Firm leadership stability in the Brazilian industry: an empirical note*

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RESUMO

A nota investiga a rotatividade de firmas líderes entre as 5 maiores firmas em cada setor da indústria de transformação ao longo do período 1986-98. Três indicadores distintos de mobilidade foram calculados para intervalos de 4 anos. A evidência assim obtida indicou uma ligeira mudança na mobilidade quando se move na direção do período pós-liberalização comercial. Dois índices indicam uma pequena redução na mobilidade enquanto um terceiro favoreceria um aumento modesto na mobilidade. Os resultados indicam que apesar de um ambiente potencialmente mais competitivo nos anos recentes, a rivalidade nos mercados é ainda limitada sob diferentes aspectos.

Palavras-chave: liderança, mobilidade.

ABSTRACT

This note investigates the leadership turnover among the top 5 firms in each manufacturing sector along the 1986-98 period. Three different mobility indicators were calculated for intervals of 4 years. The evidence thus obtained indicated only a slight change of mobility when one moves towards the post-trade liberalization period. Two indexes indicate a slight decrease in turnover whereas a third one would favor a modest increase in turnover. The results indicate that despite a potentially more competitive environment in the recent years, market rivalry is still limited in different aspects.

Key words: leadership, turnover.

JEL classification: L10, L60.

1 Introduction

Firm leadership is an unquestionable and central topic in Industrial Economics. Traditional Stackelberg dominance in different oligopolistic settings illustrate the pervasiveness of first-mover advantages that favor a exogenously determined leader (see e.g. Shapiro, 1989). An important challenge, however, pertains the assessment of explanatory factors determining the identity of the leader and possible market share profiles emerging from that leadership behavior. In that sense, the literature has focused on the sources of leadership persistence and to a less extent to specific market share patterns.

Gruber (1992) consider an oligopoly model with 3 firms and vertical product differentiation, where the timing of innovations has an important role in determining leadership persistence if learning by doing effects are important.

Deneckere *et al.* (1992) investigate a price-setting duopoly where leadership is endogenously determined. It can be shown that the identity of the leader is crucially related to the share of loyal consumers (not identified a priori) with respect to its product.

Staiger and Wolak (1992) generalizes super-game models of collusion, that focused on uncertain demand, by introducing capacity constraints. Two leading results emerge. First, if excess capacity is small in equilibrium one will observe mild price wars with smooth price reductions that will imply relatively stable market shares over time. Second, if excess capacity is substantial, a severe price-war will occur with aggressive price undercutting and the resulting market shares will be very unstable.

It is important to stress that the theoretical models are able to partially explain leadership, but do not predict very specific profiles for market share over time.

From a practical point of view, actual industrial structures often display a salient behavior in terms of market dominance and therefore issues pertaining market share stability are important to assess rivalry. Market shares that are more stable could be indicative of mild competitive pressures (see Hymer and Pashigian, 1962; Davies and Geroski, 1997).

The study of market share stability gains special momentum as better data become increasingly available and thus the exploration of the related time-series properties has given rise to intense investigation efforts as indicated by Das et al (1993), Cable (1997), Barla (1999), Mazzucato and Semmler (1999) and Doi (2001) among others. Moreover, an emerging strand of the empirical literature investigates the stationarity of market

shares relative to sector-level mean levels as exemplified in the work of Gallet and List (2001) and Resende and Lima (2005) that respectively considered the American and Brazilian cases. The referred studies support the non-stationarity associated with significant market share instability

In the Brazilian case, however, investigation efforts on the topic have been scarce. It is worth mentioning the earlier descriptive study by Tavares *et al.* (1978) that investigated firm leadership for the year 1970 at the 4-digits level, together with other relevant dimensions of market structure such as internationalization of production and indicators of conduct and performance. The focus on the 1970-73 period, when Brazilian industry experienced a boom, was in the internationalization as affecting the behavior of investment, relative prices, real output and profit margins classified by use groups. Unfortunately, this study could not be replicated for additional years and therefore the investigation of leadership stability was sacrificed.

The present paper intends to resume the specific topic of firm leadership stability in Brazil taking as reference the 1986-98 period. For that purpose, we consider quantitative studies undertaken in other countries. Geroski and Toker (1996) is a representative example of this scarcely explored branch of the literature that investigates the turnover of firm leadership. The paper develops turnover indicators for leaders in Brazilian manufacturing industry.

The paper is organized as follows. The second section describes the data construction procedures and provides initial motivations. The third section discusses conceptual aspects on the analysis of firm turnover and the corresponding empirical results. The fourth section brings some final comments.

2 Data construction

The basic data source is the data bank on the 1000 largest firms in Brazil which is generated in an annual basis and comprises balance sheets and income accounts. This data bank is organized by the Centre of Entrepreneurial Studies and Finance – Getulio Vargas Foundation-Brazil. It was possible to obtain annual data for the period 1986-98 and included 21 sectors.[1] The original data was classified in terms of a 3 digits classification. In this sense, it was important to carefully select relatively homogeneous sectors so as to

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1   Further details on the selected sectors appear in the appendix 1.

produce meaningful market shares. Based on the referred data, we were able to compute mobility indicators for the top 5 firms in each sector.

As a preliminary motivation, Tables 1, 2 and 3 present the transition between ranks in the top 5 firms in 1990, 1994 and 1998, taking as reference the initial years of 1986, 1990 and 1994 respectively. In other words, we seek to identify the number of firms that were initially leaders and managed to persist in such market dominance after some years. The tables indicate the number of firms with a particular rank (1 to 5) in an initial reference year, that possess some particular rank in a later year. For example, among the firm leaders for each of the 21 sectors in 1994, there were 4 that switched to the second position in 1998.

Table 1
Transition Table Between Ranks in the Top Five Leaders, 1986-90

1986	1990					
	1	2	3	4	5	Exits
1	9	5	1	0	0	6
2	5	3	3	1	2	7
3	0	6	6	4	0	5
4	0	3	3	2	2	11
5	0	0	2	1	3	15
Entrants	7	4	6	13	14	44

Table 2
Transition Table Between Ranks in the Top Five Leaders, 1990-94

1990	1994					
	1	2	3	4	5	Exits
1	14	2	1	0	0	4
2	1	8	7	0	1	4
3	1	5	4	4	0	7
4	1	1	2	2	4	11
5	0	1	2	4	2	12
Entrants	4	4	5	11	14	38

Table 3
Transition Table Between Ranks in the Top Five Leaders, 1994-98

1994	1998					
	1	2	3	4	5	Exits
1	8	4	0	3	1	5
2	4	5	5	0	1	6
3	2	4	6	2	1	6
4	2	1	2	4	1	11
5	0	1	1	4	3	12
Entrants	5	6	7	8	14	40

The inspection of the previous tables indicate a changing degree of leadership persistence. At a more general level there is a slight decrease in mobility in the two last periods of analysis in contrast with the first period if one considers the total entry and exit in group of top 5 firms.

A comparative perspective with previous results for the UK, as obtained by Geroski and Toker (1996), is not straightforward. In fact, the referred study only compares two years and therefore the evolution over time is not considered. Nevertheless, some similarity on the involved magnitudes of the transition table can be observed, but this cursory analysis is not sufficient to characterize leaders mobility. In this sense, we consider in the next section turnover measures that can provide a more rigorous description of the phenomenon.

3 Firm turnover: conceptual aspects

3.1 Turnover indicators

The study of firm mobility or turnover in leadership is directly associated with the persistence of specific ranks over time. If one conceives rank as states, it is possible to describe to structure of firm leadership in terms of a Markov process. Bartholomew (1973) and Geroski and Toker (1996) follow the lead of the seminal paper by Prais (1955). The

simplicity of a Markovian structure refers to the sole dependence of the state in each period with respect to the state of the previous period. In the present study, we will consider 3 turnover indicators for the market leaders.

The first two indicators were suggested by Geroski and Toker (1996):

$$D_1 = 1 - 2\,p_x$$

where p_x denotes the probability of a firm exiting the group of top 5 leaders. If the referred probability is equal to 0, one faces a complete immobility scenario. Other salient case occurs if $p_x = 1/2$, in which case both survival or exit have the same probability and one would face a perfect mobility case. The index is an inverse mobility measure and ranges between 0 and 1, and the lower and upper bounds respectively refer to perfect mobility and complete immobility.

$$D_2 = 1/p_x$$

D_2 provides the expected duration of survival in the group of top 5 leaders. If $D_2 \to \infty$ one has the complete immobility whereas with $D_2 = 2$, the perfect mobility arises. The expected duration of a state in the context of a Markov process is a well known result and the appendix 2 presents the basic arguments. These first two measures at first display some similarity as both are negatively related p_x. However, in D_1 one has a linear association, whereas in D_2 the association is non-linear. Moreover, as mentioned above, the interpretations are somewhat distinct.

Bartholomew (1973) proposes an additional measure:

$$D_3 = \sum_i \sum_j p_{ij} |i - j|$$

where i denotes the firm rank in the initial year, j the rank in the final year and p_{ij} the transition probability between rank i in period t and rank j in period t+1. This indicator assigns larger weights to broader rank shifts. It is worth mentioning that this measure only considers mobility within the 5 leaders group, without incorporating entry during the reference period

In the next sub-section the 3 mobility indicators, just described, are calculated for the Brazilian case.[2]

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2   In empirical applications, the probabilistic reasoning is implemented in terms of relative frequencies.

3.2 Empirical results

Table 4 presents the previously mentioned indicators for 3 distinct periods (1986-90, 1990-94, 1994-98). The basic motivation was to pinpoint trade liberalization and price level stabilization, as important turning points are associated with the trade liberalization initiated in 1990 and the Real Plan in 1994.

Table 4
Mobility Indicators

Period	D1	D2	D3
1986-1990	0,16	9,55	2,33
1990-1994	0,28	11,05	2,29
1994-1998	0,24	10,50	2,90

The evolution of indicators D_1 and D_2 show some slight reduction of leadership turnover, whereas D_3 shows an inverse (but modest) tendency. The obtained difference can possibly reflect the differential weights treatment given by the latter measure. In principle, the result would be somewhat unexpected as the more recent period is usually associated with a more competitive environment. The result is nevertheless consistent with the high profit persistence encountered in the Brazilian case by Resende (2002) even in the post-liberalization period. The evidence seems to indicate that despite the price stabilization that enhanced the informative role of the price system and competitive pressures arising from trade liberalization, one observes a limited degree of competition as indicated by the modest magnitude of the mobility measures.

The previous results provide an aggregate account of the mobility behaviour in the group of top 5 leaders. To get a more detailed perspective, we further analyse indicator D_2 in terms of specific ranks and not only the top 5 group. The evidence is shown in Table 5.

Table 5
Expected Duration Times for Firms of Different Ranks

1986 rank	T1	T2
1	7,00	14,00
2	4,67	12,00
3	5,60	16,80
4	4,42	7,64
5	4,67	5,60
1990 rank		
1	12,00	21,00
2	6,46	21,00
3	4,94	12,00
4	4,42	7,64
5	4,42	7,00
1994 rank		
1	6,46	16,80
2	5,25	14,00
3	5,60	14,00
4	4,94	7,64
5	4,67	7,00

The table presents two kinds of information: first it shows the expected survival duration in a specific rank within the top ranks (T_1) and second it shows the expected survival duration in the top 5 groups for firms that were initially in some specific top rank (T_2). For T_1 the results are reasonably stable over time. An important exception is given by firms ranked 1 in the initial year and expected to stay in that rank in the investigated period. For 1986-90 that expected duration was 7 years, while in 1990-94 and 1994-98, the analogous figures were respectively 12 and 6.46 years. An additional salient feature is the near monotonic decreasing behaviour of the expected duration in accordance with the initial rank.

If we focus on the more aggregate evidence provided by T_2, similar tendencies are observed, except of course, for the larger magnitude of the expected duration when one considers a larger group.

In order to get a more complete perspective on the evolution of leadership stability, Table 6 provides annual figures for the 3 mobility indicators. As it would be expected, the degree of mobility decreases when we make annual comparisons as leader displacements should take some time.

Table 6
Mobility Indicators (1986-1998)

Periods	D1	D2	D3
1986-87	0,467	3,750	2,810
1987-88	0,524	4,200	2,524
1988-89	0,467	3,750	2,381
1989-90	0,486	3,889	3,286
1990-91	0,600	5,000	3,667
1991-92	0,448	3,621	3,857
1992-93	0,429	3,500	2,667
1993-94	0,524	4,200	2,429
1994-95	0,619	5,250	2,238
1995-96	0,600	5,000	2,476
1996-97	0,505	4,038	2,095
1997-98	0,486	3,889	1,810

Finally, bivariate correlations are presented in Table 7

Table 7
Correlations

	Correlations	p-values
D1 - D2	0,995	0,000
D1 D3	-0,090	0,780
D2 - D3	-0,063	0,845

Even though, one must keep in mind that correlation coefficients capture linear associations, one must pinpoint the high correlation between D_1 and D_2. On the other hand, D_3 appears to be capturing a distinct dimension of the mobility phenomenon, what can, in part, explain the different path of the alternative mobility measures.[3]

4 Final comments

The paper investigated the evolution of leadership turnover in the Brazilian manufacturing industry along the period 1986-98. Besides the obvious gap in the empirical literature, the referred period is particularly interesting as it is possible to identify sub-periods that could in principle be associated with a more competitive and stable environment. In fact, the price stabilization following the Real Plan and especially the trade liberalization initiated in 1990. The potential relevance of that liberalization in market shares patterns were recognized by Hay (2001) but the construction of mobility indicators was absent in the Brazilian literature.

The evidence showed modest shifts in the mobility patterns in the more recent years. Two indexes suggest a small reduction in mobility whereas a third measure suggested a slight increase in leadership turnover. In any case, one faces a somewhat unexpected result as one does not observe important changes by moving towards the post-liberalization period. Moreover, there is some evidence of especially high leadership persistence when one considers the top leader. Altogether the different results refer to a specific aspect of market rivalry as even in sectors with substantial market power it is possible to observe

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3   In the present analysis data was available only for 12 time periods. Doi (2001) had access to a larger sample and was therefore able to econometrically explore the determents of a different mobility measure. Only exports, industry size and concentration exerted significant effects. Surprisingly, advertising and R&D expenditures have no impact on leadership mobility.

substantial instability of markets shares of the leaders, but a limited mobility on the other hand would reinforce a limited competition in the sector.

The present paper had a descriptive character and important extensions would be the construction of sector-specific mobility measures whose determination could be explored in terms of an econometric model. Moreover, the consideration of more updated data would be relevant. These extensions are unfortunately not currently feasible due to data availability restrictions.

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Appendix 1

Sectors
Pulp, Paper and Paperboard
Publishing and Printing
Wood
Electrical Material
Equipments for Electricity Production and Distribution
Electronic Material
Motor Vehicles, Components and Accessories
Other Metal Work
Steel
Furniture and Bedding
Pharmaceutical and Veterinary Products
Sugar and Alcohol
Plastic Products
Pesticide, Fertilizer and Other Agricultural Chemical Products
Inorganic Chemical Products
Resin and Synthetic Rubber
Paint, Coating and Adhesive
Textile
Cement
Ceramic Material
Clothing and Sweaters

Appendix 2 - Expected duration of a regime in a Markov-Switching model

In this appendix the expected duration of a regime in a Markov-Switching model is presented in details. The relevant question here is how long, in average, will the state j last. If D is defined as the duration of state j and p_{jj} as the probability that the state j survive from period t to period t+1, we have:

$D = 1, \ if \ S_t = j \ and \ S_{t+1} \neq j; \Pr[D = 1] = (1 - p_{jj})$

$D = 2, \ if \ S_t = S_{t+1} = j \ and \ S_{t+2} \neq j; \Pr[D = 2] = p_{jj}(1 - p_{jj})$

$D = 3, \ if \ S_t = S_{t+1} = S_{t+2} = j \ and \ S_{t+3} \neq j; \Pr[D = 3] = p_{jj}^2(1 - p_{jj})$

$D = 4, \ if \ S_t = S_{t+1} = S_{t+2} = S_{t+3} = j \ and \ S_{t+4} \neq j; \Pr[D = 4] = p_{jj}^3(1 - p_{jj})$

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The expected duration of state j can be obtained by the following expression:

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\begin{aligned}
E(D) &= \sum_{j=1}^{\infty} j \Pr[D = j] \\
&= 1 \times \Pr\left[S_{t+1} \neq j \,\middle|\, S_t = j\right] \\
&\quad + 2 \times \Pr\left[S_{t+1} = j, S_{t+2} \neq j \,\middle|\, S_t = j\right] \\
&\quad + 3 \times \Pr\left[S_{t+1} = j, S_{t+2} = j, S_{t+3} \neq j \,\middle|\, S_t = j\right] \\
&\quad + 4 \times \Pr\left[S_{t+1} = j, S_{t+2} = j, S_{t+3} \neq j \,\middle|\, S_t = j\right] \\
&\quad + ... \\
&= 1 \times (1 - p_{jj}) + 2 \times p_{jj}(1 - p_{jj}) + 3 \times p_{jj}^2(1 - p_{jj}) + ... \\
&= \frac{1}{1 - p_{jj}}
\end{aligned}
$$

This result means that the expected duration of a State is the inverse of the probability of change from the state j to another state. This is equivalent to the definition of the D_2 in section 3.1. This same result was used to compute the results presented in Table 5 (see eg. Kim and Nelson, 1999).