	4,01	8,68	1,59	2,86	7,46	0,44
Egypt, Arab Rep.	4,99	4,39	3,8	2,74	2,34	1,62
Georgia	0,9	5,41	4,88	1,39	6,00	5,15
Iran, Islamic Rep.	2,32	3,66	2,65	0,38	2,40	1,37
Iraq	6,83	5,03	5,52	3,96	2,21	2,34
Jordan	4,45	4,45	2,39	0,66	0,89	-1,44
Kazakhstan	3,01	6,53	4,47	2,54	5,40	3,02
Kuwait	4,56	3,55	1,6	-0,76	-0,31	-2,39
Lebanon	4,99	3,2	1,27	1,83	0,16	-2,27

Appendix 1: Emerging Economies by geographic area, and the corresponding GDP growth rate and GDP per capita growth rate by period (Constant 2010 US\$) (continued).

Country	Average GDP Growth (%)			Average GDP per capita Growth (%)		
	1980-2019	2000-2019	2010-2019	1980-2019	2000-2019	2010-2019
Middle East and Central Asia	3,99	4,79	3,50	1,68	2,64	1,49
Libya	5,31	5,31	6,12	4,00	4,00	5,07
Morocco	4,06	4,1	3,44	2,43	2,79	2,06
Oman	5,14	3,32	3,24	1,22	-0,68	-2,27
Pakistan	4,84	4,25	3,96	2,11	1,95	1,80
Saudi Arabia	2,14	3,49	3,46	-1,14	0,78	0,87
Syrian Arab Republic	3,08	4,78	0	0,93	1,99	0,00
Turkmenistan	5,42	8,16	8,99	2,11	2,14	0,87
Tunisia	3,73	3,15	1,94	3,67	6,63	7,12
United Arab Emirates	3,87	4,23	3,58	-2,02	-1,69	1,45
Sub-Saharan Africa	3,82	4,00	2,94	1,27	1,84	0,80
Angola	3,68	5,47	2,2	0,18	1,86	-1,28
Botswana	6,29	4,15	4,75	3,70	2,30	3,04
Namibia	3,09	3,75	3,11	0,85	1,97	1,26
South Africa	2,23	2,64	1,68	0,35	1,22	0,18

Note. The countries were grouped according to IMF, 2020 classification.

Source: Own computation based on World Bank database.

Appendix 2: List of countries by level of development

Developed Countries	Developing Countries	Least Developed Countries	EEs
Australia	Bahrain	Afghanistan	Albania
Austria	Barbados	Bangladesh	Algeria
Belgium	Bolivia	Benin	Angola
Canada	Cabo Verde	Burkina Faso	Argentina
Croatia	Cameroon	Burundi	Armenia
Cyprus	Cook Island	Cambodia	Azerbaijan
Czech	Cuba	Chad	Belarus
Denmark	Eswatini	Congo	Bosnia and Herzegovina
Estonia	Fiji	Ethiopia	Botswana
Finland	Ghana	Gambia	Brazil
France	Honduras	Guinea	Bulgaria
Germany	Ivory Coast	Guinea-Bissau	Chile
Greece	Kenya	Haiti	China
Hong-Kong	Lesotho	Liberia	Colombia
Iceland	Mauritius	Madagascar	Costa Rica
Ireland	Mongolia	Malawi	Croatia
Israel	Myanmar	Mali	Dominican Republic
Italy	Nicaragua	Mozambique	Ecuador
Japan	Nigeria	Nepal	Egypt, Arab Rep.
Latvia	Papua New Guinea	Niger	El Salvador
Lithuania	Qatar	Rwanda	Georgia
Luxembourg	Swaziland	Senegal	Guatemala
Malta	Taiwan	Sierre Leone	Hungary
New Zealand	Vietnam	Somalia	India
Norway	Zimbabwe	South Sudan	Indonesia
Portugal		Sudan	Iran, Islamic Rep.
Singapore		Tajikistan	Iraq
Slovak		Tanzania	Jamaica
Slovenia		Timor-Leste	Jordan
South Korea		Togo	Kazakhstan
Spain		Uganda	Kuwait
Sweden		Yemen	Lebanon
Switzerland		Zambia	Libya
The Netherlands			North Macedonia

Appendix 2: List of countries by level of development (continued)

Developed Countries	Developing Countries	Least Developed Countries	EEs
UK			Malaysia
USA			Mexico
			Montenegro
			Morocco
			Namibia
			Oman
			Pakistan
			Panama
			Paraguay
			Peru
			Philippines
			Poland
			Romania
			Russian Federation
			Saudi Arabia
			Serbia
			South Africa
			Sri Lanka
			Syrian Arab Republic
			Thailand
			Trinidad and Tobago
			Turkey
			Turkmenistan
			United Arab Emirates
			Ukraine
			Uruguay
			Venezuela, RB

Note. The countries were grouped according to IMF, World Bank, and United Nations, 2020 classification.

Appendix 3: Empirical evidence on very long-run economic growth

Group	Country	Title (published year)	Period	Method	Determinant(s)	Main results
	Australia	The Australian growth miracle: An evolutionary macroeconomic explanation. Foster (2016)	1904-2008	OLS	(6) Energy consumption	0
		Federal legislative activism in Australia: a new approach to testing Wagner's law. Kirchner (2012)	1902-2008	OLS	(7) Legislative outputs	+++
	Belgium	Stock market development and economic growth in Belgium. Nieuwerburgh et al. (2006)	1830-2000	VECM; Granger-causality	(4) Financial market development	+++
	France	Efficient government size: France in the 20th century. Facchini and Melki (2013)	1896-2008	FMOLS; Granger-causality	(4) Government expenditure	+++
Italy		Government size and economic growth in Italy: A time-series analysis. Forté and Magazzino (2016)	1861-2008	ARIMAX	(4) Government expenditure	+++
		Testing threshold cointegration in Wagner's law: The role of military spending. Caviecholi and Pistoresi (2016)	1862-2009	VECM	(4) Government expenditure	(++)
		Exports, imports and growth. New evidence on Italy: 1863-2004. Pistoresi and Rinaldi (2012)	1863-2004	VECM; Granger-causality	(5) International trade	Import-led growth (++) between 1863-1913 Export-led growth [+] between 1951-2004
		Public debt and economic growth in Spain, 1851-2013. Esteve and Tamarit (2018)	1851-2013	DOLS	(4) Public debt	---
Spain		Foreign trade and economic growth in Spain (1900-2012): the role of energy imports. Balaguer et al. (2014)	1900-2012	VECM; Granger-causality	(5) International trade	No causality, between 1900-1958 [+] between 1959-2008
	Sweden	Human capital and economic growth: Sweden 1870-2000. Ljungberg and Nilsson (2009)	1870-2000	VAR; Granger-causality	(1) Human capital	[+]
	Holland	The Contribution of Migration to Economic Development in Holland 1570-1800. Foldvari et al. (2013)	1570-1800	VAR; Granger-causality	(2) Immigration	No causality, between 1570-1700 +++ between 1700-1800
	UK	How useful is the golden triangle law in economics? Škare (2014)	1851-2011	VAR Granger-causality	(2) Unemployment, (4) Inflation	Jointly impact ---
USA		The great power dilemma: The trade-off between defense and growth in Great Britain, 1830-1980. Lai (2001)	1830-1980	OLS	(4) Military spending	[-]
		Are there ENSO signals in the macroeconomy? Berry and Okulicz-Kozaryn (2008)	1894-1999	ARDL	(6) El-Niño Southern Oscillation shock (ENSO)	0

Note. +++ (++) [+], statistically significant at 1% (5%) [10]. Determinant(s)' group: (1) Human Capital; (2) Labor and demographic change; (3) Technological progress, innovation, and structural change; (4) Macroeconomic conditions; (5) International trade and FDI; (6) Natural resources and geography; (7) Institutional conditions.

Appendix 3: Empirical evidence on very long-run economic growth (continued)

Group	Country	Title (published year)	Period	Method	Determinant(s)	Main results
EEs (#3)	Brazil	Political instability, institutional change and economic growth in Brazil since 1870. Campos et al. (2020)	1870-2003	power-ARCH	(7) Informal Political instability - IPI, Formal Political Instability - FPI	IPI: direct and indirect effect [-] FPI: direct effect [-], indirect effect (→)
	Argentina	Two to tangle: Financial development, political instability and economic growth in Argentina. Campos et al. (2012)	1896-2000	power-ARCH	(4) Financial development (7) Informal Political instability - IPI, Formal Political Instability - FPI	Financial development: direct effect [+], indirect effect 0 IPI: direct effect [-], indirect effect 0 FPI: direct effect 0, indirect effect [-]
		Growth, volatility and political instability: Non-linear time-series evidence for Argentina, 1896-2000. Campos and Karanasos (2008)	1896-2000	power-ARCH	(7) Informal Political instability - IPI, Formal Political Instability - FPI	IPI: direct effect (→), indirect effect 0 FPI: direct effect 0, indirect effect [-]
	South Africa	Infrastructural investment in long-run economic growth: South Africa 1875-2001. Fedderke et al. (2006)	1875-2001	VECM	(4) Infrastructure spending	(++)
LDC (#1)	Mozambique	Institutional drivers, historical determinism, and economic development in Mozambique. Pereira and Luiz (2020)	1900-2005	VECM; Granger-causality	(7) Property rights – ECO, Political rights – POL	POL: 0, between 1900-1974; +++, between 1975-2005 ECO: (++), between 1900-1974; 0, between 1975-2005

Note. +++ (+) [+], statistically significant at 1% (5%) [10]. Determinant(s)' group: (1) Human Capital; (2) Labor and demographic change; (3) Technological progress, innovation, and structural change; (4) Macroeconomic conditions; (5) International trade and FDI; (6) Natural resources and geography; (7) Institutional conditions.

Appendix 4: Recent empirical evidence on Brazilian economic growth

Determinant(s)	Title	Period	Method	Economic growth proxy	EG determinants (variables)	Main results
Aggregate demand	Productivity, real exchange rate, and aggregate demand: An empirical exercise applied to Brazil from 1960 to 2011. Alencar et al. (2018)	1960-2011	OLS	GDP	Real wage	[+]
	An empirical test of the Post-Keynesian growth model applied to functional income distribution and the growth regime in Brazil. de Jesus et al. (2018)	1970-2008	VAR; Granger-causality	GDP growth rate	Profit share	0 note: [-] indirect effect through capital accumulation
	The economic of demand-led growth. Theory and evidence for Brazil. Oreiro et al. (2012)	1991-2005	ARDL-ECM	GDP	Exports	[+]
					Investments	[+]
Monetary policy	Macroeconomic performance in Brazil under the inflation targeting regime. Araújo et al. (2018)	2002-2015	VAR; IRF; Granger-causality	Industrial production growth rate	Government consumption	[+]
					Money supply (M ₂)	0
	Analysis of the relationship between short and long terms monetary and fiscal policy with economic growth in Brazil: Application of models VEC. Santos et al. (2015)	2001-2013	VEC	GDP	Interest rate	Negative effect
					Inflation	[-]
Tourism	Real exchange rate, exchange rate misalignment and economic growth in Brazil (1994-2007). Oreiro et al. (2011)	1994-2007	IV	GDP growth rate	Interest rate	[-]
					Exchange rate misalignment	[-]
	A note on inflation targeting regime and economic growth in Brazil. Libânio (2010)	1999-2006	VAR	Industrial production index	Exchange rate	[-]
					Interest rate	[-]
Government expenditure	Research note: Tourism as a factor of growth: The case of Brazil. Brida et al. (2011)	1965-2007	VEC; Granger-causality	GDP per capita	International tourism industry	0
	Size of government and economic growth in the largest Latin American country. Mendonça and Cacicdo (2015)	2000-2013	OLS; GMM	GDP growth rate	Total government expenditures	(++)
					Total taxes	(++)
	Counter cyclical fiscal policy, international financial crisis and economic growth in Brazil. Gadelha (2011)	1980-2008	VAR; Granger-causality	GDP	Public investments	+++
Note. +++ (++) [+], statistically significant at 1% (5%) [10].						

Appendix 4: Recent empirical evidence on Brazilian economic growth (continued)

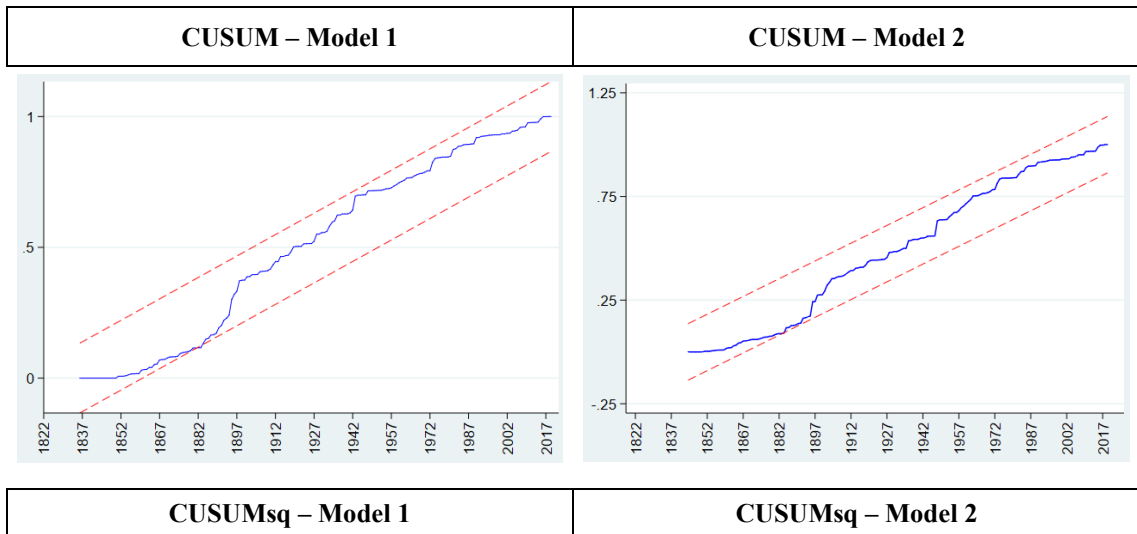
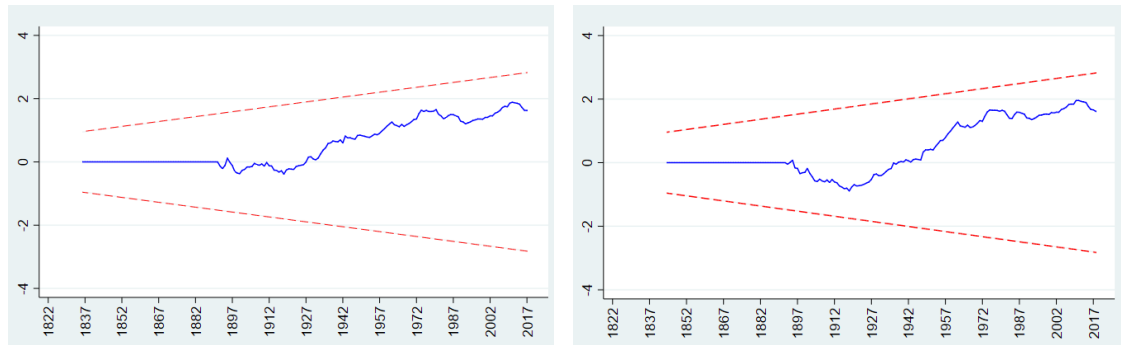
Determinant(s)	Title	Period	Method	Economic growth proxy	EG determinants (variables)	Main results
Financial system	New evidence on the causality between financial system and economic growth in Brazil using time series in the frequency domain. Rocha and Souza (2018)	1960-2010	VAR; Granger-causality	GDP per capita	Credit to private sector	+++
	Bank versus stock market development in Brazil: An ARDL bound testing approach. Nyasha and Odhiambo (2017)	1980-2012	ARDL-ECM	GDP growth rate	Bank-based financial development index Market-based financial development index	0 [+]
	Financial liberalization, economic performance and macroeconomic stability in Brazil: An assessment of the period 1994-2007. de Paula et al. (2012)	1994-2007	VAR; IRF	GDP	Financial integration index	Negative effect
	Financial development and economic growth in Brazil: 1986-2006. Stefani (2007)	1986-2006	VAR	GDP	Credit to private sector Stock market capitalization	(++) (++)
Commodities exports	Types of commodities, exchange rate and economic growth: Evidence from natural resource curse for Brazil. Verissimo and Xavier (2014)	2000-2011	VAR; IRF	GDP growth rate	<i>Commodities price:</i> Food sector Raw materials Mining resources Energy	<i>Commodities price:</i> (-) Food sector (-) Raw materials [-] Mining resources [-] Energy
	Exchange rate, exports and growth: An investigation on the hypothesis of the dutch disease in Brazil. Verissimo and Xavier (2013)	1999-2010	VAR; IRF; Granger-causality	GDP growth rate	Commodities export Commodities price	Negative impact. Variance decomposition (3%) Negative impact. Variance decomposition (6.4%)
	Revisiting the growth of Brazilian economy. Orçiro et al. (2018)	1980-2012	OLS	GDP	Share of manufacturing industry	+++
Energy consumption	Economic growth and energy consumption in Brazil: Cointegration and causality analysis. Mele (2019)	1980-2017	VEC; Granger-causality	GDP per capita	Energy consumption per capita	[+] bidirectional causality
Note. +++ (++) [+], statistically significant at 1% (5%) [10].						

Appendix 4: Recent empirical evidence on Brazilian economic growth (continued)

Determinant(s)	Title	Period	Method	Economic growth proxy	EG determinants (variables)	Main results	Indirect effect
Institutional quality	Political instability, institutional change and economic growth in Brazil since 1870. Campos et al. (2020)	1870-2003	power-ARCH	GDP growth rate	<i>Informal Political instability:</i>		
					Anti-government demonstrations	[-]	[-]
					Assassinations	[-]	[-]
					General strikes	[-]	[-]
					Guerilla warfare	0	[-]
					Number of coup d'état	(-)	[-]
					Revolutions	---	0
					Riots	0	[-]
					<i>Formal Political instability:</i>		
					Changes in effective executive	[-]	[-]
					Government crisis	0	---
					Legislative effectiveness	(-)	(-)
					Legislative selection	[-]	(-)
					Major constitutional changes	[-]	0
					Number of cabinet changes	[-]	[-]
					Purges	0	(-)
					Size of cabinet	[-]	[-]

Note. +++ (++) [+] [-], statistically significant at 1% (5%) [10].

Appendix 5: CUSUM and CUSUMsq plots – Models 1 and 2.



Note. The red dashed lines represent the 5% confidence interval; the blue line stands for CUSUM and CUSUMsq.

Source: Authors' computation using STATA 15.1

Appendix 6: Bai-Perron test for multiple structural breaks on VECM models

Variable	t-statistic		Critical values		
	Model 1	Model 2	1%	5%	10%
$F(1 0)$	0.22	0.38	22.40	18.23	16.14
$F(2 1)$	0.27	0.57	24.42	19.91	18.14
$F(3 2)$	0.16	0.38	25.53	20.99	19.10
$F(4 3)$	0.10	0.17	26.17	21.71	19.84
$F(5 4)$	0.18	0.02	26.53	22.37	20.50

Note. Each row correspond to a different hypothesis, that is, the null of s breaks against the alternative of one more break, $s+1$ ($F[s+1|s]$).

Source: Authors' computation using STATA 15.1.

Appendix 7: Long-term relations of growth, human capital, structural change and institutional quality, Brazil, 1930-2019

	VECM 1	VECM 3
Human capital (HC)	0.970*** (0.155)	1.765*** (0.396)
Structural change (SC)	1.431*** (0.302)	4.010*** (0.942)
	-2.906* (1.611)	0.372 (0.420)
Institutional quality (IQ)	0.071 (0.089)	-0.039 (0.060)
Lags	2	2
Number of cointegrating vectors	1	1
Cointegration vector	Restricted constant	Restricted constant
Jarque-Bera test (overall) ⁽¹⁾	5.028 (0.081)	5.936 (0.051)
Lagrange-multiplier test ⁽²⁾	13.827 (0.612)	15.793 (0.921)
Eigenvalue stability condition ⁽³⁾	0.120	0.065

Notes. All variables are in logarithms; The number of lags was established according to the Schwarz's Bayesian information criterion (SIC); All cointegrating vectors include a constant and a trend. (1) H_0 : the disturbances in the VECM are normally distributed; (2) H_0 : no autocorrelation at lag order; (3) the cointegrating equations are stationary when the estimated root is not close to 1.

Source: Authors' computation using STATA 15.1.

Appendix 8: Granger (non-) causality tests, Brazil, 1930-2019

Null hypothesis	Model 1
Structural change <i>does not</i> Granger cause Economic growth	9.761*** (0.008)
Human capital <i>does not</i> Granger cause Economic growth	13.152*** (0.043)
Institutional quality <i>does not</i> Granger cause Economic growth	3.137 (0.208)
Economic growth <i>does not</i> Granger cause Structural change	2.423 (0.298)
Economic growth <i>does not</i> Granger cause Human capital	9.300*** (0.010)
Economic growth <i>does not</i> Granger cause Institutional quality	1.354 (0.508)
Structural change <i>does not</i> Granger cause Human capital	0.192 (0.908)
Structural change <i>does not</i> Granger cause Institutional quality	0.488 (0.784)
Human capital <i>does not</i> Granger cause Structural change	0.090 (0.956)
Human capital <i>does not</i> Granger cause Institutional quality	0.214 (0.784)
Institutional quality <i>does not</i> Granger cause Structural change	3.089 (0.213)
Institutional quality <i>does not</i> Granger cause Human capital	6.955** (0.031)

Notes. (**) [*] statistically significant at (5%) [10%]; All variables are in logarithms; The number of lags was established according to the Schwarz's Bayesian information criterion (SIC); The re-estimated VAR involves the set of endogenous variables with p lags plus a constant; Wald test chi-square are displayed with p-values in brackets.

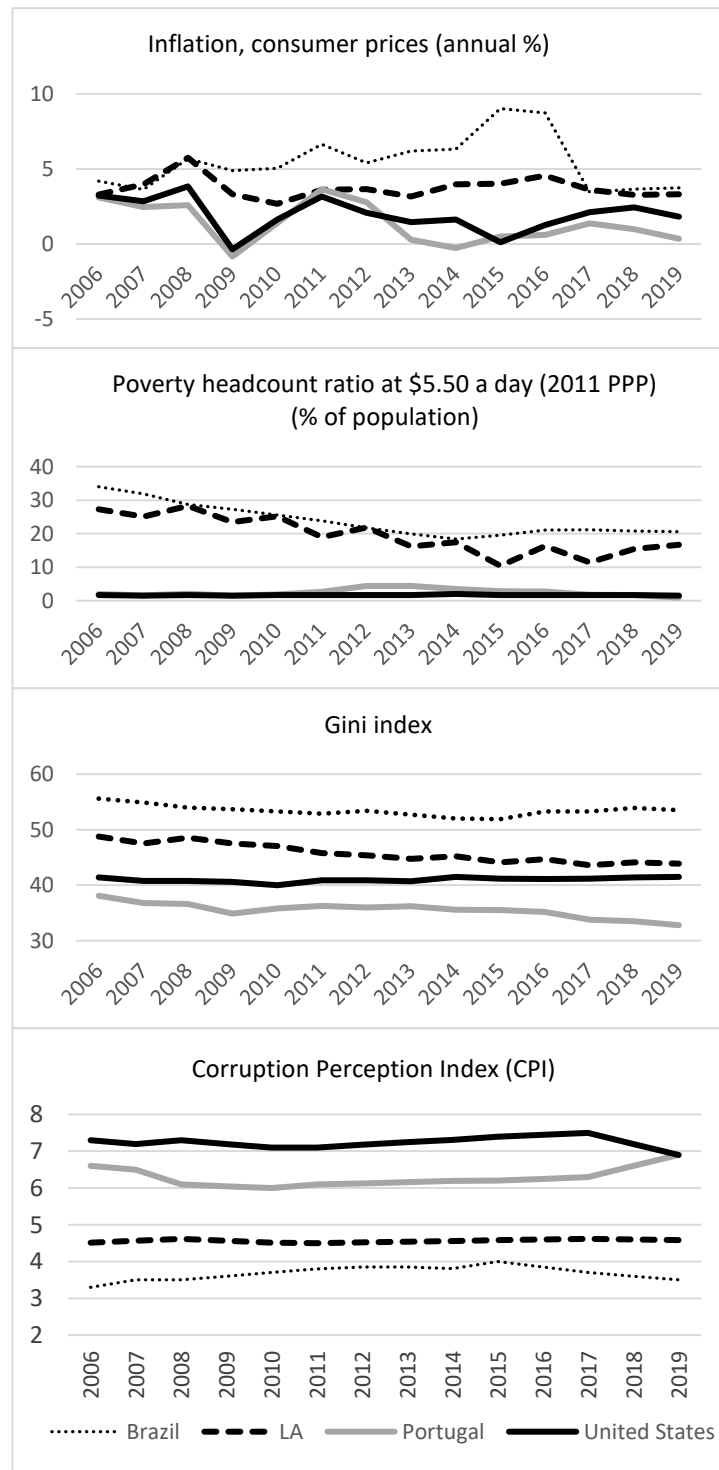
Source: Authors' computation using STATA 15.1.

Appendix 9: List of Emerging Economies in Latin America and the Caribbean

Latin America		The Caribbean
Argentina	Costa Rica	Dominican Republic
Brazil	Ecuador	Jamaica
Chile	El Salvador	Trinidad and Tobago
Colombia	Guatemala	
Mexico	Panama	
Peru	Paraguay	
Uruguay	Venezuela, RB	

Note. The countries were grouped according to the 2020 classification of the IMF, World Bank, and United Nations. Countries in bold are those considered in the study.

Appendix 10: Inflation, Poverty, Gini index, and CPI – Brazil, LA6, Portugal, the US, 2006-2019



Source: Authors' elaboration based on data from WB Database and Transparency International Database.

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