Cost Stickiness in Brazilian Firms*

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Abstract

Conventional cost accounting assumes that the relation between cost and volume is symmetric for volume increases and decreases. We test an alternative model where costs increase more when activity rises than they decrease when activity falls by an equivalent amount. We find, for a sample of Brazilian firms that selling, general, and administrative costs increase 0.59% per 1% increase in sales but decrease only 0.32% per 1% decrease in sales. We test several hypotheses about the properties of sticky costs and how the stickiness of SG&A costs changes with firm circumstances and we confirm cost stickiness for Brazilian firms.

1. Introduction

The study of cost behavior is relevant not only for academic researchers but also to those whose professional activities are directly related to corporate activities. In the conventional model of cost behavior generally accepted in the accounting literature, costs are taken as fixed or variable with respect to changes in activity level. In this model, variable costs vary proportionately with changes in the activity driver (Noreen, 1991), implying that the magnitude of a change in costs depends only on the extent of a change in the level of activity, not on the direction of the change. However, some authors have sustained costs rise more with increases in activity volume than they fall with decreases (Cooper and Kaplan, 1998, p. 247; Noreen and Sanderstrom, 1997). This kind of cost behavior is called by Anderson, Banker and Janakiraman (2003) "sticky costs". According to these authors, costs are sticky if the magnitude of the increase in costs associated with an increase in volume is greater than the magnitude of the decrease in costs associated with an equivalent decrease in volume.

The prevalence of sticky costs is consistent with an alternative model of cost behavior in which managers deliberately adjust resources in response to changes in volume. This model distinguishes between costs that move mechanistically with changes in volume and costs that are determined by the resources committed by managers. When there is uncertainty about future demand and firms must incur adjustment costs to reduce or restore

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committed resources, managers may purportedly delay reductions to committed resources until they are more certain about the permanence of a decline in demand. This suggests that stickiness observed in one period may reverse in a subsequent period and that stickiness may be less pronounced when the observation period is longer.

The reason for this relevance consists in the fact that the basis of many managerial decisions is the knowledge of how costs can change as a function of activity level. Anderson, Banker e Janakiraman (2003), refers to Sales, general and administrative costs when it would be more correct to name them expenses. The reason for that is the paucity of data on costs and drivers. Similar to Anderson, Banker e Janakiraman (2003), this paper also uses sales, general and administrative expenses as a proxy for costs.

As put forward by Garrison and Noreen (2001, p. 131), attempts to take decisions without the thorough knowledge of costs involved and of how they change relative to the activity level might lead to disaster.

There are diverging views in the accounting literature with respect to cost behavior. Garrison and Noreen (2001), Horngren, Foster and Datar (2000) sustain that costs will react or change insofar as changes on the activity level occur, without concern with the direction of these changes (increase or decrease). However, Noreen and Soderstrom (1997) and Anderson, Banker e Janakiraman (2003), state that costs vary with greater intensity with an increase in activity volume than in the opposite direction, i.e. with a decrease in activity volume, i.e. costs are sticky downwards.

This study adopts the assumption that cost behavior depends on the intensity and direction of the variation in the activity driver as in Anderson, Banker and Janakiraman (2003), who concluded that costs are sticky. The question we try to answer is: are the costs of Brazilian firms sticky? Sticky costs in this study mean a more intense (positive) cost response when revenues increase than a (negative) cost response when revenues decrease in the same proportion. Therefore, the paper's main purpose is to identify how costs behave with respect to changes in net revenues in Brazilian firms.

The paper is divided in six sections. In the following section, a literature review on cost behavior including published works on the existence of cost stickiness is presented. The third section describes the hypotheses to be tested in the study. The fourth section describes the methodology used. The econometric models utilized are presented in the fifth section and the empirical results obtained are shown in the sixth section. The seventh section presents the conclusions.

2. Cost Behavior with respect to Activity Levels

To understand cost behavior in response to changes in the level of production and Sales is critical for firms' management virtually in all sectors (Atkinson et al., 2000; Horngren; Foster; Datar, 2000).

Garrison and Noreen (2001, p. 131) define that cost behavior means how will cost react or change when changes on the activity level occur. Managers who understand how costs behave have better conditions to predict what will be the trajectory of costs in several operating situations, allowing them to better plan their activities and, consequently, earnings. Suppose, for example, the following questions:

What is the effect of eliminating a product line on operating profits? Is it better to produce or purchase? Which prices must be raised? Which effect will an increase of 10% on sales have on operating profit? Theses and many other managerial decisions depend upon the knowledge of cost behavior.

The semi-variable cost is composed of a fixed part (the activity costs when the volume of services is equal to zero) and a variable part (which must vary according to the activity driver). The semi-variable or mixed costs (for example, wages of maintenance workers) remain constant within large activity ranges and increases or decreases in response to reasonably large changes on the activity level only. Small changes in the production level might not affect for example the number of employees required to adequately handle maintenance.

Fixed costs can be considered as committed or discretionary (Garrison and Noreen, 2001). Committed fixed costs are by nature long run and cannot be reduced to zero even for short periods. Depreciation of fixed assets, property tax, salaries of management and operating personnel are examples of committed fixed costs. Discretionary fixed costs are generally short-run costs and can be cut for short periods, with minimum damage for the organizations' long run targets. Examples of discretionary fixed costs are advertising, research, and public relations.

Some managerial accounting experts argue that costs are neither genuinely variable nor fixed (Ingram, Albright and Hill, 1997) and that the relationship between variable and fixed costs and the activity level is valid within the so-called "relevant range" (Horngren, Foster and Datar, 2000; Maher, 2001).

The relevant range is the activity range in which the cost behavior hypotheses assumed by the manager is valid. Despite the emphasis given by economists to the non-linearity of many variable costs, it is assumed that a non-linear cost can be approximated by a straight line, within the activity range (Garrison and Noreen, 2001).

Innes and Mitchell (1993, p. 86) consider that the accounting literature has a myopic view on how costs behave. Generally cost behavior is analyzed and measured by one driver only – production level. They add that classifying indirect costs as fixed (costs which do not change with changes in volume) might lead to wrong

decisions insofar as in many organizations these costs have shown high growth rates without an increase in activity volume (Miller and Vollmann, 1985; Berliner and Brimson, 1992). The basis for this argument comes from the activity based costing (ABC) assumption that costs are primarily influenced by the volume of each activity flow, rather than by the volume of production (Innes and Mitchell, 1993). Hence, the efficacy of the cost-driver information is in providing a series of factors which might be used to explain fixed cost behavior (Innes and Mitchell, 1993). For the activity based costing a linear relationship between cost drivers and costs exists (Kaplan and Cooper, 1998).

Noreen (1991) demonstrates that cost allocation – even in ABC – is relevant for the decisions if, and only if, the following conditions are satisfied: 1) all costs can be divided in centers and each one is defined as a function of a measured activity; 2) the cost amount in each cost center changes in direct proportion to its activity; and 3) all activities can be attributed to products in the sense that if a product is cut, then the activities associated to this product will be eliminated. Noreen and Soderstrom (1994) tested the second condition: that the costs are strictly proportional to the activity. This hypothesis was rejected in the majority of indirect cost accounts in hospitals in the US.

Anderson, Banker and Janakiraman (2003) tested and confirmed the hypothesis that costs are sticky. By specifying a model with SG&A costs as a function of net sales revenues, they found that costs increase on average 0.55% in response to a 1% increase on net sales revenues, but decreases by only 0.35% with respect to a 1% reduction on those revenues. Due to the lack of general data on costs and relevant drivers, data on SG&A costs and net sales revenues have been used to analyze cost stickiness. SG&A cost behavior can be analyzed with respect to net sales revenue because sales volume drives many of the SG&A components (Kaplan; Cooper, 1998; Noreen; Soderstrom, 1994).

According to Anderson, Banker and Janakiraman (2003), there are various reasons for cost stickiness, such as: natural reluctance in firing employees when the activity volume decreases, agency costs, and the need of time to confirm the tendency of activity volume reduction. Managerial decisions to maintain unutilized resources can also be caused by personal considerations and result in agency costs. Agency costs are incurred by the firm because of decisions taken by managers based on the maximization of their own interests and not under the perspective of creating value for the firms' shareholders (Anderson; Banker; Janakiraman, 2003) [1].

Knowledge about cost behavior is important for accountants, researchers and other professionals related to the management field that assess the changes in costs with respect to changes in revenues. The managerial inference

[1] For more on Agency Theory see, for example, Hendriksen e Van Breda (1999) e Brealey, Myers e Marcus (1998).

from the analysis is that cost stickiness can be recognized and controlled. Managers must assess their exposition to cost stickiness by considering the sensitivity of cost changes relative to volume reductions, increasing the firms' response capacity vis-à-vis reductions in the demand for products or services. This may contribute to improve the accountability process. By and large, this expression means the obligation of the agent or representative – either private or governmental – to give account to the principal or represented. By verifying cost stickiness, firm owners can analyze if managers are incurring in agency costs.

Understanding cost behavior is also relevant for external users (financial analysts, for example) who want to assess the firm's performance. The common procedure of financial analysts involves the comparison of SG&A components as a percentage of net sales revenues across firms or within the same firm through time. This analysis may be incorrect if cost behavior relative to decreases or increases in revenues is not observed and this can be improved when analysts understand how costs change with respect to revenues.

3. Hypotheses

In connection with the asymmetric cost behavior four hypotheses are tested in this study, as follows:

H_1: the magnitude of a cost increase as a function of an increase in net sales revenues is greater than the magnitude of a cost reduction as a function of an equivalent reduction in net sales revenues.

Hypothesis H_1 considers how the managerial intervention affects the process of resource adjustment. Managers make discrete changes in committed resources because some corresponding costs cannot be added or reduced fast enough to combine changes in resources with small changes in demand.

Firms have to incur in adjustment costs to remove committed resources and to replenish these resources when demand is reestablished. Adjustment costs include, for example, expenses with dismissing employees and hiring new ones, as well as organizational costs deriving from reduction motivation of the remaining employees after the dismissing of many professionals.

When demand rises, managers raise committed resources in order to match the additional demand. When demand declines, however, some committed resources will not be totally utilized, unless managers take the deliberate decision to cut them. In order to do this, it is necessary that managers assess the probability that this demand decline is temporary, when the time is come to decide upon the reduction of committed resources. Sticky cost behavior will occur if the manager decides to keep unnecessary resources instead of incurring in adjustment costs when volume declines.

Managerial decisions of holding unnecessary resources can also be caused by personal interests, resulting in agency costs. Managers may keep idle resources in order to avoid personal consequences of cost reductions, such as loss of status when a branch is restructured or the anguish of firing familiar employees, contributing to cost stickiness. Brealey, Myers and Marcus (1998) consider the understanding of the Agency Theory as one of the main foundations of financial management.

Observing cost stickiness in one time period only reflects the costs of maintaining unused resources in a period when a revenue decline occurred. When the observation window includes several time periods, more complete adjustment cycles are captured. During longer time intervals, the managerial assessment about the permanence of a change in revenues becomes more precise and then adjustment costs become lower relative to the cost of keeping unused resources. Therefore, it is likely that cost stickiness is less pronounced when time periods are aggregated into two, three or four-year periods, instead of one-year periods. Besides, the cost adjustment to revenue changes can occur not only contemporaneously but also in a lagged way, i.e. cost stickiness might be lower if its behavior is observed including one lagged period. In order to test these two possibilities, hypothesis H_2 and H_3 were specified as follows:

H_2: Cost stickiness decline with the aggregation of periods.

H_3: There is a lagged adjustment of costs relative to revenue changes.

Changes in sales revenues can reflect short-term market conditions or structural shifts in demand for products and services. Managers, when observing a sales drop can wait for information which will allow them to assess the permanence of the demand fall before taking decisions on cutting resources. Such delays provoke cost stickiness, since unused resources are kept during the period between the reduction in volume and the adjustment decision. A time interval between the decision of cutting resources and the effective cost reduction can also occur, since contractual commitments take time to be undone. A consequence of the delay in taking decisions and undoing contractual arrangements is that the asymmetric change observed in one time period might be reverted in subsequent periods. In order to test this possibility, hypothesis H_4 was established.

H_4: Cost stickiness is reverted in subsequent periods.

Section 4 presents the methodology and the data utilized to test the four hypotheses described.

4. Methods

This paper employs panel data log-linear regressions to test cost stickiness. Three panel-data models were used in order to ensure the robustness of results: constant coefficients or pooled-regression model, fixed effects

model and random effects model (Greene 2003, p. 285-287). The constant coefficients model assumes that both the intercept and the slope do not vary, being the same for all firms. The individual fixed effects model assumes that the slopes are fixed but the intercepts are different for each firm. In this case, there are no time effects affecting the regression, but individual effects only. These effects can be observed or not observed and they are generally correlated to the regressors, i.e., they are endogenous. The random effects model assumes that, if there are effects not belonging to the model, these are exogenous and uncorrelated to the regressors (Baltagi, 2001, p. 20).

In order to further assure the robustness of the empirical study, individual time-series regressions were carried out for Model I. Results are shown in section 5.

4.1. Panel Unit Root Tests

According to econometric literature, data series must prove to be stationary in order to avoid otherwise spurious regressions (Greene, 2002, p. 631). This means that all series must be free from unit roots. One possible approach when dealing with panel data is to test each one of the series for unit roots. However, several panel unit root tests have been recently developed to deal with panel data. Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. In this study, we computed the following five types of panel unit root tests: Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher-type tests using ADF and PP tests (Maddala and Wu, 1999; Choi, 2001). The tests were applied to the Model II only, since Model I is nested in it, which means that if there is no evidence of unit roots in Model II, than there will be no evidence of unit roots in Model I either. The results of these tests are given in Table 1, in section 5.

4.2. Models

Model I is utilized to asses how costs react to net sales movements and to discriminate the periods when revenues increases or decreases. Its specification is:

$$\log\left[\frac{SGA_t}{SGA_{t-1}}\right] = \beta_0 + \beta_1 \log\left[\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right] + \beta_2 Dummy_{i,t} * \log\left[\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right] + \varepsilon_{i,t} \qquad \text{(I)}$$

Because of the great diversity of firms in terms of performance and size, the log-linear specification provides a better comparativeness of variables among firms and alleviates potential cross-section heterocedasticity. The dummy variable is equal to one when the revenue of the *i*-th firm in time *t* is lower that revenue in time *t-1*. Since the dummy is equal to zero when revenue increases, coefficient β_1 measures the percentage rise in costs with respect to a 1% rise in revenue. Because the dummy is equal to one when revenue goes down, the sum of coefficients ($\beta_1 + \beta_2$) measures the percent fall in costs with respect to a 1% drop in revenue. If costs are sticky, cost

change relative to an increase in revenue must be greater than the change relative do a revenue drop. Therefore, hypothesis H_1 for stickiness implies that $\beta_1 > 0$ and $\beta_2 < 0$. On the other hand, if the conventional model of fixed and variable costs is valid, the cost changes (reduction or increases) will be symmetric and hence $\beta_2 = 0$. Besides, if fixed costs exist, $\beta_1 < 1$, meaning economies of scale (Anderson, Banker and Janakiraman, 2003).

In order to test hypothesis H_2 that cost stickiness decreases with the aggregation of years per period, regressions were carried out with Model I for aggregate periods of 1, 2, 3, and 4 years.

In order to test hypotheses H_3 and H_4, Model I was extended to include an additional variable designed to capture the one-year lagged effect of changes in sales revenue on cost changes becoming Model II:

$$\log\left[\frac{SG\&A_t}{SG\&A_{t-1}}\right] = \beta_0 + \beta_1 \log\left[\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right] + \beta_2 Dummy_{i,t} * \log\left[\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right] + \\ + \beta_3 \log\left[\frac{\text{Revenue}_{i,t-1}}{\text{Revenue}_{i,t-2}}\right] + \beta_4 Dummy_{i,t-1} * \log\left[\frac{\text{Revenue}_{i,t-1}}{\text{Revenue}_{i,t-2}}\right] + \varepsilon_{i,t} \quad \text{(II).}$$

The table below summarizes what is expected of the model's coefficients in order to validate the hypotheses:

Hypothesis	Condition for acceptance
H1	$\beta_1 > 0$, $\beta_2 < 0$, $\beta_1 + \beta_2 < 1$
H2	β_2 decreases in absolute value with aggregation of years per period.
H3	$\beta_3 > 0$
H4	$\beta_4 > 0$, $\beta 4 < \lvert\beta 2\rvert$

The panel-data estimation results for Models I and II are shown in Tables 2, 3, and 4, in section 5.

4.3. Data description

Annual data for SG&A costs and net sales revenues of Brazilian publicly listed firms reported by Economatica® for the 1986 through 2003 period were utilized. All data were adjusted for inflation using the Brazilian General Price Index (IGP-DI). From the original 542 firms, those belonging to the Financial, Insurance, and Pension Funds sectors were excluded, together those with no net revenues reported in more than eight years. The resulting sample is composed by 198 Brazilian firms.

5. Results

Results of the unit root tests mentioned in section 4.1 are shown in Table 1.

Table 1: Panel unit root tests				
Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-409.357	0.0000	765	10291
Breitung t-stat	-31.2377	0.0000	765	9526
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-78.9139	0.0000	765	10291
ADF - Fisher Chi-square	6478.54	0.0000	765	10291
PP - Fisher Chi-square	9160.91	0.0000	770	10823
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.				

It can be seen that results reported in Table 1 show that the null of a unit root is strongly rejected in all tests employed, according to the statistics and p-values obtained.

The empirical tests carried out in this study in connection with the specified models are presented in this section, together with those obtained by Anderson, Banker and Janakiraman (2003), for comparison.

Table 2 shows, side by side, the results obtained by panel data pooled regression reported in Anderson, Banker and Janakiraman (2003) and the corresponding ones obtained in the present study, for models I and II. Model I was estimated for one year periods and for aggregate periods of 2, 3 and 4 years, whereas model II was estimated for one-year periods only. Besides the coefficient values and their t statistics (between brackets), F statistics, adjusted R^2, Durbin-Watson statistics and the number of observations are reported.

	Table 2: Panel data regressions with common coefficients Coefficient Estimates (t statistics)									
	Model I								Model II	
	One-year periods		Two-year periods		Three-year periods		Four-year periods		One-year periods	
	AB&J	Current	AB&J	Current	AB&J	Current	AB&J	Current	AB&J	Current
β_0	0.048 (39.88)	-0.020 (-2.98)	0.0574 (25.12)	-0.026 (-5.29)	0.060 (16.31)	-0.024 (-5.81)	0.078 (16.67)	-0.032 (-8.71)	0.033 (25.90)	-0.008 (-1.03)
β_1	0.545 (164.11)	0.593 (32.60)	0.681 (141.91)	0.665 (31.92)	0.714 (104.71)	0.666 (32.99)	0.742 (97.00)	0.741 (34.86)	0.532 (130.43)	0.646 (30.53)
β_2	-0.191 (-26.14)	-0.269 (-10.99)	-0.156 (-13.40)	-0.388 (-14.85)	-0.091 (-5.56)	-0.396 (-15.81)	-0.034 (-1.76)	-0.501 (-19.51)	-0.187 (-23.47)	-0.363 (-12.64)
β_3									0.103 (29.79)	-0.032 (-1.72)
β_4									0.104 (13.23)	0.216 (7.44)
$\beta_1+\beta_2$	0.354	0.324	0.525	0.277	0.623	0.270	0.708	0.240	0.345	0.283
F	-	921.68	-	891.84	-	942.15	-	975.55	-	430.59
R^2	0.3663	0.4238	0.5349	0.4330	0.6513	0.4638	0.6513	0.5097	0.6513	0.4262

Analyzing the results reported in Table 2, it can be seen that our coefficient β_1 is higher to that reported by Anderson, Banker and Janakiraman (2003), both in value and sign. This is true both for Models I and II,

independently of the number of years per period. This coefficient measures the cost elasticity with respect to revenues. For one-year periods, the significant value of 0.593 obtained for β_1 indicates that costs increased by 0.593% in response to an increase of 1% in revenues. Anderson, Banker and Janakiraman (2003) found 0.545%. The estimated value de $\beta_2 = -0.269$ provides strong support to hypothesis H_1 of cost stickiness. The combined value $\beta_1 + \beta_2 = 0.324$ shows that costs fell by 0.32% in response to a 1% drop in revenues. The fact that both β_1 and $\beta_1 + \beta_2$ are significantly smaller than 1 show that cost changes are not proportional to revenue changes, despite the relevance of this cost driver. With this result, the cost stickiness hypothesis H_1, accepted in Anderson, Banker and Janakiraman (2003), is also accepted in our study. Comparing $\beta_1 + \beta_2$ from our study with those of Anderson, Banker and Janakiraman (2003), we can see that this coefficients' sum is always lower for Brazilian relative to American firms, and that the difference increases as the number of years per period increases. This is an indication that firms' cost stickiness is higher in Brazil relative to the US.

It can also be seen from Table 2 that hypothesis H_2 that cost stickiness falls with the aggregation of years per period, which is accepted in Anderson, Banker and Janakiraman (2003), is rejected for Model I in our study with common intercept. In that study, β_2 in Model I decreases in absolute value as the number of years per period increases, whereas in our study β_2 increases in absolute value, showing the cost stickiness gets worse as aggregation of years per period increases.

Model II, which includes revenue changes lagged by one period, was used to test hypothesis H_3 that cost stickiness is reversed in subsequent periods. In our estimation of Model II with common intercept (*pooled regression*), we found $\beta_1 = 0.646$ [against $\beta_1 = 0.532$ in Anderson, Banker and Janakiraman (2003)], which is somewhat higher than that obtained for Model I. Coefficient $\beta_2 = -0.363$ [against $\beta_2 = -0.187$ in Anderson, Banker and Janakiraman (2003)], confirms cost stickiness in Model II. However, in Model II β_3 is not significant, which leads to the rejection of H_3, contradicting Anderson, Banker and Janakiraman (2003), who found a significant $\beta_3 = 0.103$. A significant and positive $\beta_4 = 0.216$ confirms the partial reversion of cost stickiness in the period subsequent to a revenue drop, since $\beta_4 < |\beta_2|$, which leads to accepting H_4. Therefore, whereas in Anderson, Banker and Janakiraman (2003) all four hypotheses were accepted, in our study H_1 and H_4 were accepted, but H_2 and H_3 were rejected, as far as a common-intercept panel-data estimates are concerned.

Models I and II were also estimated by panel data with fixed effects and random effects, in order to check the robustness of the results reported so far. Tables 3 and 4 demonstrate that the fixed and random effects regressions, respectively, confirm the results of Table 2. Although the values of the estimated coefficients are

slightly different from those of Table 2, the magnitudes and signs lead to the same conclusions. The fixed effects and random effects regressions yield significant β_1 and β_2, with $\beta_1 > 0$ and $\beta_2 < 0$, which means that $\beta_1 + \beta_2 < \beta_1$, i.e. costs are sticky. Here too, β_3 is not significant, which does not confirm the lagged adjustment of costs, i.e. H_3 is rejected. Coefficient β_4 is significant and $\beta_4 < |\beta_2|$, which confirms the partial reversion of stickiness in subsequent periods. The results also show that stickiness increases with the aggregation of years per period, which contradicts H_2.

	Table 3: Panel data regressions with fixed effects Coefficient Estimates (t statistics)				
	Model I				**Model II**
	One-year periods	Two-year periods	Three-year periods	Four-year periods	One-year periods
β_1	0.589 (29.77)	0.654 (29.89)	0.653 (30.87)	0.745 (32.78)	0.647 (28.67)
β_2	-0.306 (-11.08)	-0.433 (-15.47)	-0.436 (-16.27)	-0.562 (-20.25)	-0.373 (-12.13)
β_3					-0.029 (-1.50)
β_4					0.204 (6.48)
F	11.05	12.38	13.75	15.03	10.09
R^2	0.4227	0.4676	0.5119	0.569	0.4062

	Table 4: Panel data regressions with random effects Coefficient Estimates (t statistics)				
	Model I				**Model I**
	One-year periods	Two-year periods	Three-year periods	Four-year periods	One-year periods
β_0	-0.019 (-1.81)	-0.026 (-3.04)	-0.024 (-3.24)	-0.032 (-6.08)	-0.008 (-1.01)
β_1	0.584 (32.14)	0.653 (31.48)	0.659 (32.72)	0.738 (34.44)	0.646 (30.55)
β_2	-0.267 (-10.95)	-0.388 (-14.98)	-0.397 (-15.93)	-0.499 (-19.36)	-0.363 (-12.65)
β_3					-0.032 (-1.74)
β_4					0.217 (7.46)
R^2	0.4138	0.4166	0.4543	0.5024	0.4262

As mentioned earlier, in order to further assure the robustness of the empirical study, individual time-series regressions were carried out for Model I. We removed anomalous results such as $\beta_1 > 1$ and $\beta_2 > 0$, which make no sense in any cost accounting theory. The average values for β_1 and β_2 are shown in Table 5, together with those reported by Anderson, Banker and Janakiraman (2003). It can be seen that when revenues move upwards, cost response is very similar for Brazilian ($\beta_1 = 0.7212$) and American firms ($\beta_1 = 0.7156$). However, when revenues

move downwards, cost response is significantly lower for Brazilian firms ($\beta_1+\beta_2$ = 0.2322) relative to American firms ($\beta_1+\beta_2$ = 0.4753). This indicates that cost stickiness in Brazilian firms is significantly more intense than in American firms.

Table 5 – Time-series estimates for Model I		
	Current	AB&J
β_1	0.7212 (0.1951)	0.7156 (0.3756)
β_2	-0.4890 (0.2799)	-0.2403 (0.8615)
$\beta_1+\beta_2$	0.2322	0.4753
Figures between brackets are standard deviations		

6. Conclusion

The evidence documented in our study confirms partially the results by Anderson, Banker and Janakiraman (2003) that the behavior of costs with respect to revenue changes is sticky. Hypothesis H_1 of cost stickiness with respect to revenue changes is wholly confirmed for Brazilian firms. Hypothesis H_2 that cost stickiness diminish when we consider longer periods, i.e. with the aggregation of years per period is not confirmed. Hypothesis H_3 of lagged adjustment of costs in response to revenue reductions is not verified. However, hypothesis H_4 of partial reversion of stickiness in subsequent periods is confirmed. It was also shown that cost stickiness in Brazilian firms is significantly more intense than in American firms.

A possible inference from the rejection of H_2 and H_3 in our study, as well as for the apparently higher degree of cost stickiness in Brazilian firms is that Brazilian managers are more lenient towards the necessity to further reduce costs after a period of revenue drops, and to proceeding to the adjustment of resources in a longer term, with respect to managers of American firms. Several explanations can be put forward for this. First, Brazilian managers are possibly less inclined to fire workers when revenue drops because of the persistent social problems in Brazil, with high unemployment rates, poverty, and so on. Second, skilled workers are not abundant in the Brazilian labor market, and the usually firms have to train their own personnel if they need skillful manpower. Third, perhaps as an emerging country, Brazil has not reached yet the status of full-fledged capitalism. Finally, since the Brazilian economy is more unstable than the developed ones, it is possible that Brazilian managers fell more difficult to reckon if a revenue drop is a slump or it is only a short-term fluctuation.

In opposition to the model conventional of fixed and variable costs, our results, although not confirming completely those of Anderson, Banker and Janakiraman (2003), are consistent with an model alternative of cost behavior that takes into account the role of managers in adjusting resources in response to demand fluctuations. This

brings important implications for accountants, financial analysts and other professionals who assess cost changes with respect to revenue variations.

The traditional approach to cost behavior recommends methods such as regression analysis to estimate the average cost change associated to a unit change in the activity driver. Performing such estimations with no consideration to cost stickiness, leads to underestimation of cost responses when activity rises and to overestimation of cost responses when activity falls.

A managerial inference of the analysis is that cost stickiness can be verified and controlled. Managers can assess their exposition to sticky costs when observing the cost sensitivity to volume reductions. They can increase the costs sensitivity to volume fluctuations by taking contractual decisions which reduce the adjustment costs connected to change the levels of committed resources.

The empirical models tested in this paper provide a basis for additional research on the causes and consequences of sticky cost behavior in Brazilian firms. Evidence was provided that sticky cost behavior is consistent with deliberate decisions by managers who weight the economic consequences of their actions. To acquire a deeper understanding of the managerial decision processes and the factors leading to sticky cost behavior is an important step forward to improve cost accounting in Brazil.

7. References

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