E C O N O M I C S B U L L E T I N

Financial Development and Economic Growth in Brazil: 1986-2006

Patricia Stefani
Ideias Consultoria

Abstract

This paper tries to investigate the relationship between financial development and economic growth in Brazil between 1986 and 2006, using a cointegrated VAR model. It finds that there exists a positive and significant relationship between these phenomena, with the measures of financial development being the driving forces.

The author would like to thank Standard and Poor's for providing the data on stock market capitalization from its Emerging Markets Database, and Samuel Kinoshita for helpful comments. The usual disclaimer applies.
Citation: Stefani, Patricia, (2007) "Financial Development and Economic Growth in Brazil: 1986-2006." *Economics Bulletin*, Vol. 3, No. 69 pp. 1-13
Submitted: November 12, 2007. **Accepted:** December 19, 2007.
URL: http://economicsbulletin.vanderbilt.edu/2007/volume3/EB-07C30084A.pdf

1. Introduction

The literature on financial development and economic growth is vast and, yet, controversial. At least since Bagehot (1873) and Schumpeter (1912), the role of financial intermediaries in managing risks, screening borrowers, channeling and allocating savings, has been recognized as having a central role in promoting long run growth. On the other hand, many argue that financial development and growth are either unrelated, as Miller (1998) does, that financial development may be harmful for economic growth as it may depress savings, as discussed in Levine (1997), or that financial development follows economic growth, as Robinson (1952) argues.

The empirical evidence has mixed results, depending on how financial development is measured or on the empirical strategy being employed. The issue of causality is also not forcefully documented, with several studies pointing to the existence of a bi-causality relationship, while others presenting evidence that supports the argument that financial development promotes growth. However, as pointed out in Levine (2005): *"the bulk of existing research suggests that (1) countries with better functioning banks and markets grow faster, but the degree to which a country is bank-based or market-based does not matter much, (2) simultaneity bias does not seem to drive these conclusions, and (3) better functioning financial systems ease the external financing constraints that impede firm and industrial expansion, suggesting that this is one mechanism through which financial development matters for growth."*

The detailed description of the studies is beyond the scope of this paper.[1] Some examples are King and Levine (1993), that on a study with 77 countries between 1960 and 1989, controlling for factors affecting long run growth, presents evidence suggesting that their measures of financial development in 1960 are good predictors of subsequent rates of economic growth. Also, Levine and Zervos (1998) construct measures of stock market development for 42 countries between the period of 1976-1993 and, controlling for other determinants of growth and for the banking sector development, find that these measures are significantly and positively related to economic growth.

The majority of the empirical literature rely on cross-country studies, although employing several strategies to try to take the simultaneity issue

[1] See Levine (2005) for a detailed review of both the theoretical and empirical literature on financial development and growth.

into account. However, relative little attention have been devoted to the use of time series techniques and single country analysis, which may be fruitful in elucidating the mechanisms behind the relationship between financial development and growth, as it is not subject to many institutional factors or country specific issues that might hinder the connection at study. One of the exceptions is Arestis et al (2001), which uses a vector autoregressive model to study the relationship between stock market development measures and economic growth for developed economies, controlling for the banking sector development. They find that both may be able to promote growth, with the impact of the banking system being stronger.

The contribution of this paper is twofold. First, it tries to shed light on how did financial development in an emerging economy like Brazil has contributed to the country's long run economic growth. Second, it uses time series techniques and quarterly data to try to better handle the causality question. It is closely related to Arestis et al. (2001) and it extends the work of Carneiro de Matos (2002) which has studied the impact of the development of the banking system on economic growth using annual data for Brazil.

2. Empirical Strategy

The statistical model is a p-dimensional Gaussian vector autoregressive model - VAR(k)[2] as proposed by Johansen (1988), Johansen and Juselius (1992) which, in its error correction formulation, can be described by:

$$H(r) : \Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \alpha\beta_0' t + \mu_0 + \Phi D_t + \varepsilon_t \qquad (1)$$

The advantage of using this method is that it doesn't impose any *a priori* restriction, with all hypothesis being tested within the model. The $p \times 1$ vector X_t comprises the variables which are related by r cointegrating relationships. The rank of the Π=$\alpha\beta'$ matrix, which contains all the long run information of the system, is $r \leq p$. The matrices α and β are of dimension $p \times r$, with β' representing the cointegrating vectors, α representing

[2]Details on the theory, estimation and empirical applications can be found in Johansen (1996) and Juselius (2007).

the adjustment vectors, that is, the equilibrium correction and $u_t = \beta' X_t$ corresponds to deviations from equilibrium. The matrices $\Gamma_1, ..., \Gamma_{k-1}$ give the short run dynamics. We assume that $\varepsilon_t \sim N_p(0, \Omega)$, iid, and condition on $X_{-k+1}, ..., X_0$ initial values; see Johansen (1988), Johansen (1996), Juselius (2007) and Nielsen (2007).

The model in equation (1) allows for a linear trend in all combinations of the data, including the cointegrating relations, and for an unrestricted constant. It also has a vector, D_t, of both seasonal and intervention dummies, with all being tested within the model.

It is important to note that the order of integration of the variables is tested in a multivariate framework. We start from a stationary VAR model, and unit roots impose testable restrictions on the dynamic system through tests on the rank of the Π matrix.

Our empirical model has $p = 3$ variables, $X_t = [GDP_t, cred_t, cap_t]$, consisting, respectively, of gross domestic product, and two measures of financial development: credit from the financial system to the private sector and stock market capitalization, both measured as shares of GDP.[3] Needless to say that the measures of financial development employed here do not exhaust all the possible ones that may have an influence on economic growth. However, they capture both the credit and the stock market aspect of financial development and are widely used in the empirical literature. Moreover, the existence of a cointegration relationship between these variables is invariant to the information set, meaning that extending the information set to include other relevant variables should not destroy an eventual long run relationship between the variables being considered here.

3. Results

The model was estimated using quarterly data from 1986 Q2 to 2006 Q4 and two lags. As argued in Juselius (2007), adjusting a model with too many lags results in an over-parametrized model, with more than two lags being rarely needed to describe the dynamic structure of the data. This seems to be the case here, since the model has passed the specification tests and no

[3] All estimations were performed using the software CATS for RATS, see Dennis et al. (2006). The description of the variables and all tests results not shown in the text can be found in the appendix.

residual autocorrelation was left.[4] Appart for seasonal dummies, the model includes three intervention dummies, referring to 1987 Q2, 1989 Q2 and 1990 Q1, in order to capture the effects of, respectively, three stabilization plans: the Bresser Plan (June, 1986), the Summer Plan (January, 1989) and the Collor Plan (March, 1990).

The trace test, detailed in Johansen (1996), indicates $r = 1$ as the appropriate choice for the rank of Π, meaning that the system has one cointegrating relation.[5] In this case, the identification of the cointegrating vectors limits itself to the normalization of the β' vector, which has been normalized on GDP.

As discussed in Johansen (1996) and Juselius (2007), tests on the α matrix are associated with hypotheses about the common driving forces in the system. Testing a variable for being weakly exogenous[6] for the long run parameters is a test of a corresponding zero row in α, and defines the cumulated empirical shocks to that variable as being one of the $(p - r)$ common driving trends in the system. The weak exogeneity tests reveal that both our measures of financial development can be considered as being weakly exogenous to the long run parameters, representing the two common stochastic trends in the system, with this joint restriction being accepted with a p-value of 0.83. The final model is then given by:

[4]The tests for normality, autocorrelation and heteroscedasticity of the residuals can be found in the appendix and show that we cannot reject that they are normal, non-autocorrelated, but with moderate first order Autoregressive Conditional Heteroscedasticity (ARCH) effects. However, as shown in Rahbek et al. (2002), the cointegration tests are robust against moderate residual ARCH effects.

[5]The trace test, presented in table 3, indicates $r = 1$ as the appropriate choice for the rank of Π at a 5% level of significance. This choice was complemented by the analysis of the roots of the companion matrix, the Π matrix and the significance of the adjustment coefficients of the unrestricted estimated system, as suggested in Juselius (2007).

[6]Hall and Wickens (1993) and Hall and Milne (1994) argue that tests of weak exogeneity in a cointegrated system are equivalent to the notion of long run causality.

Table 1 - Estimation Results				
	GDP	cred	cap	trend
β'	1	-0.089	-0.096	-0.004
	[n.a.]	[-2.40]	[-4.58]	[-10.108]
	ΔGDP	Δcred	Δcap	
α'	-0.496	0.00	0.00	
	[-5.68]	[0.00]	[0.00]	

Test of the restricted model:
$\chi^2(2) = 0.360$; p-value: 0.83
Log-Likelihood = 802.479

The cointegrating relation can be written as:

$$GDP_t = 0.089cred_t + 0.096cap_t + 0.004t \tag{2}$$

It shows that there exists a positive relationship between both measures of financial development and GDP in the long run, with GDP equilibrium correcting, as shown in Table 1. As Johansen (2006) puts, *"The cointegrating relations are long-run relations. This is not taken to mean that these relations will eventually materialize if we wait long enough, but rather that these are relations, which have been there all the time and which influence the movement of the process X_t via the adjustment coefficient α, in the sense that the more the process $\beta' X_t$ deviates from $E\beta' X_t$, the more the adjustment coefficients pull the process back towards its mean."*

4. Conclusion

This paper have tried to shed some light on the relationship between financial development and economic growth in Brazil between 1986 and 2006. The results presented indicate that there exists a strong positive relationship between those phenomena, with the financial development variables being the driving forces in the system.

This is a very important result, which calls for a more reflective discussion on how to strengthen and design institutions and how to shape policies in order to promote further efficiency of the financial intermediaries and foster economic growth.

References

Arestis, P., P. O. Demetriades, and K. B. Luintel (2001): "Financial Development and Economic Growth: The Role of Stock Markets," *Journal of Money, Credit, and Banking*, 33, 16–41.

Bagehot, W. (1873): "Lombard Street," *Homewood, IL: Richard D. Irwin, (1962 Edition).*

Carneiro de Matos, O. (2002): "Financial Development and Economic Growth in Brazil: Causality Evidences," *Brazilian Central Bank Working Paper n. 49.*

Dennis, J. G., H. Hansen, S. Johansen, and K. Juselius (2006): "CATS in RATS. Cointegration Analysis of Time Series, Version 2," *Estima: Evanston, Illinois, USA.*

Dickey, D. A., and W. A. Fuller (1979): "Distribution of The Estimates for Autoregressive Time Series With a Unit Root," *Journal of the American Statistical Association*, 74, 427–431.

Doornik, J. A., and H. Hansen (1994): "An Omnibus Test for Univariate and Multivariate Normality," *Discussion paper, Nuffield College, Oxford University.*

Godfrey, L. G. (1988): "Misspecification Tests in Econometrics.," *Cambridge: Cambridge University Press.*

Hall, S. G., and A. Milne (1994): "The Relevance of P-Star Analysis to UK Monetary Policy," *The Economic Journal*, 104, 597–604.

Hall, S. G., and M. Wickens (1993): "Causality in Integrated Systems," *London Business School Discussion Papers, 27-93.*

Johansen, S. (1988): "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, 12, 231–254.

——— (1996): "Likelihood-based Inference in Cointegrated Vector Autoregressive Models," *Oxford University Press, Oxford, 2nd ed.*

JOHANSEN, S., AND K. JUSELIUS (1990): "Maximum Likelihood Estimation and Multivariate Cointegration Analysis of the PPP and the UIP for UK," *Journal of Econometrics*, 53, 211–244.

——— (1992): "Testing Structural Hypothesis in a Multivariate Cointegration Analisys of the PPP and UIP for UK," *Journal of Econometrics*, 53, 211–224.

JUSELIUS, K. (2007): "The Cointegrated VAR Model: Methodology and Applications," *Oxford University Press, USA*.

KING, R. G., AND R. LEVINE (1993): "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics*, 108, 717–738.

LEVINE, R. (1997): "Financial Development and Economic Growth: Views and Agenda," *Journal of Economic Literature*, 35, 688–726.

——— (2005): "Finance and Growth: Theory and Evidence," *In Aghion, P and Durlauf, S (Eds), Handbook of Economic Growth, Elsevier*, 1A, 865–923.

LEVINE, R., T. BECK, AND A. DEMIRGUÇ-KUNT (2000): "A New Database on Financial Development and Structure," *World Bank Economic Review*, 14, 597–605.

LEVINE, R., AND S. ZERVOS (1998): "Stock Markets, Banks, and Economic Growth," *American Economic Review*, 88, 537–558.

LÜTKEPOHL, H., AND M. KRÄTZIG (2004): "Applied Time Series Econometrics," *Cambridge University Press.*

MILLER, M. H. (1998): "Financial Markets and Economic Growth," *Journal of Applied Corporate Finance*, 11, 8–14.

NIELSEN, H. B. (2007): "UK Money Demand 1873 − 2001: A Long-run Time Series Analysis and Event Study," *Cliometrica*, 1, 45–61.

RAHBEK, A., E. HANSEN, AND J. G. DENNIS (2002): "ARCH Innovations and their Impact on Cointegration Rank Testing," *Department of Theoretical Statistics, University of Copenhagen, Working paper no.22, Centre for Analytical Finance.*

Robinson, J. (1952): "The Generalization of the General Theory," *In The Rate of Interest and Other Essays, London: MacMillan*.

Schumpeter, J. A. (1912): "Theorie der Wirtschaftlichen Entwicklung. Leipzig: Dunker & Humblot," *The Theory of Economic Development, translated by R. Opie. Cambridge, MA: Harvard University Press, 1934.*

Appendix

I. Data

The GDP series is the log of the quarterly chained index (average 1995=100) from the Quarterly National Accounts system.[7] The series of credit from the financial system to the private sector refers to the balance of the credit operations from the financial system to the private sector at the end of the period (quarter), in millions of current R$ (reais). Last, the data on stock market capitalization, comes from the Standard & Poor's Emerging Markets Database and is originally in current US$ at the end of the period (quarter).

In order to express the measures of financial development as ratios to GDP, a series of GDP in millions of R$ is needed. To obtain an adequate measure of quarterly GDP in constant R$, we have first computed the percentage change of the quarterly GDP chained index. Then, from the value of the GDP of the fourth quarter of 2006, the series was constructed using the percentage change (i.e., the quarterly growth) from the chained GDP index from the fourth quarter of 2006 back to the second quarter o 1986.

An additional issue is the fact that the measures of financial development are available on a monthly basis. To transform them into quarterly measures, the inflation within each quarter had to be taken into account, specially when we are dealing with a high inflation period such as Brazil in the 80's and mid 90's.

For this, the approach taken is the one proposed by Levine et al. (2000). For the credit variable, it is described by:

$$\frac{0.5 \times (\frac{cred_t}{CPI_{e,t}^{BR}} + \frac{cred_{t-1}}{CPI_{e,t-1}^{BR}})}{GDP_t}$$

where t are the quarters and e represents the end of period consumer price index (CPI) in Brazil (BR) at that quarter. For the stock market capitalization measure, which is originally expressed in current US$, we use:

[7] In the year 2000 the methodology of the national accounts system was revised and the series used in this paper for GDP and credit from the financial system to the private sector refer to the ones computed according to this methodology and made available by the Instituto Nacional de economia Aplicada (IPEA).

$$\frac{0.5 \times (\frac{cap_t}{CPI^{US}_{e,t}} + \frac{cap_{t-1}}{CPI^{US}_{e,t-1}})}{\frac{GDP_t}{\gamma_{e,t}}}$$

where, t are the quarters, e represents the end of period consumer price index (CPI) at the United State (US) at that quarter, and $\gamma_{e,t}$ is the end of period R\$/U\$ exchange rate in quarter t.

II. Additional tables and test results

The autocorrelation test is the test proposed by Godfrey (1988) which has no autocorrelation under the null hypothesis. The multivariate normality test is the one suggested by Doornik and Hansen (1994) and has normality under H_0. Finally, the multivariate test for ARCH effects of order q is suggested by Lütkepohl and Krätzig (2004) and has no ARCH effects under the null.

Table 2 - Multivariate Specification Tests

Autocorrelation	
$LM(1)$	$\chi^2(9) = 9.28[0.41]$
$LM(2)$	$\chi^2(9) = 9.58[0.38]$
Normality	
LM	$\chi^2(6) = 5.22[0.51]$
ARCH	
$LM(1)$	$\chi^2(36) = 53.28[0.03]$
$LM(2)$	$\chi^2(72) = 85.35[0.13]$
[ ] p-values	

The trace test, as described in Johansen (1996) is a Likelihood Ratio (LR) test, which has a null hypothesis that the rank of Π is r, which means that the system has $p - r$ unit roots. To determine the cointegration rank, a sequence of hypothesis is considered starting with the hypothesis of p unit roots. When the hypothesis is accepted, we have the number of unit roots and, therefore, the number of cointegration vectors. In our case, at a 5%

level of significance, we cannot reject the hypothesis of 2 unit roots and one cointegration vector, as shown in table 3; see Dennis et al. (2006).

Table 3 - Trace Test

p-r	r	Trace*	Frac95**	P-Value
3	0	61.30	41.45	0.00
2	1	25.16	25.73	0.06
1	2	9.01	12.42	0.16

* Bartlett corrected values
** Corresponding to the 95% quantile of the asymptotic tables

The weak exogeneity test is a LR type test, as proposed in Johansen and Juselius (1990), which has weak exogeneity under the null.

Table 4 - Weak Exogeneity test for $r = 1$

Critical value 5%	GDP	cred	cap
3.84	16.64	0.14	0.24
	[0.00]	[0.70]	[0.60]

[ ] p-values

The stationarity test is χ^2 test, which, as opposed to the usual Dickey-Fuller (1979) test, has stationarity under the null hypothesis. It has stationarity under the null hypothesis, given the cointegration space.

Table 5 - Stationarity Test for $r = 1$

Critical value 5%	GDP	cred	cap
5.99	20.54	28.49	25.87
	[0.00]	[0.00]	[0.00]

[ ] p-values