Economics Bulletin

Volume 32, Issue 4

Long Memory in Mergers and Acquisitions: Sectoral Evidence for an Emerging Economy

Marcelo Resende
Instituto de Economia, Universidade Federal do Rio de Janeiro

Abstract

The paper aims at testing for the presence of long memory in domestic and cross border mergers and acquisitions in Brazil along the 2002-1/2011-4 period. The evidence from the estimation of fractional ARIMA models at the sectoral level provided scant evidence of the presence of persistent long memory processes. The results display contrast with previous aggregate evidence and sectoral evidence for developed countries. In fact, except for a few cases, with a strong example in financial institutions, one cannot detect salient persistent patterns

The author acknowledges the comments from an anonymous referee but the usual caveats apply
Citation: Marcelo Resende, (2012) "Long Memory in Mergers and Acquisitions: Sectoral Evidence for an Emerging Economy", *Economics Bulletin*, Vol. 32 No. 4 pp. 2876-2883.
Contact: Marcelo Resende - mresende@ie.ufrj.br.
Submitted: June 10, 2012. **Published:** October 16, 2012.

1. Introduction

The time series empírical literature on mergers and acquisitions (M&A) attempted to uncover features of the underlying data generation process. Representative works include linear models [Melicher et al. (1983), Shughart and Tollison (1984) and Clark et al. (1988)], non-linear Markov switching models [Town (1992) for the U.S., and Resende (1999) for the U.K on a sectoral basis] and simple tests for wave detections [Golbe and White (1987,1993)].

Two salient issues of interest pertain the prevalence of M&A waves and the persistence of processes. Even though the existence and identification of wave patterns still warrant further investigation [see e.g. Gärtner and Halbheer (2009)], it appears that some stylized facts are gradually emerging as for example: (a) simpler random walk specifications tend to be rejected; (b) some common sectoral patterns of merger waves appear to exist; (c) a non-negligible degree of persistence appears to prevail in terms of the detected waves. The issue of persistence has been previously addressed in terms of high staying probabilities in a given M&A regime and yet alternative approaches that assess the long-run dependence of M&A and not the persistence in waves [as considered by Resende (1996) for sectoral data in the U.K. and Barkoulas et al. (2001) for aggregate data in the U.S.].

The present paper intends to investigate for the presence of long memory in M&A in Brazil for domestic and cross-border operations at the sectoral level. The focus of the previous literature on developed countries further motivates the work as M&A have become increasing important in emerging countries in general [see Rothenbuecher and Hoyningen-Huene (2008)] and in Brazil in particular after the 90s [see Miranda and Martins (2000)]. That tendency in part reflects the reduction of macroeconomic uncertainty and more stable institutional rules that provided a more favorable business environment.

The paper is organized as follows. The second section makes a brief digression on the empirical literature on M&A. The third section presents some basic concepts on long memory in the context of ARFIMA models. The fourth section discusses data sources and presents the empirical results. The fifth section brings some final comments

2. Mergers and Acquisitions: a Brief Digression

A growing empirical literature on mergers and acquisitions-M&A attempted to uncover the data generation process so as to highlight essential features that should be addressed by the theoretical research, In particular, a recurring puzzle refers to the occurrence of merger waves that tended to be characterized in terms of non-linear models as previously mentioned. However, a more basic aspect pertains the nature of shocks in the context of M&A. Indeed, the influential work by Gort (1969) emphasize the role of disturbances in driving mergers that could include more perennial structural changes often associated with regulatory and institutional settings.

The persistence of processes can be consistent with herd effects in M&A and highlights the importance of distinguishing between the transitory or permanent nature of shocks. Moreover, it is important to identify whether shocks are sector-specific or likely to propagate throughout the economy. As for the source of the

relevant abrupt changes, the standard neoclassical literature that relies on shareholder's wealth maximization and perfect capital markets but appears to provide an incomplete explanation. [1] Jovanovic and Rousseau (2002) propose that merger activity could follow from a gap between the q ratios of potential acquiring firms and targets that would tend to increase during a stock market boom and therefore favour the purchase of other firms, however empirical evidenbce does not seem to corroborate that argument.

Other authors emphasize the role of industry shocks (that can internal or external to the industry) with proeminent examples given by deregulation, changes in input prices and foreign competition. This first aspect seems particulalty relevant in Brazilian regulated utilities where more stable rules favoured the attraction of foreign investors. The role of industry shocks was discussed in Mitchell and Mulherin (1996) and Powell and Yawson (2005) and in the former work an important result for the 80s stressed the role of broad industry shocks in addition to specific deregulation and technological innovation shocks.

Finally, it is worth discussing the role of expectation-driven M&A movements. The model by Shleifer and Vishny (2003) underscores overvaluated shares during stock market boom and relaxes usual assumptions pertaining postmerger wealth creation and capital market efficiency. Temporary overvaluations would tend to induce exchange of overvalued shares for assets that are not subjected to misvaluation.

It is important to note that expectations-driven arguments for M&A based on temporary optimism episodes would not favor persistent patterns that are likely to be associated with longer run structural changes. Altogether industry specificities tend to be important and one should contrast sectors where M&A can react more rapidly to expectation changes and where future restructuring is more of managerial nature (as in many services industries) with sectors where restructuring can involve substantial physical restructuring (as for example in some capital-intensive industrial sectors). In a loose sense, one could in principle expect that highly persistent processes would be less likely in the latter example.

3. Long Memory: Basic Aspects

Persistence is often a salient feature in various economic settings. The class of Fractional ARIMA models (ARFIMA) naturally accommodates that feature by allowing a slower decay in the autocorrelation function. The ARFIMA (p,d,q) model advanced by Granger and Joyeux (1980) and Hosking (1981) can be summarized as:

$$\phi(L)(1-L)^d y_t = \theta(L)\varepsilon_t \ , \ \varepsilon_t \sim WN(0,\sigma_\varepsilon^2) \qquad (1)$$

where L denotes the lag operator, d the potentially fractional integration parameter, $\phi(L) = 1 - \phi_1 L - \phi_2 L^2 - ... - \phi_p L^p$, $\theta(L) = 1 - \theta_1 L - \theta_2 L^2 - ... - \theta_q L^q$. Following a binomial expansion one has:

$$(1-L)^d = 1 - dL + \frac{d(d-1)}{2!}L^2 + \frac{d(d-1)(d-2)}{3!}L^3 + ... \qquad (2)$$

[1] Resende (2008) provides a similar synthetic road map to the literature though more focused on M&A waves.

One needs d < 0.5 for stationarity and d > - 0.5 for invertibility and a long memory process is characterized by d ≠ 0 and as indicated by Brockwell and Davis (1987) give rise to two possibilities: (i) for - 0.5 < *d* < 0 the process is antipersistent; (b) for 0 < *d* < 0.5 the process is persistent.[2]

4. Empirical Analysis

4.1- Data sources

The paper relies on quarterly data on the number of domestic and cross-border mergers and acquisitions (M&A) in Brazil during the 2002-1/2011-4 period. Those could be obtained upon reports from *KPMG Corporate Finance*.[3] The sectoral data were somewhat more aggregated than analogous data used in studies for the U.K. and the analysis developed in the present paper tend to focus more on service industries. In fact, in some industries the occurrence of M&A was very rare and in a very few cases there were changes in the classification of sectors. Summary statistics are reported in table 1 and indicate non negligible heterogeneity. Next, one could proceed the estimation of ARFIMA models for 14 sectors as later reported in table 2.

Table 1
Mergers and Acquisitions in Brazil [2002-1/2011-4] – Summary Statistics

Sector	**Domestic**				**Cross-Border**			
	min.	**max.**	**mean**	**std. dev.**	**min.**	**max.**	**mean**	**std. dev.**
Mining	0	5	0.725	1.240	0	10	2.050	2.551
Food, beverages and tobacco	1	11	4.350	2.597	1	13	5.925	3.300
Metallurgy and steel	0	6	1.350	1.442	0	12	3.425	2.934
Electrical and electronic eq.	0	2	0.500	0.751	0	7	1.9	2.122
Chemical and petrochemical products	0	6	1.275	1.502	0	13	2.775	2.722
Chemical and pharmaceutical products	0	3	0.725	0.847	0	7	2.l75	1.810
Hygiene	0	4	0.875	1.202	0	4	0.650	0.975
Advertising and publishing houses	0	13	3.225	2.713	0	7	2.200	1.977
Transportation	0	8	2.025	1.860	0	6	0.825	1.279
Company services	0	8	2.175	2.099	0	8	2.375	2.317
Retail outlets	0	6	1.425	1.781	0	3	0.475	0.784
Shopping centers	0	19	2.725	4.261	0	3	0.250	0.630
Insurance	0	6	2.000	2.088	0	5	1.575	1.448
Financial institutions	0	9	2.775	2.154	0	8	2.825	1.946

[2] Useful overviews on long memory processes are provided by Lardic and Mignon (1997) and Guégan (2005).
[3] Studies based on counts of M&A are common in the empirical literature.

4.2 – Empirical results:

The estimations were carried out with Stata 12.0 taking as reference maximum likelihood procedures advanced by Sowell (1992a,b). We consider all the combinations of specifications for p and q ranging from 1 to 4, though in some cases the maximum likelihood function was misbehaved and no convergence was achieved. The selection criterion was based on the minimization of the Akaike Information Criterion (AIC). The estimated values for the fractional integration parameter are reported in table 1.[4]

The results for domestic M&A indicate the presence of long memory only in 6 of the 14 considered sectors and was associated with both antipersistent pattern [as in food, beverages and tobacco; electrical and electronic equipment; company services] and persistent patterns [as in hygiene; shopping centers; financial institutions]. As for cross border M&A, in principle, one should expect more cautious underlying decisions and it should be stressed that even with sound macroeconomic fundamentals the ratings for the Brazilian economy were not always completely positive. The results for that case were somewhat weaker and from the total of 14 sectors one observes antipersistent patterns in 2 sectors [mining; transportation] whereas 1 sector exhibited a persistent pattern [financial institutions]. With this last notable exception, one sees a contrast in terms of the sectors involved under the two types of M&A.[5] How do those results compare with previous evidence? In that sense, Barkoulas et al (2001) had provided aggregate evidence for the U.S, case that displayed strong robustness with respect to estimation methods and indicated a long-range dependence in the data. A possible interpretation could favor, as suggested by the authors, the "economic disturbance" theory advanced by Gort (1969) and that later motivated contributions like Mitchel and Mulherin (1996). Nevertheless, one would need have in mind possible propagation mechanisms of sector-specific shocks that could give rise to aggregate effects.

At the sectoral level some relevant intuitive examples include deregulation and foreign trade shocks.[6] However, the evidence from M&A studies is more limited. Resende (1996) considered sectoral data at a more disaggregated level than in the present application and the evidence, based on the variance-ratio statistics, indicated a consistently low degree of persistence across sectors that could possibly reflect short-termism.

The above evidence for Brazil, as stressed before, favoured long memory only in a small number of cases. Interestingly, a strong result was obtained for financial institutions both in domestic and cross-border M&A. That sector constitutes, of course, a more expectation-sensitive case and prone to more frequent shocks, most notably following the frequent and substantial international crises.

[4] The simulation results by Lieberman et al. (2000) on smaller samples for ARFIMA models provide additional confidence on the consideration of moderate size samples like in this study.

[5] In the case of chemical and petrochemical products there was evidence of a non-stationary process.

[6] One observed significant M&A activity in regulated sectors under more stable institutional rules, in particular for energy companies but for the totality of combinations of the ARFIMA models the maximum likelihood was mis-behaved and no convergence was reached in the estimations.

Table 2
Mergers and Acquisitions in Brazil [2002-1/2011-4]
Fractional Integration Parameter

Sector	**Domestic**			**Cross-Border**		
	coefficient	**p-value**	**Selected model (p,q)**	**coefficient**	**p-value**	**Selected model (p,q)**
Mining	0.163	0.554	(2,1)	- 0.489	0.044	(1,1)
Food, beverages and tobacco	- 0.098	0.000	(2,1)	- 0.260	0.386	(1,2)
Metallurgy and steel	0.248	0.226	(2,1)	- 0.003	0.905	(1,2)
Electrical and electronic eq.	- 0.206	0.000	(2,2)	0.170	0.305	(1,1)
Chemical and petrochemical products	- 0.058	0.926	(1,2)	- 0.500	0.000	(3,1)
Chemical and pharmaceutical products	0.077	0.517	(2,3)	0.017	0.887	(1,1)
Hygiene	0.113	0.000	(2,2)	0.115	0.734	(2,3)
Advertising and publishing houses	- 0.465	0.298	(1,4)	0.131	0.485	(1,4)
Transportation	0.244	0.207	(1,2)	- 0.320	0.018	(2,3)
Company services	- 0.392	0.000	(2,2)	- 0.069	0.725	(3,1)
Retail outlets	0.236	0.173	(1,1)	- 0.214	0.773	(2,4)
Shopping centers	0.197	0.000	(2,2)	- 0.014	0.951	(3,1)
Insurance	0.126	0.446	(1,4)	0.056	0.832	(1,2)
Financial institutions	0.249	0.000	(2,2)	0.200	0.000	(2,2)

Notes: p-values are reported in parentheses; (p,q) orders of the model selected in accordance to the Akaike Information Criterion (AIC)

5. Final Comments

The paper aimed at investigating the presence of long memory in the case of M&A in Brazil. The evidence obtained for domestic and cross-border M&A favoured long-run dependence only in a few cases what contrasted with the previous aggregate evidence for the U.S.. A possible interpretation could be that despite the lower economic uncertainty following macroeconomic stabilization and more stable institutional rules, that short-termism by decision makers still prevails.

Future avenues for research include the detection of merger waves and the assessment of co-movements across sectors. For that purpose, Markov switching models can provide a useful approach.

References

Barkoulas, J.T., Baum, C.F., Chakraborty, A. (2001) "Waves and persistence in merger and acquisition activity", *Economics Letters*, **70**, 237-243

Brockwell, P., Davis, R. (1987) *Time Series: Theory and Methods*, New York, Springer-Verlag.

Clark, J., Chakrabarti, A. ,Chiang, T. (1988) "Trend and stochastic movements in U. S. merger activity", *Quarterly Review of Economics and Business*, **28**, 5–18.

Gärtner, D.L.. Halbheer, D. (2009) "Are there waves in merger activity after all?" , *International Journal of Industrial Organization*, **27**, 708–718

Golbe, D., White, L. (1987) "A time series analysis of mergers and acquisitions in the U.S. economy", In A. Auerbach (ed.), *Corporate Takeovers*, Chicago, University of Chicago Press, 708–29

Golbe, D., White, L. (1993) "Catch a wave: the time series behavior of mergers", *Review of Economics and Statistics*, **75**, 493–99.

Gort, M. (1969) "An economic disturbance theory of mergers", *Quarterly Journal of Economics*, **83**, 624-642

Guégan, D. (2005) "How can we define the concept of long memory? An econometric survey", *Econometric Reviews*, **24**, 113-149

Granger, C., Joyeux, R. (1980) "An introduction to long-memory time series models and fractional dfferencing", *Journal of Time Series Analysis*, 1, 15-29

Hosking, J. (1981) "Fractional differencing", *Biometrica*, **68**, 165-176.

Jovanovic, B, Rousseau, P. L. (2002) "The Q theory of mergers", *American Economic Review-Papers and Proceedings*, **92**, 198–204

Lardic, S., Mignon, V. (1997) "Essai de mesure du degré de mémoire longue des series. L´exemple de la modelisation ARFIMA", *Economie Applique*, **50**, 161-95

Lieberman, O., Rousseau, J., Zucker, D.M. (2000) "Small sample likelihood-based inference in the ARFIMA model", *Econometric Theory*, **16**, 231-248

Melicher, R., Ledolter, J.. D'Antonio, L. (1983) "A time series analysis of aggregate merger activity", *Review of Economics and Statistics*, **65**, 423–429

Mitchell, M.L., Mulherin, J.H. (1996) "The impact of industry shocks on takeover and restructuring activity", *Journal of Financial Economics* . **41**, 193-229

Miranda, J.C., Martins, L. (2000) "Fusões e aquisições de empresas no Brasil", *Economia e Sociedade*, **14**, 67-88

Powell, R. and Yawson, A. (2005) "Industry aspects of takeovers and divestitures: evidence from the UK" *Journal of Banking & Finance*, **29**, 3015–3040.

Resende, M. (1996) "Mergers and acquisitions in the U.K.: a disaggregated analysis", *Applied Economics Letters*, **3**, 637-640

Resende, M. (1999) "Wave behaviour of mergers and acquisitions in the U.K.: a sectoral study", *Oxford Bulletin of Economics and Statistics*, **61**, 85-94

Resende, M. (2008) "Mergers and acquisitions waves in the UK: a Markov-switching approach", *Applied Financial Economics*, **18**, 1067-1074

Rothenbuecher, J., Hoyningen-Huene, J. (2008) "The rise of emerging markets in mergers and acquisitions", A.T. Kearney

Shleifer, A., Vishny, R. W. (2003) "Stock market driven acquisitions", *Journal of Financial Economics*, **70**, 295–311.

Shughart, W. F., Tollison, R. D. (1984) "The random character of mergers", *RAND Journal of Economics*, **15**, 500–509.

Sowell, F. (1992a) “Maximum likelihood estimation of stationary univariate fractionally-integrated time-series models”, *Journal of Econometrics*, **53**, 165–188.
Sowell, F. (1992b) “Modeling long-run behavior with the fractional ARIMA model”, *Journal of Monetary Economics*, **29**, 277–302.
Town, R.J. (1992) “Merger waves and the structure of merger and acquisition time-series”, *Journal of Applied Econometrics*, **7**, S83–S100.