The Finance-Growth Nexus and Public-Private Ownership of Banks: Non-Linear Time Series Evidence for Brazil since 1870

Nauro F. Campos[a*,b,c], Menelaos G. Karanasos[a], Jihui Zhang[a] and Panagiotis D. Koutroumpis[d]

[a]*Brunel University, London,* [b]*IZA Bonn,* [c]*ETH Zurich,* [d] *Queen Mary University London*

This draft: November 2017

Abstract

How does finance affect economic growth? And does ownership matters? This paper investigates whether and how deposits in public vis-a-vis in private banks affect economic growth. It uses the power-ARCH (PARCH) framework with annual time series for Brazil from 1870 to 2003. There are three main findings: (a) the effect of private banks on growth is mostly direct, (b) that of public banks is mostly indirect (through growth variance) and (c) the short-run effect of public and private banks is negative, while only for the latter the positive long-run effect dominates.

Keywords: bank ownership, economic growth, financial development, volatility, power-ARCH, private banks

JEL classification: C14, O40, E23, D72.

*Address for correspondence: Menelaos Karanasos, Economics and Finance, Brunel University, West London, UB3 3PH, UK; email: menelaos.karanasos@brunel.ac.uk, tel: +44(0)1895265284.

1 Introduction

There is an extensive literature on the finance and growth nexus. Its main objective is to establish whether financial development uni-directionally causes economic growth and to identify and understand the main mechanisms through which this occurs (cf. Demirguc-Kunt et al., 2013, and references therein). One issue that has not been yet carefully explored is the one about ownership. This paper investigates whether (and how differently) deposits in public and in private banks affect economic growth using the power-ARCH (PARCH) framework with annual time series for Brazil from 1870 to 2003.

Ours are unique data series in that they allow for deep analysis of the issue of ownership, a topic that has not been sufficiently studied in the frame of the finance-growth nexus literature. Does ownership matter? How payoffs in terms of economic growth vary according to whether financial development is in the form of deposits at public or at private banks? We construct historical data series that separate deposits at private banks from those in public banks. Our data for deposits at commercial banks exclusively covers private banks. On the other hand, Banco do Brasil today is a public bank and has been a state-owned bank for most of its history. Yet its history has been long and convoluted: Banco do Brasil was founded in 1808 and is the oldest (and largest by assets) financial institution in Latin America. It was bankrupt twice (in 1821 and 1898) and changed name, structure and functions many times.[1] Because the Brazilian Central Bank was created only after World War II, Banco do Brasil has for long periods performed several of its tasks (e.g., issuing currency, having monopoly over currency transactions and serving as Treasury holder). The head of Bank do Brasil has always been a political appointment, nominated by the President. Although these gradations and changes are clearly important and do raise some caveats, it is also clear that Banco do Brasil is best classified throughout its history as a public-owned bank. This is broadly accepted in the literature (cf. Berg and Haber, 2009, and Goldsmith, 1986) and thus followed here.

[1] Haber writes about the Brazilian economy in the late 1890s: "The banking system then began to expand, led and controlled by a semi-official super-bank, the third Banco do Brasil, which acted both as a commercial bank and as the treasury's financial agent" (2003, p. 271).

2 A Short Brazilian background since 1870

The main objective of this section is to provide general background information about the main economic eras of Brazilian economic history. The reason for this is to help judge the range of variables we choose to focus on in the econometric analysis as well as to assess our main estimation results.

There is little disagreement among economists and economic historians that the period from 1870 to 1930 is a period of growth, though Brazil also went through difficulties caused in part by World War I and later by the Great Depression. The so-called Coffee Economic Cycle would then drive Brazil's economy for almost a century, and at least until year 1930. The impact of coffee on Brazilian economy was much stronger than that of sugar and gold since when the coffee surge began, Brazil was already freed from limitation of colonialism. Further, slavery was also finally abolished in 1888 which completed in a way an important shift towards wage labor. By the 1920s, Brazil was supplying about 80% of world's coffee. It is very important to point out here that, differently from Argentina for example, Brazilian international trade was strongly linked with the US, with the latter importing most of the Brazilian coffee and consequently being an important source of foreign capital . Trade openness was 60 percent of GDP until 1900 while coffee exports accounted for 12.5 percent of GNP in 1920s. As Werner Baer (2001) among many other leading scholars notes, there is no doubt that coffee exports were the engine of growth throughout most of the nineteenth century. Naturally, such an economic expansion required financial support and one of our focuses in this paper is an understanding of the role of financial development. Since the early nineteenth century, Brazil declared its independence and also built up its first modern style financial system[2]. The attention to the role of the financial system is not a hallmark of this literature and we intend to contribute to it by focusing more on it. Thus, whether financial development together with other factors have affected Brazil's output growth is one central question of this paper.

The Second Empire

In 1864 – 1870 Brazil and its allies, Argentina and Uruguay, fought a bloody war with Paraguay. The war ended with a victory of Brazil and its allies, but at a terrible price. As Skidmore states in "Brazil:

[2]For example, Banco do Brasil was founded in 1808 and functioned both as bank of issue and a commercial bank until 1829.

Five Centuries of Change": victory over such a small, poor, and desolate country hardly qualified Brazil for the annals of glorious warfare but raised fundamental questions about whether their own ill-integrated society was ready to join the race to modernity. Although the decline of the empire can be attributed to various reasons, it can be roughly divided into three factors: economic ones, political factors as well as the army. All these reasons concomitantly led to the end of the Second Empire in year 1889.

The First Republic

After the emperor was dethroned on November 15 of 1889, Brazil passed from a centralized empire to a federal republic by a bloodless coup led by the army. The period from 1889 to 1930 is known as the Old Republic or the First Republic, and economically the period is marked by the politics of coffee-with-milk ("cafe com leite"), a combination of Sao Paulo (coffee) and Minas Gerais (milk) political elites. From a political point of view, Brazil was rarely stable during this period. The tenente revolt that occurred in 1922 and then again in 1924, had shaken the interior of Brazil without ever being defeated by the army. Then, the old republic suffered a big hit with the economic crisis. In October 1929 the Great Depression began losing profit on the coffee exports, and the Paulista oligarchy tried to stay in power of the republic without respecting the alternation with Minas Gerais. This led to the end of the "politics of coffee with milk". In the year of 1930, the situation reached a breaking point. At first, vice president Mello Vianna was shot three times in the neck and in the hand at Monte Claros in the states of Minas Geraes. Later, Revolta de Princesa – Paraiba occurred. Soon after this event, Joao Pessoa, who was the governor of Paraiba, was murdered in July. After his death, more riots occurred. And, at the end on October 24th 1930, the revolution of 1930 broke out. All those political crises together with the economic crisis led to the end of the Old Republic on October 24th 1930.

The Revolution of 1930s and the Estado Novo

The Revolution of 1930 in Brazil not only marked the end of the Old Republic but also the beginning of the Vargas Era. By leading the revolution, Provisional President Getulio Dornelles Vargas ruled as dictator from 1930 to 1934, was elected as president from 1934 – 1937, and again governed as dictator from 1937 to 1945. Further, after 1945, Vargas still served as a senator until 1951 when after the general elections of 1950 once more Vargas returned to power as president (1951 - 1954). In other words, Getulio

Vargas retained central political power in Brazil for nearly 24 years. Economic historians argue that Brazil during the Vargas Era and up until the late 1970s was as one of the fastest growing economies in the world (Maddison, 1995). As such, this era is also a turning point in the political history of Brazil. Under the Estado Novo (1937 - 1945), state autonomy ended, governors were replaced and all political parties were dissolved until 1944 (Hudson, 1998).

Mid-50s and Beyond

From 1945 to the late 1970s, Brazil is widely considered to be one of the fastest growing economies in the world (see among others Maddison, 1995). Although there is wide consensus that the 1980s was a "lost decade" in economic terms (on the other hand, in political terms, it saw redemocratization) the growth of Brazil since 1990 is now a hotly debated issue. A lot of recent researches on either Latin America or Brazil covered this particular period and have paid attention to the study of financial development. Bittencourt (2011) finds that financial development played a significant role in generating growth in Latin America. Pinheiro et al. (2004) examined the relationships between financial development growth and equity.

In sum, the period since 1870 is an important one for Brazil as it sees the country economical and political take-off as well as becoming an emerging market. However, there is still debate about which factors better explain this remarkable transformation. Financial development and international financial integration (as well as trade openness and macroeconomic stability) are some of the main reasons highlighted by economists and economic historians. This paper tries to further our understanding of the mechanisms through finance affects growth, in particularly by studying whether and how different types of financial institutions (state or private banks) affect economic growth.

3 Data

The data set we put together for this paper covers the period between 1870 and 2003 for Brazil. The basic data source is Mitchell (2003). Data were recorded yearly including: Gross Domestic Product, deposits in commercial banks, deposits at Banco do Brasil, and M1 over GDP. The first two measures of financial development try to capture the efficiency of the financial sector, not its relative size. Commercial

bank deposits from Mitchell (2003). However, due to the missing figures, we follow Peláez and Suzigan (1976) to regenerate the series. Our second measure is the deposits at Banco do Brasil over GDP. It is measured by the added value of time deposits and deposits at the end of the period. We also use data on various factors often used to explain the economic performance of Brazil over the long-run (cf Abreu and Verner, 1997) such as international financial development, trade openness, and public deficit. International financial development should also have an impact on Brazil's economic growth; although for most of the period since 1930 Brazil remained a closed economy. Abreu and Verner (1997) argue that from 1930-1980 Brazil had a unique foreign economic orientation, with bold export promotion policies and a rather closed domestic market. We use the level of interest rate in US as our proxy of the global financial market. US interest rates are from Friedman and Schwartz (1982). The measures of trade openness and public deficit are from Mitchell (2003) and IBGE (2007). Trade openness is measured as the ratio of imports plus exports to GDP, while public deficit is the ratio of total public deficit to GDP.

4 Error Correction Power ARCH Model

In this paper we employ the PARCH model of Ding et al. (1993) which quickly gained currency in the finance literature.[3] Let growth (y_t) follow a white noise process augmented by the logarithm of its conditional variance[4]:

$$y_t = c + k\log(h_t) + \lambda x_{i,t-l} + \epsilon_t, \tag{1}$$

with $\epsilon_t = e_t h_t^{\frac{1}{2}}$, where x_{it} is either the financial development variable or one of the other explanatory variables.[5] Another potential benefit from this exercise is that the required use of lags may help ameliorate concerns about endogeneity. In addition, $\{e_t\}$ are independently and identically distributed (i.i.d) random variables with zero mean and unit variance.

The conditional variance of growth is specified as a symmetric[6] PARCH$(1,1)$ process:

[3] See, for example, Karanasos and Kim (2006). Karanasos and Schurer (2005, 2008) use this process to model output growth and inflation respectively.

[4] h_t is positive with probability one and is a measurable function of the sigma-algebra $\sum_{t-1}$, which is generated by $\{y_{t-1}, y_{t-2}, \ldots\}$.

[5] Because the original deposits at Banco do Brasil and the US interest rate variables are I(1), they enter our models in first differences.

[6] The estimated asymmetric parameters were insignificant.

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} |e_{t-1}|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \phi x_{i,t-l} + \gamma y_{t-n}, \tag{2}$$

with lagged growth included in the variance equation, where δ (with $\delta > 0$) is the heteroscedasticity parameter; α and β are the ARCH and GARCH coefficients respectively, γ is the level term for the lth lag of growth. In order to distinguish the general PARCH model from a version in which δ is fixed (but not necessarily equal to two) we refer to the latter as (P)ARCH. The model imposes a Box-Cox power transformation of the conditional standard deviation process and the asymmetric absolute residuals.[7]

Our set of variables comprises domestic and international financial developments and it allows us to investigate how differently do deposits in public vis-a-vis in private banks affect economic growth. In order to study the direct effects of our set of explanatory variables, we specify model 1 with $\phi = 0$ in equation (2), while model 2 with $\lambda = 0$ in equation (1) allows us to investigate their indirect impacts on growth.[8]

We also investigate how short- and long-run considerations help us refine our baseline results. The error correction (P)ARCH form estimates such short- and long-run relationships and is specified as

$$\Delta y_t = \mu + \theta \Delta x_{i,t-l} + \varphi(y_{t-1} - c - \zeta x_{i,t-1}) + \varepsilon_t, \tag{3}$$

where the lag of the first difference of either the financial development variable (domestic or international) or trade openness or public deficit ($\Delta x_{i,t-l}$) characterizes the short-run effect, captured by θ; φ is the speed of adjustment to the long-run relationship and ζ captures the long-run effect.. The condition for the existence of a long-run relationship (dynamic stability) requires that the coefficient on the error-correction term be negative and not lower than -2 (that is, $-2 < \varphi < 0$).[9]

[7] We estimate also asymmetric (P)ARCH models but the leverage terms were insignificant.

[8] As a robustness check we estimate model 1 using $\sqrt{h_t}$ for the in-mean effect. We also estimate model 2 using an EGARCH specification. The results (not reported) are very much similar to the results we report in the paper.

[9] We also take into account the heteroscedasticity effects by specifying the error term ε_t as a (P)ARCH process.

5 Empirical Results

We present our main results in three interdependent blocs: the direct, indirect and dynamic (short and long-run) effects. We proceed with the estimation of the (P)ARCH$(1,1)$ model in equations (1), (2) and (3) in order to take into account the serial correlation observed in the levels and power transformations of our time series data. Tables 1 and 2 below report the estimated parameters of interest for the period 1870-2003.[10] Our results are presented following specific types of effects. That is, we discuss direct (on mean economic growth), indirect (via volatility), dynamic (short and long-run) and structural break effects. Moreover, in trying to satisfy both the time-series and economic growth literature traditions (the former mostly univariate and the latter multivariate), for each effect we report and discuss the full multivariate results whereas estimates for one variable at a time before are available upon request.

5.1 Direct Effects, Indirect Effects and Dynamic Aspects

One of the main advantages of the (P)ARCH framework is that it allows us to study not only the direct growth effects from the full set of explanatory variables described above, but also their indirect effects on economic growth through the predicted component of growth volatility (conditional on its past values). As we can see from Table 1 (see the k column) the effect of conditional or predicted volatility on growth is in all cases positive ($k > 0$) and statistically significant at conventional levels, which is in line with the theoretical argument of Black (1987), among others. Also the power term coefficients δ are rather stable, with the Akaike IC (AIC) criterion choosing a (P)ARCH specification with power term in most of the cases equal to to 1.00 (e.g., commercial bank deposits).

The parameter we are most interested in, are the λ's in Panel A of Table 1 and the ϕ's in Panel B, which capture the direct and indirect effects respectively. The results reveal that the lagged direct effects of domestic financial development (M1 and commercial, that is private, bank deposits) on per capita economic growth rates are negative and statistically significant, whereas the impact of international financial development (US interest rate) is positive and statistically significant as well. As we will see

[10] These were obtained by quasi-maximum likelihood estimation (QMLE) as implemented in EVIEWS. The best fitting specification is chosen according to the Likelihood Ratio (LR) results and the minimum value of the Information Criteria (IC) (not reported). Once heteroscedasticity has been accounted for, our specifications appear to capture the serial correlation in the power transformed growth series.

below the lagged direct effect on growth is equivalent to the short-run impact. Public bank deposits (deposits at Banco do Brazil) have no direct impact on growth.[11]

We now turn to the investigation of the indirect effects. Panel B in Table 1 reports the estimation results for all four elements in our data set for what we call the indirect impact, which is the effect on growth via the volatility channel.[12] Of particular interest is the sign and the significance of the ϕ_{fd} estimated parameters. Our results show that the effects of two measures of domestic financial development (M1 and deposits at Banco do Brazil, that is deposits in the state-owned bank), on the conditional volatility of per capita economic growth rates are negative and statistically significant whereas the US interest rate affects it positively and significant and private deposits have no impact on growth volatility.[13]

5.2 Short- and Long-run Effects

Table 2 presents the results on the estimation of short- and long-run parameters. In all cases, the estimated coefficient on the error correction term (φ) lies within the dynamically stable range $(-2, 0)$. In particular, the estimates of φ lie within the range -1.00 to -0.74. From investigating whether dynamic considerations affect our conclusions, we find important differences in terms of short- and long-run behavior of our explanatory variables.

In particular, observing the short and long-run estimates, θ_i and ζ_i respectively, and focusing our analysis on those obtained from the domestic financial development, we find that in the long-run M1 and commercial (private) bank deposits affect growth positively (see the ζ_{fd} column in Table 2). Interestingly, we find that the short-run impact of financial development (two out of the three measures) on growth is negative and significant (see the θ_{fd} column). Thus our results square well with recent findings by Loayaza and Rancière (2006), among others, in that the sign of the relationship between economic growth

[11] In summary, we find that the main explanatory factors, solely in terms of their direct effects on economic growth in Brazil, turn out to be domestic (two out of the three measures) and international (US interest rate) financial development. Interestingly, the effects of the later work in the opposite direction from those of the former. Public deficit and trade openness also seems to play an important role.

[12] In the expressions for the conditional variances reported in Table 1, various lags of growth (from 1 to 12) were considered with the best model ($l = 8$) chosen on the basis of the minimum value of the AIC.

[13] In summary, we find strong evidence that domestic financial development (M1 and deposits in Banco do Brazil), trade openness and public deficit have a negative indirect (via volatility) impact on growth whereas US interest rate affects it positively. Interestingly, for the last three variables direct and indirect effects work in the same direction. It is also worth noting that, since the estimates for the in-mean parameter (k) and the level coefficient (γ) are statistically significant and positive, there is strong evidence for a positive bidirectional feedback relationship between growth and its volatility, which seems robust to the presence of various finance and economic variables.

and financial development depends on short- versus long-run considerations (the effect being negative in the former case and positive in the latter).[14]

5.3 Public vis-a-vis Private Banks

The contrasting results we find for deposits in commercial banks and deposits at Banco do Brasil are interesting and important. Our results show that although both public and private banks have important economic growth effects, these are fundamentally different. The effects of private banks (that is, of deposits in commercial banks) on economic growth tends to be direct, while that of public banks (deposits at Banco do Brasil) tend to be indirect. In other words, the impact of public banks on growth is mostly through the variance, while that of private banks is mostly through the mean. In both cases, we find a negative effect: private banks slow down growth and public banks dampen its variance. It is worth noting that these results are robust to controlling for potential omitted variables biases (as they do not change qualitatively when accounting for international trade and government deficits).

Further decomposing these growth effects in their short- and long-run aspects is key. This is so not only because of the relatively large time window (historical series) but also because an important finding in the finance-growth nexus literature is that the effect of finance on growth tends to be positive in the long- but negative in the short-run. Our results for Brazil not only provide broad support for this finding (as overall results are stronger for the broad M1 aggregate) but also add a novel element to it, namely, that this asymmetry holds only for private (not for public) banks. We only find evidence of such pattern (negative impact on growth in short- and positive in long-run) for private banks. In the case of public banks, both effects we estimate tend not be statistically significant.

5.4 Breaks

Finally, we present evidence that this set of results on public-private differences is also robust to one more important concern, namely that of the existence of structural breaks. Given that in our analysis we focus on an unusually long period of time, this is almost a natural and obvious concern. We employ

[14] They compare well with similar results for Argentina (Campos et al., 2012). The results for US interest rate are positive in the short but negative in the long-run (in two out of the three cases). Finally, the negative short-run effect of public deficit disappear in the long-run (in two out of the three cases).

the methodology developed by Bai and Perron (2003) to identify multiple breaks and, unsurprisingly, there are a number of findings. For the economic growth series, we identify only one structural break, coinciding with the end of World War I, that is, for year 1918. Interestingly, the financial development variables reveal different break dates. We estimate two breaks for the M1 series, one in 1889 and the other 1930, both reflecting massive changes in monetary policy following two important coups d'Etat (1889 is the end of the Empire and the start of the Republic, and the 1930 marks the start of the "Estado Novo"). The finding that the negative short-term effect of M1 on growth is substantially larger for the period before 1889 accords with the historical experience (Triner, 1996; Goldsmith, 1986) and the same can be seen (to a smaller extent) for the two bank deposits series.[15] Also it is worth noting that the magnitude of such difference (and the reasons for it) is substantially smaller in the post 1930 period (when contrasting it with the pre 1930 period). Interestingly, for both deposits at Banco do Brasil and at private commercial banks there is one break before World War I (1911 and 1914 respectively) while only for the latter we identify a second break. The Bai-Perron tests identify 1962 as the second break of the deposits at commercial banks series, taking place just before a major re-organization of the Brazilian financial system that culminated with the creation of the Central Bank, after the military coup in March 1964. As mentioned, our main conclusions are robust to taking into account this set of structural breaks: private banks seem to be the driving force behind the finance-growth nexus, with public banks playing a smaller but still important indirect role (that is, through the volatility of growth).

6 Conclusions

Using a PARCH framework and data for Brazil from approximately 1870 to 2003 this paper has a main new finding, namely that the effect of private banks on growth is mostly direct, while that of public banks is mostly indirect (through growth variance). We also find that the intensity and the direction (the sign) of the former effect varies over time and, in particular, it varies with respect to short- versus long-run considerations. In other words, from investigating whether dynamic considerations affect our

[15] We incorporate dummy variables in the equations (1), (2) (3), thus taking into account breaks in growth and domestic financial development (results not reported).

conclusions, we find important differences in terms of short- and long-run behavior of our key financial development variables, more specifically, the effects of M1 and commercial bank deposits are negative in the short- and positive in the long-run.

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Figures:

Figure 1. Growth Rate of Brazil and Financial Development

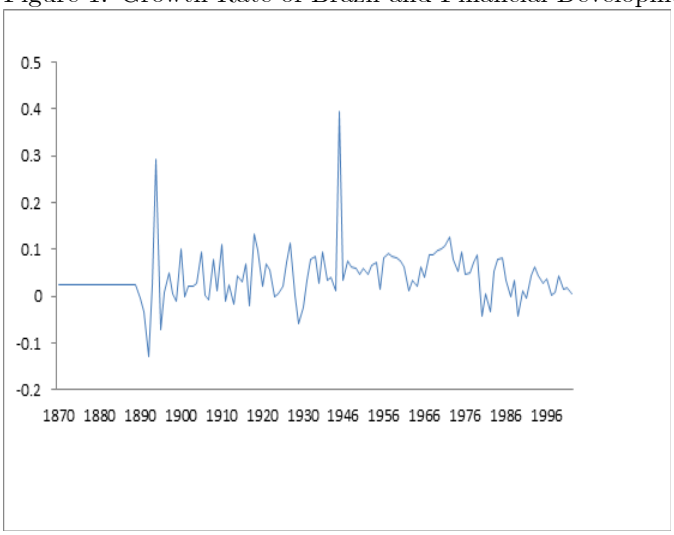

Fig 1.a: Growth Rate of Brazil since 1870

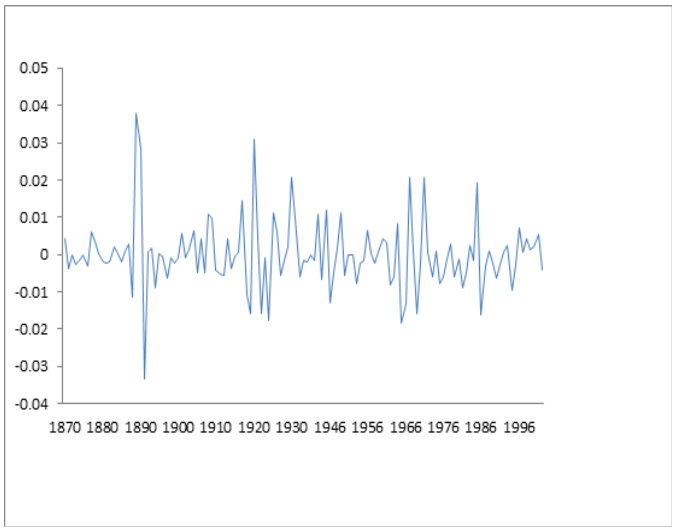

Fig 1.b: Money Supply (M1) over GDP

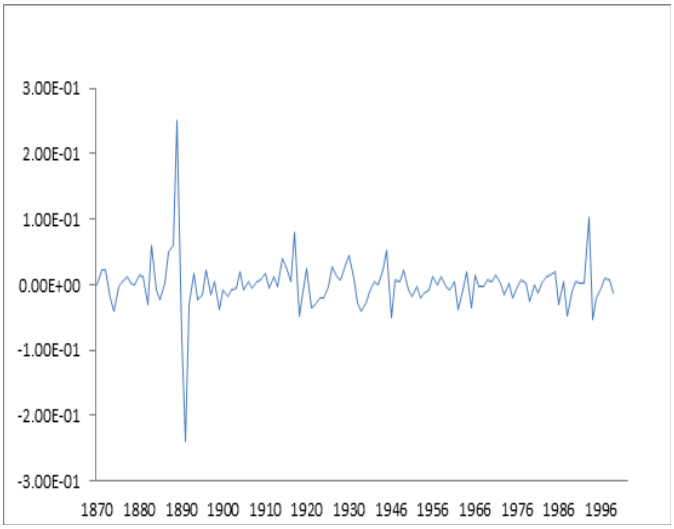

Fig 1.c: Commercial Bank Deposits over GDP

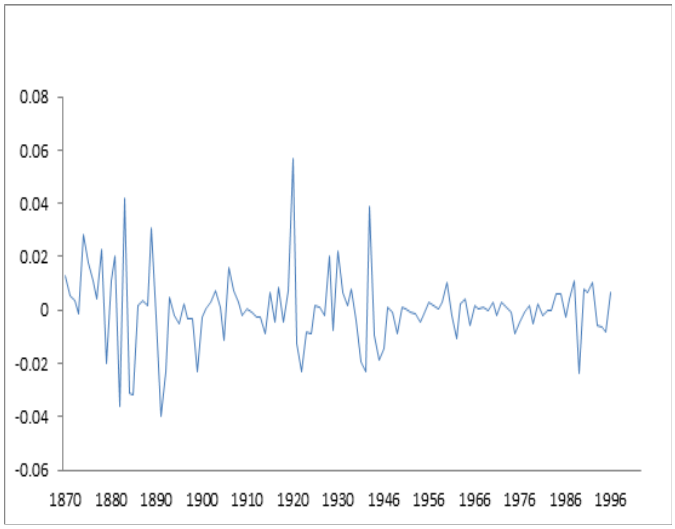

Fig 1.d: Deposits at Banco do Brasil over GDP

Table 1 Direct and Indirect Effects of Financial Development, Trade Openness, Public Deficit and US Interest Rate on Economic Growth

Panel A. Direct Effects (Model 1; $\phi_i = 0$)

	k	λ_{fd}	λ_{to}	λ_{pd}	λ_{us}	α	β	γ	δ
M1	2.65 (2.42)	−0.015 (−1.69) $_{l-8}$	−0.033 (−3.67) $_{l-8}$	−0.004 (−2.75) $_{l-4}$	0.003 (7.46) $_{l-6}$	0.62 (4.12)	0.31 (2.22)	0.14 (2.48) $_{n-8}$	0.80 –
CBD	2.27 (2.14)	−0.052 (−4.31) $_{l-4}$	−0.005 (−0.31) $_{l-3}$	−0.002 (−1.74) $_{l-6}$	0.002 (7.08) $_{l-6}$	0.60 (3.79)	0.37 (3.07)	0.08 (2.67) $_{n-8}$	1.00 –
DBB	3.77 (3.22)	0.009 (1.18) $_{l-5}$	−0.057 (−3.93) $_{l-4}$	−0.003 (−2.27) $_{l-4}$	0.002 (7.74) $_{l-6}$	0.58 (3.58)	0.36 (2.70)	0.18 (4.43) $_{n-8}$	0.90 –

Panel B. Indirect Effects (Model 2; $\lambda_i = 0$)

	k	ϕ_{fd}	ϕ_{to}	ϕ_{pd}	ϕ_{us}	α	β	γ	δ
M1	0.0098 (5.03)	−0.196 (−1.71) $_{l-6}$	−0.140 (−3.38) $_{l-8}$	−0.098 (−2.98) $_{l-3}$	0.013 (6.36) $_{l-1}$	0.44 (4.15)	0.39 (3.92)	0.125 (5.91) $_{n-8}$	1.00 –
CBD	0.0100 (5.02)	−0.006 (−0.57) $_{l-8}$	−0.122 (−4.13) $_{l-8}$	−0.069 (−2.76) $_{l-3}$	0.013 (5.77) $_{l-8}$	0.50 (4.73)	0.36 (3.67)	0.127 (6.76) $_{n-8}$	1.00 –
DBB	0.0078 (6.03)	−0.350 (−3.89) $_{l-5}$	−0.134 (−2.91) $_{l-8}$	−0.156 (−4.24) $_{l-3}$	0.018 (6.89) $_{l-6}$	0.35 (4.84)	0.37 (5.16)	0.145 (5.83) $_{n-8}$	0.80 –

Table 1 reports parameter estimates of direct and indirect effects for the following models:

$$y_t = c + k\log(h_t) + \lambda_{fd}x_{fd,t-l} + \lambda_{to}x_{to,t-l} + \lambda_{pd}x_{pd,t-l} + \lambda_{us}x_{us,t-l} + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha h_{t-1}^{\frac{\delta}{2}} \mid e_{t-1} \mid^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \sum_{i=fd,to,pd,us} \phi_i x_{i,t-l} + \gamma y_{t-n},$$

$x_{fd,t-l}$ is either M1 or commercial bank deposits (CBD) or deposits at Banco do Brasil (DBB)

$x_{to,t-l}$ is trade openness, $x_{pd,t-l}$ is public deficit,

and $x_{us,t-l}$ is US interest rate. l and n are the order of the lags.

The numbers in parentheses are t statistics.

Table 2 The Short- and Long-run Effects on Growth

	θ_{fd}	θ_{to}	θ_{pd}	θ_{us}	ζ_{fd}	ζ_{pd}	ζ_{us}	φ
M1	-0.809 (-4.51) $_{l-3}$	-0.058 (-2.47) $_{l-5}$	-0.130 (-3.11) $_{l-6}$	0.008 (3.01) $_{l-5}$	0.621 (8.52)	0.0149 (1.58)	-0.0005 (-1.63)	-0.74 (-11.70)
CBD	-0.343 (-2.52) $_{l-3}$	-0.119 (-1.29) $_{l-8}$	-0.237 (-2.45) $_{l-6}$	0.018 (3.41) $_{l-5}$	0.021 (7.03)	-0.007 (-0.06)	-0.0002 (-0.30)	-0.96 (-11.56)
DBB	-0.046 (-1.02) $_{l-3}$	-0.062 (-0.85) $_{l-8}$	-0.064 (-1.80) $_{l-4}$	0.017 (11.57) $_{l-5}$	-0.128 (-1.50)	-0.1025 (-4.21)	-0.0018 (-2.06)	-1.00 (-11.54)

Table 2 reports parameter (mean) estimates for the following model:

$$\Delta y_t = \mu + \sum_{i=fd,topd,us} \theta_i \Delta x_{i,t-l} + \varphi(y_{t-1} - c - \sum_{i=fd,to,pd,us} \zeta x_{i,t-1}) + \varepsilon_t,$$

$$h_t^{\frac{\delta}{2}} = \omega + \alpha \left|u_{t-1}\right|^{\delta} + \beta h_{t-1}^{\frac{\delta}{2}} + \gamma y_{t-n}.$$

θ_i and ζ_i capture the short- and long-run effects respectively.

φ indicates the speed of adjustment to the long-run relationship.

$x_{i,t-l}$ can be either financial development or trade openness or public deficit or US interest rate.

l and n are the order of the lags.

The numbers in parentheses are t statistics.

The long-run impact of trade openness is insignificant (results not reported).