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Distribution of Underpricing in Privatization Auctions: Evidence from an Event Study

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Abstract: Winners of the Brazilian privatization auctions (BPAs) earned, on average, a 0.7 percent abnormal return on the days of the auctions. This translates into 13 percent underpricing. In contrast, using results from the literature as a reference, seasoned share issue privatizations register less underpricing and less *excess* underpricing. This raises doubts about the prevailing wisdom that auctions are the best method for governments seeking to maximize privatization revenues. Brazilian buyers did not profit. Underpricing for foreign buyers averaged 21 percent. Foreign participation may have been insufficient to extract full surplus. In cross-section, controlling for *relative* size, buyers' size does not explain gains among foreigners but mildly explains gains among nationals.

JEL Classifications: G14, L33, G34
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1. Introduction

Brazil raised approximately U$ 100 billion through its privatization program, one of the largest privatization programs in the world.[1] Yet, it has attracted proportionally much less academic attention than what one would expect given its dimension and almost exclusive use of auctions. Netter and Megginson (2001) have the most comprehensive survey of privatization around the world. They cite to 228 papers, 25 of which provide empirical evidence of underpricing in share issue privatizations around the world. In this comprehensive study, however, there is little empirical evidence specifically about Brazil and its experience with privatization auctions.[2]

[1] To put this figure in perspective, Jones et al. (1999) examined 630 SIPs in 59 countries with total proceeds of over US$ 446 billion during the period 1977-1997. Through the BPAs, Brazil alone raised over 22 percent of this total, in half of the time.

[2] There are four basic methods through which governments privatize their assets: fixed-price share sales; tenders or auctions; private placements; and voucher privatization. In fixed-price share sales, the government splits up the ownership of the company into many shares and sets the unit price of the shares. Interested parties indicate the number of shares they are interested in buying at the given price. Once the distribution of the shares and payment are effective, the ownership transfer is complete. This method is also known as privatization initial public offerings (PIPOs or privatization IPOs) or share issue privatizations (SIPs). State-owned activities can also be privatized in competitive auctions where a few pre-qualified competitors place bids for the price (above some minimum price) and the quantity of shares they want to acquire. A private placement scheme is one in which the government somehow reaches an agreement with some particular investor group on the terms of the sale. Finally, voucher privatization is a privatization method where numerous citizens are given or can inexpensively buy a book of vouchers that represent potential shares in any state-owned company.

Brazil relied almost exclusively on auctions to sell its government-owned companies,[3] making its privatization sales more akin to private sector mergers and acquisitions (M&A). I review the literature in Section 2. I describe the Brazilian case in Section 3.

While one can directly measure the underpricing of privatization share offerings as the difference between the initial offering prices of the shares of the privatized company and selling price of these shares after the first day of open market trading, measuring auction underpricing requires examining the impact of the purchase on the buyers' market value.

For this purpose I offer two event-study modeling approaches (Section 4 contains the methodological details). These empirical applications place the study of abnormal returns at privatization auctions in the context of the literature on privatization underpricing. I am not aware of another author who has done a similar empirical analysis.

The paper uses a unique dataset (described in Section 5) to answer questions that may have policy implications: was there underpricing in the BPAs? What is its average magnitude? How does the Brazilian privatization process compare to analogous private sector transactions and to other privatization methods? Do domestic buyers benefit as much as foreign buyers do? Is the bidding firms' size a variable related to heterogeneous valuation among bidder in the BPAs?

I find reliable evidence that buyers do earn some premium on the days of the auctions. On average, their daily stock returns are 0.7 percent higher than the daily returns that would have been expected had they not won their respective auctions (or 472 percent compounded annually). In monetary terms, it suggests that the government collected, on average, 13 percent less revenue than what it could have extracted from the buyers. On the one hand, by comparing this underpricing with the M&A literature that provides plentiful evidence that underpricing is typically nil in the private sector, I argue that the BPAs' *excess* underpricing reaches 13 percent. On the other hand, by comparing my results with published seasoned SIP results, I collect evidence that the BPAs generated more underpricing and more *excess* underpricing than the seasoned SIPs. This is a surprising result given that the rationale for the choice of auctions in the Brazilian privatization program was revenue maximization while SIPs may have objectives other than revenue maximization.

Further, I collect evidence that underpricing among foreign buyers is, on average, 21 percent whereas there is no evidence that domestic buyers gain, on average, anything.

Next, I use (*relative* and *absolute*) size variables in cross-section analysis. In the domestic buyers subsample, there is mild support to the conjecture that the larger domestic acquirers profited more than the smaller ones. Among the foreign buyers, however, I find no support that firm size is a source of relevant valuation heterogeneity. These findings are presented in Section 6. Section 7 concludes the article.

2. Related Literature

2.1 Previous Studies in Privatization Underpricing

Typically, the government choice of the privatization method depends on the government's main objective. In voucher privatization and in private placements the main objective of the government is not necessarily to maximize revenue, rather it may be to achieve some particular allocation of post privatization ownership among citizens, labour groups or firms. Competitive auctions are the preferred method when the government is mostly concerned about raising as much revenues as possible.

[3] Companies in 11 industries: petrochemical, petroleum, mining, financial, electrical, transport, ports, natural gas, sanitation, telecommunications and information technology.

In the privatization literature, underpricing occurs when the government sells shares of its companies at prices that are lower than those shares' market values. Given this concept of underpricing and the understanding that the government's choice of privatization method may depend on the goals it aims to achieve through privatization, a relationship between underpricing and the different privatization methods may exist. Therefore, the interpretation of a direct comparison between underpricing observed under different privatization methods may not be as straight forward as it might seem at the first sight.

Jones, et al. (1999) find, among other things, that governments consistently under price their privatization offers. Netter and Megginson (2001) report that the median level of underpricing in seasoned SIPs is 3.3 percent, with 9.4 percent mean (p. 344). In preliminary analysis, da Graça (2008) reports that, the Brazilian government did leave some money on the table. But how can one know whether these estimates are excessive or normal? A comparison between the underpricing associated with a given privatization method and the underpricing associated with similar transactions in the private sector may help us to perform such an evaluation. If the former is larger than the latter, I say that that privatization method yields *excess* underpricing.

Indeed it has been suggested that underpricing is greater when a government sells off its assets using the fixed-price method compared to similar private transactions. However, Dewenter and Malatesta (1997) and Jones, et al. (1999) collect empirical evidence that suggests that privatization IPO is associated with some underpricing but not with *excess* underpricing.

Finally, with a theoretical model, Jovanovic and Szentes (2007) compare two private sector IPO mechanisms: auctions and book-building. They find that underpricing of IPOs arises under book building but not under auctions.

2.2 Previous Studies in Private Sector Acquisitions

Compared to private sector M&As, the governmental role in a privatization auction is analogous to the role of the acquired firm insofar as both seek to raise revenues upon sale of their property rights. Maximization of revenues seems quite a palatable assumption in the private context. As for the government, there may also be political goals in privatizing companies. However, after the decision to utilize an auction is made, the government's objective is to extract as much revenue as it can from the sales.[4] In either case, the potential buyers are expected to offer as little as possible, just enough to outbid its competitors.

The empirical literature on private sector acquisitions has provided plentiful evidence on the acquirers' abnormal returns upon announcements of takeovers. E.g., Franks and Harris (1989), with UK data; Bühner (1991), with German data; Ding (1999), with data from Singapore; and Jarrell et al. (1988) in a comprehensive survey report that typically acquirers' shareholders at best break even in takeovers . In addition to being consistent across different countries, this evidence seems to be uniform over time as Leeth and Borg (2000) show with US data from the period 1919-1930.

Interestingly Moeller et al. (2004) find that, despite the fact the smaller buyers profit, "large firms experience significant shareholder wealth losses when they announce acquisitions of public firms."

Moeller et al. (2005) study the acquiring-firm returns over the 1990's merger wave, which overlaps with the BPAs in my sample. They find that the acquirers' shareholders lost an aggregate US$ 216 billion. All these findings reinforce Jensen (1986): "it appears that bargaining power of

[4] Bel (2002) corroborates this assumption as the author finds evidence that governments tend to be pragmatic with respect to privatization revenue maximization, regardless of the ideological differences between parties in power.

target managers, coupled with competition among potential acquirers, grants much of the acquisition benefits to selling shareholders." (p.8).

Another branch of the literature in this topic is about cross-border transactions. Corhay and Rad (2000) find that cross-border acquisitions create wealth for the Dutch firms, especially in the U.S. In the U.S., Dewenter (1995) finds that foreigners pay more than domestic investors in hostile transactions, but pay less when there are rival bidders.

In summary, vast empirical evidence shows that acquirers at best breakeven in their acquisitions. Whether the buyer is a domestic or foreign firm (with respect to the target's nationality) appears to have some effect on the distribution of gains. Also there is evidence that the buyer's size is related to the profitability of the purchase.

3. Privatization in Brazil

The National Program of Privatization (PND) was established in 1991.[5] The first sale under PND occurred in October 1991. According to Velasco (2002 – Section 3.2),[6] the Brazilian government opted for the auction method in the vast majority of the cases so as to maximize privatization revenues. Through these auctions, the Brazilian privatization program raised approximately US$ 100 billion between 1990 and 2001.

For each auction a minimum acquisition price (reserve price) was set so that even if only one bidder qualified for a given auction, that bidder would have to pay that minimum price. Most of the first price sealed bid auctions resulted in bids higher (often much higher) than the respective minimum prices.[7]

Netter and Megginson (2001) point out that it is a common practice among some less open economies to design their privatization processes in ways to favour domestic over foreign investors. Likewise, historical and political considerations may significantly limit foreign purchases of divested assets. Historically Brazil has been a fairly closed economy. Indeed, in the PND early years the Brazilian Congress imposed several legal restrictions on foreign participation. Only in 1994, foreign interests were permitted to hold 100 percent of the privatized companies.

In light of this ambivalence towards foreign participation in the Brazilian privatization program, and the widespread interest in understanding the effect of foreign participation in privatizations around the world, examining to what extent underpricing is related to the nationality of the acquirer is an issue worth pursuing.

[5] Before 1990, even though some state-owned companies were privatized, those sales were casual events without any stated broader public policy justification.

[6] At the time of his writing, Licinio Velasco was the Head of the BNDES Privatization Services Department. BNDES stands for National Development Bank. BNDES was the administrator of the Brazilian Privatization Fund in charge of providing administrative, financial, and material support to the privatization program. Velasco (2002) is available at BNDES website at: http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_en/Galerias/Download/studies/privat2.pdf

[7] At the time, government officials emphasized in the news media the difference between the winning bid and the minimum price in support of their claims that the auctions had been "successful" in raising revenues. Insofar as it is not clear the extent to which those minimum prices reflected market prices, one must remain sceptical about those claims.

4. Methodological Approach

4.1 The Concept of Underpricing

The concept of underpricing is crucial for the understanding of the methodology I use herein. The focus is on the buyer, the firm that bids highest in the BPAs; not on the seller, the government. Suppose that government-owned firm G is for sale in an auction. Suppose that, prior to the sale, economists and financial analysts figure that the "market value" of G is $100. Based on this expert valuation, the government sets the minimum price for the auction at $100. Suppose two bidders participate in the auction. Other firms that value G at less than $100 do not participate in the auction. Firm Low Valuation (L) values G at $110, while firm High Valuation (H) values G at $150. These heterogeneous valuations are congruent with the view that the interest of buyers may have been specific to the assets being sold. The firms do not know each other's valuations with certainty but they have rational expectations about those valuations. The expected outcome of a first bid, sealed auction outcome is such that Firm H wins the auction by bidding $110.01. In this case, I say that the underpricing is $39.99 (=$150-$110.01).[8] One may also interpret this concept of underpricing as underpayment or buyer surplus.

Notice that if one considers the government's valuation for G, one would compute an *overpricing* of $10.01 ($110.01-$100). However, G' true market value is Firm H's valuation of G, $ 150, which is not directly observed. As the stock market gets the news that Firm H bought G for $110.01 (the market expects that G increases Firm H's present value of future stream of profits by $150) Firm H's stock price increases, reflecting the gain. This is the gain that is associated with the abnormal returns the event study I conduct here measures.

Given that potential buyers may not have full information about the true state of the assets and/or the operation of the assets in the long run, buyers may have lower valuations than the valuation they would have with perfect information. In this example, let us assume that Firm H's valuation of $150 corresponds to the incomplete information value and that the full information value is $160. One may conclude that the $39.99 underpricing is, in fact, an underestimate of the true underpricing of $49.99. Following this line of reasoning, the presence of asymmetric information would bias the estimation process so as to underestimate underpricing. Therefore, the underpricing of the BPAs would have been even larger that what I estimate herein. However, one may consider that the asymmetric information discount of $10 is appropriately priced in the stock market so that, in fact, no miscalculation occurred.

There may have been alternative factors (e.g., uncertainties about the regulatory regime after privatization) that affected G's true valuation from the point of view of potential buyers. As long as these factors are correctly priced in the stock markets, they do not bias the underpricing estimates.

This concept of underpricing is the concept underlying the investigations of the distribution of gains and losses in *private sector* M&As. The empirical evidence in the literature (briefly reviewed in Section 2.2) does not reject the hypothesis that no underpricing occurs in M&As. In this paper I use this reference as a benchmark, even though the motives for acquiring and divesting in the private between private M&As may not align exactly with the motives for government privatization.

[8] Although the social value might have entered the "expert" valuation, notice that G's value according to the "experts" ($100) does not enter the computation of underpricing. In fact, any valuation for G prior to its sale is irrelevant for this determination. What matters are the *private* looking-forward valuation of the highest bidder and the winning bid. Hence uncertainties surrounding the ability of the stock market to reflect the *social* value of the asset prior to the sales do not play any role in assessment of underpricing herein.

Nonetheless, in properly functional stock markets, where the buyers' stock prices are correct, different motivations are inconsequential for the purpose of the present analysis.[9]

4.2 Event Study

An event-study is designed to measure the change of the value of firms as a result of an identifiable and unanticipated event using financial market data.[10] In the case of takeover activity in the private sector, the methodology consists of comparing the share returns of the acquirers surrounding the key events with some counterfactual proposal of what these returns might have been in the absence of the takeover negotiation. The difference between the actual and counterfactual returns over the corresponding time interval is called an abnormal return attributable to the information impounded on that key event. Positive abnormal returns accrued by the acquirer around the announcement of its victory measure how good the terms of the deal were in its favor, i.e., a measure of underpricing, underpayment or buyer surplus. I.e., an acquirer's positive abnormal return is a result of the acquirer paying less than what the target is worth for its operations.

4.3 The Abnormal Returns

4.3.1 Fixed Effects Model

The statistical framework herein follows Thompson (1985) Section III-B and Da Graça and Masson (2012). This is a one-equation regression that pools together all the firms' data and estimates the average abnormal return directly. A dummy variable singles out the effect of the event and a set of dummy variables make the correspondence between a firm's stock return and the respective market index return, as follows:

$$R_{it} = \sum_{j=1}^{N} D_i\left(\alpha_j + \beta_j R_{mt}^j\right) + D_t\delta + \varepsilon_{it}$$

where: R_{it} is firm *i*'s stock return on day (time) *t*; R_{mt}^j is stock market *m*'s return on day (time) *t*. Firm *j*'s headquarter is located in the same country as the stock market *m* is; *N* is the number of firms; D_i is a firm-specific dummy variable such that $D_i = \begin{cases} 1, \text{ if } & j = i \\ 0, \text{ if } & j \neq i \end{cases}$

D_t is a dummy variable that indicated the period over the event window, i.e.,

$$D_t = \begin{cases} 1, \text{ if } & t \in \text{event window} \\ 0, \text{ if } & t \in \text{estimation window} \end{cases}$$

[9] Suppose a buyer correctly values a product at $12 but buy it for $10 through an online auction. According to this concept of underpricing, there is a 20 percent underpricing in this transaction. And this does not depend on the motives that led the seller to sell the product. In fact, buyer and seller may not even know each other.

[10] In the BPAs the winner and the winning bid amount were not known with certainty until the opening of the envelopes. However, because the auction dates and the potential participants (participants had to pre-qualify in order to participate in a BPA) were publicly known several weeks before the opening of the envelopes, the stock markets may have partially anticipated the auctions' outcomes. In this case, the estimated abnormal return would reflect only a correction from the partially anticipated outcome to the actual outcome. Therefore, the absolute value of the estimated abnormal return (which is negative and statistically and economically significant in this paper) may underestimate the absolute value of the true negative abnormal return, i.e., the methodology may underestimate the actual underpricing.

δ is the abnormal return; ε_{it} is an unsystematic error that varies independently across time and firms, i.e.,

$$E(\varepsilon_{it}) = 0, \quad Var(\varepsilon_{it}) = \sigma_i^2, \quad Cov(\varepsilon_{it}, \varepsilon_{j\tau}) = 0, \ for\ i \neq j\ and\ any\ t, \tau$$

$$Cov(\varepsilon_{it}, \varepsilon_{i\tau}) = 0, \ for\ t \neq \tau.$$

This model assumes that the variances of returns do not change in response to the event.

The object of interest is $\hat{\delta}$ and the procedure estimates it directly as an average (across the firms) abnormal return. More precisely it is an inverse variance weighted average estimator (see Da Graça (2010) for its statistical properties). In contrast the traditional event-study methodology estimates the firm-specific abnormal returns in the first stage and then averages them out.

Despite the fact that $\hat{\delta}$ is estimated as an average, I will refer to it throughout the paper as the "abnormal return", for the sake of parsimony.

4.3.2 Mixed Effects Model

One could interpret the event effect as a random effect and all other regressors as fixed effects. The combination of fixed and random effects in a linear model yields the so-called mixed model.

With respect to the pure fixed effects model above, the key difference in the foregoing analysis is that δ is normally distributed with

$$E(\delta) = \delta, \quad Var(\delta) = \sigma_\delta^2, \quad Cov(\varepsilon_{it}, \delta) = 0, \ for\ all\ i\ and\ all\ t$$

In matrix notation, the variance of $\boldsymbol{R}$ (the vector of the R_{it} s) is, therefore,

$$V = \sigma_\delta^2 D_t D_t' + Var(\varepsilon)$$

Brown and Warner (1985, p.22) claim: "There is evidence of substantial increases in the variance of a security's return for the days around some types of events." They indicate that "the variance in some event studies could increase by a factor of almost two." The mixed model allows contemplating this conjecture in my data, in addition to estimating the abnormal return.

4.4 The Determinants of Abnormal Returns

I investigate the following potentially relevant explanatory variables: the acquirer's nationality, the natural logarithm of the acquirer's size (*S*) and the size of the purchase relative to the acquirer's size (*relative* size variable - *rs*).[11]

Other things constant (specifically, the *relative* size between the target and the acquirer), a negative *absolute* size effect[12] could be associated with the stock market perception that larger firms

[11] The BPAs sold companies in 11 industries. Presumably abnormal returns vary across industries. In order to control for industry-specific effects, 10 dummy variables must be included in the analysis. This is equivalent to split the sample into 20 subsamples (due to the presence of the nationality dummy). However my cross-section sample size is only 64. Therefore, introducing the industry dummies consumes virtually all the statistical power of the analysis. On the other hand, leaving the industry effect out of the analysis may bias the results. An optimal, practical and parsimonious solution for this dilemma is to focus the analytical effort on the explanatory variables that have attracted most of the attention in the empirical literature, i.e., nationality and size.

(buying larger targets) are less efficient than smaller firms (buying smaller targets) in the process of integrating their acquisitions.[13]

The inclusion of the *relative* size variable is supported by economic theory. All else equal, it is expected that if a larger company makes a *profitable* acquisition at a given value, its stock's abnormal return should be lower than a smaller company's stock's abnormal return (holding stock price constant and appropriately adjusting for the share in the winning bid) since the value of the acquisition to the larger firm is smaller relative to the *ex ante* value of the company. Likewise, if a larger firm makes an *unprofitable* acquisition, its stock's abnormal return should be lower in absolute value, or less negative, than a smaller company's corresponding abnormal return.

I run two regression models to evaluate the *absolute* size and the *relative* size effects on the determination of abnormal returns:

1. $\delta_i = \theta + \lambda rs_i + \varphi S_i + \eta_i$, $Var(\eta_i) = \hat{\sigma}_i^2$, the "normal" model;
2. $|\delta_i| = \alpha + \beta rs_i + \gamma S_i + \varepsilon_i$, $Var(\varepsilon_i) = \hat{\sigma}_i^2$, the "absolute value" model;

where δ_i and $\hat{\sigma}_i^2$ for all firms are obtained from the step described in Section 4.3, noting that $\delta_i = \hat{\delta} + e_{i0}$, i.e., the average abnormal return plus firm *i*'s error term on the event day. In both models, all covariances are assumed to be zero.

The "normal" model is adequate to factor in the *absolute* size. $\hat{\varphi}$ is expected to be negative. In this model, however, $\hat{\lambda}$ cannot appropriately account for *relative* size, as there may be negative abnormal returns in the sample.

The *relative* size effect is appropriately accounted for through the estimation of the "absolute value" model by examining its $\hat{\beta}$. However $\hat{\gamma}$ is not an appropriate estimate upon which one could infer the relevance of the *absolute* size effect, as the fact that taking the absolute values of the abnormal returns is likely to bias the relationship between the abnormal returns (originally positive or negative) and the firms' sizes.

Hence, although the two models may look alike, they are structurally different and necessary to evaluate how a firm's size explains the estimated abnormal returns.

4.5 The Brazilian privatization auctions (BPAs)

The BPAs are events that occurred on publicly known dates, and, in most cases, the winners' identities were neither known nor anticipated until the end of the auctions. As such, an event-study is an appropriate methodology for analyzing the occurrence of abnormal returns realized by the winning bidders in those auctions.

The estimation window consists of the previous 251 closing quotes or, equivalently, 250 return observations, which cover approximately a one-year period ending six trading days, or one week before the realization of the corresponding auction. This gap between the last day of the estimation window and the day of the auction is a device designed so as to provide the parameters of the normal return model, which should not be influenced by the auction-related returns.

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[12] Moeller et al. (2004) present evidence that, on average, "Acquisitions by small firms are profitable for their shareholders, but these firms make small acquisitions with small dollar gains. Large firms make large acquisitions that result in large dollar losses."

[13] Typically, daily abnormal returns are in the order of one percent at the most. On the other hand, the percent difference in size among firms may reach hundreds even thousands of percents. Therefore, the coefficient of *absolute* size is expected to be a small number even if it is statistically different than zero.

5. The Data Sets

The event-study methodology requires a minimum set of variables and information, namely: identification of the state-owned companies or assets being privatized; date of the privatization auction of each of those companies/assets; indication about the number of participants in each auction; identification of the winning bidders; stock market closing prices of the stocks of the winners in their respective domestic markets with 250 daily (about one year) observations prior to the week before the realization of the auction; and local market indexes time series corresponding to the nationality of the winning bidders over the same period of time of that of the stock prices.

I relied on various sources, each providing partial information or data, to build my unique data set: the annual reports of BNDES (National Development Bank), Manzetti (1999, pp. 174-179), the Rio de Janeiro Stock Exchange website (www.bvrj.com.br), the Dow Jones Interactive service, Bloomberg and DataStream Advance. At times multiples sources provided information about the same detail. This allowed me to crosscheck the sources yielding reasonable reliability for the variables listed above and for the cross-section analysis as described next.

In the case of only one participant in the auction, I only included in the data set the auctions in which that participant became aware of its uniqueness on the day of the auction (the other participant/participants withdrew its/their bids at the last minute). Otherwise, the victory in the contest would not be an unanticipated event.

DataStream Advance does not retrieve meaningful stock price time series data for Brazilian companies up until mid 1994. In any event, this does not impose serious a constraint in the analysis, because it was only after 1995 that privatization in fact became a core policy of the market reform agenda, and the greater part of the sales (in number and in value) happened.

For the cross-section analysis, nationality is determined by the location of the company's main headquarters. If it is located in Brazil, I say the company is domestic; otherwise, foreign.

The *relative* size variable was built from the market value of the acquiring firm; the total amount of the purchase (including cash and transferred debts); and, when the firm was part of a bidding consortium, its participation share in the consortium. *Relative* size is the product of the purchase value times the participation share of the acquiring firm, divided by the acquirer's market value. Appendices 1 and 2 present the data set used to perform the cross-section analysis.[14]

6. Empirical Results and Discussion

6.1 Abnormal Returns

Let us call the event window that includes the day of the auction (day 0), the trading day immediately prior to the auction (day –1) and the trading day immediately after the auction (day +1) as the *widest event window*. The event window that includes day –1 (+1) and day 0 is called the *left (right) wide event window*. I call the event window that includes only day –1 (+1) the *left (right) narrow window* or *day –1(+1) window*. As for day 0, I say *day 0 window*, *center window* or simply, *the window*.

[14] The market values of some buyers were very low, yielding extremely high *relative* sizes. Since I could not check the reliability of such very low market values, as a precautionary measure I removed six problematic pairs – acquirer, target – from the sample that was submitted to the cross section analyses. In Appendix 1 these pairs are identified by the symbol "n/a" in their respective market value cells.

Among other relevant statistics, Table 1 presents the abnormal returns over the narrow event windows (columns 4 to 7), using the methodology described in Section 4.3. It also presents the cumulative abnormal returns over the widest and wide windows (columns 1 to 3). Cumulative means the sum of the abnormal returns over the corresponding narrow windows. Column 7 presents the results obtained by using the mixed effects model as discussed in Section 4.3.2. The estimated volatility increase is $\hat{\sigma}_{\delta}$.

Table 1. Estimated Cumulative Abnormal Returns, Abnormal returns and related statistics

Panel A: Full Sample (domestic and foreign acquirers) (N=71)							
Column	1	2	3	4	5	6	7
Event window	(-1,0,+1) cumul.	(-1,0) cumul.	(0,+1) cumul.	-1	0	+1	0 (Mixed Model)
Abnormal Return %	.4198	.5370 *	.5848 **	-.1660	.7006 ***	-.1150	.6433 ***
Std %	.3462	.2821	.2819	.1980	.1981	.1986	.1899
t-stat	1.21	1.89	2.07	-0.84	3.54	-0.58	3.39
p-value	.2253	.0590	.0382	.4024	.0004	.5631	.0007
Volatility Increase	n/a	n/a	n/a	n/a	n/a	n/a	.0067 (7.69%)#
Panel B: Domestic acquirers subsample (N= 35)							
Column	1	2	3	4	5	6	7
Event window	(-1,0,+1) cumul.	(-1,0) cumul.	(0,+1) cumul.	-1	0	+1	0 (Mixed Model)
Abnormal Return %	.5196	.1679	.4305	.0813	.1076	.3272	n/c
Std %	.6741	.5465	.5465	.3847	.3828	.3855	n/c
t-stat	0.77	0.31	0.79	0.21	0.28	0.85	n/c
p-value	.4409	.7586	.4308	.8327	.7786	.3961	n/c
Volatility Increase	n/a	n/a	n/a	n/a	n/a	n/a	n/c
Panel C: Foreign acquirers subsample (N= 36)							
Column	1	2	3	4	5	6	7
Event window	(-1,0,+1) cumul.	(-1,0) cumul.	(0,+1) cumul.	-1	0	+1	0 (Mixed Model)
Abnormal Return %	.3890	.6630 **	.6483 **	-.2540	.9200 ***	-.2730	.8593 ***
Std %	.4033	.3278	.3291	.2309	0.2315	.2317	.2238
t-stat	0.96	2.02	1.97	-1.10	3.97	-1.18	3.84
p-value	.3348	.0431	.0489	.2709	<0.0001	.2394	.0001
Volatility Increase	n/a	n/a	n/a	n/a	n/a	n/a	.0087 (17.59%)#

* - significant at 10% level, left and right-hand tails
** - significant at 5% level, left and right-hand tails
*** - significant at 1% level, left and right-hand tails
n/a – not applicable
n/c – numerical procedure did not converge
- The estimated percentage volatility increase (the number in parenthesis) is determined as

$$\%\Delta v = \left(\frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\sigma}_{\delta}}{\hat{\sigma}_i} \right) \times 100\%$$

6.1.1 Full Sample Analysis

Panel A reports the results for the full sample. The estimated cumulative abnormal return over the *widest* window is positive, 0.41 percent but it is not statistically significant. However, narrowing the event window, significance emerges. A 0.53 percent estimated cumulative abnormal return becomes statistically significant at the 10 percent level over the *left wide* window. An estimated 0.58 percent is 5 percent significant over the *right wide* window. These findings suggest that the most part of the auctions' effects are concentrated over the *center window* and that the *left* and *right* impacts are likely to be negative.

Indeed, the estimated abnormal returns over the *left and right narrow* windows are slightly negative, -0.16 percent and –0.11 percent, respectively. Both are far from being statistically significant. The estimated effect over the *center* window is 0.70 percent and matches the 1 percent significance level easily.

Column 7 presents the results for the *center window*, allowing the variance to increase uniformly across all the firms on the days of the auctions. The estimated abnormal return is similar to that reported in column 5: a highly statistically significant 0.64 percent abnormal return. This modeling allows estimating that there was a uniform increase in standard deviation over the *center* window of 0.0067, which corresponds to an average 7.69 percent volatility increase.

Whether variance is allowed to increase over the *center* window or not, is immaterial for the statistical significance of the average abnormal returns at the 1 percent level. This can be seen as a sensitive analysis exercise, in which the results are robust to changes in the model specification. No variance increase was detected over the other *narrow* windows, as the numerical procedure did not converge.

This evidence of positive average abnormal return for the acquirers in the BPAs suggests the occurrence of some underpricing, in the sense that the winning bidder paid less for the privatized assets than the market believed they were worth for the acquirer.[15]

A monetary expression of this abnormal return can be estimated by multiplying the buyer's market capitalization on the day prior to the auction and its estimated abnormal return. Summing up the monetary abnormal valuation changes across all firms/auctions in the sample, one obtains an estimation of the total monetary surpluses enjoyed by the winners. The auctions in my sample raised approximately US$ 40 billion. The corresponding estimated total monetary value change is US$5.2 billion, or 13 percent of the sample revenue. This reasoning is summarized as: $\text{underpricing} = (\sum_{i=1}^{N} \delta_i \times MV_i) \Big/ (\sum_{i=1}^{N} \text{winning bid}_i)$, where MV_i is acquirer i's market value on the day prior to the auction.

The entire Brazilian privatization program collected approximately US$100 billion. If the auctions that were not included in the sample had the same underpricing level of 13 percent,[16] an

[15] Under the guard of rationality and market efficiency, the auction theory offers an explanation for why and how an acquirer may collect positive abnormal returns when it wins an auction. If the bidders have heterogeneous valuations, the highest valuation bidder bids just above the expected second highest valuation, which is less than the former's true valuation of the asset being privatized. In an efficient market, the capital market incorporates this new information quickly and the winner's stock price moves up, reflecting that gain. This upward price movement may be a source of the positive abnormal return.

[16] My sample does not include those auctions in which:

inference could be made: the Brazilian government failed to extract US$13 billion surplus from the winners of its privatization auctions.[17]

The M&A literature offers plentiful evidence in which M&A underpricing is nil, at most. Consequently, the BPAs' *excess* underpricing reaches 13 percent, which is greater than the SIP's *excess* underpricing.

6.1.2 Does Nationality Matter?

In panels B and C, I consider the effects acquirers' nationalities might have had on the auction winners' abnormal returns.

All estimated abnormal returns in panel B are slightly positive and statistically insignificant even at the 10 percent significance level. This is particularly the case for the *center* window, where no variance increase is detected. These results are consistent with three possibilities:

(1) the domestic winners' bids were perceived as being very close to the value that the privatized companies were expected to add to the acquirers;

(2) the Brazilian capital market correctly anticipated the outcome of the auctions (the winners and the bid amounts); or

(3) the Brazilian capital market is so inefficient that there was a lot of noise in estimated parameters, which prevents finding any statistical significance.

Panel C presents the results for the subsample of foreign acquirers. The estimated cumulative abnormal return over the *widest* window is positive, 0.38 percent but it is not statistically significant. However, narrowing the event window, significance emerges. A 0.66 percent estimated cumulative abnormal return becomes statistically significant at the 5 percent level over the *left wide* window. An estimated 0.64 percent is 5 percent significant over the *right wide* window. As it is the case for the full sample, these findings suggest that the most part of the auctions' effects are concentrated over the *center window* and that the *left* and *right* impacts are likely to be negative.

Indeed, the estimated abnormal returns over the *left and right narrow* windows are slightly negative, -0.25 percent and -0.27 percent, respectively. Both are not statistically significant (not

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- the acquirers' stocks were not publicly traded in a stock exchange. This happened to some Brazilian buyers. Given that it seems that domestic buyers didn't profit from their acquisitions, it is likely that excluding these auctions from the sample biases the results upward;
- there was only one registered bidder, who won the auctions bidding the minimum prices. It seems reasonable to assume that the abnormal returns are nonnegative in these situations. So it is likely that excluding these auctions from the sample biases the results downward.

Therefore, it is not clear in which direction my sample biases the estimated abnormal return, if at all. The underlying assumption supporting my inference with respect to the total privatization program revenues of US$100 billion, is that these biases cancel each other out.

[17] Coordination among BPAs' participants (bid rigging) may explain some of the underpricing but it is unlikely. In order to be successful (yet illegal), coordination requires either repeated interaction among participants and/or side payments. In the BPAs the set of participants changed from one auction to the other. Therefore, opportunities for repeated interaction were either nonexistent or very short lived. As such the possibility of punishment in the next round in case of deviation from the agreement was either nonexistent or limited. In consequence, participants had strong incentive to deviate from the agreement, if an agreement existed. For the same reason, agreements with respect to side payments would not be enforceable among participants.

even at the 10 percent level). The estimated effect over the *center* window is 0.92 percent and is significant at the 1 percent threshold.[18]

Column 7 reports a uniform standard deviation increase over the *center* window of 0.0087 (or 17.59 percent volatility increase) and a highly statistically significant 0.85 percent abnormal return. As in the full sample case, this estimated abnormal return is a little lower than that estimated under the no variance increase assumption (column 5). The same comment holds for its standard deviation.

The results in panel C indicate that the stock markets reacted positively and significantly to the announcement of the results of the auctions in the case of foreign buyers. On the previous day, however, the *left* narrow window's abnormal return emerges as negative and statistically insignificant. Together these two pieces of evidence preclude the rejection of the hypothesis that the stock markets did *not* anticipate with certitude the winner of the privatization auctions and the respective bid amounts. Therefore, one cannot affirm that the auctions were unfair. Besides, given that in many auctions there were foreign and domestic participants, I can rule out the potential explanation (2) for why the average abnormal return among Brazilian buyers is not statistically significant.

In panel C, the slightly negative *right* narrow window average abnormal return suggests that some correction effect might have taken place on the trading day immediately after the auctions. The markets might have overestimated the values of winning the auctions on the day of their announcements and reevaluated their calculations on the very next day. On the other hand, the fact that the average abnormal return over the *right* narrow window is insignificant precludes the rejection of the hypothesis that the foreign stock markets reacted quickly and efficiently to the auctions' announcements.

Summarizing, foreign buyers benefited more from their purchases than domestic buyers, as the former make 0.92 percent average abnormal return (at 99 percent confidence level) while there is no statistical support that the latter group earns positive average abnormal return. Converting abnormal returns into underpricing, I find that the average foreign underpricing is 21 percent, but the average domestic underpricing is statistically inexistent.

This result should be interpreted carefully. One may erroneously use it as evidence to re-ignite, yet again, those old historical resentments and justify that early resistance to foreign participation in the Brazilian privatization program. On the contrary, this evidence is most likely related to insufficient participation of foreign bidders. Because the Brazilian environment (social, political and economic) was turbulent in the 90's, potential foreign participants may have stayed away from the Brazilian auctions. Some plausible explanations for this distancing are: 1) the rules of the auction, albeit more flexible over time, were still restrictive to foreigners; 2) doubts about the actual commitment of the government (and future governments) to the incipient market reforms; and 3) uncertainty about the Brazilian economy's exposure to financial crises around globe. The findings suggest that those foreign investors who decided to take the risk and won those auctions were rewarded in the stock market. In order to raise as much revenue as possible, the auctions rules and the country's broader context (social, political and economic) should be such that there is minimal (if any at all) differentiation between foreign and domestic participation. If this were the case, many other interested foreign investors could have participated in the auctions. With more foreign bidders, the expectation is that the winning bids would be higher and, consequently, underpricing and *excess* underpricing would be lower.

[18] When a government owned firm was put up to auction, all participants – domestic and foreign – simultaneously presented their bids in sealed envelopes on a given day and time. No bids were accepted after that moment. Then all bids were opened simultaneously and whoever bided the highest won the auction.

6.2 Cross-section Analysis

I ran the models of Section 4.4 over the full sample and two subsamples (domestic and foreign acquirers). I also ran variations of the "complete" models so as to check the robustness of the parameter estimates. In other words, I perform some sensitive analysis by eliminating one of the independent variables to verify the extent to which result change in response to this modification. In total, there are 12 regressions. One set of models has in its left-hand side the estimated abnormal returns, which can be either positive or negative. The other set's dependent variable is the absolute value of the abnormal returns.

One feature that stands out from Table 2 (on the next page) is that, whether or not the accessory variable is included in a regression does not cause wild swings in the estimates of the parameters of interest. For this reason, I focus my attention on the discussion of the results of the complete models only, i.e. the models that include *relative* size and *absolute* size.

In the full sample (panel A) neither *relative* size nor *absolute* size explains the abnormal returns, as none of the parameter estimates are statistically significant.

In the domestic acquirers' subsample (panel B), the estimated coefficient of the size variable is positive (.0071) and statistically significant at the 10 percent level. Contrary to Moeller et al. (2004), there is some mild evidence that larger deals (large Brazilian acquirers buying proportionately large targets) entail larger abnormal returns than smaller deals (small Brazilian acquirers buying proportionately small targets) do. This effect may be related to some characteristic of the Brazilian capital market at the time where larger domestic firms may have obtained more favorable financing conditions than smaller domestic firms[19].

Still in panel B, no other estimate is statistically different from zero at the conventional significance levels. In particular, the estimated coefficient of the *relative* size variable in the complete absolute value model is slightly positive though far from being statistically different than zero. Recall that, after controlling for *absolute* size, in Section 4.4 we discussed that larger acquisitions have greater impact, positive or negative, on abnormal returns. But this effect only occurs if there are gains or losses associated with those acquisitions. Otherwise, this effect is expected to be mute. Indeed, we have seen that there is no evidence that Brazilian buyers gained any abnormal return. Therefore, the fact that this coefficient came out statistically insignificant is coherent within this context.

The *relative* size variable gains relevance in the foreign acquirers' subsample (panel C). The *relative* size variable estimated coefficient is positive and statistically significant at the 1 percent level in the absolute value model. This is in line with what the economic theory predicts as discussed in Section 4.4. On the other hand, the normal model does not provide support for the *absolute* size effect, as the size variable estimated coefficient is not statistically different than zero. One possible interpretation of this result is that the size of the deal is not related to efficiencies that one might have expected to emerge from the acquisition following Moeller et al. (2004).

Moreover, expect for the intercepts, the absolute value and normal models present numerically similar parameter estimates, which is coherent with the finding that the foreign average abnormal return is positive at a high significance level. This reflects the fact that only a few of the firm-specific estimated abnormal returns are negative. Taking their absolute values does not have much impact on the models' slopes but does affect their standard deviations and general fitness. The absolute value model has a better fit and its parameter estimates have smaller standard deviations than the normal model.

[19] Brazil was going through a series of market reforms in the 90's. Brazil used to be a more closed economy and to have a more inefficient capital market than what is observed nowadays.

Table 2. Parameter estimates of the "normal" and the "absolute value" models

Here I report the parameter estimates (T-statistics are in parenthesis) of the models below:
"normal" model : $\delta_i = \theta + \lambda rs_i + \varphi S_i + \eta_i$;
"absolute value" model: $|\delta_i| = \alpha + \beta rs_i + \gamma S_i + \varepsilon_i$,
where δ_i is firm *i*'s abnormal return and $|\delta_i|$ is its absolute value. As for the explanatory variables *rs* is the *relative* size and *S* is the log of the acquirer's market value. These models allow examining the conjectures discussed in Section 4.4.

Panel A: Full Sample (domestic and foreign acquirers) (N=64)					
Model	Dependent variable	Intercept	*Relative* size(RS)	Ln Size	R^2
Normal	δ_i	-.0247 (.0295)	.0004 (.0004)	.0013 (.0012)	.0300
Normal	δ_i	-.0105 (.0272)		.0007 (.0011)	.0066
Absolute value	$\|\delta_i\|$	.0027 (.0199)	.0002 (.0002)	.0005 (.0008)	.0187
Absolute value	$\|\delta_i\|$	.0147*** (.0018)	.0002 (.0002)		.0128
Panel B: Domestic acquirers subsample (N=28)					
Model	Dependent variable	Intercept	*Relative* size(RS)	Ln Size	R^2
Normal	δ_i	-.1587 (.0824)	.0006 (.0004)	.0071* (.0037)	.1500
Normal	δ_i	-.0930 (.0746)		.0043 (.0034)	.0574
Absolute value	$\|\delta_i\|$	-.0445 (.0625)	.0001 (.0003)	.0025 (.0028)	.0328
Absolute value	$\|\delta_i\|$	.0124*** (.0030)	.0000 (.0002)		.0007
Panel C: Foreign acquirers subsample (N=36)					
Model	Dependent variable	Intercept	*Relative* size(RS)	Ln Size	R^2
Normal	δ_i	-.0055 (.0351)	.0022** (.0009)	.0004 (.0014)	.1426
Normal	δ_i	.0206 (.0353)		-.0004 (.0015)	.0028
Absolute value	$\|\delta_i\|$	.0033 (.0205)	.0022*** (.0005)	.0003 (.0008)	.3294
Absolute value	$\|\delta_i\|$	.0128*** (.0020)	.0022*** (.0005)		.3251

Note: *, ** and *** imply the significant levels of 10%, 5% and 1%, respectively.

In summary, with respect to the *relative* size variable, in the sub sample analyses, these regressions (panels B and C of Table 2) show that the estimated abnormal returns among the winners of the privatization auctions simply reflect what one would expect from basic economic theory. As such this is a variable that one must control for in a regression analysis, otherwise the results could be seriously biased.

On the other hand, given that the *absolute* size variable is not significant in the foreign sample and only mildly significant in the domestic sample, one cannot forcefully argue that the size of the acquirer is a characteristic of the bidder that could be associated with heterogeneous valuation about the acquired firm. Consequently, it is unlikely that the auctions could have been designed in a way to extract more surpluses from the winners exploring their *absolute* size differences as indicators of value heterogeneity.

7. Conclusions

This paper bridges a gap in the mainstream empirical literature on privatizations as it quantitatively examines the degree of underpricing and its distribution among domestic and foreign buyers in the Brazilian privatization. Moreover the findings challenge the established view that, among privatization methods, auctions are the best method when a government seeks to maximize revenue collection from its privatization program.

The Brazilian privatization program raised approximately US$ 100 billion as a result of the sale of state-owned firms and assets between 1991 and 2001. I address the question of whether or not the Brazilian government extracted all it could potentially extract from the winners of the privatization auctions. Using stock market data and a fixed-effect event-study analysis, I find robust and statistically strong evidence that the winners of the privatization auctions earned positive abnormal returns of 0.7 percent on the days of the auctions (or 472 percent annually). This average abnormal return converts into 13 percent underpricing. In monetary terms, it is likely that the acquirers could have paid an additional US$ 13 billion for their purchases and still have broken even, i.e., earned nil abnormal return. This result contrasts with the private sector M&A literature where the empirics support that the acquirers' gains are at best zero, on average. From the comparison between the results herein and this established academic benchmark, I conclude that there has been 13 percent *excess* underpricing in the BPAs.

Another branch of the literature informs us that there is scarce evidence against the hypothesis that SIP *excess* underpricing is nil. While SIPs are associated to motives that do not necessarily focus on revenue maximization, auctions are associated with revenue maximization. Hence, 13 percent *excess* underpricing in the BPAs is surprising.

The cross-section analysis indicates that nationality matters as foreign acquirers benefit from even higher underpricing (21 percent) while domestic buyers do not seem to gain. One plausible and likely explanation for this contrast and for the overall underpricing is that foreign participation in the Brazilian privatization program was insufficient to the goal of maximizing revenue collection.

Finally, I examine whether the *absolute* size of the acquirer is an indicator of value heterogeneity. I find mild evidence of this effect among domestic buyers. This may be a reflection of some inefficiency of the Brazilian capital market in the 90's, rather than a flaw of the auction design. Among foreign buyers, their *absolute* sizes do not emerge as a statistically significant explanatory variable for abnormal returns. So buyer size related efficiencies do not appear to be the source of the foreign buyers' gains.

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Appendix 1: Data set for the cross-section analyses

privatized company	acquirer	auction's date mm/dd/yy	abnormal returns	standard deviation	premium over minimum price %	acquired share %	nationality 0=domestic 1=foreign	acquirer's mkt val in millions of its domestic currency	exchange rate R$ per domestic currency	acquirer's mkt val in R$ millions	acquisition price R$ millions	Relative Size %
Celma	General Electric	01/11/1991	-0.005028	0.009181549	25.04	9.70	1	59501.32	0.00023	13.69	0.02	0.01
Acominas	Banco SRL	10/09/1993	0.03848	0.01588422	190.67	13.40	1	121070.56	0.00034	40.94	21.53	7.05
Escelsa	Citigroup	11/07/1995	-0.000369	0.011655085	11.78	25.00	0	14667.42	0.92390	13,551.23	357.92	0.66
CPC	Odebrecht	29/09/1995	0.079456	0.044392547	0.00	23.13	0	183.5	1.00000	183.50	95.53	12.04
Salgema	Copene	05/10/1995	-0.000787	0.030503876	0.00	9.37	0	388.85	1.00000	388.85	133.43	3.21
RFFSA - West network	Bank of America	05/03/1996	0.022746	0.011635199	3.59	18.00	1	23228.85	0.97630	22,678.33	62.36	0.05
Light	AES	21/05/1996	0.043718	-0.089076795	0.00	11.40	1	1959.7	1.00850	1,976.36	2,264.32	13.06
Light	CSN	21/05/1996	-0.008884	-0.004205703	0.00	7.10	0	643.39	1.00000	643.39	2,264.32	24.99
RFFSA - Center east network	CSN	14/06/1996	-0.009331	0.017495406	0.00	12.97	0	667.03	1.00000	667.03	316.90	6.16
RFFSA - Center east network	CVRD	14/06/1996	0.014366	0.02793257	0.00	9.73	0	5359.03	1.00000	5,359.03	316.90	0.58
RFFSA - Southeast network	Bradesco	20/09/1996	-0.003848	0.037545126	0.00	4.70	0	3611.36	1.00000	3,611.36	888.91	1.16
RFFSA - Southeast network	CSN	20/09/1996	0.019246	-0.132302193	0.00	20.00	0	593.5	1.00000	593.50	888.91	29.95
RFFSA - Southeast network	Gerdau	20/09/1996	0.033188	-3.133899906	0.00	5.30	0	n/a	1.00000	n/a	888.91	n/a
RFFSA - Southeast network	Usiminas	20/09/1996	-0.000261	-0.000216463	0.00	20.00	0	1104.39	1.00000	1,104.39	888.91	16.10
EDN	Dow Chemical	26/09/1996	-0.00779	0.010665681	0.28	26.70	1	19930.45	1.03200	20,568.22	17.03	0.02
Cemig	AES	02/06/1997	0.024348	-0.193330157	0.00	12.97	1	5904.36	1.07050	6,320.62	1,130.00	2.32
CEG	Enron	14/07/1997	0.021573	0.018094815	85.68	18.80	1	12301.64	1.08000	13,285.77	464.23	0.66
Riogas	Enron	14/07/1997	-0.015538	0.012607817	49.36	37.50	1	12301.64	1.08000	13,285.77	157.95	0.45
CEG	Gas Natural	14/07/1997	0.01425	-0.046218215	85.68	18.80	1	7131.71	1.20774	8,613.28	464.23	1.01
Riogas	Gas Natural	14/07/1997	-0.004886	-0.003528792	49.36	37.50	1	7131.71	1.20774	8,613.28	157.95	0.69
Banerj	Itau	14/07/1997	0.023309	0.013535219	0.36	100.00	0	3638.53	1.00000	3,638.53	311.10	8.55
RFFSA - North east network	Bradesco	18/07/1997	0.013967	0.015916446	37.86	20.00	0	4751.79	1.00000	4,751.79	15.80	0.07
RFFSA - North east network	CSN	18/07/1997	-0.003848	-0.00420781	37.86	20.00	0	895.5	1.00000	895.50	15.80	0.35
RFFSA - North east network	CVRD	18/07/1997	0.019246	-0.080108221	37.86	20.00	0	5359.03	1.00000	5,359.03	15.80	0.06
Coelba	Iberdrola	31/07/1997	0.020658	0.023197682	77.38	8.50	1	9440.78	1.18031	11,143.08	1,730.89	1.32
Cachoeira Dourada	Endesa	05/09/1997	-0.007959	-0.004280436	43.49	60.00	1	2534340	0.00255	6,463.95	779.76	7.24
CEEE - Center West	AES	21/10/1997	0.066439	-0.07436813	93.56	90.00	1	7956.57	1.09970	8,749.84	1,510.00	15.53
CEEE - North/Northeast	Bradesco	21/10/1997	0.007553	0.018234712	82.62	33.00	0	5749.66	1.00000	5,749.66	1,635.00	9.38
CPFL	Bradesco	05/11/1997	-0.014151	-0.00422621	70.28	13.67	0	4276.61	1.00000	4,276.61	3,014.00	9.63
Enersul	Iven	19/11/1997	-0.003219	0.004301923	83.80	52.00	0	n/a	1.00000	n/a	625.56	n/a
Cia. Uniao de Seguros	Bradesco	20/11/1997	-0.047618	0.168320961	48.89	71.50	0	3801.43	1.00000	3,801.43	50.10	0.94
Cemat	Inepar	27/11/1997	0.0025	-0.001138672	21.09	35.00	0	268.46	1.00000	268.46	391.50	51.04
Energipe	Cataguazes	04/12/1997	-0.002762	-0.141062308	96.06	86.00	0	n/a	1.00000	n/a	577.10	n/a
Cosern	Iberdrola	12/12/1997	0.02319	0.01200814	73.61	34.70	1	10945.2	1.25917	13,781.83	676.40	1.70
Coelce	Endesa	02/04/1998	0.013642	0.010556536	27.20	25.53	1	24283.8	1.22636	29,780.79	987.00	0.85
Coelce	Enersys	02/04/1998	0.013314	0.011282668	27.20	25.53	1	1886.999	1.13710	2,145.71	987.00	11.74
Eletropaulo	AES	15/04/1998	0.007848	0.020212218	84.18	3.25	1	9527.41	1.14040	10,865.06	2,026.00	0.61
Eletropaulo	CSN	15/04/1998	0.008442	0.024142073	84.18	2.57	0	2640.47	1.00000	2,640.47	2,026.00	1.97
Capuaba	CVRD	06/05/1998	-0.000463	0.024839056	0.00	100.00	0	6249.57	1.00000	6,249.57	30.00	0.48
Sanepar	Vivendi	08/06/1998	-0.016826	0.014525709	0.00	41.40	1	30257.92	1.29922	39,311.62	249.28	0.26
Celpa	Inepar	09/07/1998	-0.002025	0.070020747	0.00	35.00	0	1364.04	1.00000	1,364.04	450.26	11.55
Flumitrens	CAF	15/07/1998	0.008491	0.022385384	671.42	50.00	1	129.8	1.28756	167.12	279.66	83.67
Telecoms (see Appendix 2)	Alianca da Bahia	29/07/1998	0.000638	0.000182103	1.00	10.05	0	n/a	1.00000	n/a	345.12	n/a
Telecoms (see Appendix 2)	Banco Bilbao Vizcaya	29/07/1998	0.002881	0.001180017	64.29	7.00	1	n/a	1.30995	n/a	404.81	n/a
Telecoms (see Appendix 2)	Bradesco	29/07/1998	-0.009572	-0.133092325	198.90	25.00	0	4645	1.00000	4,645.00	340.00	0.07
Telecoms (see Appendix 2)	Iberdrola	29/07/1998	0.000974	0.000948384	110.38	10.11	1	12787.46	1.30995	16,750.91	765.37	0.05
Telecoms (see Appendix 2)	Inepar	29/07/1998	-0.000291	0.000798836	1.00	20.00	0	1394.91	1.00000	1,394.91	686.80	0.49
Telecoms (see Appendix 2)	Italia Telecom	29/07/1998	0.019441	0.17270143	79.48	31.29	1	40670	1.30995	53,275.59	1,091.93	0.02
Telecoms (see Appendix 2)	Portugal Telecom	29/07/1998	0.037398	-3.072966311	157.51	52.44	1	10750.89	1.30995	14,083.11	4,914.50	0.35
Telecoms (see Appendix 2)	Telefonica de Espana	29/07/1998	0.028979	2.685727525	83.89	59.28	1	47983.57	1.30995	62,855.99	4,488.38	0.07
CDRJ	CSN	03/09/1998	-0.032317	0.025361784	0.00	20.00	0	1203.63	1.00000	1,203.63	95.97	1.59
Bemge	Itau	14/09/1998	0.037643	0.028319616	85.59	90.70	0	2865.12	1.00000	2,865.12	583.00	18.46
Gerasul	Tractbel	15/09/1998	-0.008136	0.015949501	0.00	42.00	1	12638.11	1.39647	17,648.80	945.70	2.25
EBE	Bradesco	17/09/1998	-0.018448	-0.008947695	0.00	6.22	0	3307	1.00000	3,307.00	1,021.85	1.92
EBE	CPFL	17/09/1998	0.012603	0.025935301	0.00	6.22	0	1100.8	1.00000	1,100.80	1,021.85	5.77
EBE	Electricidade de Portugal	17/09/1998	0.023177	-0.032970582	0.00	6.22	1	13314.9	1.40058	18,648.53	1,021.85	0.34
RFFSA - Sao Paulo network	CVRD	10/11/1998	0.013967	0.062979664	5.00	33.00	0	3002.29	1.00000	3,002.29	245.05	2.69
Bandepe	ABN	17/11/1998	-0.008125	0.013398526	0.00	100.00	1	24788.07	1.42470	35,315.46	182.90	0.52
Comgas	British Gas	14/04/1999	0.010821	0.027334041	120.00	70.00	1	13729.21	2.70248	37,102.98	1,675.00	3.16
Comgas	Royal Dutch	14/04/1999	0.006937	0.00908567	120.00	6.00	1	104105.5	1.81084	188,518.66	1,675.00	0.05
Comgas	Shell	14/04/1999	0.014829	0.027899757	120.00	4.00	1	41057.97	2.70248	110,958.53	1,675.00	0.06
Baneb	Bradesco	22/06/1999	0.000359	0.028267717	3.18	100.00	0	3780.44	1.00000	3,780.44	260.00	6.88
Datamec	Unisys	23/06/1999	0.004327	0.026604771	0.00	87.87	1	10414.54	1.78900	18,631.61	83.65	0.39
CESP - Paranapanema	Duke	28/07/1999	-0.030068	0.013642592	90.19	100.00	1	19941.31	1.79400	35,774.71	1,239.00	3.46
CESP - Tiete	AES	27/10/1999	0.008636	0.026266805	30.00	33.50	1	11382.98	1.98800	22,629.36	938.10	1.39
Celpe	Iberdrola	17/02/2000	0.00461	0.012720751	0.00	29.87	1	10845.63	1.74769	18,954.74	1,780.98	2.81
Gassul	Gas Natural	26/04/2000	-0.024325	0.019466852	461.89	50.00	1	8539.08	1.66479	14,215.77	533.80	1.88
Cemar	PPL	15/06/2000	0.024861	0.018617173	0.00	84.70	1	3417.23	1.81100	6,188.60	522.79	7.16
Manaus Saneamento	Suez Lyonnaise des Eaux	29/06/2000	0.000881	0.020365233	5.01	90.00	1	36711.19	1.72879	63,465.85	193.00	0.27
Banestado	Itau	17/10/2000	0.027998	0.020010006	273.27	88.00	0	9516.78	1.00000	9,516.78	1,620.00	14.98
Saelpa	Alliant	30/11/2000	0.011975	0.019831741	0.00	40.34	1	2518.35	1.98000	4,986.33	362.98	2.94
Saelpa	Cataguazes	30/11/2000	0.003133	0.07562153	0.00	82.00	0	n/a	1.00000	n/a	362.98	n/a

Appendix 2: Compounding data for the telecommunication companies

	Telecom companies privatized on 07/29/98									
	Telesp Cel	Tele SE Cel	Tele Cel Sul	Tele L Cel	Tele NE Cel	Tele N Leste	Tele Centro Sul	Telesp	Total amount purchased by acquirer in telecoms R$ mil	Weighted average share purchased (%)
min price R$ million	1,100	570	230	125	225	3,400	1,950	3,520		
price R$ million	3,588	1,360	700	428	660	3,434	2,070	5,783		
Acquirers	**Shares (%) that aquirers purchased in each of the privatized companies**									
Portugal Telecom	99.9							23.0	4,915	52.44
Telefonica de Espana		93.0		38.0				52.9	4,488	59.28
Iberdrola		7.0		62.0				7.0	765	10.11
Italia Telecom			50.0		50.0		19.9		1,092	31.29
Bradesco			25.0		25.0				340	25.00
Banco Bilboa Vizcaya								7.0	405	7.00
Inepar						20.0			687	20.00
Alianca da Bahia						10.05			345	10.05

Notes:

Total amount purchased represents the sum of an acquirer's spendings,
which is the sum of the product of the price of the acquisition by its share on the purchase

The weights in the weighted average share is the final price paid for the privatized telecoms.