Finance, Institutions and Growth in Brazil since 1890: Evidence from a New Dataset

ABSTRACT

This study revisits the growth-finance nexus using a new econometric approach and unique data set. In particular by employing the smooth transition framework and annual time series data for Brazil from 1890 to 2003, we attempt to address on the one side, what is the relationship between financial development, trade openness, political instability and economic growth and, on the other, how it changes over time. The main finding is that financial development has a mixed positive and negative time-varying impact on economic growth, which significantly depends on jointly estimated trade openness thresholds. Moreover our estimates highlight a positive impact of trade openness on growth but with interesting variation regarding their size and power, whereas the effect of political instability (both formal and informal) on growth is mainly negative. We also find that changes between regimes tend not to be smooth. Finally, our estimates show that in 57% of the years in which financial development has a below the mean effect, we find that trade openness experiences a substantial above the mean change.

JEL classification: C14; O40; E23; D72

Keywords: Economic growth; financial development; political instability; smooth transition models; trade openness

1. Introduction

Already by the end of the 1990s, the gross domestic product of the four BRIC countries (Brazil, Russia, India and China) accounted for almost a quarter of the world's total gross domestic product (*gdp*) in purchasing power parity terms. According to Goldman Sachs (O'Neil 2001) it is noted that the Brazilian economy is expected to overtake the Italian by 2025, the French by 2031 and the German and British by 2036. Brazilian *gdp* was about US$ 2.253 trillion in 2012 making it the seventh largest economy in the world and by far the largest one in Latin America. This constitutes a remarkable transition. In the last 130 years or so, Brazil (and a handful of other emerging markets) was transformed from a poor, rural, authoritarian, and over-specialized economy to a vibrant and democratic market economy. This transition has not received the attention it deserves and, consequently, a number of important questions remain inadequately addressed and under-researched.

This paper tries to start filling these lacunae by systematically investigating the time-varying links between finance, political instability, trade openness and economic growth in Brazil from the 1890s. It uses the smooth transition framework and new data for Brazil covering a very long period of time (1890-2003). The study addresses the following specific questions: What is the precise relationship between economic growth, on the one hand, and financial development, trade openness, and political instability on the other? Does the intensity and the sign of these effects systematically vary over the time? Has the transition between such possible regimes been often smooth or has it generated substantial costs and negative externalities?

Martin (2000) argued that one of the key elements of economic geography renaissance is the so-called institutional turn, that is the realization that the evolution of economic activity cannot be fully understood without careful examination of various political and social institutions. Hence an important issue consists of the channels through which political instability (that is, changes in formal and informal institutions) is expected to influence economic growth. It might be expected that instability will make property rights less secure and transaction costs too high, the rule of law weak and state capacity too thin to support sustained growth episodes. For example, Torstensson (1994) argues that many developing countries lack secure private property rights and that arbitrary seizures of property slow down economic growth.

Kovac and Spruk (2016) quantified the impact of transaction costs on cross-country economic growth and find a significant negative effect of increasing transaction costs on growth. Weingast (1997) puts forward a game-theoretic framework to study the issue of political officials' respect for the political and economic rights of citizens in which democratic stability and the rule of law entails that political officials have motives to honor a range of self-enforcing limits on their behavior. Concluding, Acemoglu et al. (2015) study the direct and spillover effects of local state capacity in Colombia and find that the existence of central and local states with the ability to impose law and order is vital for economic development. They also note that the efficiency of state capacity is affected by various factors such as geographic, historical, political and social ones.

Our econometric result supports as main finding the notion that development of financial institutions should occupy center stage in understanding the process of economic growth. For the case of Brazil it is found to have more direct and robust impacts than, for instance, trade openness or political institutions. Hence the paper relates closely to the literature on the finance-growth nexus. Schumpeter (1934), Gurley and Shaw (1955) and Goldsmith (1969) argue that financial development is central to economic growth, while Hicks (1969) illustrates this case by documenting that financial development drove industrialization in England by encouraging flows of capital. More recent

endogenous growth scholarship concludes that the financial sector has an extremely positive role in the economy (Bencivenga & Smith, 1991). Financial development leads to more efficient allocation of resources, reduces uncertainty and transaction costs, and promotes more rapid capital accumulation and technological advancement (Roubini & Sala-I-Martin, 1992; King & Levine, 1993; Greenwood & Smith, 1997; Levine, 1997; Levine, 1999; Levine, 2005). It should be noted, however, that authors such as Gavin and Hausmann (1996), and Loayza and Ranciere (2006) argued that in the short-run financial liberalization and expansion without any constraints could cause banking crises and thus economic collapse. Kar et al. (2011) highlight the difficulty in establishing the exact relationship between economic growth and financial development and argue that there is no clear evidence on the direction of the causality between them.

One of the most influential studies of the long-run Brazilian economic growth is de Paiva Abreu and Verner (1997). Covering a period from 1930 to 1990 they analyze the effects of various factors such as financial development, trade openness and education policies on economic growth. Their results show little evidence supporting the notion that financial development boosted economic growth. In contrast Bittencourt (2011) argued that financial development played a significant role in promoting growth in Latin America. Moreover Pinheiro and Bonelli (2005), Vale (2005), Muichos and Nakane (2006) and Stefani (2007) examined the relationship between financial development and economic growth in Brazil and found that a strong positive relationship exists between financial development and output growth.

Another contribution of the paper relates to the economics of an important emerging market, Brazil. Brazil is a relevant case to study because of its size (both in terms of populations and output), its hegemonic role in South American and its relatively important role globally (as one of the original BRIC countries). This exercise also provides a deeper understanding of the specific case of Brazil. The Brazilian case is important because despite the reputation of having a relatively peaceful history, this is a country that exhibits a huge variety of types of instability of political institutions (indeed of all the formal and informal types one can find in large cross-sections of countries) under considerable variation of contexts (empire and republic as well as over varying degrees of democracy and autocracy), over the very long time window we consider.

Our study uses a new econometric approach to these issues, namely the smooth transition framework, which allows us to examine positive and negative effects jointly. We find that financial development has a mixed positive and negative time-varying impact on economic growth, which significantly depends on jointly estimated trade openness thresholds. As far as trade openness is concerned there is a positive effect on growth throughout the period, albeit we identify periods where this impact is either high or relatively low. Finally, with respect to the impact of political instability, both informal and formal, on output growth, this is mainly negative, with the interesting exception of the revolutions where a mixed time-varying relation was detected.

This paper is organized as follows. Section 2 presents a brief early economic and political history, which explains the economic performance of Brazil from 1890 to 2003. Section 3 provides details and justification for our econometric methodology and Section 4 describes the data. Section 5 presents our results and finally Section 6 concludes and suggests directions for further research.

2. Economic and Political Environment of Brazil

In the following paragraphs we will cover the period 1890 to 2003 from an economic and political point of view as well, stressing both financial development and political instability[1].

Late 19th and Early 20th Century

The military started to express its opinion publicly and to debate government policies in 1879. More specifically the latter supported education, industrialization, abolition of slavery, regeneration of the nation and guarding of the fatherland, the so-called *solider citizen*, by proclaiming them as agents of social change. Under Deodoro's orders, on November 15th 1889, the army captured the Royal Palace, the main government building and silenced Rio de Janeiro. Using a strict authoritarian tone the Marshal of the general order announced to the surprised nation that from then on the empire belonged to the past. The day after November 15th, Deodoro declared Brazil a federal republic. The period that followed, the First Republic (1889-1930), was characterized by political unrest as well as the politics of coffee with milk (known as *cafe com* le*ite*), a combination of the São Paulo coffee and the Minas Gerais milk political elites. The main target of the First Republic was to balance the power between the two oligarchic elites (that of coffee and milk) and the army. However, the problems of the oligarchic system developed further. More specifically the `Tenent Revolt' of 1922 and 1924 rocked the interior of Brazil.

1930s and 1940s

During the Great Depression of 1929, coffee exports were brought to a deadlock, while the Paulista regime hooked up to power, resulting in the end of the politics of coffee with milk agreement. In 1930, the situation got out of control, where gun assassinations and revolutions took place (for example the Revolta da Princesa outburst in the Northeastern state of Paraiba and the assassination of João Pessoa, governor of Paraiba occurred. Shorty after Pessoa's death, more riots followed, including the Revolution of 1930, on October 24th 1930).

Getúlio Vargas, after failing to be elected as president in 1930, led a revolt that placed him in power. From 1930 until 1934 he ruled Brazil as a dictator, from 1934 to 1937 he was elected as president and then again as a dictator from 1937 to 1945. Under the Estado Novo (1937-1945), among others, state autonomy ended, all political parties were dissolved and governors were replaced until 1944 (see Hudson, 1998). After 1945, Vargas still served as a senator until 1951, when, after general elections, he was elected president, a position which was held by him until 1954. Hence Getúlio Vargas played a central political role in Brazil for nearly 24 years. According to Maddison (1995), during the Vargas era (and up to 1980) the economic growth of Brazil was among the highest in the world. The Vargas years had a significant impact on national politics and economics. Even in the 1990s, the local political leaders were still called colonels. During his era, reorganization of the armed forces, the economy, international trade and foreign relations took place. The average annual *gdp* growth rate during that period was 4%. Finally, the 1930-1945 period added a new term to the Brazilian political lexicon, that of corporatism[2]. Vargas committed suicide on August 24, 1954. However, his influence in Brazilian

[1] For more information for the early and mid-19th Century see Appendix C.

[2] The term developed mostly in Italy under Benito Mussolini. Corporatism is a concept opposite to that of Marxism and Liberal Democratic political philosophies.

politics remained indelible for decades (Hudson, 1998). Thus during the 1930s and 1940s Brazil was characterized by significant political unrest.

1950s and 1960s

If corporatism was the benchmark of the 30s and 40s period, populism, nationalism and developmentalism dominated the two following decades (50s and 60s). Each of these terms contributed to the crisis that occurred in Brazil, which resulted in the authoritarian regime that occurred after 1964. By the early 1960s, Brazilian society was boiling. Labor classes became more and more active seeking a better future, and the population continued to grow beyond the state's capability to increase educational and social services. As a consequence, the conservative elites alongside the middle classes, which tended to follow the elites' vision considering the lower classes as a threat, feared that they were going to lose control of politics and of the state. It was the same elites that opposed Vargas due to his intention to use the state for a fairer distribution of resources.

During the period 1956-1961 Juscelino Kubitschek (who was the only post Vargas elected president to serve a full term) promoted the establishment of an automotive industry, which could help Brazil to overcome the economic stagnation. The new factories produced 321,000 vehicles in 1960. Among his legacies are the world's eighth largest automobile production and a great highway network of the late twentieth century. Constant motorized advancement in farm equipment and changes in transportation transformed the vast countryside areas of Mato Grosso and Goias, making Brazil the world's number two food exporter. All these led the overall economy to grow by 8.3% a year. Hence there might be some truth in Kubitschek's motto *Fifty Years of Progress in Five* (Hudson, 1998).

Brazil of 1960 was completely different from that of 1930. The population reached 70 million from 34 million in 1930, with 44% residing in urban areas. Life expectancy increased as well. The number of workers increased from 1.6 million in 1940 to 2.9 million in 1960, an approximate 100% increase in 20 years. The share of industrial productivity as a percentage of *gdp* was higher (25.2%) than of agriculture (22.5%). From the other side the annual rate of inflation kept rising from 12% in 1949 to 26% in 1959 and to the shocking 39.5% in 1960. Savings depreciated, lenders' unwillingness to offer long-term loans that are essential for investments, high interest rates and the government's refusal to comply with the International Monetary Fund (IMF) conditions created a negative environment among the people. The high differences between poor and rich remained, with 40% of the national income to be enjoyed by 10% of the population, 36% going to the next 30% and the remaining 24% distributed to the remaining 60% of the population. Struggling to maintain control, the government of João Goulart[3] in a huge rally in Rio de Janeiro on March 13th 1964 attempted to promote reforms. An opposition rally held six days later in São Paulo put 500,000 people on the streets. Rio de Janeiro's Correio da Manha (a daily newspaper of Rio de Janeiro) published an unusual front cover with the headline *Enough* whereas the next day's front cover had the title Out. In the next few days the military intervened to secure the country and Goulart fled to Uruguay. The period of the military republic (1964-1985) had begun. Summarizing, the 1950s and 1960s periods were marked by high political instability, which in turn affected the level of the trade openness of the Brazilian economy in different ways.

1970s and 1990s

[3] Vice President, a populist and a minister of labor under Vargas, he won the presidency on the 7th of September 1961 until the 1st of April 1964 when he left power.

As with the previous regime changes of 1889, 1930 and 1945, the coup of 1964 divided the military into two groups. The first one included those who believed that they should focus on their professional duties and the second group, the hard-liners, who believed that politicians were betrayers that would deliver Brazil to communism. The dominance of the hard liners' opinion led Brazil into what a political scientist (named Juan J. Linz) defined as *an authoritarian situation*. In 1983 the economy was running with average *gdp* growth of 5.4%, but the importance of this was diminished by the rising inflation and the weak and disheartening political leadership. Millions of Brazilians went out to the streets in all major cities demanding a direct vote (diretas ja). In April 1984, Congress failed to achieve the necessary numbers in order to grant the people's wish and the choice was left to an electoral college. On January 15th 1985, the Electoral College elected Tancredo Neves of Minas Gerais. Similarly to the regime changes of the previous years (namely that of 1822, 1889, 1930, 1946 and 1964) the 1985 change would prove to be full of obstacles as well. Some years later it was Fernando Collor de Mello's turn to rule the country (in office from 1990 to 1992). Mello was the first Brazilian president elected directly by the people. During his term in office he attempted to control hyperinflation and started a massive program of privatization of state-owned firms. His tenure ended in 1992 with the presidency of Itamar Franco, who stayed in power until 1995. The last five years of the 20th century found Fernando Henrique Cardoso in office, whose administration was characterized by the promotion of human rights in Brazil.

To sum up, the period since 1890 is a significant era for Brazilian history since the country experienced significant economic and political expansion, being transformed to an emerging market and forming one of the BRIC countries. However, there is an ongoing debate which tries to identify the key factors that are responsible for this astonishing route. Financial development, trade openness and macroeconomic stability are the main factors that most of the previous literature pays attention to. This paper will attempt to shed light on the main causes of economic growth since there seems to be a dissatisfaction within the empirical growth literature. Using data that cover a period from 1890 to 2003 we will try to explain (under a smooth transition approach) the role that financial development, trade openness and political instability played in economic growth and the transformation of Brazil in general (for a brief review of the main political events\periods in the history of Brazil see Table B1 in the Appendix B).

3. Econometric Framework

Non-linear models have attracted the interest of more and more researchers in recent years. Chan and Tong (1986) introduced the threshold autoregressive (TAR) models. Then Teräsvirta (1994) suggested a specification technique of three stages, assuming that if the process is not linear, then the alternative might be a smooth transition autoregressive (STAR) model, which captures regime-switching behavior. The first stage of the estimation procedure is to identify a linear autoregressive model. The second focuses on testing linearity for different values of d, the delay parameter, and the third one on choosing between an exponential STAR (ESTAR) or a logistic STAR (LSTAR) by testing a sequence of three hypotheses (see Teräsvirta, 1994). Nevertheless, initial estimation of both models and the usage of post-estimation information criteria could provide us with the final choice between the models, Teräsvirta (1994). The STAR model for the economic growth series y_t is given by

$$y_t = \phi_1' x_{t-l} + \phi_2' G(s_{t-d}) x_{t-l} + \epsilon_t \qquad (1)$$

where $x_{t-l} = (1, x_{1,t-l_1}, x_{2,t-l_2}, x_{3,t-l_3})'$ is the 4×1 vector of the constant and the three explanatory variables, $\varphi_i = (\varphi_1^{(i)}, \dots, \varphi_4^{(i)})', i = 1,2$ (where superscript i in parentheses denotes an index), are the 4×1 vectors of coefficients, and $G(s_{t-d})$is the transition function (see eq. 2 below), which changes smoothly from 0 to 1 as the transition variable s_{t-d} increases; the term d determines the lag-length of the transition variable and $\{e_t\}$ are independently and identically distributed $(i.i.d)$ random variables. Here we use the first order logistic function, which is defined as:

$$G(s_{t-d}) = \frac{1}{1 + e^{-\gamma(s_{t-d}-c)}}, \qquad (2)$$

where γ determines how smooth the change in the value of the logistic function is (and hence the transition from one regime to another) and the intercept c is the threshold between regimes. In eq. 2, when the smoothness parameter becomes very large ($\gamma \to \infty$) then the transition is abrupt. When $\gamma \to 0$ the logistic function approaches a constant. Thus when $\gamma = 0$ the LST model reduces to a linear one. However, previous research shows that the transition parameters γ and c are quite difficult to estimate (see Teräsvirta, 1994). Following Teräsvirta (1994) we test whether the non-linear model is preferred and if the use of the logistic function is warranted.

4. Construction of our New Dataset

Our data set contains annual data of economic growth, financial development, trade openness and political instability for Brazil between 1890 and 2003, excluding the World War years. The main data source for the first three series is Mitchell (2003), (see Figures A.1-A.6 in the Appendix A). Economic growth is measured as the annual growth rate of *gdp* at level. Our three measures of financial development consist of commercial bank deposits (*cbd*), deposits at Banco do Brasil (dbb) and money supply (*m1*). *Cbd* is defined as the sum of time deposits in commercial banks and deposits at the end of the period in commercial banks over *gdp* and alongside dbb it tries to capture the efficiency of the financial sector and not its relative size. Data have been reported by Mitchell (2003) but due to missing values we follow the approach of Pelaez and Suzigan (1976) to reconstruct the series. The second financial development indicator is the ratio *m1* over *gdp* (retrieved from Mitchell, 2003). One potential drawback of this measure is that the ratio reflects the depth or the relative size of the financial system and not its efficiency. The third and final one, *dbb*, is measured by the added value of time deposits and deposits at the end of the period in the central bank over *gdp*. Given *m1*'s and *dbb*'s more restrictive nature we use both of them as a robustness check of our results and thereby we attach greater weight to commercial bank deposits.

As far as trade openness (*to)* is concerned we use the standard ratio of exports plus imports as a share of *gdp*. The idea that trade liberalization is the horsepower of growth has its roots back in Adam Smith. Among others Krueger (1978) and Wacziarg and Welch (2008) argued that trade openness does indeed lead to higher growth rates. The IMF (1997) has stated that policies favoring international trade are among the most significant elements in promoting economic expansion and convergence in developing countries. In addition, a report from the OECD (1998) concluded that more open and outward oriented economies tend to surpass countries with restrictive and more isolated trade policies. Finally, Fischer (2000) during a lecture (for further information see Rodriguez and Rodrik, 2001), argued that the optimal way for a nation to grow is to harmonize its policies with the global economy. However, these arguments were lacking general approval especially after the Great War in developing countries and in particular Latin America, which very often adopted the so-called Import Substitution Industrialization policies that imposed barriers on international trade. The outbreak of

World War II turned Latin America back to protectionism and to high tariff policies and it was not until the 1990s when liberal policies took effect (Edwards, 1994). This paper tries to capture these changes in trade policies by using trade openness as the transition variable in the case of Brazil for the following reasons. Brazil is the most advanced industrial economy in South America (Pereira et al., 1993). According to the United Nations' statistical agency[4] it is a major exporter of iron ore and concentrates, petroleum oil, soya beans, coffee and processed meat, and it is involved in the manufacture of small aircraft. Finally, the importance of trade policies for successive Brazilian governments is apparent from: the fact that its patent law dates back to 1809 (in contrast to Germany, where it only appeared 70 years later); their participation in every international conference associated with intellectual property rights since that time; and the signing of the founding declaration of GATT (General Agreement on Tariffs and Trade) in 1947 (Lattimore and Kowalski, 2009).

The data we use for political instability measures constitutes one of the main contributions of this paper. We use a taxonomy of political instability divided into two categories, informal and formal (Campos et al., 2012). Formal political instability originates from within the political system, whereas informal from outside. Both formal and informal political indicators are recorded yearly for Brazil from 1919 to 2003 with the exclusion of the World War II period (1940-1945), see Banks (2005). However, in order to track our political instability variables back to the year of 1890, we constructed our own informal and formal political instability series from 1890 to 1919.

In the spirit of Acemoglu et al. (2019) and according to the definitions of the political instability variables (see below), we collect the related political events from 1890 to 1930. Then, by comparing the data we constructed to the existing data from 1919 to 1930, we can evaluate the accuracy of the series we generated. More specifically, for the creation of this new data set of political instability measures, all suitable political events from years 1890 to 1930 were recorded and grouped into different forms of political instability[5]. We then took advantage of the intentional overlap between the series during the period 1919 to 1930 to assess whether or not the new dataset was reliable. We find that there are a few cases where there is little difference between the two series and hence argue that the new data set is as reliable as the Banks (2005) data.

The informal political instability measures consist of: the number of demonstrations (*dem*), defined as peaceful public gatherings of at least 100 people; revolutions (*rev*), representing illegal or forced change in the top governmental elite, attempts at, or successful or unsuccessful armed rebellion; the number of strikes (*str*) of 1000 or more workers involving multiple employers and aimed at government policies; and coups d'etat (*coup*) measuring the number of overthrows/sudden and forced seizure of the government (see Figures A.2 and A.5).

Formal political instability is measured by: purges (*pur*) including any systematic elimination by jailing or execution of political opposition within the ranks of the regime or the opposition; the number of constitutional changes (*cc*) including governmental crises; legislative selections (*ls*) taking the value 0 when no legislature exists, the value 1 in the case of nonelective legislature (an example could be the selection of legislators by the effective executive, or by means of heredity or ascription) and 2 when legislators or members of the lower house in a bicameral system are selected by means of either direct or indirect popular election; and legislative elections (*le*) defined as the number of elections for the lower house each year (see Figures A.3 and A.6).

[4] For further information regarding Brazil's profile check the: http://comtrade.un.org.

[5] Detailed archives of each year's political events available upon request.

The substantial number of informal and formal indicators may introduce strong biases and inflate the measurement error by increasing the noise-to-signal ratio. To circumvent these concerns, we conduct principal component (PCA) as well factor (FA) analysis in order to classify variables into components/factors and hence check whether this kind of latent analysis confirms the dominant blocks of informal and formal political instability[6]. From the PCA and FA two main components/factors were extracted (with a zero-correlation coefficient). The first component has an eigenvalue of 2.53 and it consists of formal political instability indicators whereas the second component has an eigenvalue of 2.26 consisting of the informal political instability measurements. Moreover, based on the explained and unexplained variation of each of the two components the formal instability is more powerful than the informal one. Furthermore, among all informal indicators, guerrilla warfare and coups d'etat display the lowest unexplained variation, whereas among the formal ones it is legislation selection and purges (figures not tabulated).

Results from the various unit root tests are presented in the Appendix A. In particular, unit root tests with breaks (provided by Zivot-Andrews [ZA], 1992 and Lumsdaine-Papell [LP], 1997) have been conducted (see Tables A.1a and A.1b). Results from the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests are presented in Table A.2. The various tests suggest that either the level of the series or their first differences are stationary. For *gdp* and informal and formal political instability the unit root hypothesis is rejected in all cases (with the exception of le, which fails to reject the unit root hypothesis when we allow for a break in the trend). Regarding the two measures of financial development, *cbd* and *dbb*, the ADF fails to reject the unit root hypothesis, while the other three tests reject it.

When we use the first difference of the series the results from the ADF (and the PP) test reject the unit root hypothesis. Similarly, for the *m1* and to, the ADF and the PP tests do not reject the unit root hypothesis for the level, whereas both tests reject it when the first differences of the series were considered. Therefore, due to the aforementioned incongruity, for all the three measures of financial development (*cbd, dbb*, *m1*) and for *to* we employ first differences. Our political instability variables enter our econometric framework one by one and thus the results are not affected by the taxonomy itself.

Comparison With Other Measures of Democracy and Institutional Development

How are our measures of informal and formal political instability related to the existing measures of Brazil's institutional development? Although our definitions and coding do not strictly match the concepts and measurements of democracy and institutional development introduced in past literature, we can still find some substantial correlations between our political instability indicators and those measures introduced by Acemoglu et al. (2002), Boix et al. (2013), Lindberg et al. (2014) and Spruk (2016a, 2016b) such as the executive constraints, dichotomous measures of democracy, various electoral factors and "de jure" and "de facto" political institutions respectively[7].

[6] To ensure the usage of principal component analysis the Kaiser-Meyer-Olkin measure of sampling adequacy was conducted. Results are not reported, but are available upon request.

[7] Due to space limitation the series are not projected but are available upon request.

5. Empirical Results

The Transition Model

In this section we use the smooth transition approach to investigate the relationship between economic growth, financial development and political instability with the level of trade openness in the economy as the transition variable. The economic history of Brazil demonstrates the close relation between trade openness and economic growth (Baer, 2013), so this is clearly the most intuitive choice for our transition variable. The reasons for the choice of trade openness as our transition variable are not just easily found in economic history but this choice is also fully supported econometrically by standard linearity tests. In particular, when *cbd* and *dbb* are used as the transition variable the rejection of the linearity hypothesis fails (from now on LM_2) to occur in the majority of the cases, 9 out of 12 (see Tables A.3a and A.3b)[8]. The reason why we do not test linearity using political instability as the transition variable is simply because our measures display (in most of the cases) the characteristics of a binary variable (taking either the value 0 or 1) and thus show very little time variation. Hence we could say that linearity rejection shows homogenous behavior only when we use trade openness as the transition variable (where linearity rejection occurs in all models).

Logarithmic Versus Exponential

A range of linearity tests suggest the use of logistic instead of the exponential function (see Tables A.4a-A.4c). The only case in which an ESTAR is the preferred choice is in two out of three cases when legislative elections serve as the political instability measure. However, based on Teräsvirta (1994) the choice between the two functions could be postponed until after both types of models are estimated and evaluated using post-estimation criteria. In our case an LSTAR model seemed more appropriate (this choice was derived from post-estimation Ljung and Box [LB] statistic for residual autocorrelation and on the basis of the minimum value of Akaike information criterion [AIC]). We use the RATS software to estimate equations (1) and (2) above.

The Lag Order

As noted in Section 3, Teräsvirta (1994) argued that specifying a linear autoregressive model constitutes the first stage of the estimation procedure. A common way would be the usage of the AIC or the Schwarz information criterion (SBIC) in order to select the appropriate lag structure of the model. However, a choice based on SBIC could lead to too parsimonious models since the estimated residuals derived from the selected model are not free from serial correlation. Hence, models suggested by any information criteria should be followed by a test of residual serial correlation, for instance the LB portmanteau test. In addition, Luukkonen and Teräsvirta (1990) stressed that (they examined the case of US unemployment) the linearity might be rejected when the lag length is increased, which indicates on one side the significance of longer lags in explaining nonlinearity and the weakness of shorter ones on the other side. We select the optimal lag length (l) that rejects stronger linearity, that is, for financial development measures $l = 3$, while for demonstrations, strikes, coups, purges and legislative elections $l = 4$. For trade openness, revolutions, constitutional changes and legislative selections the selection of $l = 4$ was made on the basis of the minimum value of LB and the General to Simple (GS) information criterion (see Table A.5). Finally, a portmanteau test, namely the LB was conducted to control for residual autocorrelation in our model and hence possible

[8] Only when *m1* serves as the transition variable does rejection of the linearity hypothesis take place in all cases (see Table A.3c).

misspecification. The results indicated no residual serial correlation (results not reported but are available upon request).

The Delay Parameter

The choice of the delay parameter is determined by the strongest linearity rejection relative to different values of d. Accordingly, we set $d = 4$. The vector of explanatory variables, for our models of Table 1 below (see also Tables A.6 and A.7), contains the drift, the third lag of the three financial development measures (*fd*) and the fourth lags of the various measures of political instability (*pi*), and trade openness (*to*). That is, $x_{t-4} = (1, fd_{t-3}, pi_{t-4}, to_{t-4})$. The preferred model was the one with $\varphi_4{}^{(2)} = 0$ and where the regime indicator variable s_{t-d} was chosen to be to_{t-4}.

Table 1 reports the baseline results. In order to calculate the time-varying effects of trade openness, political instability and financial development on growth we use the three equations A.1, A.2 and A.3 respectively.

Table 1. LSTAR model (*cbd* as the financial development measure).

	$\phi_1^{(1)}$	$\phi_2^{(1)}$	$\phi_3^{(1)}$	$\phi_4^{(1)}$	$\phi_1^{(2)}$	$\phi_2^{(2)}$	$\phi_3^{(2)}$	γ	c
dem	0.08^{***} (0.02)	-0.86^{***} (0.18)	-0.04^{***} (0.02)	0.58^{**} (0.28)	-0.04 (0.02)	1.16^{***} (0.38)	0.04^{**} (0.02)	5.54 (5.07)	-0.008 (0.00)
rev	0.07^{***} (0.02)	-0.80^{***} (0.20)	0.03^{***} (0.01)	0.88^{**} (0.39)	-0.05 (0.04)	1.12^{***} (0.44)	-0.03^{*} (0.02)	4.09 (3.26)	-0.005 (0.00)
str	0.09^{***} (0.03)	-0.86^{***} (0.25)	-0.03^{**} (0.01)	0.76^{*} (0.41)	-0.06 (0.05)	1.21^{***} (0.51)	0.03 (0.02)	3.52 (2.84)	-0.007 (0.00)
ls	0.14^{***} (0.03)	-0.78^{***} (0.21)	-0.04^{***} (0.01)	0.69^{**} (0.34)	-0.12^{*} (0.06)	1.18^{***} (0.46)	0.04^{*} (0.02)	3.94 (3.11)	-0.005 (0.00)
cc	0.06^{***} (0.02)	-0.79^{***} (0.24)	0.03 (0.02)	0.52^{**} (0.32)	-0.03 (0.03)	1.10^{**} (0.49)	-0.04 (0.04)	4.33 (4.67)	-0.007 (0.00)
le	0.13^{**} (0.06)	-1.02^{**} (0.46)	-0.02^{**} (0.01)	0.91 (0.60)	-0.14 (0.11)	1.62^{*} (0.88)	0.03 (0.02)	2.02 (1.50)	-0.005 (0.00)

Notes: Table reports parameter estimates for the following model:

$$y_t = \phi_1^{(1)} + \phi_2^{(1)} cbd_{t-3} + \phi_3^{(1)} pi_{t-4} + \phi_4^{(1)} to_{t-4} + (\phi_1^{(2)} + \phi_2^{(2)} cbd_{t-3} + \phi_3^{(2)} pi_{t-4})(1 + \exp[-\gamma(to_{t-4} - c)])^{-1} + \epsilon_t.$$

The numbers in parentheses represent standard errors.

***, **, * indicates significance at the 1%, 5% and 10% level respectively.

As far as the level of γ is concerned, the change between the two regimes is not so smooth, with the exception of legislative elections, where the transition is smoother (see the parameter estimates of Table 1 and Figure A.7a). The value of c represents the point when the transition between the two regimes happens.

5.1 Commercial Bank Deposits

5.1.1 The Impact of Trade Openness

First notice that there is a positive and statistically significant (see the coefficient $\phi_4{}^{(1)}$) time-varying relationship between trade openness and economic growth in all models of Table 1, except in the case when le is the political instability measure, where the link is positive but statistically insignificant. Notice from Figure A.8 (see also: the parameter estimates in Table 1, equation A.1 on how we calculate this effect, and the summary Table 2 below) that there are periods where the size of the positive effect of trade openness on growth is high and some periods where it is relatively low (though still positive). In the analysis below we will focus on the dates\periods where trade liberalization displayed low values, which in turn might explain the low size effect of trade openness on growth.

First Period of Low Size Effects: 1893

From our results it follows that the first period where the low size effects of trade openness on growth took place was during 1893. Political instability and violence during the first years of the First Brazilian Republic created a negative macroeconomic environment for the Brazilian economy, which might explain low levels of trade openness. The main source was the fight for power between different elite groups that had contrasting visions regarding the government model and the role of the military in society. After the adoption of the new constitution of 1891 (which established the Republic of the United States of Brazil and adopted the US system of governance) Deodoro da Fonseca and Floriano Peixoto were elected president and vice president respectively, with the former receiving 123 votes and the latter 153. However, after difficulties that the president (Deodoro da Fonseca) faced in sharing power with the Congress, he dissolved it in November 1891, simultaneously encouraging revolts in the navy and in the Rio Grande do Sul (a state in the southern part of Brazil, which is the ninth largest by area and the fifth most populous region). One of the most cruel revolts was the one that broke out in Rio de Janeiro in September 1893, the well known Revoltas da Armada (Brazilian Naval Revolts), which could constitute an extra cause of low trade liberalization levels (for more details see Appendix C).

1908 to *1910*

The second period of reduced trade openness size effects on growth occurred from 1908 to 1910. Events that might explain low trade openness during that period are the following. In 1906, the Taubate Convention was signed, in which it was proposed that the government should buy the excess coffee production at a price which would be at a minimum pre-established level, and that it should restrict the production of low-quality coffee, stimulate internal consumption, and promote the product abroad. It was the first trade intervention policy following the coffee crisis of 1902 (Luna and Klein, 2014). The aim of this Treaty was to mitigate the problems caused by the excess stock of Brazilian coffee. By 1906 Brazil was producing alone all the quantity that the whole world was consuming in a year. The significance of the coffee economy can be seen by the fact that it represented more than half of Brazilian exports, defining it as the main economic activity of the country. Although the government politics until that time were in favor of free trade, they were forced to implement policies that had a negative impact on trade liberalization during the period 1908 to 1910.

1929 to *1933*

The third period covered the years from 1929 to 1933, namely the Great Depression. The US stock market collapse of 1929 affected Latin America severely. Specifically in the case of Brazil the political repercussions of the revolution of 1930 (under Getulio Vargas) put an end to the Old Republic. In the field of the economy, the Depression had a severely negative impact on Brazil's exports, whose value fell from US$ 444.9 million in 1929 to US$ 180.6 million in 1932 (Baer, 2003). This fall in export earnings combined with the large amount of foreign exchange that the country needed in order to serve its external debt forced the government to take actions. Accordingly, after a devaluation of the currency, the cost of imports increased and hence the value fell from US$ 416.6 million to US$ 108.1 million (or by 75%). The combination of the aforementioned events (reduction in exports and imports) caused a drop in the level of trade openness that may explain the low levels of the size effect of trade liberalization on growth (for more details see Appendix C).

1947 to *1954*

The fourth period where trade liberalization size effects on growth were low covers the period from 1947 to 1954 (with the exception of 1948 and 1950, see again Figure A.8). The years after the second

war and up to 1962 were marked by severe Import Substitution Policies (ISP). From 1947 exchange controls were introduced that lasted up to 1953. The overvalued cruzeiro (the currency of Brazil from 1942 to 1986 and from 1990 to 1993) encouraged imports, which were boosted by the outbreak of the Korean War as well (Baer, 2003). Hence ISPs were considered to be an antidote to the aforementioned exchange controls by keeping the economy protected and relatively closed. Notably our results suggested a significant drop in the effect of trade openness on growth from 1951 to 1954 (when the ISP's launched). An additional occasion that might have kept trade liberalization at low levels might be when Getúlio Vargas, the Brazilian president as of 1951, tried to re-boost the weak economy (it was 3rd of October of 1953 when Petrobas was established. Petrobas is a multinational energy company with headquarters in Rio de Janeiro of Brazil). In particular during the early 1950s the government introduced a multi-level exchange rate system (the tariff law designed in 1957 with some minor changes was in force up to 1990) whose main purpose was not only to rationalize the scarcities in foreign exchange but also to offer insurance for a range of import-competing business activities (see Braga and Tyler, 1990). The main effect of these inward-looking trade policies (alternatively less extrovert trade policies) was to allocate capital to import-substitution activities and to provide protection for the domestic industry.

1969 to *1973*

An exception to the rule was the period from 1969 to 1973, where, despite the fact that we detect low size trade openness effects on growth, the history suggests that the aforementioned period was characterized by spectacular growth as well as by the increased levels of trade openness. In particular only in that period was the average annual growth of *gdp* around 11%, with that of industry reaching 13%. After years of ISPs, timid openings in trade policies occurred from 1967 to 1973 (Braga and Tyler, 1990). Policy makers realized that growth without opening in trade cannot be sustainable. Among these measures were included modifications in the exchange rates policies, the introduction of export incentives and the relaxation of the import obstacles. Following *gdp*'s upward trend, exports increased from US$ 1.4 billion in 1963 to 6.2 US$ billion in 1973 while imports in the same period rose from US$ 1.3 billion to US$ 4.4 billion (Hudson, 1998).

1974 to *1980 and 1982* to *1989*

The year 1974 and the period from 1978 to 1980 is the sixth period where low size trade openness effects (on growth) were observed. This might be attributed to events that reduced the level of the trade liberalization such as the oil shock of 1973, which might have resulted in reductions of terms of trade (this period covers from 1974 to 1980 and it is known as the period of growth with debt).

The penultimate period of low size trade liberalization effects spans from 1982 to 1989 (with the exception of 1988, when the new constitution institutionalized the first presidential election directly from the people since 1960). While the economy tried to cope with the first oil shock in 1973 a second one in 1979 doubled the price of imported oil in Brazil and worsened the balance of terms of trade even more. The debt crisis and the Lost Decade (1979-1989) had just started. The reaction was the same as with the first oil shock of 1973. The policy makers increased borrowing from abroad and further import tariffs were imposed (which worsened the trade openness). For further information see also Appendix C.

1993 to *1999*

Finally, the last period of constraint size effects of trade openness on output growth was during 1993 and from 1996 to 1999 (see again Figure A.8). The series of events and policies listed below might be responsible for low trade liberalization levels and possibly, therefore, for the low size effects of

trade openness on growth. In particular, after the constitution of 1988, the first presidential election since 1960 was held in 1989 appointing Fernando Collor de Mello (a former governor of Alagoas, located in the Northeast region and member of National Reconstruction Party [NRP] at that time) as the first president elected by the people after 30 years of military regimes. Collor de Mello was considered the solution to Brazil's economic difficulties. Despite the government's efforts to control hyperinflation and to heal the almost bankrupted public sector, inflation continued to run with rates higher than 30% a month, the levels of productivity gains were relatively low and real exchange rate appreciation, which lowered the degree of competitiveness, was observed in Latin America during 1993 (where our results indicate low trade openness size effects), Edwards (1994). In the following year the implementation of the Real Plan (Plano Real), despite its successful attempts to maintain inflation rates at lower levels, could not do much in terms of the real exchange rate appreciation that occurred. Hence the Brazilian products became more expensive and less competitive, which in turn contributed to higher current account deficits. The situation became worse when the policy of overvalued inflation rate as a stabilization tool between 1994 and 1998 was implemented by the government. The burden of these deficits became even heavier when the Asian financial crisis in 1997 and the default of Russian bonds in late summer of 1998 broke out. It was a blow to investors' confidence in emerging markets (where Brazil's exports to East Europe and Asia fell by 11.4% and 27.4% respectively, while globally they shrank by 3.5% between 1997 and 1998, see Averbug, 1999; for more details see Appendix C).

5.1.2 The Effect of Political Instability

Regarding the time-varying impact of political instability (either informal or formal) on economic growth the results show that it is mainly negative throughout (see additionally: the parameter estimates of Table 1, equation A.2, on how we calculate this effect, and the summary Table 2 below). The only exception is revolutions, where the impact on growth seems to be mixed (positive effect in 60 out of 104 cases\years) whereas that of cc is statistically insignificant[9]. According to Stokes (1952) since 1900 and up to 1950 Latin American governments were overthrown by revolts seventy six times, and nobody knows how many unsuccessful attempts occurred during those years. In the analysis below we will focus on the most important periods when revolutions seem to have affected positively economic growth.

1899 to *1902 and 1920* to *1926*

The first period with a positive size effect of revolutions on economic growth was from 1899 to 1902. During that period events of great political and economic importance took place, which might explain this positive impact. More specifically, the last decade of the 19th century was marked by countless political rebellions (two naval revolts in 1891 and 1893-1894, the Federalist Riograndense Revolution of 1893-95 and the war of Canudos in 1896-97) and a major economic bubble called Encilhamento. The devastated economy was in the hands of Manuel Ferraz de Campos Sales (the Old Republic's first civilian government), ex minister of Justice in Deodoro's provisional government, where he fulfilled his duties successfully (Bello, 1959). Campos Sales's non-inflationary policies and drastic but harsh measures at the financial level allowed the Brazilian economy to recover and to avoid the danger of bankruptcy. Notably even the Rothschilds (a well known international banking family)

[9] Time-varying effects of political instability on growth are not illustrated diagrammatically, results available upon request.

were applauding Campos Sales's efforts in the field of the economy at the end of his term of office (Bello, 1959).

The second period covers the years from 1920 to 1926 (with the exception of 1923). After the end of the first War and the signing of the Treaty of Versailles in 1919, Brazil was faced with events of great importance (which might explain this positive link) such as the Bolshevik Revolution in Russia in 1917, which was welcomed very enthusiastically by the Brazilian elite of the labor movement (Alexander and Parker, 2003) and considered by many as the harbinger of subsequent changes. Furthermore, during 1922 and later from 1924 to 1927 the Revoltas Tenentistas (Tenente Revolt) outbreak took place. The revolt was orchestrated by low rank officers demanding, among others, significant reforms in the agricultural sector, nationalization of the mines and modernization of the society. Despite the fact that it was unsuccessful it opened the way for the Revolução de 1930 (Revolution of 1930), which ended the era of the Old Republic and paved the foundations of the reinvention of the Brazilian economy (with the Constitution of 1937, for more details see Appendix C).

1930 to *1938 and 1948* to *1958*

The next nine years (1930-1938) marked the end of the Old Republic and the beginning of the Vargas Era. During most of that period (excluding the years 1931, 1933 and 1935) our results indicate a positive link between revolutions and economic growth. This might be explained by the fact that the leader of the country (at that period) Getúlio Dornelles Vargas was to leave his footprint on Brazilian political and economic life for the next 15 consecutive years. More specifically he attempted (using his populist rhetoric) to stimulate the middle class by converging the interests between the Paulista coffee oligarchy and the bourgeoisie. With his policies, especially from 1930 to 1934, he favored Brazilian manufacturers, since the traditional elites had little interest in promoting the interests of the former (industrial/manufacturers interests) during the previous years. Influenced by the Revoltas Tenentistas mentioned before, he implemented a program of social welfare and reforms that were in parallel with the New Deal (a series of reforms over the period 1933-1938, which were focused on the 3 Rs, Relief, Recovery and Reform. These reforms were the response of the American government under Franklin D. Roosevelt to the Great Depression) in the United States of America, promoting a benign macroeconomic environment that boosted growth. Sharing the dream of the New Deal, Vargas attempted to mitigate the differences between capital and labor (for further details see Appendix C).

The fourth period when revolutions had a constructive effect on growth was during 1948-1958 (excluding 1951 and 1954). Following the resignation of Vargas in 1945 the second Brazilian Republic (1946-1964) begun. History shows that during that period a series of constructive events took place (among others Dutra's and Kubitschek's presidency). In particular it all started when Eurico Gaspar Dutra (1946-1951) took control of the country. Dutra's period of administration was marked by a sequence of significant reforms and actions that favored economic growth, such as the establishment of the 5th Constitution[10], the strengthening of the relations between US and Brazil, the breaking of diplomatic relations with the USSR and the implementation of the Salte Plan, which incorporated reforms in basic economic sectors such as transportation, energy, food and health. Among others more than 4,000 new schools in rural areas were founded, railways were expanded and improved as were roads connecting Rio de Janeiro with Salvador and Sao Paolo (Hudson, 1998). Finally, the average growth rate during his term was around 7.20% (according to ipeadata) and 8.06% from 1948 to 1950 (where our results report positive impact of revolutions on *gdp* growth). In the following years (1952-

[10] The first constitution that provided full political freedom, even for the banned Communist Party and the last one that officially used the name Estados Unidos do Brasil (United States of Brazil). One of the key points of the new constitution referred to postal privacy and the prohibition of entering houses by the police without permission.

1953) Brazil continued to experience high growth rates as a consequence of the political reforms that Dutra established. The economic success of the country continued as well during the presidency of Juscelino Kubitschek de Oliveira (1956-1958), who was the only post-Vargas era president that managed to remain in office for a full term of five years. His term was characterized by political stability and respect for democratic principles. Kubitschek's political legacy was represented by the Plano de metas (Goals' Plan) comprising 31 goals[11].

1975 to *1978 and 1994* to *1995*

The penultimate period where the revolutions seem to have had a positive influence on economic expansion was from 1975 to 1978, during the Brazilian (economic) Miracle. In particular, at that time Ernesto Beckmann Geisel came to the presidency with Medici's approval. He was the second president appointed by the military junta of 1969. Despite the oil shock of 1973 he sought ways to sustain the high economic growth rates of the previous years. In particular during Emilio Garrastazu Medici's term the economy was growing at an average of 11%. This period is well known as The Brazilian Miracle, which might explain why revolutions had a positive link with output growth during that period.

Concluding with our analysis related to political instability, the final period when revolutions contributed towards growth was from 1994 to 1995 during Itamar Augusto Cautiero Franco's leadership (who was the last non-elected president of Brazil and the one that restored political stability). During his term a series of actions (for example, the free trade zone in South America could be credited to his administration) and policies led to the economic recovery of Brazil, hence possibly explaining why the revolutions displayed a positive link with economic growth during the aforementioned period (for more details see Appendix C).

5.1.3 The Impact of Commercial Bank Deposits

Our principal findings refer to the financial development, (Figure A.8 shows our estimates for this mixed time-varying relationship); notwithstanding the annual frequency, we estimate a negative effect in 56 cases (years) out of 104 (see: the parameter estimates of Table 1, equation A.3 on how we calculate this effect, the summary Table 2 below as well as Figure A.8). While previous research argues in favor of a negative relationship between financial development and growth in the short-run and a positive one in the long-run, we argue that there is a mixed (negative and positive) time-varying impact of financial development on output growth, which captures the short-run. The aforementioned finding constitutes one of the contributions of this paper.

In particular in three periods financial development has a clearly positive effect on economic growth, namely 1968-1974, 1991-1993 and 1997-1999. Levine (1996) argued that Goldsmith's cross country work in 1969 provided evidence that rapid economic growth was accompanied by above the average financial development. Similarly Haber (1991, 1996) suggested that capital market development had a significant impact on economic growth. He justified this view by using the case of Brazil, Mexico and the United states. In Brazil the liberalization of the capital markets after the fall of the monarchy in 1889 provided the Brazilian firms with easier access to foreign capital. While Mexico followed the example of Brazil, the opening of the financial policies was much more subdued. Consequently economic growth in Mexico was weaker and slower than that of Brazil. Finally McKinnon (1973) studied the link between financial systems and economic expansion among others in Argentina

[11] For more details see Appendix C.

and Brazil after the end of the 2nd War. His findings strongly indicated the beneficial nature of well functioning financial systems for economic growth.

The first of the three periods indicating positive financial development effects (1968-1974) is the one known as the Milagre Economico (Economic Miracle), when average annual growth rates were extremely high following a number of important financial sector reforms that underpinned a massive increase in infrastructure investment, Goldsmith et al. (1986).

The second period of positive *cbd* impact on growth occurred during the period 1991-1993. Among the reasons that could explain the positive link between *cbd* and *gdp* growth during that period might be the fact that from the early 1990s there were various attempts to develop non-inflationary sources of finance and to diminish Brazil's dependency on foreign savings. More specifically, despite the political turmoil that marked the early 1990s, 1991 saw law changes allowing foreign institutions to trade domestically issued bonds and securities, Studart (2000). From 1992 onwards capital flows rose rapidly due to the repatriation of the capital that fled in the 1980s after the interest rate shocks of 1979.

The third and final period of constructive impact of *cbd* on output growth covers the late 1990s (1997-1999, see again Figure A.8). This could be attributed to the successful implementation of the 1994 Real Plan and the expansion of the PROER programme from 1997 onwards, which supported a wave of mergers and acquisitions in the financial sector (see Folkerts-Landau et al., 1997). Moreover, the opening of the Brazilian market to new financial institutions contributed towards liberalization of the financial system, Bittencourt (2011). An interesting point in our results is the fact that when the financial development effect was positive (and at relatively high levels) trade openness levels were either stagnant (1969-1974) or on a downward slope (1993, 1995-1999). This could potentially show us the changes in the priorities of the Brazilian government after 1969.

Omitted Variable Bias

One possible drawback of the identification strategy is to neglect the omitted variable bias. Even though we know from the work of Knack and Keefer (1995) and Rodrik et al. (2004) onwards that the institutions trump the contribution of geography and trade in explaining cross-country income differences over time, it is impossible to isolate the confounding effects of human capital as a competing channel that feeds directly into growth rates. Glaeser et al. (2004) show that poor countries tend to escape the poverty trap through human capital investment often pursued by benevolent dictators while Jeffery Sachs, Jared Diamond and his followers believe that geography makes all the difference. Relatedly, could it be that the informal instability variables partially capture the role of culture which many, starting with Max Weber and David Landes, believe makes all the difference by acting as a brake or filter on economic development?

To address this issue, we control for the effect of human capital formation using the average years of education (data obtained from Spruk, 2016b) and see whether controlling for human capital renders the effects of informal and formal instability weak, stronger or intact. Furthermore, to eliminate any direct confluence of political instability induced by adverse physical geography (for more details see Miguel et al., 2004) we consider the variation in rainfall (rain) as well as the annual temperature (temp), which serve as observable measures of climatic shock (data obtained from the World Bank). Our findings show a positive (negative) impact of the average year of education (variation in temperature) on economic growth whereas the effect of both informal and formal political instability (on output) remains negative with either the same or slightly weaker magnitude.

In addition, we detect a negative link between the variation of rain and growth, though statistically insignificant. Relatedly, a measure of culture would be beneficial to rule out the direct effects of culture on long-run growth. Although we are aware of the difficulty of such an easily tractable measure, we exploited the approach of McCleary and Barro (2006) and we searched for the fraction of the population that is Catholic as well as the immigration rate as rough proxies for the effects of culture, which have been one of the defining characteristics of Brazil's economic and institutional history. However, the data available from the Brazilian Institute of Geography and Statistics (IBGE) were discontinued for both variables (for example the immigration rate is available from 1870 to 1975). To address this lack of data and thus avoiding further decrease of observations in our sample, we include the immigration rate in our models separately and we find that there is a negative impact on output growth, though statistically insignificant (due to space limitations results are not tabulated).

5.2 Other Financial Development Measures - Robustness Checks

To validate the robustness of our results we additionally used money supply and deposits at Banco do Brasil as financial development measurements. As noted above, given *m1*'s and *dbb*'s more restrictive nature we use both of them as a robustness check of our results and thereby we attach greater weight to commercial bank deposits. The results in general are in full compliance with the ones reported for *cbd*. First, as far as the level of γ is concerned the change between the two regimes is not so smooth, with the exception of *str* and *le*, where the transition is smoother (see Figures A.7b and A.7c).

Accordingly, the parameter estimates of Tables A.6 and A.7 report the estimation outputs when either *m1* or *dbb* is considered as the financial development measure. First notice that there is a positive (in all 104 cases\years) and statistically significant time-varying link between trade openness and economic growth in most of the models, 10 out of 12[12]. These findings confirm our primary results on the time-varying link between trade openness and economic growth when commercial bank deposits were considered as the measure of financial development.

As far as the time-varying relation between political instability (either informal or formal) and growth is concerned the results are as follows. From the estimated parameters of Table A.6 we found a negative effect of *dem*, *str* and *ls* throughout the years (see equation A.2 on how we calculate this effect), a beneficial effect of *coup* and *pur*, though quite low in most of the cases (in 60 out of 104 cases\years) for the latter. For the *cc*, our parameter estimates indicate a mixed time-varying effect on growth (with a negative effect in 56 out of 104 cases/years). Results from Table A.7, when *dbb* is the financial development measure, are qualitatively similar to the ones reported above. Specifically we observe a statistically significant negative effect of political instability on growth [with the exception of *rev* and *cc*, where there is a mixed effect, (negative effect in 62 and 48 out of 104 cases\years respectively)].

Regarding our baseline findings for *m1*[13], we find a negative effect on growth, but significantly reduced in magnitude especially during 1968-74, 1991-93 and 1997-99 (periods where a positive association between *cbd* and economic growth was detected) whereas the results when *dbb* is considered as the financial development indicator show a mixed time-varying link between *dbb* and

[12] See the parameter estimates of Tables A.6 and A.7, equation A.1, Figures A.9 and A.10, and the summary Table 2 below.

[13] See the parameter estimates of Table A.6, equation A.3, Figure A.9, as well as Table 2.

economic growth (negative in 55 out of 104 cases\years)[14]. Notably, our parameter estimates show that the periods where *cbd* and *dbb* appeared to have a positive impact on growth were identical.

6. Concluding Remarks

Within a STAR framework utilizing data for Brazil from 1890 to 2003, we find that: (a) the level of openness of the economy displays a positive association with growth, however we detect low positive effects during the Great Depression (from 1929 to 1933); (b) informal (e.g., demonstrations and strikes) and formal (e.g., legislative selections and legislative elections) political instability have a negative impact on economic growth throughout our sample; (c) interestingly revolutions, coups and constitutional changes displayed a mixed (either positive or negative) effect on growth: one of these periods covers the years from 1975 to 1978, where despite the establishment of the military junta, the Brazilian economy was growing with an average 11%; (d) unlike the previous literature, which reports a negative short-run association between financial development and growth, we argue in favor of a mixed time-varying impact (in the short-run) when the financial development measures are the commercial bank deposits and deposits at Bank of Brazil, whereas that impact becomes mainly negative for money supply. In particular, we find three periods where financial development impacted positively growth, namely 1968-1974, 1991-1993 and 1997-1999; (e) in 57% of the years, where financial development had a below the mean effect, we estimate that trade openness had a substantial above the mean change; (f) our parameter estimates confirm the fact that the change between the regimes was not smooth. Table 2 presents a summary of our results.

The main goal of this study was to assess the role of financial development and political institutions on Brazilian economic growth. Although the study conducted a thorough survey, there were certain limitations worth mentioning. One such limitation is that the empirical evidence does not provide a definite account of the causal link between institutions and growth since we do not exploit plausibly exogenous sources of variation in Brazil's long-run growth and do not report a research design that would allow us to exploit such channels. However, we have addressed the omitted variable bias issue in greater detail (see the analysis in Section 5). Furthermore, we have not completely ruled out endogeneity. Nevertheless, the concern is greatly alleviated (with careful identification strategies and the lagged estimations) to the extent that our regressions yield consistent results. In addition, due to the historical scope of this paper, certain factors, such as culture, which potentially directly affect economic growth could not be considered due to the unavailability of data.

The aforementioned findings raise a number of new questions that we believe may be useful in motivating future research. In this paper we place emphasis to the following suggestions: on the role of finance and political instability and on methodology. As far as the role of finance in the process of economic development is concerned, our results corroborate and extend a large body of previous research by estimating a mixed either negative or positive impact of financial development on growth in the short-run.

Thus, future studies should focus on the link between financial development, political instability and economic growth in a panel of developing countries. This task might prove challenging due to lack of historical data for most of developing countries. However, the latter fact does not diminish

[14] See the parameter estimates in Table A.7, equation A.3, Figure A.10, as well as Table 2.

the significance of the task. The second suggestion refers to some further methodological considerations, such as the panel STAR modelling and the simulation analysis (under the synthetic control method) on how growth rate would have been in the absence of some shocks of instability. The latter would clearly represent progress and is something we feel future research should try to address.

Table 2. Effects of financial development, trade openness and political instability on economic growth and periods where a time-varying effect was detected.

Variables	Significant effect	Periods
Trade Openness		Panel A
trade openness	+	low size effects during the period: 1893, 1908 – 1910, 1929 – 1933, 1947 – 1954 (not 1948, 1950), 1969 – 1973, 1974, 1978 – 1980, 1982 – 1989(not 1988), 1993, 1996 – 1999
Informal Political Instability		Panel B
demonstrations	–	
revolutions	*mixed* ⟶	positive effects during the period: 1899 – 1902, 1920 – 1926(not 1923), 1930 – 1938(not 1931, 1933, 1935), 1948 – 1958(not 1951, 1954), 1975 – 1978, 1994 – 1995
strikes	–	
coups d'etat•	+	
Formal Political Instability		Panel C
purges•	+	positive during the same period as those of revolutions
legislative selections	–	
legislative elections	–	
constitutional changes*	*mixed* ⟶	positive during the same period as those of revolutions
Financial Development Measures		Panel D
commercial bank deposits	*mixed* ⟶	positive effects during the period: 1968 – 1974, 1991 – 1993 1997 – 1999
money supply	–	
deposits at Bank of Brazil	*mixed* ⟶	positive effects during the period: 1968 – 1974, 1991 – 1993 1997 – 1999

Notes: Table reports a summary of the results obtained from the parameter estimates of Tables 1, A.6 and A.7. Column 2 reports the significant effect that trade openness (Panel A), political instability (Panels B and C) and financial development (Panel D) have on economic growth. Column 3 reports the periods where a mixed time-varying impact was detected.

• when m1 is the financial development measure.

* when dbb is the financial development measure.

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