Ganhadores dos Leilões da Privatização Brasileira Realmente Ganham: Evidência Empírica de um Estudo de Evento

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Esta versão: Julho de 2001

Resumo

Durante os últimos dez anos, firmas e ativos brasileiros estatais têm sido leiloados sob o Programa Nacional de Desestatização. A literatura empírica sobre fusões e aquisições no setor privado indica que, em geral, os compradores, no melhor dos casos, não ganham nenhum excesso de retorno positivo no dia do anúncio da compra. No entanto, em negociações internacionais, eles podem ficar com algum prêmio. Usando a metodologia de estudo de evento e dados do mercado de ações, excessos de retorno ganhos pelos participantes vencedores nos dias dos leilões da privatização brasileira são estimados. A evidência estatisticamente significante sugere que os compradores ganham, em média, 0.62 % positivo a título de excesso de retorno naquele dia. Além disso, conduzindo análise transversal dos excessos de retorno específicos de cada firma, as evidências empíricas apontam para a relevância estatística de variáveis tais como nacionalidade do comprador (doméstico ou estrangeiro), tamanho relativo da aquisição com relação ao valor de mercado do comprador e, em grau menor, indústria do vencedor (a mesma ou diferente da do item privatizado). Considerando os resultados da atividade de fusões e aquisições no setor privado como referência, a evidência sugere que, ao contrário das transações privadas, as firmas ganham excessos de retorno positivos em todos os níveis de tamanho relativo, e que, de acordo com a mesma referência, compradores estrangeiros obtêm mais excessos de retorno do que compradores domésticos, *ceteris paribus*, até um certo tamanho relativo ou em todos os tamanhos relativos, dependendo na forma funcional assumida para a relação entre excessos de retorno e tamanho relativo. Portanto, pode ainda haver alguma margem para aperfeiçoamento do desenho dos leilões da privatização brasileira de modo a permitir a um governo maximizador de receitas extrair mais *surplus* dos participantes vencedores.

Palavras-chave: privatização, leilão, excesso de retorno, estudo de evento

Classificação da ANPEC: Áreas 04, 02 , 03

Classificação do JEL: D44, H82, G14

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[#] Eu sou extremamente grato à CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – do Ministério da Educação do Brasil pelo generoso suporte financeiro e a Rob Masson pelas valiosas sugestões. Quaisquer erros remanescentes são exclusivamente meus.

Winners of the Brazilian Privatization Auctions Do Win: Empirical Evidence from an Event Study

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This version: July 2001

Abstract

Over the last ten years Brazilian state-owned firms and assets have been auctioned off under the National Program of Privatization. The empirical literature in Mergers and Acquisitions in the private sector indicates that, in general, acquirers at best make no abnormal return on the day of the announcement. However, in cross-border acquisitions, they may earn some premia. Using the event-study methodology and stock markets data, abnormal returns realized by the winning bidders on the day of the Brazilian privatization auctions are estimated. Statistically significant evidence suggests that the acquirers accrue on average positive 0.62 % abnormal returns on that day. Moreover, performing a cross-section analysis of the firm specific abnormal returns, the empirical findings point to the statistical relevance of variables such as nationality of the acquirer (domestic or foreign), relative size of the acquisition with respect to the buyer's market value and, to a weaker extent, industry of the winner (same as or different from the privatized item). Taking private sector M&A activity results as a benchmark, the evidence suggests that, as opposed to the private transactions, firms earn some positive premia for all relative size levels, and that, in accordance with those deals, foreign buyers obtain more abnormal returns than domestic buyers other things equal, up to a certain relative size or for all relative sizes depending on the assumed functional form of the relation between abnormal returns and relative size. Hence there may still be some scope for improving the Brazilian privatization auction design so as to permit a maximizing revenue government to extract more surplus from the winning bidders.

Key words: privatization, auction, abnormal return, event study

ANPEC classification: Areas 04, 02 , 03

JEL classification: D44, H82, G14

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[#] I am extremely grateful to CAPES – Coordenacao de Aperfeicoamento de Pessoal de Nivel Superior – of the Brazilian Ministry of Education for generous financial support and to Rob Masson for helpful suggestions. All remaining errors are mine only.

WINNERS OF THE BRAZILIAN PRIVATIZATION AUCTIONS DO WIN: EMPIRICAL EVIDENCE FROM AN EVENT STUDY

1. Introduction

The transfer of state-owned assets to the private sector – privatization – has been in the political agenda of many countries in all continents for the last two decades. In Brazil, the establishment of the national program of privatization in 1990 marked the beginning of the sale of public assets as a mechanism for achieving political and economic goals. Since then privatization in Brazil has been conducted following a somewhat systematic set of procedures.

In 1990, eighty of the 500 largest non-financial Brazilian enterprises belonged to the public sector, representing, relative to GDP, 37% of total gross revenue, 63% of total net worth and 75% of total fixed assets. As of January 2001, about US$ 100 billion have been collected as revenues from the privatization sales.

Despite the impressiveness of the figures, there is no study (as far as I know) aiming to estimate the effectiveness of the program in terms of the amounted collected compared to the amount that could have been collected as result of the Brazilian privatization program. Some studies have empirically addressed this question in other countries and some theoretical models have attempted to explain some observed underpricing. These works have dealt with privatization sales performed under the fixed-price method. The Brazilian experience is different however. The greater part of the state-owned assets has been auction off. Therefore different and appropriate methodologies and benchmarks must be employed to carry on some meaningful analysis.

That is precisely the objective of this paper. Taking advantage of the fact that the privatization auctions are events that occur on publicly known dates, that, in many cases, the winners' identities are not known or anticipated until the end of auctions, I conduct an event study analysis, in order to measure the abnormal returns accrued to the acquirers on the day of the auction. Abnormal return is the difference between the acquirer's actual return on the day of the sale and some counterfactual proposal of what this return might have been in the absence of the auction. The market model, which assumes market efficiency and risk neutral and rational investors, is used as such counterfactual proposal in this paper. Given these assumptions, positive abnormal return is an indication of underpricing; i.e., the capital markets realize that the buyer pays less than what the purchase is worth for her, and, hence, revise upwards their expectations about her market value accordingly.

Aggregating winners' abnormal returns, I find evidence that, after conducting some statistical tests, on average, buyers do earn some premia on the day of the auction. The next natural task, then, is identifying some determinants of the estimated abnormal return. Whether or not the acquirer is domestic, and the relative size of the acquisition with respect to its own market value are factors that statistically explain some of the variability in the abnormal returns. Some weaker evidence for the same industry effect is also found.

These findings are contrasted with the empirical literature in private sector mergers and acquisitions. Underlying this comparison is an argument that, given the similarities between these private transactions and privatization auctions, the former is the private sector analogous with the latter.

2. Privatization

We say that a state-owned commercial activity is privatized when the state entity that owns or control it completely or partially transfers that ownership or control of such activity to the private sector. A privatization program is defined as a set of coordinated procedures to transfer manufacturing and services functions from the public to the private sector, resulting in the privatization of a collection of state-owned firms and commercial activities.

The recent wave of privatizations started in the 80's in the United Kingdom under Thatcher's administration. Since then it has spread out all over the world. Underlying this movement is a liberal philosophical defense of privatizations, which postulates that free and private entrepreneurship can drive the economy towards the some most efficient allocation of resources. Efficiency is expected to be

improved because privatized companies would be run in order to maximize economic profit rather than some political criteria.

The presence of state-owned companies is more notably noticed in regulated utilities industries, such as energy, transportation and telecommunications, where, otherwise, natural private monopolies had great potential to arise. Advances in regulatory mechanisms and technological changes - reducing minimum efficient scales - have given practical means for diminishing governmental participation in the economy as entrepreneur.

The liberal rationale for privatization programs materialize under diverse announced goals. Announced privatization goals are different among countries and also change over time in a given country. Typically a privatization program starts with immediate targets as, for instance, supporting stabilization programs, improving government credibility and financing budget deficits. If the program succeeds in the early stages, its goals become broader as enhancing competition, improving management operations, fostering the development of capital markets institutions or broadening share ownership or improving corporate efficiency.

Modernization – a close concept to efficiency - of domestic industry and public utilities has been a motive for privatizing as well. Over the last two or three decades, the state-owned firms have, in general, consistently undergone budgetary cuts inasmuch as many countries faced difficulties to finance new investments. As time went on, self-financing alternatives were also unviable because firms could not generate enough resources to reinvest; they had already become obsolete and efficiency, as mentioned earlier, had never been the main concern. Only private sector has been able to provide resources in quantity and quality required to catch up with international standards. However, domestic capital has been neither quantitative nor qualitatively enough to fill the gap. Foreign direct investment has made up the difference, bringing technological advances.

Many countries have also found in privatization a way of reducing their large fiscal deficits. It is accomplished as a result of two mechanisms at work: first, by selling off state-owned assets, governments raise money, which finances part of the deficit in the year when the money is collected. Yet, given that this is once-and-for-all revenue, if the structural causes of the fiscal deficit are not eliminated, its effects will only last for that year. Second, as the company is sold off, it will no longer create additional fiscal deficits, eliminating part of its structural causes. The public debt issue may be addressed directly, when, instead of collecting cash in the sale, arrangements are made so that the government accepts its own issued securities or transfers its firm's debt to the private sector in exchange for the assets sold off.

There are three basic methods through which governments privatize their assets: fixed-price share sale; tenders or auctions; and private placement. In the fixed-price share sale, the government splits up the ownership of the company in many shares and sets the unit price of the share. Anyone interested in the company submits the number of shares she/he is interested in buying at that price. Oversubscribed issues may be allocated pro-rata or by some other criterion. Once the distribution of the shares and payment are effective, the ownership transfer is complete. State-owned activities can also be privatized in competitive auctions where pre-qualified competitors place bids for the price (above some minimum price) and quantity of shares they want to acquire. Requirements for pre-qualification and rules of the auction vary across countries and over time. The private placement scheme is one in which government somehow reach an agreement with some particular investor group on the terms of the sale.

The design of a sale may also be a combination of these three basic methods and have other dimensions such as time. For example, all shares of a company may be sold at once or in trenches separated by months or years. Shares may be reserved for employees, managers, institutions, or foreign investors, or limits may be placed on the holdings of some category of investor. Shares may be sold at discounts or with concessionary financing to some investor groups. Government may retain a golden share giving it partial control over some firm decisions or create regulatory bodies through which it exercises further influence.

Previous Studies - Dewenter and Malatesta (1997) provide an analysis of initial offer prices in privatizations of state-owned companies compared to initial prices in public offerings of private companies. They test the hypothesis that privatization IPOs are, on average, underpriced more than privately owned company IPOs. Although asymmetric information among the different agents involved

in both types of IPOs is the most cited (and modeled) reason for the observed underpricing – which would be a signaling device about the true expected future returns - the sources of asymmetries in the privatization and the privately-owned cases differ. In the latter case, IPOs often involve young firms in relatively new industries, in the former, they commonly consist of old, large and well known. Therefore other things equal, privatization IPOs should be less underpriced. Nonetheless, a distinguishing feature of privatization is that the government can affect the firm value after the initial offer through its policy instruments (regulations). The commitment of the governments to some regulatory environment is exactly what some underpricing is assumed to signal. Potential explanations other than those relying on the maximizing IPO proceeds hypothesis (which is the underlying assumption in the asymmetric information models) have been offered for privatization IPOs underpricing. Some examples are building domestic political support for a privatization program by promoting widespread direct shareholding among citizens, which would also have the advantage of fostering the development of liquid domestic capital markets. Underpricing can be directed to benefit some specific group of people, such as firms' employees, who might otherwise deter privatization transaction, or political allies.

For all that, it is not clear whether privatization IPOs should be more or less underpriced than privately owned company IPOs. This is the empirical issue that Dewenter and Malatesta (1997) tried to answer by performing the test they proposed. Despite their efforts, they did not find any "general tendency for government officials to underprice IPOs to a greater degree than their private company counterparts" (p.1677). Their sample included privatization programs in Canada, France, Hungary, Japan, Malaysia, Poland, Thailand and the United Kingdom. In fact, for Canada and Malaysia, the evidence supported the opposite. Only in the U.K. there has been found evidence in favor of the privatization excess underpricing hypothesis. Their contribution went beyond this somewhat inconclusive result. They also examined some potential cross-sectional determinants of underpricing in privatization programs that are conducted by the IPO-like method. They found evidence indicating that initial returns are significantly higher in relatively primitive capital markets and for privatized companies in regulated industries.

One rationale behind the significance of the degrees of development of capital markets and of regulation of an industry as determinants of privatization underpricing is consistent with the asymmetric information stories insofar as primitive capital market conditions and incipient regulation may increase uncertainty about the intrinsic value of the offers and, as a consequence, depress offer price. Different explanations, however, such as broadening share ownership as a way of strengthening capital markets, may also be a reason why governments of countries with primitive capital markets underprice their IPOs. In the same token, some political goals (discussed later) in conjunction with informational asymmetries are consistent with the evidence underpricing and regulatory status as well. Therefore what ultimately drives the observed privatization IPOs underpricing was left as an open issue.

Perotti and Guney (1993) raise an interesting question: why in many countries is privatization made through fixed-price offering method if the auction method is potentially better at maximizing proceeds?

Their argument assumes that governments may have other goals, in addition to maximize profits, to run some business activities. If, for instance, the state entity runs an otherwise monopolistic firm, precisely to preclude private appropriation of monopoly rents, than it is natural to expect that state-owned companies will be less profitable than their private peer, as the abundant evidence suggests. Therefore profitability should not be the only measure to justify privatization. After all, if government could minimize cost while pursuing its policy goals, what would be the problem? The problem is one of incentives. Assuming that firm insiders can more easily coordinate their behavior than dispersed taxpayers, insiders will do so and will exert political pressure in order to take advantage of the governmental unconditional control power over firm assets, which allows them to appropriate rents. In the same token, this distortion of the incentive mechanism that should reward efficient behavior would not happen were the firm private because the owner/owners would have the incentive (maximizing profits) and ability to commit (contract design) to recompensing efficiency.

Alternatively, well-designed regulation and legislation imposed upon private firms, rather than state-ownership, could provide enforcing mechanisms so that those nonprofit goals would be achieved

while private ownership would achieve efficiency by seeking to maximize profits. In this setting, however, potential information asymmetry problems could arise restricting the success of legislation and regulation schemes. This argument may justify partial state-ownership or state participation in the board of directors, but is weak to defend full state-ownership.

In a privatization, the transfer of property rights to the private sector is generally protected against any direct state interference by constitutional law. Nonetheless, as mentioned before, the state entity can redistribute part of firm value through implementing different legislation or regulation after the transfer is concluded. Perotti (1995) models the case of fixed-price share sale (IPO) privatization taking into account this distinctive characteristic of privatization and assuming that executive officers seek to maximize state asset sales revenue. He shows that a government self-entitled committed to a given and publicly known set of regulatory rules can achieve its goal if it builds up such reputation among investors "by transferring control to the private sector, while initially selling only a fraction of shares and retaining the remainder for a certain period." Underpricing may also signal commitment. An interesting feature of this model is that it adds a time dimension to the distribution of shares. Its implications are: first, over time, as government erects its "good" reputation, less underpricing and larger initial offerings are expect to happen; second, the more sensitive to policy changes a industry is (those characterized by rent-earning potential), the more likely it is to observe larger underpricing, smaller initial offering and longer privatization process for a state-owned firm operating in that industry. This is so because of that government ability of modifying regulation after the privatization, affecting the value of the recently privatized business. State-owned firms in competitive markets are likely to be less exposed to such risk. They recognize the existence of other explanation whose implications would be the same as those of the confidence-building hypothesis. Shallow capital markets would also force a maximizing privatization government to opt for the gradual sales with some underpricing strategy. Absorbing a large share offer in a shallow capital markets requires that investors allocate a large fraction of their wealth in the issue, exposing them to higher risk. Higher risk makes investors demand more risk discounts, decreasing the proceeds of the sale.

After a casual observation over the IPO privatization processes in countries of different levels of capital market maturity, the authors suggest that the reputation building strategy is more likely to explain the gradual sale with underpricing pattern across countries. Their reasoning supporting this claim is that were the shallow capital market story true, then gradual sales would not be the strategy choice in countries with developed (deep) capital markets. But they are.

3. Previous studies in private sector acquisitions as benchmarks

It has been suggested that underpricing is greater when government sells off its assets using the fixed-price method than when private firms are first offered publicly [Vickers and Yarrow (1988), Jenkinson and Mayer (1988), Jacquillat (1987), and Perotti and Guney (1993)]. Dewenter and Malatesta(1997) and Levis (1993) effectively examine empirically this conjecture. Underlying the conjecture and the test is the presumption that private IPOs and state-owned firm IPOs are somehow analogous.

The fixed-price is just one basic method through which governments transfer ownership to the private sector. A natural question is how much underpricing, if any, should be expected when governments choose to auction off their assets? Let us assume for a moment that we do, somehow, observe some underpricing resulting from privatization auctions. The next question is: how could one know whether it is too much or too little?

A benchmark is needed to answer this question. Now the problem is the choice of the benchmark. Ideally it should be compared to underpricing realized in transactions in which non-state-owned companies divested all or part of their assets through auctions whose rules were the same as in a privatization program. An approximation to this ideal scenario in the private sector is the process in which firms acquire another firm by tender offers. In this case, the government role is analogous to the role of the target insofar as both seek to maximize revenues upon sale of their property rights. Maximization of revenues seems quite a palatable assumption in the private context. As for governments, they may also have some political goals in privatizing their companies, but as the auction is set up, on

that moment, it is reasonable to assume that their objective is extract as much revenue as they can from the sales. The analogy is not perfect, though. Privatization auctions are better characterized by well-established explicit set of rules. Participants meet at a previously specified time and place. In the private sector, however, the rules of the market for corporate control are fuzzier, if any exists. As soon as a company is identified as a target in this market, each potential acquirer starts negotiating with the target its terms of the acquisition; there is no requirement of time or place. Obviously, such negotiations include, among other things, the proposed price to be paid, the bid – as the literature in mergers and acquisitions denominate it in a reference to the auction-like aspect of the deal. In reality, despite the fact that this process does not fit exactly the standard definition of an auction because rules are not explicit, it has some elements of it. The market for corporate control does determine resource allocation and prices on the basis of bids from the market participants. Besides there is no standard value associated to the target, which is a situation that auctions are, perhaps, the most suitable device to deal with. Therefore, notwithstanding the absence of an explicit set of rules, the private sector market for corporate control seems to be the closest (at least, the closest I could think of) analogy to the privatization auction and, because of that, will provide the underpricing benchmark which privatization auction underprincing will be contrasted with.

The next issue is measuring underpricing in this context. The empirical literature in takeover activity in the private sector has examined the movements in the share prices of the bidders and targets around unanticipated key events along the negotiation process. The methodology consists of comparing the share returns of the participants 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 impaired on that key event. The announcement of winning bidder, its identity and the terms of acquisition is the event of interest for the purpose of measuring underpricing in the deal. I assume that positive abnormal returns accrued by the acquirer around the announcement of its victory is a measure how good the terms of the deal were in its favor, i.e., a measure of underpricing. Underlying this assumption is the market efficiency hypothesis. The price of a stock is its corresponding discounted expected future cash flow given all currently available information. If an acquisition is considered good news on its own, in the sense that it increases the acquirer's expected present value of future cash flow to a higher level than it would have been, had the acquisition not happened, the acquirer's stock price is expected to increase as soon as the announcement is made. On the other hand, the acquirer has to give something in exchange in the transaction (for instance, cash), which reduces the expected present value of future cash flow, pushing down the stock price to a level lower than it would have been in the absence of such acquisition. Putting together these two opposite forces, we expect to observe positive abnormal return if capital market participants believe that the former effect outweighs the latter, and negative, if the latter exceeds the former. In a word, acquirer's positive abnormal return is a result of acquirer paying less than what the target is worth for her.

The empirical literature in private sector acquisition has provided plentiful evidence on the acquirers' abnormal returns upon announcements of takeovers. Franks and Harris (1989) examine the effects of over 1,800 takeovers on shareholder wealth in the United Kingdom in the period 1955-1985. They show that around the announcement date targets gain 25 to 30 % and bidders earn zero or modest gains. Jarrel et al. (1988) surveyed many event studies that measure the effects of unanticipated takeover events on stock prices, after correcting for overall market influence on security returns. They summarize by saying that "Acquirers (…) receive at best modest increases in their stock price, and the winners of bidding contests suffer stock-price declines as often as they do gains." (p. 66). Bühner (1991) examines 110 takeovers involving the 500 largest enterprises in the Federal Republic of Germany in the period 1973-1985. His evidence shows that the shareholders of acquiring firms make losses, on average, of 9.83 % around the takeover. Acquisitions in the United Kingdom from 1977 to 1986 are the subject of study of Limmack (1991). The author uses three counterfactual models in order to evaluate abnormal returns and concludes that bidder firms do suffer wealth decreases. Ding (1999) analyzes acquisition events in an emerging market. Using data from Singapore, he cannot reject the hypothesis that acquiring shareholders make zero abnormal returns around the announcement date. In addition of being consistent across

different countries, the evidence that acquirers' shareholders at best break even in takeovers seems to be uniform over time as Leeth and Borg (2000) show. They examine the impact of merger announcements in the period 1919-1930 in the United States. Despite the different regulatory and economic environment at that time, their findings also suggest the acquiring firm stockholders do not make any positive abnormal return on the deal.

All these findings reinforce what Jensen (1986) wrote about the distribution of wealth in takeovers: "it appears that bargaining power of 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 (200) study the wealth effects of international acquisitions using a sample of foreign acquisitions by Dutch firms during the period 1990-96. Their finding is that cross-border acquisitions create wealth for the Dutch firms, especially for acquisitions in the United States, after controlling for variables such as the relative size of the target with respect to the acquirer's size and the relatedness of their industries. The evidence is weak, though. Examining shareholder wealth gains from domestic and foreign takeover announcements in the U.S. chemical and retail industries, Dewenter (1995) finds that foreigners pay more than domestic investors in hostile transactions, but pay less when there are rival bidders. Among her explanatory variables are exchange rates and taxes. Doukas and Travlos (1988) investigate the effect of international acquisitions on stock prices of U.S. bidding firms. They find evidence supporting the fact that firms expanding into new industry and geographic markets – especially those less developed – experience larger abnormal returns.

I have searched the economic literature extensively for some similar study for the specific case of the Brazilian market for corporate control. Unfortunately I have not found any up until now. Nonetheless, since the vast empirical evidence supporting the conjecture of null, in domestic deals, and some positive, in cross-border transactions, abnormal returns accruing to acquiring firms on the occasion of the acquisition is consistent across some countries (including an emerging one) and over time, I will extend that conjecture to Brazil and make it the benchmark which abnormal returns observed as result of Brazilian privatization auctions earned by the winning bidders will be compared with.

4. Statistical Procedures

In this section, a methodology to estimate and test individual firms and aggregate abnormal returns on a given day is described, their statistical properties are established and some criticisms to the approach is commented. Then a cross-sectional analysis of those estimated individual excess returns is proposed.

4.1. Event study methodology

A privatization auction is an important economic event to the extent that it reallocates resources among participants. This reallocation is likely to affect the value of the participant firms. What the econometric literature established as an event-study analysis is a methodology designed to measure the change of the value of one or more firms as a result of an identifiable and unanticipated event using financial market data.

This change in value is assessed by measuring the difference between the actual *ex post* return of the security over the period corresponding to the realization of the event –called event window – and the normal return that would have been observed had the occurrence not happened over the same time period. Symbolically, $\varepsilon_{it}^{*} = R_{it} - E[R_{it}|X_t]$, where ε_{it}^{*}, R_{it}, and $E[R_{it}|X_t]$ are the abnormal, actual, and conditional normal returns, respectively, for time period t of security i. X_t is the conditioning information for the normal performance model.

Many approaches have been proposed for modeling the normal return of a given security. "Statistical" models follow from assumptions concerning the time series behavior of asset returns and do not depend on economic arguments. The constant mean return model, the market model, and the multifactor market model are examples of the "statistical" class. On the other hand, "economic" models take into account assumptions concerning investors' behavior as well as statistical assumptions. The capital asset pricing model (CAPM) and arbitrage pricing theory (APT) model fall in this category.

After considering the properties of many different models, Campbell et al. (1997) claim "There seems to be no good reason to use an economic model rather than a statistical model in an event study." (p. 157). They also argue that the market model potentially improves the performance over the constant mean return model, and that "the gains from employing multifactor models for e
because "the marginal explanatory power of additional factors beyond the market factor is small, and hence there is little reduction in the variance of the abnormal return." (p. 156-157). Hence, I choose the market model to conduct the present event study.

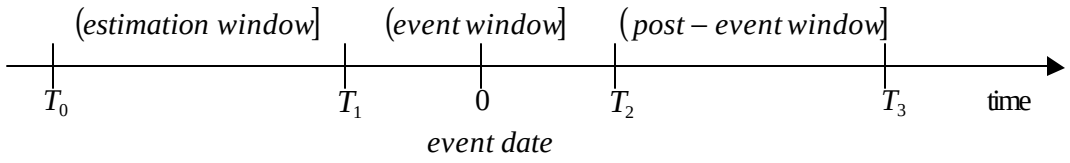

Figure 1 – Time Line for an Event Study

Figure 1 represents the timing sequence of a typical event study and illustrates the meaning of estimation, event and post-event windows. In the case of privatization auctions the sequence is simplified: the event window is the day of the auction, the estimation window consists of the previous 251 closing quotes or 250 return observations ending six trading days before the auction, and the post-event window is not considered because it is not necessary for the purpose of this paper. Figure 2 illustrates the simplifications.

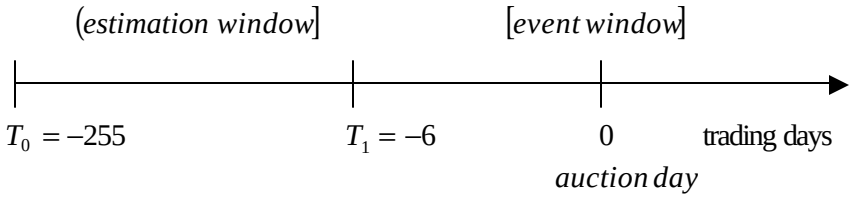

Figure 2. Time sequence for a privatization auction

The market model for security i and observation t in event time is $R_{it} = a_i + b_i R_{mt} + e_{it}$
The estimation-window observations can be expressed as a regression system. $\mathbf{R}_i = \mathbf{X}_i \boldsymbol{q}_i + \boldsymbol{e}_i$ where $\mathbf{R}_i = \left(R_{iT_0+1} \cdots R_{iT_1}\right)'$ is a $(L \times 1)$ vector of estimation-window returns, $\mathbf{X}_i = (\boldsymbol{i}\mathbf{R}_m)$ is an $(L \times 2)$ matrix with a vector of ones in the first column and the vector of market return observations $\mathbf{R}_m = \left(R_{mT_0+1} \cdots R_{mT_1}\right)'$ in the second column, $\boldsymbol{q}_i = (\boldsymbol{a}_i \; \boldsymbol{b}_i)'$ is the (2×1) parameter vector, and $L = T_1 - T_0 + 1$ is the length of the estimation window. $\mathbf{X}$ has a subscript because the estimation window may have timing that is specific to firm i. Under general conditions, such as $Cov[\mathbf{X}_i \, \boldsymbol{e}_i] = 0$ ordinary least squares (OLS) is a consistent estimation procedure for the market-model parameters. Assuming $E[\boldsymbol{e}_{it}] = 0$ and $Var[\boldsymbol{e}_{it}] = \boldsymbol{s}_{e_i}^2$, OLS is efficient. The OLS estimators of the market-model parameters using an estimation window of L observations are

$$\hat{q}_i = (\mathbf{X}_i'\mathbf{X}_i)^{-1}\mathbf{X}_i'\mathbf{R}_i \qquad \hat{e}_i = \mathbf{R}_i - \mathbf{X}_i\hat{q}_i$$

$$\hat{s}_{e_i}^2 = \frac{1}{L-2}\hat{e}_i'\hat{e}_i \quad [*] \qquad Var[\hat{\boldsymbol{q}}_i] = (\mathbf{X}_i'\mathbf{X}_i)^{-1}\boldsymbol{s}_{e_i}^2$$

I next show how to use these OLS estimators to measure the statistical properties of abnormal returns. First I consider the abnormal return properties of a given security and then we aggregate across securities.

Statistical Properties of Abnormal Returns - Given the market-model parameter estimates, one can measure and analyze the abnormal returns. Let $\hat{\boldsymbol{e}}_i^*$ be the sample abnormal return for firm i on the day of

the auction. Then using the market model to measure the normal return and the OLS estimators from the above equations, we have the following abnormal return: $\hat{e}_i^* = R_i^* - \hat{a}_i - \hat{b}_i R_m^* = R_i^* - \mathbf{X}_i^* \hat{q}_i$ where R_i^* is the firm$_i$'s actual return on the day of the auction, $\mathbf{X}_i^*$ is a (1×2) vector in which the first element is 1 and the second, R_m^*, is the market return on the auction day, and $\hat{q}_i = \left(\hat{a}_i \; \hat{b}_i\right)'$ is the (2×1) parameter vector estimate. Conditional on the market return on the day of the auction, the abnormal returns will be normally distributed with a zero conditional mean and conditional variance V_i, as shown below:

$$E\left[\hat{e}_i^* / \mathbf{X}_i^*\right] = E\left[R_i^* - \mathbf{X}_i^* \hat{q}_i / \mathbf{X}_i^*\right] = E\left[\left(R_i^* - \mathbf{X}_i^* q_i\right) - \mathbf{X}_i^*\left(\hat{q}_i - q_i\right) / \mathbf{X}_i^*\right] = 0$$

$$V_i = E\left[\left[\hat{e}_i^*\right]^2 / \mathbf{X}_i^*\right] = E\left[\left[e_i^* - \mathbf{X}_i^*\left(\hat{q}_i - q_i\right)\right]^2 / \mathbf{X}_i^*\right] =$$

$$= E\left[\left[e_i^*\right]^2 - e_i^*\left(\hat{q}_i - q_i\right)' \mathbf{X}_i^{*'} - \mathbf{X}_i^*\left(\hat{q}_i - q_i\right)e_i^* - \mathbf{X}_i^*\left(\hat{q}_i - q_i\right)\left(\hat{q}_i - q_i\right)' \mathbf{X}_i^{*'} / \mathbf{X}_i^*\right] = s_{e_i}^2 + \mathbf{X}_i^*(\mathbf{X}_i'\mathbf{X}_i)^{-1}\mathbf{X}_i^{*'} s_{e_i}^2$$

From these derivations, one can see that the abnormal return, with an expectation of zero, is unbiased. The variance of the abnormal return has two parts. The first term in the sum is the variance due to future disturbances and the second term is the additional variance due to the sampling error in $\hat{q}_i$.

Under the null hypothesis, H_0, that the given event has no impact on the mean or variance of returns, I can use the previous results and the normality of abnormal returns to draw inferences. Under H_0, for the event sample abnormal return, we have $\hat{e}_i^* \sim N(0; V_i)$. I next build on this result and consider the aggregation of abnormal returns.

Aggregation of Abnormal Returns - The abnormal return observations must be aggregated in order to draw overall inferences for the event of interest. In general, the aggregation is along two dimensions – through time and across securities. However, since I chose the window event be the day of the event – for reasons that will be discussed later, in the case of privatization auctions, time aggregation is trivial because the window event is only one day.

To aggregate across securities, we assume that there is not any correlation across the abnormal returns of different securities. This will generally be the case if there is not any clustering, that is, there is not any overlap in the event windows of the included securities. The absence of any overlap and the maintained distributional assumptions imply that the abnormal returns will be independent across securities. In the case of the Brazilian privatization program, some auctions occurs on the same day or more than one acquirer jointly participates in the auction, characterizing such undesirable overlap. I performed the analysis using seemingly unrelated regressions (SUR) analysis to deal with this problem. The results are essentially the same as those obtained by applying the simplest method. The reason for that is that the regressors in the market model (market returns) are the same, in the case of acquirers of the same country, or highly correlated, in the case of acquirers in different countries. For sake of simplicity, I will keep the simpler method in this paper. However the results of the SUR analysis are available on request.

The individual securities' abnormal returns can be averaged using $\hat{e}_i^*$. Given a sample of N events, defining $\bar{e}^*$ as the sample average of the N abnormal returns, we have

$$\bar{e}^* = \frac{1}{N}\sum_{i=1}^{N} \hat{e}_i^* \qquad\qquad Var\left[\bar{e}^*\right] = V = \frac{1}{N^2}\sum_{i=1}^{N} V_i$$

Inferences about the abnormal returns can be drawn using $\bar{e}^* \sim N(0; V)$, since under the null hypothesis the expectation of the abnormal returns is zero. In practice, since V is unknown, the consistent estimator $\hat{V} = \frac{1}{N^2}\sum_{i=1}^{N} \hat{V}_i$, where $\hat{V}_i = \hat{s}_{e_i}^2 + \mathbf{X}_i^*(\mathbf{X}_i'\mathbf{X}_i)^{-1}\mathbf{X}_i^{*'}\hat{s}_{e_i}^2$ and $\hat{s}_{e_i}^2$ is defined as in [#], is used to test H_0:

$$J_1 = \frac{\bar{e}^*}{\hat{V}^{\frac{1}{2}}} \overset{a}{\sim} N(0;1).$$

This distributional result is for large samples of events and is not exact because an estimator of the variance appears in the denominator.

A second method of aggregation is to give equal weighting to the individual standard abnormal returns, defined as $S\hat{A}R_i = \frac{\hat{e}_i^*}{\hat{V}_i^{\frac{1}{2}}}$. Defining the average over the N securities, we have $\overline{SAR} = \frac{1}{N}\sum_{i=1}^{N} S\hat{A}R_i$.

Assuming that the event windows of the N securities do not overlap, under H_0, $\overline{SAR}$ will be normally distributed in large samples with mean zero and variance $\frac{L-2}{(L-4)N}$. We can test the null hypothesis using $J_2 = \left(\frac{(L-4)N}{L-2}\right)^{\frac{1}{2}} \overline{SAR} \overset{a}{\sim} N(0;1)$.

When doing an event study one will have to choose between using J_1 or J_2 for the test statistic. One would like to choose the statistic with higher power, and this depends on the alternative hypothesis. If the true abnormal return is constant across securities then the better choice will give more weigh to the securities with the lower abnormal return variance, which is what J_2 does. On the other hand, if the true abnormal return is larger for securities with higher variance, then the better choice will give equal weight to the realized abnormal return of each security, which is what J_1 does. In most studies, the results are not likely to be sensitive to the choice of J_1 versus J_2 because the variance of the abnormal return is of similar magnitude across securities. Which does not seem the case in the case of the Brazilian privatization auctions.

Nonparametric Tests - The methods discussed to this point are parametric in nature, in that specific assumptions have been made about the distribution of abnormal returns. Alternative nonparametric approaches are available which are free of specific assumptions concerning the distribution of returns.

The sign test, which is based on the sign of the abnormal return, requires that the abnormal returns are independent across securities and that the expected proportion of positive abnormal returns under the null is 50%. The basis of the test is that under the null hypothesis it is equally probable that the abnormal return will be positive or negative. If, for example, the null hypothesis is that there is a positive abnormal return associated with a given event, the null hypothesis is $H_0 : p \leq 0.5$ and the alternative is $H_A : p > 0.5$ where $p = \Pr(e_i^* \geq 0)$. Let N^+ and N be the number of cases where the abnormal return is positive and the total number of cases, respectively. Then, as N grows, $J_3 = \left[\frac{N^+}{N} - 0.5\right]\frac{N^{\frac{1}{2}}}{0.5} \overset{a}{\sim} N(0;1)$. For a test of size $(1-\alpha)$, H_0 is rejected if $J_3 > \Phi^{-1}(\alpha)$.

A weakness of the sign test is that it may not be well specified if the distribution of abnormal returns is skewed, as can be the case with daily data. With skewed abnormal returns, the expected proportion of positive abnormal returns can differ from one half even under the null hypothesis.

Typically, nonparametric tests are not used in isolation but in conjunction with their parametric counterparts. The nonparametric tests enable one to check the robustness of conclusions based on parametric tests. Therefore I will perform these three tests presented above to evaluate whether or not winning bidders accrued positive abnormal returns when they were announced winners in privatization auctions.

4.2. Cross-section

The identification of factors that affects the potential of obtaining positive abnormal returns is important since it may influence the privatization auction design so as to increase government revenue upon the sale of the once state-owned assets.

Once individual abnormal returns have been determined in the event analysis, the next natural step is to investigate the association of the magnitude of the abnormal returns with some characteristics specific to the event observation.

Appealing once more to the similarities between private sector acquisitions and privatization auctions, the empirical literature in section 4 suggest some variables that may be associated with the estimated abnormal returns. Specifically, I examine the nationality of the winner, the relative size of the privatized asset with respect to the size of the acquirer, and the relatedness of their line of businesses. I

also include a variable related to the number of contesters in each auction. Foreign exchange rate and taxes, as suggested by Dewenter (1995), are left to be examined in another opportunity.

Let $\mathbf{y}$ be an $(N \times 1)$ vector of abnormal return observations and $\mathbf{W}$ be an $(N \times K)$ matrix of characteristics (including or not the intercept). Then the following regression equation is estimated: $\mathbf{y} = \mathbf{W}\boldsymbol{\theta} + \boldsymbol{\eta}$, where θ is the $(K \times 1)$ coefficient vector and η is the $(N \times 1)$ error vector. Assuming that the regressors are independent of the error terms, the OLS estimator is consistent. Even though there is no reason to assume that the elements of $\boldsymbol{\eta}$ are cross-sectionally uncorrelated and homoskedastic, I will assume so and then check for the presence of heteroskedasticity, performing the White Test.

5. The data sets

Here as in the previous section, I split the data into two parts. One is the raw material for the event study and the other, for the cross section analysis.

5.1. Data set for the event study

In order to empirically measure the abnormal returns that winning bidders made when they were proclaimed winners in the Brazilian privatization auctions, using the event-study methodology described in the previous section, a minimum set of variables was required and consisted of:

1. Identification of the state-owned companies or assets being privatized;
2. Date of the privatization auction of each of those companies/assets;
3. Some indication of the number of participants (one or more than one);
4. Identification of the winning bidders;
5. Stock market closing prices of the stocks of the winners in their domestic markets with 250 daily (about one year) observations prior to the week before the realization of the auction;
6. 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.

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

The annual reports of BNDES (National Development Bank) provided some partial information about the state-owned companies, date of the privatization auctions, winners and number of participants in the auction. Manzetti (1999, pp. 174-179) supplied incomplete data on the state-owned companies being privatized and the winning bidders. From the Rio de Janeiro Stock Exchange website (www.bvrj.com.br), I was able to identify almost completely the privatized firms/assets, the dates of the auctions and some indication about the number of contesters, given by the comparison between the winning bid and the minimum price set by the government (the rationale here is that if there was only one bidder, it would win the auction by bidding the minimum value). I also obtained information on the variables 1, 2, 3 and 4 by searching the "Dow Jones Interactive" service available online through the Cornell University Library. The crosschecking among all this sources yields quite a reasonable reliability for the first four variables listed above.

As for the closing stock prices of the previously identified winning bidders and respective local market indexes, DataStream Advance, which is an online time series data retrieval service, is the source of information.

An obvious drawback of use of stock price data to estimate gains upon privatization auctions is that it restricts the analysis to firms that are publicly traded. The relevance of acquisitions in these auctions made by privately owned companies and pension funds is not small. Ideally they should be included in the study, but their information is not publicly available. Hence this is a restriction that I had to live with.

Historical and technical issues also imposed some restrictions on the size of the data set. As mentioned in section 3.1, the first privatization under the PND occurred in October 1991 when inflation was sky rocketing. Inflation stayed high until mid 1994, when the Real Plan was introduced along with a currency change. DataStream Advance retrieves stock price time series data for Brazilian companies

denominated in the current currency (Real) up to the cent even for the period before the introduction of this currency. As a result, because R$1,00 was equivalent to thousands of the old currency, for the period 1991-mid 1994, the Brazilian firms' stock price time series is a vector of zeros (R$ 0,00). Accordingly, in this period, only the foreign companies that participated and won the privatization bids provided meaningful data for the purpose of estimating their corresponding market models and abnormal returns on the days of the auctions. To complicate matters, recall that before 1995 foreign participation was very restricted. Therefore most of the analyzed privatization auctions occurred from 1995 to 2000. Despite the concern about the power of statistical test being affected by the sample size, this does not impose serious constraint in the analysis, because, in the end the sample size is 71 acquirer-privatized pairs and, as I have mentioned before, 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.

The data set contains stock prices and local index. The following transformations yield stock and market returns, which are the inputs of empirical analysis:

$R_{it} = \log p_{it} - \log p_{it-1}$,where R_{it} is stock i 's return on day t and p_{it} is price of stock i on day t;

$R_{mt} = \log I_{mt} - \log I_{mt-1}$,where R_{mt} is return of index of market m on day t and I_{mt} is index of market m on day t.

5.2. Data set for the cross-section analysis

Nationality is determined by the location of the company's main headquarter. It is located in Brazil, the company is domestic and the nationality variable is set equal to zero. Otherwise, the company is said to foreign and the nationality variable is attributed the value one.

The relative size variable was built upon three pieces of information: 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. Hence the relative size is the product of the purchase value times the participation share of the acquiring firm, divided by its market value. At this point is convenient to note that the market value of some buyers were unrealistically low, yielding extremely high relative sizes. Hence I removed the five corresponding problematic pairs – acquirer, target – from the sample that was submitted to the cross section analyses. In table 4 these pairs are identified by the symbol "n/a" in their respective market value cells.

The relatedness variable is set equal to zero when the buyer and target's industries are related, and equal to one otherwise. Industries are classified as being related when their DataStream Advance industry codes match, and unrelated when they do not.

Consider the ratio between the winning bid and the minimum price set by the government minus one. This is called by the Brazilian government "premium". Let me also introduce the variable "participation indicator" as being zero when premium is zero and one, otherwise. I reason that when participation indicator is equal to zero – premium equal to zero - it is likely that only one bidder was present in the auction, and, realizing this, bid the minimum offer. Conversely, if more than one bidder places bids, it is probable the winner has placed some amount above the minimum bid, causing premium to be greater than zero, which is to say participation indicator equal to one. Admittedly this reasoning may not be always true but it is enough to defend that participation indicator (defined as a function of premium) and number of participants in an auction is positively correlated in the case of Brazilian privatization auctions.

Bloomberg, an online financial service that provides quotes and technical analysis of securities, as well as company and industry information, is the data source for the location of the acquirers' headquarters. DataStream Advance provides industry classification, market value figures and exchange rates to convert all values to the same currency – Brazilian Real. Rio de Janeiro Stock Exchange web site furnishes minimum and final prices for most of the auctions. Dow Jones Interactive and BNDES Annual Reports complement the series, and also provide, along with Manzetti (1999, pp. 174-179), data on the shares acquired by each firm.

Tables 4 and 5 present the data set used to perform the cross-section analysis of the abnormal returns accrued to the winning bidders in the Brazilian privatization auctions on the day of the auction.

6. Empirical results

First I perform the statistical procedures described in section 5.1 to estimate abnormal returns realized by each acquirer on the day of the auction, using the data characterized above. Table 4 reports the individual abnormal returns while table 1 presents the average premium and the three statistics designed to test the absence of abnormal returns as null hypothesis. Their respective significance levels are also indicated.

The figures in table 1 call for rejection of the null hypothesis at 5 % significance level in two of three tests and at 10 % in the remaining one. Hence the evidence suggests that winning bidder accrued positive abnormal returns of 0.62 %, on average, on the day of the privatization auction.

Now, the task is identifying the determinants of the abnormal returns emerging from the event study. After extensive pre-testing, ten ordinary least square models emerged as relevant for the analysis. The estimates of these models are showed in table 2.

Before I go into the details of each model, it is worth to note some regularities observed in table 2. The parameter estimates of variables nationality and relative size are positive in all models. The other explanatory variables show remarkable consistency of their parameter estimate signs as well, with the exception of three sign reversals, which are not statistically significant anyhow. Also the F-statistics of models without intercept is always greater than the F-statistics of the corresponding models with intercept.

The explanatory variables of models 1 and 2 consist of the "standard variables": nationality, industry, participation indicator and relative size. These models had poor performance in fitting the data, as no parameter estimate is statistically significant, not even at 10 % level. The interesting fact is that in model 2, in which there is no intercept, the standard variables become jointly significant at 5 % level, as the F-statistic reveals. The introduction of other variables, however, improved performance as estimates of models 3 to 10 make clear.

In models 3, 4, 5 and 6, in addition to some standard variables, interaction terms are included. The explanatory variables of models 3 and 4 are all the standard ones plus the following interaction terms: industry times relative size, nationality times relative size, and participation indicator times relative size. The difference between these two models is the intercept; 3 has it, 4 does not. The absence of the intercept improves the joint significance of the explanatory variables. Overall, both models suggest that nationality, relative size and the interaction terms involving nationality and industry are the most relevant factors in explaining abnormal returns. Hence models 5 and 6 take these relevant variables into consideration. On the one hand, the joint significance of the models increases as compared to the previous pair. On the other hand, R square of Model 5 is less than of Model 3. Model 6, the one without intercept, is joint significantly at 5 % level, and seems to improve upon Model 5 as all parameter estimates become more significant individually. Besides the intercept in 5 was not significantly different from zero. Therefore Model 6 seems to be the best among the class of models that includes some standard variables and interaction terms, even though the former are only significant at 10 % level. In other terms, there is evidence that nationality, relative size and industry matter at different significance levels. The industry effect is the weakest (10 significance level) among them, affecting the dependence between abnormal returns and relative size. Some potential forms of heteroskedasticity are tested. The results in table 3 does not reject the homoskedasticity hypothesis, not even at 10 % significance level.

Holding nationality constant, cross industry privatization has a negative effect (-0.00134) in that dependence The evidence strongly suggest that nationality matters; and does it in two ways: through a positive parallel shift (1 % significance level) in the straight line relating abnormal returns and relative size (0.0100), and by reducing the slope of such line (-0.00135), holding the industry factor constant (10 % significance level). Regardless of the industry and nationality effects, the relative size factor (0.00152) is important on its own at 5 % significance level. Compounding all factors the estimated equations are:

$AR = 0.00152 * RS$; when the acquirer is domestic and in the same industry of the privatized firm;

$AR = 0.01 + 0.00017 * RS$; when the acquirer is foreign and in the same industry;

$AR = 0.00018 * RS$; when the acquirer is domestic and in different industry;

$AR = 0.01 - 0.00117 * RS$; when the acquirer is foreign and in different industry.

According to these relationships, both domestic and foreign acquirers get higher abnormal returns when they are in the same industry of the privatized entity, for all levels of relative size. Comparing among acquisitions in the same industry, foreign buyers accrue higher abnormal returns than their domestic counterparts when relative size is less than 7.4 %. Above this percentage the inequality reverses. Among deals in different industries, foreigners have advantage up to 7.4 % too, and the reversion occurs above this level. A curious feature of the estimated equations is that it predicts that foreign firms in different industries would make negative abnormal returns if the relative size of their purchases exceeds 8.5 %. This is the only situation in which abnormal returns are a decreasing function of relative size.

Models 7, 8, 9 and 10 make up a class of models in which the variable "square of relative size" is included as explanatory variable, instead of interaction terms, along with all (models 7 and 8) or some (models 9 and 10) standard variables.

In models 7 and 8, the evidence suggests that the explanatory variables industry and participation indicator are not statistically significant. Moreover dropping them makes models 9 and 10 perform at least as good and in some aspects better in fitting the data than models 7 and 8, respectively. Specifically the joint statistical significance improves, as measured by the F-statistics, as well as the significance of the nationality variable.

Model 9 fits well the data. It explains 13 % of the variation of abnormal returns, is jointly significant at 5 % level, and all parameter estimates are individually statistically significant at 5 or 1 %, except the intercept which is not significantly different from zero. The insignificance of the intercept indicates the next move: dropping it from the model. That is what Model 10 represents. All parameter estimates of the last model are significant at 5% level and are jointly significant at 1 % level. Therefore I claim that Model 10 is the best representation of the data among those in the class of models that include some standard and the square of the relative size variables. The residual analysis does not indicate any immediate violation of the homoskedasticity assumption as indicated in table 3.

According to the estimates of Model 10, a foreign acquirer makes 0.86 %, on average, more abnormal return than a national acquirer, controlling for their relative size. In addition, abnormal return is a strictly increasing function of relative size for all relative sizes less than 38.8 % and decreasing after that. For domestic acquirers, negative premia are expected when relative size is greater than 77.6 %, and 84.7 % in the case of foreign buyers.

Hence models 6 and 10 were the best fits for the data as their parameter estimates are individually significant at, at least, 10 % level and jointly at, at least, 5 %. In both representations, the parameter estimates clearly suggest that nationality and relative size matter for explaining the level of abnormal return an acquirer is expected to obtain by placing the winning bid in the Brazilian privatization auctions. Nonetheless, they differ in respect to the functional form of the relationships. The estimates of Model 6 also indicate that the industry variable may play some role in this analysis.

7. Discussion and comments

This evidence of positive abnormal returns for the acquirers in the Brazilian privatization auctions suggests, at first sight, 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. This result is puzzling for two reasons: first, how can such good deals arise in competitive bidding auction settings? Second, why, then, in the private sector similar deals yield at best no positive abnormal return for the acquirer, on average?

The economic theory in auctions may shed some light in explaining the puzzle. Let us examine the first question. In the Brazilian privatization program, BNDES chose to auction off state-owned enterprises using a set of procedures that can be best approximated by the first-price sealed-bid auction in which potential buyers submit sealed bids and the highest bidder is awarded the item for the price he/she/it bid. For this type of auction, under the assumptions that:

A1) The bidders are risk neutral;

A2) The private-values are independent;

A3) The bidders are symmetric;
A4) Payment is a function of bids alone;
A5) The bidders know the rules of the auction that the seller has chosen and committed itself to;
A6) Number of bidders, their risk attitudes, and the probability distributions of valuations are common knowledge;

It can be proved that the price is the expectation of the second-highest valuation conditional on the winning bidder's own valuation. Moreover, the bidder bids some amount less than its true valuation. The exact amount depends on the probability distribution of the other bidder's valuation and the number of competing bidders.

Inasmuch as this proposition predicts than the winning bid is expected to be less than the winner's valuation of the subject, positive abnormal returns accrued to the winners should also be expected, as long as the capital markets are efficient and investors are rational. But to what extent this is a reasonable explanation for the empirical finding? It depends on the validity of the assumptions A1 to A6 as applied to the actual privatization auctions.

Risk aversion is likely to be important when the item being sold is very valuable so that the bids are large relative to any bidder's assets. In my sample of the Brazilian privatization program, the amount paid for the state-owned assets was, on average, 6.14 % of the market value of the acquirer on the day of the auction. Even though it is not a negligible fraction, it is not so large as to be sure about the necessity of assuming risk aversion as well. Nonetheless, the statistical significance and negativeness of the quadratic term of the relative size variable in Model 10 may reflect the fact that, indeed, investors become risk averse as the relative size of their acquisitions increase. On the other hand, risk neutrality is a core assumption underlying the market model, which is the reference for determining the magnitude of abnormal returns. So, in order to benefit from maintaining consistency between the empirical procedure and the theoretical analysis, I will keep the risk neutrality assumption, because, in this case, it seems to impose meager costs because risk aversion does not change qualitatively the previous prediction (other assumptions maintained); it is true that the winner is expected to bid higher than what she would were she risk neutral, but still the winning bid is expected to be less than the winner's valuation. Therefore, even with risk aversion, positive abnormal returns may arise.

At this point it is useful to recall the Revenue-Equivalence Theorem, which establishes that, under assumptions A1 to A6, the English auction and the first-price sealed bid auction (and two more types of auctions) yield the same price on average. In the English auction, the price is successively raised until only one bidder remains and, at any moment of the auction, all bidders know the current best bid. As a consequence, bidders stop bidding up the price when the second-last bidder drops out of the bidding because the price has just exceeded her own valuation of the item. The highest valuation participant wins the bidding and pays a price just above the valuation of the last remaining rival and strictly below her own valuation.

Now let us continue the exercise of checking whether or not the assumptions A1 to A6 are valid in the context of the Brazilian privatization auction. If some (or all) of them are not valid, two questions will be addressed: how would their invalidity change the theoretical predictions? And how would such changes relate to the empirical findings?

Maintaining all other assumptions, let us relax the independent-private-values assumption, allowing interactions among different bidders' valuations. A well-known case of valuation interaction is the one in which all bidders value the item at the same amount. In a first-price sealed-bid auction, each bidder makes her own estimate of the true value of the item. Because higher estimates yield higher bids, the winner is the bidder who makes the highest estimate, i.e., winning the auction means that everyone else estimated the item's value to be less than what the winner did. That is why victory may, in a sense, convey bad news to the winner. This is what has been named the "winner's curse".

Bad news in a rational capital markets is likely to drive the winner's stock price down, as opposed to the positive abnormal returns observed in the data. The incongruence may lie in the fact that, as McAfee and McMillan (1987a, p. 721) put it, the winner's curse "would violate basic notions of rationality". In fact, in privatization auctions, the participants, being large companies with access to state-

of-the-art financial advising, can be considered sophisticated bidders, in the extent that they would not be repeatedly surprised by the outcomes of auctions.

Nonetheless, the common value assumption is rather an extreme one. Let us consider instead a more realistic situation in which the fact that one bidder perceives the item's value to be high makes it likely that other bidders perceive the value to be high as well. When this happens valuations are said to be affiliated. Under this hypothesis, Milgrom and Weber (1982) show that the English auction yields a higher expected price than the first-price sealed-bid auction, because during the bidding process, in the English auction, the remaining bidders observe the prices at which the others drop out the contest, and this conveys information to the participants. Even though the revenue-equivalence breaks down under affiliated valuation, it does so in a way that does not compromise the general statement that the highest bid will be just above the second highest valuation and strictly below the winner's even in the English auction, not to mention in the first-price sealed-bid auction.

Inasmuch as bidders are easily differentiated into domestic and foreign competitors in the privatization auctions – due to, perhaps, systematic production-cost differences or different opportunities for market expansion, the symmetric bidders assumption is highly questionable as a description of the reality. In addition to the nationality asymmetry, bidding firms in, say, different industries may also constitute different groups. Within each group, firms draw their valuations from a group-specific distribution function. This contrasts with the symmetry hypothesis in that the latter establishes a common distribution function for all participants in the auction. The cross section analysis, through models 6 and 10, strongly supports the differentiation between domestic and foreign acquirers and weakly corroborates the same industry effect.

In the English auction, this assumption is immaterial: bids rise until the price reaches the second-highest valuation. When A2 is relaxed, the revenue-equivalence theorem breaks down, however. The first-price sealed bid auction's expected price can be either higher or lower than the benchmark, meaning that, in the former, the bidder with the highest valuation does not necessarily win. Surprising as it may seem, this result does not claim that the winner, being or not the one with highest valuation, bids higher than her own valuation. She may bid a little bit more than she would were the participants symmetry valid, but never more than what she values the item. The violation of this hypothesis, however, has important implications for a revenue-maximizing seller. Besides it may potentially yield to some inefficiency, because a lower value bidder may win the auction, instead of the highest value competitor.

As for the remaining hypotheses, they seem to be reasonable approximation of the corresponding aspects of the Brazilian privatization auctions. Thus the exercise of relaxing hypothesis and check its consequences is not necessary for these assumptions.

Hence the general conclusion is that, under the guard of rationality and market efficiency, the auction theory may help us to understand why and how acquirers collected positive abnormal returns when they won and were announced winners in the Brazilian privatization first-price sealed bid auctions; they are expected to bid less than their valuation of the asset being privatized and, appealing to the concept of efficiency, capital markets incorporate the new information and update expectations quickly. The theory, however, is silent regarding the magnitude of the winner's surplus.

Let us now address the second issue that I raised in the beginning of this section. The positive and statistically significant average abnormal return realized by the buyers in the auctions of the Brazilian privatization program is a striking result when compared to the empirical evidence of mergers and acquisitions studies which points out that the acquirers make at best zero abnormal return.

In order to compare privatization auctions with private negotiation processes towards mergers or acquisitions – private auctions, as I call it – under the auction theory, it is necessary first to determine the type of these private auctions.

Abstracting a little bit from reality, I assume that private auctions are best described as a first-price sealed bid type. Let us consider also that in the private bidding setting, no acquirer knows for sure the number of potential competitors, as opposed to the Brazilian privatization auctions where contesters know exactly the number of pre-qualified competitors. If bidders are risk averse, in a first price sealed-

bid auction, McAffee and McMillan (1987b) show that the expected selling price is strictly higher when the bidders do not know how many other bidders there are than when they do know this. This is in accordance with the empirical fact that winners in privatization auctions make greater abnormal returns than their "private" counterparties. The only problem here is the risk aversion, which, as I mentioned before, is assumed away in the empirical procedure.

On the one hand uncertainty about the number of bidders seems to fit the reality of private auctions – it is never known whether or not someone else will place a bid at the last moment. On the other hand the iterative character of such private negotiations makes private auctions more similar to the English auction. Interested parties may update their bids and terms of the deal as the process goes. The resemblance is not perfect, though. In general, there is doubt about the ability of the seller to commit to its own rules of the private auction, if such rules exist at all. To what extent dropping assumption A5 affects the outcome as compared to the basic benchmark is a question, which I did not find an answer to.

Yet, let us describe private auctions and the English type for a while. In this case, all I have written about auctions applies. It is convenient to recall here that, under affiliated valuation assumption, the English auction yields a higher expected price than the first-price sealed-bid type does. But also, under bidders asymmetry, the inequality can go either way. Therefore the pure auction theory does not provide a definitive answer for the puzzle.

Conceivably what is missing in the analysis is the bargaining aspect of the private auctions. Due to the fact that those deals last for a long period of time (months, years sometimes), there is scope for direct negotiations while the auction-like feature remains.
If, for some reason, the seller (target) has greater bargaining power, it is expected to extract all the winner's surplus. This dual aspect of the private auctions would explain why acquirers do not make any positive abnormal return over the announcement period of their acquisition, while keeps their auction nature that justifies them as a rough benchmark which the abnormal returns in privatization auctions are contrasted to.

Summing up, I have just presented rationales intended to unravel those two puzzles. Assuming that all agents are rational, the auction theory grants that the winner is expected to bid less than her valuation of the item and this fact is acknowledged in efficient capital markets. That is the explanation for the observed positive abnormal returns accrued, on average, to the winners in the Brazilian privatization auctions. The bargaining element, considered to be present in the private auctions, and absent in the privatization auctions, if biased in favor of the seller, may be the reason for the observed difference in terms of abnormal returns that emerges, on average, depending on whether the auction is a private or privatization one. In the former, a powerful (in bargain terms) seller can extract all the surplus from the winner, and, as a consequence, the winner is expected to earn zero abnormal return when the announcement of the acquisition is made.

Therefore that positive 0.62 % of abnormal return earned, on average, by the winners in the Brazilian privatization auction is not a clear and definitive sign of underpricing, in the sense that the government, for some reason, deliberately manipulated rules so as to achieve some goal other than privatization revenue maximization, as we have seen in the case of privatization IPOs. However it is a signal that the government did not collect as much revenue as it could have collected potentially.

As for the determinants of the abnormal returns, the results are intriguing and require more investigation. Despite the fact I could not rank the two most suitable regression models to the data, both of them support the relevance of the relative size and nationality variables. The interaction terms model (Model 6) also suggest the advantage of the same industry effect regardless of the nationality and relative size factors. These findings are in accordance with the previous empirical literature in private sector M&A that suggests the significance of these three variables. The quadratic and interaction terms specifications differ, however, with respect to the overall effect of their corresponding variables.

8. Conclusions

The Brazilian privatization program has raised about US$ 100 billion as a result of the sale of state-owned firms and assets. Some have claimed that the privatization auctions have been very

successful insofar as in many instances impressive premia above the minimum price set by the government have been realized. To the extent that such minimum price is parameter chosen in a somewhat arbitrary manner, it is imprudent, to say the least, to accept that claim as true.

In this article, a statistical procedure – analogous with the methodology employed in private sector mergers and acquisitions – is proposed to address the question of whether or not the Brazilian government extracted all it could potentially do from the winners of the privatization auctions in a more systematic and less arbitrary way. Using stock market data and event study analysis, unlike the private sector benchmark where the empirical results support that the acquirers at best get even, the evidence of the Brazilian privatization program suggests that indeed the buyers make, on average, significant and positive abnormal returns of 0.62 % on the day of the auction, i.e., 0.62 % more than what they would have made had they not won the auctions. This evidence of underpricing does not necessarily mean, I must say it, that the government, for some reason deliberately manipulated rules so as to achieve some goal other than the revenue maximization. It might well be a consequence of the behavior of rational investors – as the theory of auction indicates - and the reaction of efficient capital markets. It signals, however, that there may be some scope for redesigning the privatization auctions in order to extract more surplus from the winning bidders.

As for the determinants of the abnormal returns, the parameter estimates cross section analyses point to the statistical significance of the following explanatory variables: nationality of the acquirer (domestic or foreign), relative size of the acquisition with respect to the buyers' market value, and, to a weaker extent, its industry of operations (same or different from the target). In accordance to the cross border acquisitions empirical literature, the evidence suggests that foreign buyers obtain more abnormal returns than domestic buyers, other things equal, up to a certain relative size or for all relative sizes depending on the assumed functional form of the relationship between abnormal returns and relative sizes. The estimates of the functional form that includes some interaction terms weakly support that when the industries of the acquirer and the privatized firm are the same the abnormal returns are greater than when they differ, regardless of relative size or nationality.

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Table 1 – Summary statistics of the event study

Average abnormal return = 0.0062 or 0.62%		
J_1	J_2	J_3
1.771*	3.165**	1.780@

Table 2 – Parameter estimates of several models

Parameter estimates of several models. Standard deviations are in parenthesis

Expl. Var.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Intercept	0.00130		-0.0192*		-0.00117		-0.00817		-0.00517	
	(0.00796)		(0.0109)		(0.00497)		(0.00853)		(0.00494)	
Nationality	0.00797	0.00885	0.0264**	0.0112**	0.0112*	0.0100***	0.0137*	0.00832*	0.0130**	0.00860**
(Nat)	(0.00745)	(0.00505)	(0.0105)	(0.00618)	(0.00617)	(0.00357)	(0.00752)	(0.00489)	(0.00547)	(0.00343)
Industry	0.000208	0.00110	0.0185*	0.00403			0.00147	-0.00324		
(Ind)	(0.00751)	(0.00511)	(0.0104)	(0.00644)			(0.00722)	(0.00529)		
Participation	0.000424	0.000826	0.00152	-0.00225			0.00274	0.000315		
Indicator(PI)	(0.00573)	(0.00513)	(0.00686)	(0.00663)			(0.00558)	(0.00496)		
Relative	0.000211	0.000219	0.00362***	0.00196**	0.00161*	0.00152**	0.00152***	0.00126**	0.00147***	0.00111**
size.(RS)	(0.000207)	(0.000200)	(0.00130)	(0.000914)	(0.000840)	(0.000740)	(0.000562)	(0.000490)	(0.000546)	(0.000418)
Ind * RS			-0.00307**	-0.00171*	-0.00139 *	-0.00134*				
			(0.00119)	(0.000920)	(0.000820)	(0.000790)				
Nat * RS			-0.00280**	-0.00149	-0.00144	-0.00135*				
			(0.00117)	(0.000914)	(0.000875)	(0.000779)				
PI * RS			-0.000644	-0.000310						
			(0.000667)	(0.000651)						
Square of							-0.0000195**	-0.0000161**	-0.0000187**	-0.0000143**
RS							(0.00000781)	(0.00000699)	(0.00000758)	(0.00000627)
F test	0.71	2.75**	1.46	2.17*	1.49	3.63**	1.86	3.42***	3.09**	5.71***
R square	0.0443	0.1507#	0.1499	0.2045#	0.0888	0.1898#	0.1342	0.2191#	0.1302	0.2136#

Table 3 – Testing for heteroskedasticity

Func. form of square residuals	df	Model 6		Model 10		c^2_{df} at 10%
		Intercept signif 5%?	White stat	Intercept signif 5%?	White stat	
$a + b * RS$	1	Yes	0,1452	yes	0,3432	2.71
$a + g * RS^2$	1	Yes	0,0462	yes	0,066	2.71
$a + b * RS + g * RS^2$	2	Yes	2,3034	yes	4,6068	4.61
$a + j * Nat$	1	Yes	0,0132	yes	0,6204	2.71

* means significant at 10% level left and right-hand tails
** means significant at 5% level left and right-hand tails
*** means significant at 1% level left and right-hand tails

@ means significant at 5% level right-hand tail
# means no intercept in the model. R square is redefined.

Table 4 - Data set for the cross section analyses

privatized company	acquirer	auction's date mm/dd/yy	estimated abnormal returns	premium over minimum price %	acquired share %	participation indicator	nationality 0=domestic 1=foreign	industry 0=same 1=different	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	11/1/91	-0.005085	25.04	9.70	1	1	0	59501.32	0.00023	13.69	0.02	0.01
Acominas	Banco SRL	9/10/93	0.038606	190.67	13.40	1	1	1	121070.56	0.00034	40.94	21.53	7.05
Escelsa	Citigroup	7/11/95	-0.000424	11.78	25.00	1	0	1	14667.42	0.92390	13,551.23	357.92	0.66
CPC	Odebrecht	9/29/95	0.079456	0.00	23.13	0	0	1	183.5	1.00000	183.50	95.53	12.04
Salgema	Copene	10/5/95	-0.000827	0.00	9.37	0	0	0	388.85	1.00000	388.85	133.43	3.21
RFFSA - West network	Bank of America	3/5/96	0.022893	3.59	18.00	1	1	1	23228.85	0.97630	22,678.33	62.36	0.05
Light	CSN	5/21/96	-0.008972	0.00	7.10	0	0	1	643.39	1.00000	643.39	2,264.32	24.99
Light	AES	5/21/96	0.043866	0.00	11.40	0	1	0	1959.7	1.00850	1,976.36	2,264.32	13.06
RFFSA - Center east network	CSN	6/14/96	-0.009484	0.00	12.97	0	0	1	667.03	1.00000	667.03	316.90	6.16
RFFSA - Center east network	CVRD	6/14/96	0.014436	0.00	9.73	0	0	1	5359.03	1.00000	5,359.03	316.90	0.58
RFFSA - Southeast network	CSN	9/20/96	-0.001891	0.00	20.00	0	0	1	593.5	1.00000	593.50	888.91	29.95
RFFSA - Southeast network	Bradesco	9/20/96	-0.002756	0.00	4.70	0	0	1	3611.36	1.00000	3,611.36	888.91	1.16
RFFSA - Southeast network	Usiminas	9/20/96	-0.000291	0.00	20.00	0	0	1	1104.39	1.00000	1,104.39	888.91	16.10
RFFSA - Southeast network	Gerdau	9/20/96	0.033295	0.00	5.30	0	0	1	n/a	1.00000	n/a	888.91	n/a
EDN	Dow Chemical	9/26/96	-0.007849	0.28	26.70	1	1	0	19930.45	1.03200	20,568.22	17.03	0.02
Energipe	Cataguazes	12/4/97	-0.002968	96.06	86.00	1	0	0	n/a	1.00000	n/a	577.10	n/a
Cemig	AES	6/2/97	0.024428	0.00	12.97	0	1	0	5904.36	1.07050	6,320.62	1,130.00	2.32
Riogas	Enron	7/14/97	-0.015629	49.36	37.50	1	1	0	12301.64	1.08000	13,285.77	157.95	0.45
Riogas	Gas Natural	7/14/97	-0.004927	49.36	37.50	1	1	0	7131.71	1.20774	8,613.28	157.95	0.69
Banerj	Itau	7/14/97	0.023867	0.36	100.00	1	0	0	3638.53	1.00000	3,638.53	311.10	8.55
CEG	Enron	7/14/97	0.021672	85.68	18.80	1	1	0	12301.64	1.08000	13,285.77	464.23	0.66
CEG	Gas Natural	7/14/97	0.014264	85.68	18.80	1	1	0	7131.71	1.20774	8,613.28	464.23	1.01
RFFSA - North east network	CVRD	7/18/97	0.014361	37.86	20.00	1	0	1	5359.03	1.00000	5,359.03	15.80	0.06
RFFSA - North east network	CSN	7/18/97	-0.004462	37.86	20.00	1	0	1	895.5	1.00000	895.50	15.80	0.35
RFFSA - North east network	Bradesco	7/18/97	0.019938	37.86	20.00	1	0	1	4751.79	1.00000	4,751.79	15.80	0.07
Coelba	Iberdrola	7/31/97	0.020770	77.38	8.50	1	1	0	9440.78	1.18031	11,143.08	1,730.89	1.32
Cachoeira Dourada	Endesa	9/5/97	-0.008039	43.49	60.00	1	1	0	2534340	0.00255	6,463.95	779.76	7.24
CEEE - North/Northeast	Bradesco	10/21/97	0.007521	82.62	33.00	1	0	1	5749.66	1.00000	5,749.66	1,635.00	9.38
CEEE - Center West	AES	10/21/97	0.067390	93.56	90.00	1	1	0	7956.57	1.09970	8,749.84	1,510.00	15.53
CPFL	Bradesco	11/5/97	-0.014344	70.28	13.67	1	0	1	4276.61	1.00000	4,276.61	3,014.00	9.63
Enersul	Iven	11/19/97	-0.003316	83.80	52.00	1	0	1	n/a	1.00000	n/a	625.56	n/a
Cia. Uniao de Seguros	Bradesco	11/20/97	-0.047911	48.89	71.50	1	0	0	3801.43	1.00000	3,801.43	50.10	0.94
Cemat	Inepar	11/27/97	0.002469	21.09	35.00	1	0	1	268.46	1.00000	268.46	391.50	51.04
Cosern	Iberdrola	12/12/97	0.023269	73.61	34.70	1	1	0	10945.2	1.25917	13,781.83	676.40	1.70
Coelce	Enersys	4/2/98	0.013374	27.20	25.53	1	1	0	1886999	1.13710	2,145,706.56	987.00	0.01
Coelce	Endesa	4/2/98	0.013680	27.20	25.53	1	1	0	24283.8	1.22636	29,780.79	987.00	0.85
Eletropaulo	CSN	4/15/98	0.008446	84.18	2.57	1	0	1	2640.47	1.00000	2,640.47	2,026.00	1.97
Eletropaulo	AES	4/15/98	0.007854	84.18	3.25	1	1	0	9527.41	1.14040	10,865.06	2,026.00	0.61
Capuaba	CVRD	5/6/98	-0.000533	0.00	100.00	0	0	1	6249.57	1.00000	6,249.57	30.00	0.48
Sanepar	Vivendi	6/8/98	-0.016925	0.00	41.40	0	1	0	30257.92	1.29922	39,311.62	249.28	0.26
Celpa	Inepar	7/9/98	-0.002060	0.00	35.00	1	0	1	1364.04	1.00000	1,364.04	450.26	11.55
Flumitrens	CAF	7/15/98	0.008500	671.42	50.00	1	1	0	129.8	1.28756	167.12	279.66	83.67
Telecoms (see Table 5)	Portugal Telecom	7/29/98	0.037612	157.51	52.44	1	1	0	10750.89	1.30995	14,083.11	4,914.50	0.35
Telecoms (see Table 5)	Telefonica de Espana	7/29/98	0.029098	83.89	59.28	1	1	0	47983.57	1.30995	62,855.99	4,488.38	0.07
Telecoms (see Table 5)	Iberdrola	7/29/98	0.000976	110.38	10.11	1	1	1	12787.46	1.30995	16,750.91	765.37	0.05
Telecoms (see Table 5)	Italia Telecom	7/29/98	0.019594	79.48	31.29	1	1	0	40670	1.30995	53,275.59	1,091.93	0.02
Telecoms (see Table 5)	Bradesco	7/29/98	-0.009535	198.90	25.00	1	0	1	4645	1.00000	4,645.00	340.00	0.07
Telecoms (see Table 5)	Banco Bilbao Vizcaya	7/29/98	0.003392	64.29	7.00	1	1	1	n/a	1.30995	n/a	404.81	n/a
Telecoms (see Table 5)	Inepar	7/29/98	-0.000867	1.00	20.00	1	0	1	1394.91	1.00000	1,394.91	686.80	0.49
Telecoms (see Table 5)	Alianca da Bahia	7/29/98	0.000784	1.00	10.05	1	0	1	n/a	1.00000	n/a	345.12	n/a
CDRJ	CSN	9/3/98	-0.033740	0.00	20.00	0	0	1	1203.63	1.00000	1,203.63	95.97	1.59
Bemge	Itau	9/14/98	0.038525	85.59	90.70	1	0	0	2865.12	1.00000	2,865.12	583.00	18.46
Gerasul	Tractbel	9/15/98	-0.008200	0.00	42.00	0	1	0	12638.11	1.39647	17,648.80	945.70	2.25
EBE	Electricidade de Portugal	9/17/98	0.023551	0.00	6.22	0	1	0	13314.9	1.40058	18,648.53	1,021.85	0.34
EBE	CPFL	9/17/98	0.012704	0.00	6.22	0	0	0	1100.8	1.00000	1,100.80	1,021.85	5.77
EBE	Bradesco	9/17/98	-0.018524	0.00	6.22	0	0	1	3307	1.00000	3,307.00	1,021.85	1.92
RFFSA - Sao Paulo network	CVRD	11/10/98	0.006922	5.00	33.00	1	0	1	3002.29	1.00000	3,002.29	245.05	2.69
Bandepe	ABN	11/17/98	-0.008189	0.00	100.00	0	1	0	24788.07	1.42470	35,315.46	182.90	0.52
Comgas	Royal Dutch	4/14/99	0.006959	120.00	6.00	1	1	0	104105.5	1.81084	188,518.66	1,675.00	0.05

Table 4 - Data set for the cross section analyses (cont.)

privatized company	acquirer	auction's date mm/dd/yy	estimated abnormal returns	premium over minimum price %	acquired share %	participation indicator	nationality 0=domestic 1=foreign	industry 0=same 1=different	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 %
Comgas	Shell	4/14/99	0.014910	120.00	4.00	1	1	0	41057.97	2.70248	110,958.53	1,675.00	0.06
Comgas	British Gas	4/14/99	0.010840	120.00	70.00	1	1	0	13729.21	2.70248	37,102.98	1,675.00	3.16
Baneb	Bradesco	6/22/99	0.000333	3.18	100.00	1	0	0	3780.44	1.00000	3,780.44	260.00	6.88
Datamec	Unisys	6/23/99	0.004316	0.00	87.87	1	1	0	10414.54	1.78900	18,631.61	83.65	0.39
CESP - Paranapanema	Duke	7/28/99	-0.030217	90.19	100.00	1	1	0	19941.31	1.79400	35,774.71	1,239.00	3.46
CESP - Tiete	AES	10/27/99	0.008649	30.00	33.50	1	1	0	11382.98	1.98800	22,629.36	938.10	1.39
Celpe	Iberdrola	2/17/00	0.004597	0.00	29.87	0	1	0	10845.63	1.74769	18,954.74	1,780.98	2.81
Gassul	Gas Natural	4/26/00	-0.024467	461.89	50.00	1	1	0	8539.08	1.66479	14,215.77	533.80	1.88
Cemar	PPL	6/15/00	0.024966	0.00	84.70	0	1	0	3417.23	1.81100	6,188.60	522.79	7.16
Manaus Saneamento	Suez Lyonnaise des Eaux	6/29/00	0.000715	5.01	90.00	1	1	0	36711.19	1.72879	63,465.85	193.00	0.27
Banestado	Itau	10/17/00	0.028229	273.27	88.00	1	0	0	9516.78	1.00000	9,516.78	1,620.00	14.98
Saelpa	Alliant	11/30/00	0.012052	0.00	40.34	0	1	0	2518.35	1.98000	4,986.33	362.98	2.94
Saelpa	Cataguazes	11/30/00	0.003080	0.00	82.00	0	0	0	n/a	1.00000	n/a	362.98	n/a

Table 5 - Compounding data for the telecommunication companies

	Telecom companies privatized on 07/29/98									
	Telesp Cel	Tel SE Cel	Tel Cel Sul	Tel L Cel	Tel NE Cel	Tel N Leste	Tel Ctr Sul	Telesp	Total amount	Weighted
min price R$ million	1,100	570	230	125	225	3,400	1,950	3,520	purchased by	average
price R$ million	3,588	1,360	700	428	660	3,434	2,070	5,783	acquirer in	share
Acquirers	**Shares (%)**	**that**	**acquirers**	**purchased in**	**each of**	**the privatized companies**			telecoms R$ mil	purchased (%)
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.