A Multivariate CAPM Approach to Regulatory Risks in Securities Markets

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Abstract

Most studies around that try to verify the existence of regulatory risk look mainly at developed countries. Looking at regulatory risk in emerging market regulated sectors is important to improving and increasing investment in those markets. In this study, we use data from Brazil one of the most important emerging markets and also one that has the most developed corporate governance rules. We propose multivariate two-step procedure and estimate CAPM betas by using a Kalman filter in the first step and then use these betas as inputs in a Random-Effect panel data model. We find evidence of regulatory risk in electricity, telecommunications and all regulated sectors in Brazil. Also we find evidence that regulatory changes in the country either do not reduce or increase the betas of the regulated sectors, going in the opposite direction to the buffering hypothesis as proposed by Peltzman (1976).

Key Words: Regulatory Risk, CAPM, Kalman Filter, Random-Effect Panel Data

JEL Classification: C12, C22, G12, G18, L51.

1 INTRODUCTION

Global investors seek for superior returns, mainly after the crisis in 2008, when the interest rates declined across the developed world. A reason for looking at emerging economies is that, in general, they have done well since the beginning of the crisis and seem to be an excelent opportunity to make money and to diversify investments. In order to accomplish that, it is important to map all risks involved in such an operation. One very important risk associated with emerging markets is regulatory risks, given that higher returns may come from regulated firms that are partially or totally financed by foreign resources.

Regulatory risks are more important in underdeveloped economies, where institutions are still growing and are not consolidated. However, curiously most studies end up focusing on developed countries and only a very few try to document these effects in emerging markets. Thus this paper is about filling this gap.

Regulatory risks do have role because politicians keep some interest in making laws that benefit themselves. Since private firms know that, it is crucial for policy makers to evaluate the regulatory risk impacts in order to determine a fair price to offset such risks and maintain the services working well. This is one of the aspects noted by Peltzman (1976), who set out the theoretical basis for the measurement of such effect. His model made endogenous the role of the policy maker in the price system, in such a way that regulation should reduce systematic risk by buffering the firm against demand and cost shocks. Therefore, profits are more stable and returns are less correlated with systematic risk, meaning that the regulated firm's beta should be lower than the non-regulated one.

A series of studies attempted to test Peltzman's hypothesis. Basically, the studies try to test whether betas vary based on a control group where no regulation occurs by looking at betas across sectors and comparing regulated to unregulated sectors. Riddick (1992) followed such approach, taking the CAPM for granted in order to estimate the betas. He found that regulation reduces risks of regulated sectors, in the sense that the correlation returns between regulated firms and the market declines.

Another series of papers use events studies to measure the effects of a change in the rules of a regulated sector. Some authors as Buckland and Fraser (2001a, b) find evidence of effects from political regulatory shocks on systematic risk in the UK electricity and water utilities sectors, respectively. Robinson and Taylor (1998) and Paleari and Redondi (2005) also note regulatory effects of unanticipated shocks are reflected in higher betas.

Binder and Norton (1999), on the other hand, confirm Peltzman's hypothesis that regulation reduces the variability of returns in the United States. The main idea is that producers and consumers face uncertainty as reflected in the variability of returns.

There is still another approach that tries to access whether regulation affects prices. Norton (1985) creates a measure to test regulation in US States. That is, he runs regressions of state agencies' headcount and budget on population. A larger residual would corresponds to a larger degree of regulation. Davidson, Rangan and Rosenstein (1997) show that the Peltzman hypothesis is valid only in years of increasing input prices for utilities.

We use Brazilian data to explore the question of regulatory risk in an emerging market because it has a number of advantages in comparison with other countries, mainly considering the so-called BRICs, namely Russia, India and China. First, Brazil has the most advanced corporate governance rules compared with other BRICs. Second, Brazil imposes no restrictions on foreign investment in the local market despite short-term policies implemented from time to time to prevent strong appreciations of the Real[1]. And finally, the stock exchange comprises sectors regulated and non-regulates, what is necessary to carry out the examination.

Our goal is to evaluate regulatory risks in Brazil. We analyze the electricity and telecommunications sectors. We also consider all regulated sectors including water utilities, roads, and gas distributors. What they all have in common is the prices they charge consumers are directly set up by the government and are adjusted periodically.

Many current studies deal with formulating better regulation strategies in emerging markets. Among them we refer to Pires and Piccinini (1998). They describe the theoretical evolution of the three main objectives of regulation: (i) internal rate of return (IRR), (ii) Marginal cost, and (iii) Price-caps. They also develop a regulatory framework for the Brazilian electricity sector. However, such exploration is beyond the scope of this work and therefore we do not deal with it here.

Ideally, we would like to have similar regulated and non-regulated firms at the same time. But, generally we do not have, and often we also do not have periods of non-regulation to contrast with periods of regulation as in Buckland and Fraser (2001 a and b) and Paleari and Redondi (2005). Instead, our approach uses as control a group of non-regulated firms as in Riddick (1992).

We propose a two-step procedure to test for regulatory risks in Brazil. First, we acknowledge that the CAPM betas can be time-varying, as pointed out by Buckaland

[1] Decree-Law number 6,983, October - 20, 2009. Available at Secretariat of the Federal Revenue of Brazil at the following homepage: http://www.receita.fazenda.gov.br/legislacao/Decretos/2009/dec6983.htm;

and Fraser (2001 a, b) for the English market. Thus, we use Kalman Filter to estimate the betas of each firm in our sample. Second, after constructing such a panel of betas, we run random-effects estimation to verify: (i) whether the betas of regulated sectors are on average smaller than those of other sectors; and (ii) if betas are smaller after the introduction of specific regulations, as event study in electricity and telecommunications sectors.

The results indicate the existence of regulatory risk in Brazil and are robust to proxies of market portfolios and risk free rate choices. Especifically, we find evidence that regulatory risk exists in the telecommunications and the electricity sectors when examined one at a time, and also in all regulated sectors simultaneously.

A change in the regulatory framwork may bring risks to the sector. For exemple, policy makers might increase instability and increase regulatory risk. We test such hypothesis for both the electricity and telecommunication sectors. The New Regulatory Framework for Brazilian Electricity Sector introduced on March 16, 2004 indeed increased the betas of the firms in the sector. In telecommunications, the New Telecommunications Sector Index (IST) of June 18, 2003 and the approval of New Interconnection Rates on December 20, 2005 did not reduce the betas, violating the buffering hypothesis.

Regulatory risks has a cost. Although the telecom tariffs in Brazil are the highest in the world, telecom stock prices have underperformed other sectors since January, 1999. Our results may prove useful to policy makers improve the regulatory framework in such sectors and enhance private investment.

This paper is organized as follows. In Section 2 we present the CAPM used to obtain the betas, while in Section 3 we show the econometric strategy, which involves the two-step procedure. In Section 4, we detail and describe the data. Then in Section 5 we present the results before concluding the work in Section 6.

2 CAPM TESTABLE IMPLICATIONS

The main prediction of Sharpe's (1964), Lintner's (1965) and Mossin's (1966) version of the CAPM is the linear relationship between the return of a equity and the market portfolio:

$$E[R_{i,t+1} - R_{f,t+1}] = \beta_i \lambda_m,$$

where

E_t is the conditional expectation on information at t;

$\beta_i = \frac{cov(R_i,R_m)}{var(R_m)}$ is the amount of risk of portfolio i at time t;

$R_{i,t}$ is the return of portfolio i at time t;
$R_{m,t}$ is the return of the market portfolio at time t;
$R_{f,t}$ is the risk free rate return;
$\lambda_m = E[R_{m,t} - R_{f,t}]$ is the market premium ou price of risk.
To estimate β_i, one should run the following ordinary least squares regression:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i(R_{m,t} - R_{f,t}) + \varepsilon_{i,t}, \tag{1}$$

where
α_i is a constant term;
$\varepsilon_{t,i}$ is the idiosyncratic error term.
According to Campbell, Lo and MacKinlay (1997), the Shape-Lintner-Mossin version of CAPM has focused on testing whether:

1. The intercept α_i is jointly zero in equation (1);

2. The betas completely captures cross-sectional variation of expected excess returns;

3. The market risk premium is positive

One of the assumptions of the CAPM model is the existence of both a risk free asset and a market portfolio. Both are a matter of debate in the literature though. Black (1972) proposed an alternative version by relaxing the hypothesis of an existing risk free asset, while Roll (1977) is suspicious about the economic meaning of the market portfolio. Instead of using alternative versions of the model we test for different proxies of both the risk free assets and market portfolio.

In Peltzman's approach, the betas could also capture regulatory risk besides their linear relationship with assets returns. This effect has empirical support based on time-varying betas as in Ghysels (1998). This motivates alternative versions of the CAPM model that permit betas and market risk premia to vary over time as the conditional CAPM model (Jagannathan and Wang, 1996).

Hence, we suggest a two step procedure to test Peltzman's hypothesis. In the first step we use the Kalman filter technique to estimate time-varying betas of each firm in our sample, assuming the CAPM holds. In the second step, we check two hypotheses about the betas estimated earlier. The first test compares whether betas of the regulated sectors are less than betas of non-regulated sectors. This is motivated by Riddick (1992), who uses as control a group of non-regulated firms. The second adopts the event study framework to test whether ad hoc changes in legal acts results in variation in betas of sectors so affected.

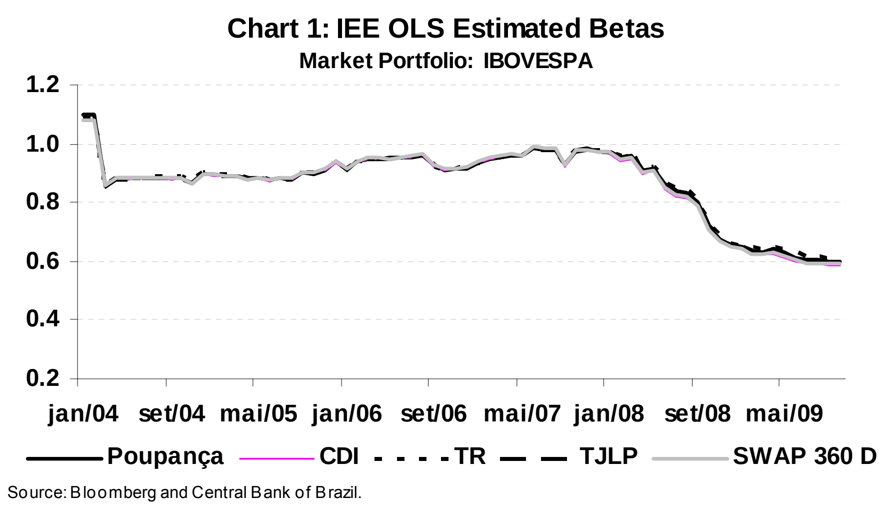
3 ECONOMETRIC STRATEGY

3.1 TIME-VARYING BETAS IN THE BRAZILIAN MARKET

Betas of regulated sectors in Brazil are time-varying as are in more developed countries. An evidence of this conclusion is in Chart 1, where we estimate by OLS the betas of the electricity and telecommunications sectors, using a rolling window with 60 monthly observations over Jan/2004 to Oct/2009, provided the sample starts at Feb/1999.

Notice that the composite index is an average of all firms in the sector. If such average is time-varying, with even more reason each stock in the sector will be varying.

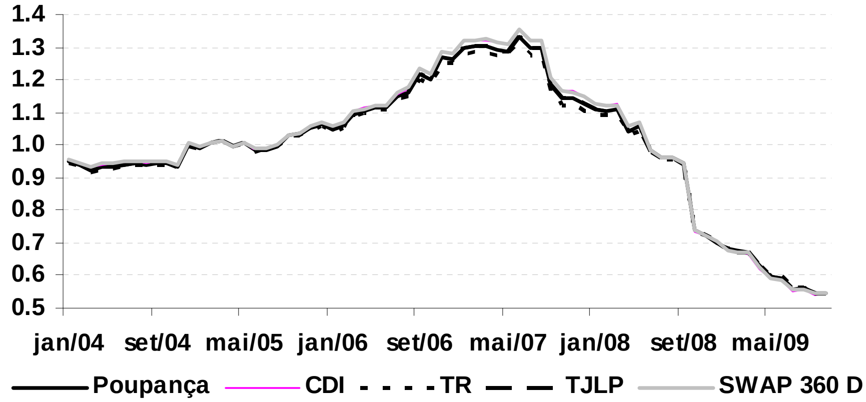
For both IEE and MSCI utilities benchmarks the market portfolio is the Ibovespa, the main Brazilian stock market index . For robustness the same charts are constructed considering the MSCI Brazil index as discussed in the Appendix (Charts A1 and A2). Each of these charts includes five risk free assets for robustness, since Brazilian market does not have consensus regarding which risk free rate to adopt. Therefore, we employ all acceptable risk free rates, includin one based of future expectations as SWAP 360 days.



Charts 3 and 4 show the evolution of betas estimated by OLS for two Brazilian telecommunications sectors benchmarks, the Telecommunications Index calculated by Bovespa (ITEL) and MSCI Telecom.

Chart 2: MSCI Utilities OLS Estimated Betas

Market Portfolio: IBOVESPA

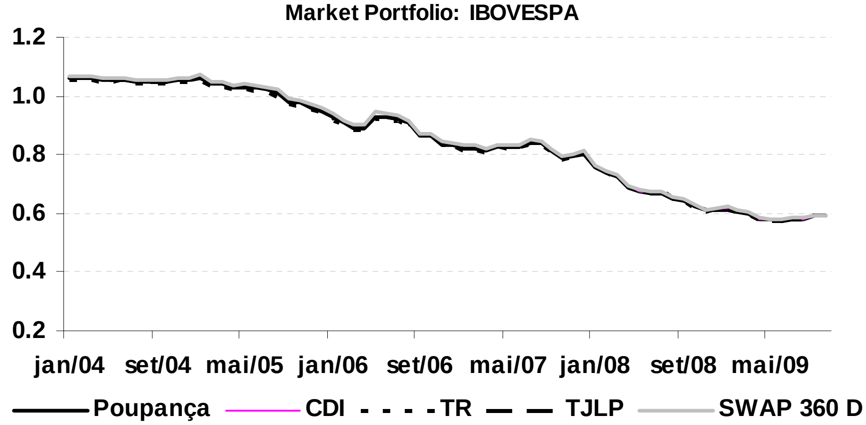


Source: Bloomberg and Central Bank of Brazil.

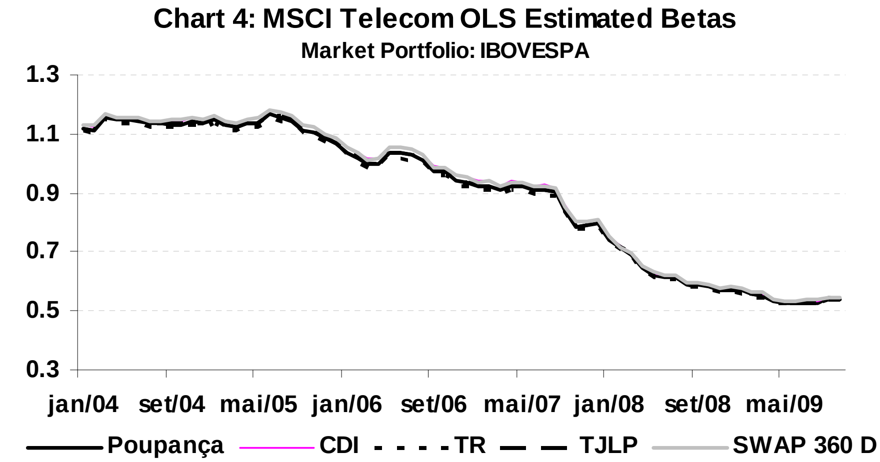
The market portfolio is the Ibovespa and also for robustness we used the MSCI Brazil, whose results are presented in the Appendix (Charts A3 and A4).

Chart 3: ITEL OLS Estimated Betas

Market Portfolio: IBOVESPA



Source: Bloomberg and Central Bank of Brazil.



Source: Bloomberg and Central Bank of Brazil.

3.2 FIRST STEP: KALMAN FILTER ESTIMATES OF BETAS

In this first step, we obtain betas through a modified version of the CAPM model using Kalman Filter (Hamilton, 1994).

In this paper, we consider the simplest case that consists of an AR(1) structure for the evolution of the betas:

$$\begin{aligned} R_{i,t} - R_{f,t} &= \beta_{i,t}(R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \\ \beta_{i,t} &= (1-\pi_i)\,\beta_i + \pi_i \beta_{i,t-1} + v_{i,t} \end{aligned} \tag{2}$$

The estimation uses the initial conditions as represented by (5):

$$\begin{aligned} \beta_{i,0} &= \beta_i = \widehat{\beta}^{OLS} \\ \sigma_{\varepsilon}^2 &= \widehat{\sigma}_{\varepsilon}^{2(OLS)} \\ \sigma_{v_i}^2 &= var(\beta_i^{OLS}) \\ \pi_i &= 1 \end{aligned} \tag{3}$$

For each stock we run an equation as represented by (4). Together there are 67 betas, with monthly observations from February, 1999 to October, 2009, in a total of 130 months, with 129 returns. Section (4.3) provides more information on the sample used here.

3.3 SECTORS AND EVENT STUDY

The main goal in the second stage is to answer the following questions: i) do regulated firms have betas greater than they should?; and ii) does the introduction of ad hoc regulations increases betas? We answer those questions by testing whether the betas estimated in the first step vary by sector and if they are affected by changes in legislation.

3.3.1 REGULATED AND NON-REGULATED SECTORS

We use random-effects panel model to test whether betas of regulated sectors (electricity, telecommunications and all regulated sectors) are higher than they should. We estimate these three cases independently using the following regression equation.

$$\widehat{\beta}_{i,t} = \gamma_0 + \gamma_1 D_i + \gamma_2' TimeControls + \gamma_3' Equities + v_{i,t} \tag{4}$$

where

the betas corresponding to each stock i at time t were estimated by Kalman Filter;

γ_0 is a constant coefficient for all firms;

γ_1 is the coefficient associated with a dummy variable that assumes value 1 when the firm is regulated and 0 otherwise;

γ_2 represents a vector of parameters associated with monthly and year controls at time t,

γ_3 is a vector of parameters associated with the companies' dummies controls for each stock i; and

$v_{i,t}$ is the erratic term.

Table 1 shows the importance of regulated sectors in the sample. At the beginning, the telecommunications sector was the most important sector in the Ibovespa Index, weighting nearly 39.0% of the index while the total number of regulated sectors represented 51.9% in the first quarter of 2004. In the following quarters, regulated sectors weight has been decreasing steadily, and in September 2009 its participation in the sample was 11.0% of the total.

The random-effect panel model is used to verify whether the betas of regulated sector vary independently of other sectors. That is why we use time (or month) and equities controls, which are taken into account in the estimation of the variance and covariance matrix.

The Peltzman's hypothesis in our environment amounts to verify the significance of the following null hypothesis:

$$\begin{aligned} H_0 &: \beta^{regulated} = \beta^{unregulated} - \text{There is regulatory risk} \\ H_a &: \beta^{regulated} < \beta^{unregulated} - \text{There is no regulatory risk} \end{aligned} \tag{5}$$

Such hypothesis amounts to testing whether the parameter γ_1 is greater than zero, i.e.:

$$\begin{aligned} H_0 &: \gamma_1 = 0 - \text{there is regulatory risk associated with the sector;} \\ H_a &: \gamma_1 < 0 - \text{there is no regulatory risk associated with the sector} \end{aligned} \tag{6}$$

To address possible distortions, each test is performed using firms of only one sector against firms of all non-regulated sectors. For example, tests of regulatory risk for the electricity sector exclude sectors as telecommumnications, water utilities, gas distribution and Road Concessions. Similarly, the same is done regargind the telecommunications sector.

Table 1: Electricity, Telecommunications and All Regulated Sectors dummies as percentage of the sample

I consider the BM&FBovespa criteria for Ibovespa, that is it represents a liquidity participation. The Electricity and Telecommunications sectors lost weight in the sample systematically during almost the entire period, which reduced the contribution of the regulated sectors in the Brazilian market. On the other hand, the other regulated industries have their weight increased, such as Gas Distribution, Road Concessions and Water Utilities.

Period	Electricity	Telecom	All Regulated	All Regulated Less Electrical Energy and telecom
Jan-04	11.2%	39.0%	51.9%	1.7%
May-04	11.4%	37.0%	50.0%	1.7%
Sep-04	9.7%	34.7%	45.9%	1.5%
Jan-05	10.9%	31.1%	43.5%	1.5%
May-05	10.1%	27.3%	38.9%	1.4%
Sep-05	9.6%	23.5%	34.6%	1.4%
Jan-06	8.8%	21.3%	31.4%	1.3%
May-06	8.8%	18.9%	29.6%	2.0%
Sep-06	8.2%	15.6%	25.8%	2.1%
Jan-07	8.0%	11.9%	22.1%	2.2%
May-07	8.2%	10.5%	20.8%	2.1%
Sep-07	8.4%	9.2%	19.7%	2.0%
Jan-08	7.8%	8.1%	17.8%	1.8%
May-08	7.6%	7.1%	16.2%	1.5%
Sep-08	5.9%	5.3%	12.4%	1.2%
Jan-09	6.4%	4.9%	12.4%	1.1%
May-09	5.8%	4.2%	11.0%	1.0%
Sep-09	5.5%	4.5%	11.1%	1.0%

Source: BM&FBovespa.

3.4 EVENT STUDY

In this second test, we consider only regulated sector stocks. The equation to be estimated, therefore, is very similar to the first test. We also use the random-effect panel method. However, the dummy variable in this case is defined around a period in advance and after the change in regulation.

$$\widehat{\beta}_{i,t} = \gamma_0 + \gamma_1 D^{Event} + \gamma_2' TimeControls + \gamma_3' Equities + v_{i,t} \qquad (7)$$

Here γ_0, γ_2 and γ_3 have the same meaning as before. However, γ_1 is the parameter associated with the dummy variable D^{Event}, which assumes value 1 if the period belongs to the interval between 2 months before and 2 months after the regulatory event, and zero otherwise. We consider one event for electricity, the New Electricity Regulatory Framework, and two for the telecommunications sector: The New Text to Concession Contracts[2] and The New Maximum Rates of Remuneration that a

[2] http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=56441&assuntoPublicaca

Table 2: Dates of Major Recent Changes in Legislation in the Electricity and the Telecommunications Sectors

Sector	Date	New Regulation
Electricity	March-16, 2004	President of the Republic signed the laws 10,847 and 10,848 for the new regulatory framework for Brazilian Electricity Sector. The Law number 10,847 authorized the creation of the Energy Research Company - EPE, while the Law 10,848 has established the new negotiation model for electrical energy.
Telecom	June-18, 2003	New text of concession contracts. New contracts will have a new index, called the Telecommunications Sector Index (IST), which will replace the IGP-DI and which is composed by several indices (already existing). There are other measures, like the free access to the list of subscribers and the portability of phone numbers (Anatel, 2003).
	December-20, 2005	New maximum rates of remuneration that a telecom operator raises by receiving a call from another operator. In 2006, the value of the fee LAN will be 50% of the minutes and it would reduced to 40% by 2007. Since 2008, the value will be based on the concessionaires costs (Anatel, 2005).

Source: Aneel and Anatel.

telecom operator raises by receiving a call from another operator[3] (see Table 3.4).

To test whether regulation changes beta, it is necessary to reject the null hypothesis that this event is not significant, i.e.:

$$\begin{aligned} H_0 &: \gamma_1 = 0 - \text{there is regulatory risk associated with the sector;} \\ H_a &: \gamma_1 < 0 - \text{there is no regulatory risk associated with the sector} \end{aligned} \tag{8}$$

4 DATA

4.1 DATA SOURCE

Our data can be grouped into three set of variables: equity prices[4], market portfolios and risk free securities proxies. The equity prices are obtained directly from Bloomberg data stream. We have considered two indexes as market portfolios both measured in Brazilian currency Real (BRL). The first one is the Bovespa Index (Ibovespa) obtained from Bloomberg. It is the most important and widespread market portfolio in Brazil. It comprises the most traded and liquid stocks in the Bolsa

[3]http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=116427&assuntoPublicac 2005rl1.pdf

[4]We also used benchmarks for electricity and telecommunications sectors to show the time-varying nature of betas. The procedure to calculate returns is similar to those used for equities.

de Valores de São Paulo and its composition is updated each third of the year. The second one is the MSCI Brazil, which is used for robustness. It is also obtained from Bloomberg and has a number of advantages over other indexes. First, the MSCI gives greater weight to larger companies in terms of market value. Second, the MSCI excludes related companies from the index, keeping only the most liquid of them. Such features is based on portfolio diversification. Moreover, an sector cannot weight more than 30% of the index.[5] Finally, it is an index whose methodology is the same in every country MSCI has a representative market portfolio making it easy to compare the performance of several countries.

For the risk free rate, there is the Brazilian market is the Certificados de Depósitos Interbancários (CDI), obtained from Bloomberg by means of an index of accumulated returns[6]. CDI is similar to the London Interbank Offering Rates (LIBOR) system, but it is an overnight index and has been the most important benchmark for Brazilian fixed income markets in the last years.

Despite a well-developed financial system, Brazil still has remnants of more interventionist eras since significant amounts of credit funds is managed by the government, who also set interest rates for special targets as home acquisition and long-term business investment, for instance. Such policy eventually affects the results of any regulatory risk test. Therefore, for robustness checks we use three other common interest rates benchmarks, namely, the Reference Rate (TR), the return on regular saving accounts (Poupança) and the long-term interest rate (TJLP), a reference rate used by the National Development Bank (BNDES). All data are from the Central Bank of Brazil .

TR is based on a monthly weighted average of fixed rate deposits in determined big financial institutions. Regular saving accounts are deposits widely used by most of Brazilian families (blue-collar workers). Such funds are deposited in financial institutions and are remunerated at 6.0% year rate plus TR. Funds from these accounts can afford the purchase of real estate. The TJLP is the interest rate that the BNDES charges on loans from companies and also serves as a reference for all directed credit. By October, 2009 this rate stood at 6.5% per year[7].

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[5] The Petrobrás shares are an example of such concentration in Ibovespa. The combined participation of all their shares (ON and PN, for instance) account for more than 16% of the Ibovespa' weight by September, 2007;

[6] To obtain the accumulated returns, Bloomberg calculates a CDI return index accruing the rates at a daily basis through the following specification:

$IndexCDI_t = 100x[1 + [1 + \frac{CDI_t}{100}]^{252}]^{\frac{1}{12}}$, where CDI_t is the annual Brazilian overnight rate, calculated over during 252 working days.

https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries;

[7] Fortuna (2008) provides a detailed discussion of Brazilian financial markets products.

All rates used so far are backward looking, however we know that investors forward looking. Therefore, we also use the swap rate between the fixed and floating rate for one year known as Pré-DI swap for 360 days (Swap 360D), which is a forward looking benchmark. This rate is also obtained from the Central Bank of Brazil.

4.2 RETURNS AND ESTIMATION WINDOWS

We use end-of-month closing prices and rates for the period from January, 1999 until the end of October, 2009.

For stocks and market portfolios as the Ibovespa and MSCI Brazil, the return to asset i at time $t = 1, ..., N$, where $R_{i,t}$, is defined as:

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \tag{9}$$

where $P_{i,t}$ is the price of asset i at time t.

Most of the risk free proxies used in this work are expressed in accumulated. monthly returns that have the advantage of adjusting for work days and for changes in interest rates in the midterm. This is the case of TR, TJLP and Poupança, where monthly returns come from the Central Bank of Brazil. Since we use monthly data for these three risk free proxies ($R_{f,t}$) they can be represented as follows

$$R_{f,t} = \ln(1 + i_t) \tag{10}$$

where it represents the accumulated monthly returns of TR, TJLP and Poupança at time t.

For the CDI Bloomberg provides an index of accumulated returns. In this case, the logarithmic return is obtained using the same procedure for equities return according to Equation (11).

For the Swap 360D, considering its forward looking nature and since its given yearly the risk free rate return at month t, $R_{f,t}$ is:

$$R_{i,t} = \frac{\ln(1 + i_t)}{12} \tag{11}$$

Although liquidity in the Brazilian stock market has been increasing during the last years as a result of a stable macroeconomic environment, individual liquidity has been quite poor with many stocks. In fact, liquidity has been concentrated in few companies, mainly large caps. Thus to avoid liquidity problems, we use the most liquid stocks. Since the Ibovespa is indeed composed by the most liquidy stocks, we work with those from Ibovespa.. As that Ibovespa's implied portfolio is updated every four months, we update the shares in the portfolio accordingly.

For historical reasons, the Brazilian equity market has a high proportion of preferred shares compared to common stocks. The preferred stocks have preference in the dividends distribution, but are non voting shares and may last forever. Ordinary shares have voting rights but do not have preference on the distribution of dividends. In order to not double count and avoid over-representation of one company, less liquid stocks – whether ordinary or preferred stock – are excluded from the sample if both belong to the Ibovespa.

Another feature of the theoretical portfolio composition is that each stock needs to be traded in at least in 48 of the 60 previous trading months. To comply with the Ibovespa portfolio, we consider only stocks that have a minimum of 48 returns and, for this, we consider January, 2004 as the first Ibovespa portfolio. Those that do not satisfy this condition are excluded from the sample. A list of all the shares used in this paper as well as descriptive statistics such as mean and variance of returns can be found in the Section (4.3).

4.3 DESCRIPTIVE STATISTICS

The purpose of this Section is to provide details about the characteristics of each of the stocks of our sample, as well as market portfolios, risk free assets and sectorial benchmarks for electricity and telecommunications.

Table 3 shows the evolution of the Ibovespa portfolio since 2004. There are two major changes in composition. The first one was that the importance of telecommunications has been falling compared to other sectors, most notably relative to commodities such as mining, oil, gas and steel. Currently, a new trend in the stock market is under way with the percentage of commodity sectors shrinking in favor of those more focused on domestic market, i.e. the composition of the index is starting to better reflect actual economy.

The distribution of individual equities returns is detailed in Table 4. On average, the annualized monthly return of all stocks together is 19.5%, with an average standard deviation of 48.8%.

Regarding to the risk free proxies, Table 5 shows that subsidized financing instruments have the worst performance, with TR – linked instruments putting in the worst performance of all[8]. Its average annualized monthly return from January, 1999 until October, 2009 is 2.5%. TR return is only slightly outperformed by Poupança and TJLP-linked investment. Poupança averaged an annualized monthly return of

[8]The TR rate has a specific calculation formula and it represents a percentage of CDI rate

8.5%, whereas TJLP-linked averaged 8.8%. The volatility of those instruments, on the other hand, is very small. TR and Poupança have a standard deviation of 0.5% per year and TJLP 0.6%.

Conversely, the interbank market rates - CDI - and Swap 360D are those that provided the greatest gains accrued for the period. The CDI rate has lower market risk than Swap 360D because it represents the interest paid overnight, that is, its duration is only one day (Table 4). CDI has an annualized monthly return of 15.8% and a standard deviation of 1.3%, but the outlook for the coming years is that this rate will fall as a result of persistent inflation stabilization in Brazil over the last two decades.

The Swap 360D, in turn, has the highest returns since January, 1999, averaging 16.7% per year. Its volatility is the highest among fixed income benchmarks, reaching 1.6% per year. This strengthens the previous perception that the Swap 360D may be the best risk free asset because it takes into account the forward looking nature of interest rates.

The details of the market portfolios are shown in Table 6. The MSCI Brazil seems to have performed better than the Ibovespa. The Morgan Stanley index has higher monthly returns: on average, 18.9% per year against 18.8% of Ibovespa with lower volatility. The standard deviation of its returns for the entire period is 26.4% per year, while the standard deviation for the main stock index of the Brazilian market is 28.9%.

Table 7shows the risk and return for electricity and telecommunications benchmarks in Brazil. For the electricity sector, we use the Electricity Index (IEE) and the MSCI Utilities, both measured in BRL. The IEE has a 26.0% return per month annualized, higher than the MSCI Utilities with 10.3%.The MSCI Utilities, however, has lower volatility at 34.5% per month compared to the IEE whose volatility is 40.4%. Table A3 in the Appendix details the composition of IEE from September, 09 to December, 09 while Table A4 shows the composition of the MSCI Utilities for October, 09.

For telecommunications benchmarks, we use the Telecommunications Index (ITEL) and the MSCI Telecommunications Services, both measured in BRL. The MSCI sector benchmark shows the worst results. One explanation may be the inclusion of fewer shares as opposed to ITEL. This may justify the MSCI's greater volatility, with a standard deviation 29.2% per month annualized, than the ITEL, with volatility of 32.6% (Table 6). Table A5 in the Appendix details the composition of the ITEL from Sep-09 to Dec-09 while Table A6 shows the composition of the MSCI Telecommunications Services Oct-09.

Table 3: Evolution of the selected sectors weight in the Ibovespa

In percentage considering the first composition of the year

(i) Electricity and Telecommunications follows the classification of the Bovespa. For the sector classification of Commodities and Domestic, I also used the following sectors based on the Brazilian Stock Exchange criteria - Commodities: Oil and Gas, Steel and Metallurgy, Wood and Paper, Chemical and Petrochemical and Mining. Domestic: Banks and Financial Intermediaries, Transportation, Consumer Staples, Consumer Discretionary and Real State.

(ii) It is important to note the importance of the commodities sector weight in the Bovespa index. However, it is worth noting the growing importance of sectors more oriented to the domestic market. Its weight in the index increased from roughly 12% in early 2004 to almost 35% in early 2009. The Telecommunications sector was the one that lost the most, from more than 40% to around 6.0%. The Electricity sector also lost share, but in intensity much more modest, declining from 12.4% in January 2004 to around 7.0% in January 2009.

Period	Electrical Energy	Telecom	Commodities	Domestic	Other
2004	12.40	42.04	28.52	11.98	5.07
2005	12.99	33.30	39.83	10.02	3.87
2006	10.30	23.72	49.58	13.18	3.23
2007	9.32	14.88	47.81	24.71	3.28
2008	8.74	10.09	46.24	29.91	5.03
2009	7.06	6.13	49.45	34.66	2.70

Source: BM&FBovespa.

Table 4: Descriptive Statistics of Equities Monthly Returns - Annualized
From February, 1999 up to October, 2009

Company	Average	Median	Standard deviation	Number of obs
ACES4	31.4%	11.5%	42.5%	111
ALLL11	12.4%	7.3%	40.5%	55
AMBV4	24.1%	26.6%	27.7%	129
ARCE3	43.1%	45.3%	43.3%	101
ARCZ6	1.2%	-2.4%	52.3%	129
BBAS3	24.1%	24.2%	41.6%	129
BBDC4	24.4%	23.4%	37.2%	129
BRAP4	16.8%	22.1%	42.2%	110
BRKM5	17.3%	0.7%	49.3%	129
BRTO4	10.1%	9.4%	37.8%	129
BRTP4	2.9%	-14.2%	34.9%	129
BTOW3	21.7%	28.6%	54.7%	55
CCRO3	26.4%	21.0%	41.5%	93
CESP6	5.6%	52.9%	61.0%	39
CGAS5	17.6%	8.2%	40.3%	129
CLSC6	12.0%	17.1%	35.7%	129
CMET4	61.2%	55.2%	40.0%	88
CMIG4	13.2%	25.9%	35.7%	129
CPFE3	11.7%	0.4%	24.8%	61
CPLE6	12.0%	15.4%	37.8%	129
CRTP5	17.9%	21.0%	60.7%	77
CRUZ3	16.6%	17.9%	31.0%	129
CSNA3	32.1%	48.7%	49.1%	129
CSTB4	42.9%	37.6%	48.1%	82
CYRE3	41.3%	-19.6%	66.8%	51
DURA4	21.5%	14.4%	37.9%	129
EBTP4	-4.2%	8.6%	66.8%	129
ELET6	5.0%	11.6%	40.5%	129
ELPL5	12.5%	10.6%	51.6%	129
ELPL6	10.8%	5.2%	30.3%	38
EMBR3	-0.7%	11.4%	69.8%	129
EMBR4	108.0%	17.2%	290.1%	90
GGBR4	34.8%	30.8%	45.0%	129
GOAU4	36.2%	34.0%	41.6%	129
GOLL4	-6.9%	4.0%	50.3%	64
ITAU4	25.2%	23.3%	34.3%	129
ITSA4	26.7%	25.5%	32.9%	129
KLBN4	22.0%	11.2%	38.7%	129
LAME4	39.1%	49.5%	60.4%	129
LIGT3	1.5%	-4.4%	50.1%	129
LREN3	46.7%	15.9%	75.5%	111
NATU3	24.1%	38.5%	29.3%	65
NETC4	-2.7%	11.3%	80.1%	128
PCAR4	15.3%	17.7%	35.6%	129
PETR4	28.1%	24.6%	37.4%	129
PRGA3	26.3%	26.0%	39.3%	129
PTIP4	20.2%	26.0%	37.2%	108
RDCD3	-9.1%	-21.6%	31.6%	21
RSID3	18.7%	7.4%	69.9%	124
SBSP3	13.5%	-3.6%	42.1%	129
SDIA4	21.0%	31.8%	43.0%	128
TAMM4	19.2%	-2.1%	67.9%	70
TBLE3	27.8%	16.6%	41.2%	129
TCOC4	24.4%	19.9%	46.0%	86
TCSL4	2.5%	3.0%	48.3%	129
TLCP4	-0.4%	0.0%	64.5%	86
TLPP4	1.8%	-3.0%	32.3%	129
TMAR5	6.9%	5.7%	39.1%	129
TMCP4	13.1%	7.8%	42.7%	128
TNEP4	18.7%	32.6%	54.7%	69
TNLP4	7.9%	14.7%	37.5%	129
TRPL4	29.8%	44.7%	44.2%	123
UBBR11	19.7%	28.5%	43.9%	122
UGPA4	13.8%	16.2%	30.2%	120
USIM5	33.8%	60.7%	51.3%	129
VALE5	25.7%	18.4%	33.1%	129
VCPA4	16.4%	25.8%	47.3%	127
VIVO4	-10.9%	1.2%	57.6%	129
AVERAGE	**19.5%**	**17.7%**	**48.8%**	**110.4**

Source: Bloomberg.

Table 5: Descriptive Statistics of Risk Free Assets Monthly Returns - Annualized
From February, 1999 up to October, 2009

Risk Free asset	Average	Median	Standard deviation	Number of obs
POUPANÇA	8.5%	8.2%	0.5%	129
CDI	15.8%	15.3%	1.3%	129
TR	2.5%	2.2%	0.5%	129
TJLP	8.8%	9.3%	0.6%	129
SWAP360	16.7%	16.2%	1.6%	129

Source: Bloomberg and Central Bank of Brazil.

Table 6: Descriptive Statistics of Market Portfolios Monthly Returns - Annualized
From February, 1999 up to October, 2009

Market Portfolio	Average	Median	Standard deviation	Number of obs
IBOVESPA	18.8%	23.0%	28.9%	129
MSCI BR	18.9%	23.5%	26.4%	129

Source: MSCI Barra and Bloomberg.

Table 7: Descriptive Statistics of Sectorial Benchmarks Monthly Returns - Annualized
From February, 1999 up to October, 2009

Benchmark	Average	Median	Standard deviation	Number of obs
IEE (BRL)	26.0%	23.9%	40.4%	129
MSCI UTILITIES (BRL)	10.3%	14.2%	34.5%	129
ITEL (BRL)	3.1%	3.1%	29.2%	118
MSCI TELECOM (BRL)	2.9%	2.2%	32.6%	129

Source: BM&FBovespa and MSCI Barra.

5 RESULTS

5.1 ARE THE BETAS OF REGULATED SECTORS LOWER THAN THOSE OF OTHER SECTORS?

Theoretically, if there is no regulatory risk, the betas of firms in regulated sectors should be lower than those with non-regulation. This is not the case, however, in electricity, telecommunications and all regulated sectors in the Brazilian market.

The econometric tests in general do not reject the hypothesis that the betas of firms in regulated sectors are similar to the other sectors. In fact, the tests show that their betas are even higher compared to non-regulated sectors.

Table 8 summarizes the results obtained for the electricity sector from regressions based on Equation (5). For robustness, we used two market portfolios, the Ibovespa

Table 8: Are the betas of the regulated sectors lower than those of other sectors?

Electricity

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+} \gamma_1 D_i + \gamma_{2t} Time\ Controls_t + \gamma_{3i} Equities\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one if the equity belongs to the Electricity Sector and zero otherwise, γ_{2t} is the t-dimensional parameter vector associated with a time-trend, γ_{3t} is the i-dimensional parameter vector associated with equities controls and v_{it} are the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.593 ***	0.595 ***	0.594 ***	0.598 ***	0.605 ***
	(0.0488)	(0.0486)	(0.0495)	(0.0486)	(0.0476)
Electricity Dummy	0.495 ***	0.556 ***	0.560 ***	0.555 ***	0.557 ***
	(0.04740	(0.0473)	(0.0481)	(0.0472)	(0.0462)
Number of Observations	5024	5024	5024	5024	5024
Number of equities	50	50	50	50	50
χ^2 **(Wald)**	6248.61	5109.39	4990.72	5074.62	5097.6
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.308 ***	0.313 ***	0.311 ***	0.310 ***	0.321 ***
	(0.0380)	(0.0379)	(0.0379)	(0.0374)	(0.0367)
Electricity Dummy	0.534 ***	0.529 ***	0.533 ***	0.531 ***	-0.090 ***
	(0.0369)	(0.0368)	(0.0369)	(0.0364)	(0.0295)
Number of Observations	5024	5024	5024	5024	5024
Number of equities	50	50	50	50	50
χ^2 **(Wald)**	4700.47	4524.95	4652.57	4733.85	4848.94
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.
** Statistically significant at 5%.
*** Statistically significant at 1%.

and the MSCI Brazil, and five risk free rates proxies, CDI, Poupança, Swap 360D, TJLP and TR. The parameters associated with time and equities controls are not reported.

When both the Ibovespa and MSCI Brazil are used as market portfolios, the majority of coefficients associated with electricity sector are positive and significant at a 1% level. Only one regression resulted otherwise, namely, when we used TR as risk free asset and MSCI Brazil as market portfolio, the coefficient associated with the beta parameter was negative and significant at 1%.

With such exception, the results are robust to changes in risk free assets. The parameter associated with the electricity dummy range from 0.495 to 0.560.

Table 9 presents the results obtained using the same procedure for telecommunications sector. The difference is that the dummy variable assumes value one for telecommunications sector and zero for the other sectors.

The results are similar to those obtained before. The coefficients associated with dummy variable for telecommunications sector are all positive and significant when using both Ibovespa index and the MSCI Brazil as market portfolios. Unlike for the electricity sector, there are no negative significant betas, further evidence of regulatory risk.

Table 9: Are the betas of the regulated sectors lower than those of other sectors?

Telecommunications

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_0 + \gamma_1 D_i + \gamma_{2t}\, \textit{Time Controls}_t + \gamma_{3i}\, \textit{Equities Controls} + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one if the equity belongs to the Telecommunications Sector and zero otherwise, γ_{2t} is the t-dimensional parameter vector associated with a time-trend, γ_{3t} is the i-dimensional parameter vector associated with equities controls and v_{it} are the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.574 ***	0.579 ***	0.570 ***	0.577 ***	0.600 ***
	(0.0592)	(0.0568)	(0.0592)	(0.0593)	(0.0342)
Telecommunications Dummy	0.643 ***	0.619 ***	0.647 ***	0.623 ***	0.580 ***
	(0.0346)	(0.0332)	(0.0346)	(0.0347)	(0.0584)
Number of Observations	5591	5591	5591	5591	5591
Number of equities	54	54	54	54	54
χ^2 **(Wald)**	5109.8	4658.46	4231.61	4148.99	4130.99
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.289 ***	0.294 ***	0.290 ***	0.288 ***	0.293 ***
	(0.0495)	(0.0527)	(0.0528)	(0.0525)	(0.0522)
Telecommunications Dummy	0.416 ***	0.413 ***	0.418 ***	0.415 ***	0.409 ***
	(0.0289)	(0.0308)	(0.0309)	(0.0307)	(0.0305)
Number of Observations	5591	5591	5591	5591	5591
Number of equities	54	54	54	54	54
χ^2 **(Wald)**	3720.61	3299.62	3280.41	3383.29	3397.78
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

Finally, Table 10 shows the tests for all regulated sectors together, including electricity, telecommunications, gas distribution, road concessions and water utilities. The coefficients associated with the dummies are all positive and significant and therefore we can not say that regulation reduces the betas

In all regressions we use time and equities controls. Consequently, specific effects associated with period of time or that have affected only the beta of a specific share in a given instant of time are mitigated in the estimates

Table 10: Are the betas of the regulated sectors lower than those of other sectors?

All Regulated Sectors

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+} \gamma_1 D_i + \gamma_{2t}$ *Time Controls* $_t + \gamma_{3i}$ *Equities Controls* $+ v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one if the equity belongs to All Regulated Sector and zero otherwise, γ_{2t} is the t-dimensional parameter vector associated with a time-trend, γ_{3t} is the i-dimensional parameter vector associated with equities controls and v_{it} are the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.505 ***	0.514 ***	0.501 ***	0.508 ***	0.515 ***
	(0.0532)	(0.0511)	(0.0533)	(0.0529)	(0.0518)
General Dummy	0.647 ***	0.624 ***	0.652 ***	0.628 ***	0.605 ***
	(0.0346)	(0.0332)	(0.0347)	(0.0344)	(0.0337)
Number of Observations	6985	6985	6985	6985	6985
Number of equities	67	67	67	67	67
χ^2 **(Wald)**	5963.94	5553.47	5097.51	5066.84	5098.29
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.223 ***	0.227 ***	0.222 ***	0.224 ***	0.237 ***
	(0.0421)	(0.0443)	(0.0447)	(0.0442)	(0.0437)
General Dummy	0.422 ***	0.420 ***	0.424 ***	0.422 ***	0.415 ***
	(0.0274)	(0.0288)	(0.0291)	(0.0287)	(0.0284)
Number of Observations	6985	6985	6985	6985	6985
Number of equities	67	67	67	67	67
χ^2 **(Wald)**	5271.88	4690.07	4679.74	4789.93	4813.44
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

5.2 ARE THE BETAS OF REGULATED SECTORS AFFECTED BY *AD HOC* REGULATION CHANGES?

]If an unexpected change in regulation reduces the uncertainty about companies' cash flow, the betas around the period of regulation change should fall compared to other periods. If a change in legislation does not change or even increase the uncertainty of investors, variability of returns should increase and betas should rise for that period.

It seems to be the case when the Brazilian government launched a new regulatory framework for the electricity sector on March 16, 2004. The estimates show evidence of regulatory risk induced by this policy change.

In Table 11, all coefficients associated with the dummy variable for the period between two months before and two months after the law came into force are positive and significant at the 1% level by estimating Equation (9). This result is robust to using different risk free proxies and market portfolios.

Table 11: Are the betas of regulated sectors affected by adhoc regulation changes?

Electricity

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_0 + \gamma_1 D^{Event} + \gamma_{2t}\, Time\ Controls_t + \gamma_{3i}\, Equities\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the adhoc regulatory change, γ_{2t} is the t-dimensional parameter vector associated with a time-trend, γ_{3t} is the i-dimensional parameter vector associated with equities controls and v_{it} are the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.291 **	0.326 **	0.315 ***	0.310 ***	0.329 ***
	(0.1156)	(0.1118)	(0.1169)	(0.1105)	(0.1055)
Dummy March-16, 2004	0.445 ***	0.344 ***	0.430 ***	0.436 ***	0.406 ***
	(0.1617)	(0.1563)	(0.1634)	(0.1545)	(0.1475)
Number of Observations	1043	1043	1043	1043	1043
Number of equities	10	10	10	10	10
χ^2 **(Wald)**	1106.67	1097.32	1082.82	1125.94	1144.78
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.059	0.060	0.067	0.076	0.110 *
	(0.0633)	(0.0578)	(0.0631)	(0.0589)	(0.0581)
Dummy March-16, 2004	0.367 ***	0.384 ***	0.368 ***	0.368 ***	0.316 ***
	(0.0886)	(0.0808)	(0.0882)	(0.0824)	(0.0813)
Number of Observations	1043	1043	1043	1043	1043
Number of equities	10	10	10	10	10
χ^2 **(Wald)**	2568.7	2817.7	2595.91	2658.48	2425.06
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.
** Statistically significant at 5%.
*** Statistically significant at 1%.

For the telecommunication sector, the two events tested in this study showed the same results as before. That is, in almost all regressions, the tests do not reject the null hypothesis of regulatory risk. Only when the TR is used as risk free asset and Ibovespa as market portfolio, the coefficient on the dummy variable associated with the new tariffs of December 20, 2005 is positive and significant.

That is, even with the evidence of regulatory risk in the electricity and telecommunications, and all regulated sectors, the Brazilian policy makers can even increase the risk according to the investors' perception when they change regulation. This result may help policy makers improve the regulatory framework and make better use of private resources that could be targeted for investment in infrastructure.

Table 12: Are the betas of regulated sectors affected by adhoc regulation changes?

Telecommunications

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+}\gamma_1 D^{Event1} + \gamma_2 D^{Event2} + \gamma_{3t}\, Time\ Controls_{\,t} + \gamma_{4i}\, Equities\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random-Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 and γ_2 are the parameter associated with the adhoc regulatory change, γ_{3t} is the *t*-dimensional parameter vector associated with a time-trend, γ_{4t} is the *i*-dimensional parameter vector associated with equities controls and v_{it} are the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	1.164 ***	1.224 ***	1.167 ***	1.151 ***	1.139 ***
	(0.1463)	(0.1349)	(0.1433)	(0.1439)	(0.1402)
Dummy June-18, 2003	0.133	0.105	0.282	0.139	0.152
	(0.1768)	(0.1630)	(0.1732)	(0.1739)	(0.1695)
Dummy December-20, 2005	0.249	0.032	0.245	0.264	0.280 **
	(0.1768)	(0.1630)	(0.1732)	(0.1740)	(0.1696)
Number of Observations	1610	1610	1610	1610	1610
Number of equities	15	15	15	15	15
χ^2 **(Wald)**	1374.64	1549.64	1450.21	1413.14	
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.8007 ***	0.8053 ***	0.8026 ***	0.8081 ***	0.8082 ***
	(0.1260)	(0.1410)	(0.1432)	(0.1414)	(0.1405)
Dummy June-18, 2003	0.2179	-0.0876	-0.0974	-0.0899	0.2495
	(0.1523)	(0.1704)	(0.1730)	(0.1708)	(0.1698)
Dummy December-20, 2005	0.1539	-0.0334	0.1549	-0.0333	-0.0335
	(0.1523)	(0.1704)	(0.1731)	(0.1709)	(0.1699)
Number of Observations	1610	1610	1610	1610	1610
Number of equities	15	15	15	15	15
χ^2 **(Wald)**	1362.60	1175.90	1140.28	1175.00	1175.10
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

6 CONCLUSIONS

From Peltzman's work, we learned that systematic risk may contain a component of regulatory risk, to the extent that the regulation should reduce the variability of returns and therefore the betas.

Evidence from a number of countries is mixed, but our work confirms with a number of robustness checks that there are regulatory risks in Brazi. And it is conceivable that Brazil is a representative example of others emerging economies. The results, unfortunately, show the existence of regulatory risk in all regulated sectors of the country, especially in electricity and telecommunications. They also show that investors perceive significant regulatory risk, since the betas are calculated based on stock prices, indexes, and market portfolios traded on the market.

Regulated sectors betas are greater than or equal to non-regulated sector betas over a roughly 10 year period even after controlling for time-varying nature and considering equities and time-specific controls. This result is opposed to Peltzman's buffering hypothesis and therefore shows the existence of regulatory risk in such sectors.

Even in this higher risk environment in electricity and telecommunications sectors, policymakers can further increase instability by changing the regulatory framework. In this sense, we find evidence that the betas in periods of regulatory change are higher than they should in the electricity and telecommunications sectors. In the case of the electricity sector, we find evidence that a new regulatory framework for Brazilian electricity sector increased betas around the time of enactment, i.e. around the period of March 16, 2004. In the telecommunications sector case, the periods around the inception of the new telecommunications sector index (IST) on June 18, 2003 and the approval of new interconnection rates of December 20, 2005 did not reduce betas, also violating the buffering hypothesis.

The cost of regulatory risk is reflected in the fact that although the country has high tariffs in many sectors compared to other countries, they do not compensate investors who demand even higher returns because of the associated risk.

Future work that explicitly prices that risk may prove useful for policy makers when designing more appropriate public policies to promote increased investment and ultimately the countries' own growth.

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APPENDIX

A1: THE PELTZMAN MODEL AND EXTENSIONS

NÃO PROSSEGUI ALÉM DESTE PONTO.

Two main views of regulation permeate traditional economic theory. The first one defends the idea that regulators should act to avoid market failures. The allocation that is created should generate Pareto improvements. This view is known as the Positive Theory of Regulation. The other one defends the idea that the government acts not only to deal with market failures but also to generate the maximum political support for the politicians. This is referred to as Capture Theory and the main contributions are found in Stigler (1971) and Peltzman (1976).

The Peltzman Model (1976) consists of a game between consumers who benefit from low prices (p) and monopolist producers who maximize profits $\pi(p)$. Producers will finance the politicians so long as their efforts increase profits.That is, Equation (A1) can represent the objective function of the politicians (M):

$$M = M(p, \pi) \tag{A1}$$

where $M_P < 0$ (higher prices implies low political support given by consumers) and $M_\pi > 0$, which means that higher profits implies higher political support.

The producers profit function is the restriction of this model. It considers the demand costs and it is represented by the equation (A2):

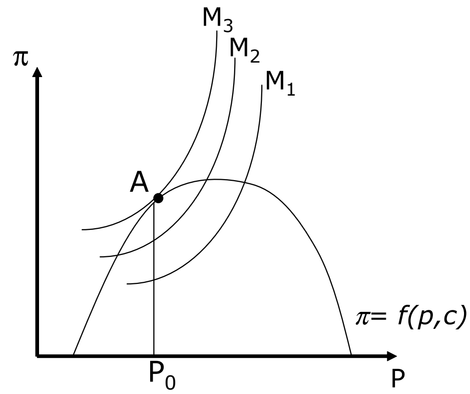
$$\pi = f(p, c) \tag{A2}$$

Costs increase with production, that is, $f_c > 0$. Revenues also increase with prices but at a decreasing rate, that is,$f_p \geq 0$ and $f_{pp} < 0$,

The indifference curves of politicians and producers, represented by M and π, are shown in Figure 1. The northwestern M curves represent more political support. The tangency of the indifference curves of regulators and the producers (M and π respectively) represents the equilibrium point (point A). The optimum is neither the competitive outcome nor the monopoly equilibrium level. It is an intermediary level represented by the relation (π, p).

A corollary of the Peltzman model is that regulation makes the costs and firm demand more predictable. The profits are more stable over time and so are firm stock prices. If regulation (or lack of) is widespread, it should also decrease systematic risk in addition to diversifiable risk for the entire economy. Using annual data from 1871 up to 1942, Peltzman tested two episodes of regulation change. The first is the railroad regulation change in 1887 and the second one is the start of utility regulation in 1907. For this, he checked first the railroad and utilities stock prices changes after the new regulatory framework using Cowles Sectorial Indexes for Railways and Utilities. In order to verify the impact on systematic risk he constructed after a measure of relative risk: the ratio between the standard deviations of annual changes of these stock indexes relative to the industrials indexes of Standard and Poor's. The results confirm the reduction of volatility after the introduction of regulation although the results are not statistically significant.

Figure 1: Representation of the Peltzman Model



A2: DETAILS ON THE EQUITIES OF THE SAMPLE

Table A1: Details on the Equities of the Sample

According to the Brazilian Stock Exchange Subectors Parameters

In general, all the classifications were based on the Bovespa Sector, that represents a more general rule. However, in order to deal with the specific condititions, this more general rule was divided in Subsector, that was applied to the follwing: (i) The Basic materials sector was divided in Steel and Metallurgy, Mining, Wood and Paper and Chemical and Petrochemical; (ii) Construction and Transportation sector was split in Real State and transportation; and (iii) The holdings Subsector was considered alone, despite the fact that it belongs to the Banks and Finantial Intermediaries Sector because they were not necessarilly related to the financial system.

Bovespa Code	Equity	Type	Sector
ACES4	ACESITA	PN *	Steel and Metallurgy
ALLL11	ALL AMER LAT	UNT N2	Transportation
AMBV4	AMBEV	PN *	Consumer Staple
ARCE3	ARCELOR BR	ON	Steel and Metallurgy
ARCZ6	ARACRUZ	PNB EDS	Wood and Paper
BBAS3	BRASIL	ON	Banks and Financial Intermediaries
BBDC4	BRADESCO	PN	Banks and Financial Intermediaries
BRAP4	BRADESPAR	PN N1	Holdings
BRKM5	BRASKEM	PNA*	Chemical and Petrochemical
BRTO4	BRASIL TELEC	PN *	Telecom
BRTP4	BRASIL T PAR	PN *	Telecom
BTOW3	B2W VAREJO	ON NM	Consumer Discretionary
CCRO3	CCR RODOVIAS	ON NM	Transportation
CESP4	CESP	PN *	Electrical Energy
CESP6	CESP	PNB N1	Electrical Energy
CGAS5	COMGAS	PNA*EDS	Oil and Gas
CLSC6	CELESC	PNB	Electrical Energy
CMET4	CAEMI	PN	Mining
CMIG4	CEMIG	PN *ED	Electrical Energy
CPFE3	CPFL ENERGIA	ON NM	Electrical Energy
CPLE6	COPEL	PNB*EJ	Electrical Energy
CRTP5	CRT CELULAR	PNA*	Telecom
CRUZ3	SOUZA CRUZ	ON	Consumer Staple
CSNA3	SID NACIONAL	ON *EDJ	Steel and Metallurgy
CSTB4	SID TUBARAO	PN *	Steel and Metallurgy
CYRE3	CYRELA REALT	ON NM	Real State
DURA4	DURATEX	PN N1	Wood and Paper
EBTP4	EMBRATEL PAR	PN *	Telecom
ELET6	ELETROBRAS	PNB*ED	Electrical Energy
ELPL4	ELETROPAULO	PN *	Electrical Energy
ELPL5	ELETROPAULO	PNA	Electrical Energy
ELPL6	ELETROPAULO	PNB	Electrical Energy
EMBR3	EMBRAER	ON	Transportation Materials
EMBR4	EMBRAER	PN	Transportation Materials
GGBR4	GERDAU	PN EB	Steel and Metallurgy
GOAU4	GERDAU MET	PN EJ N1	Steel and Metallurgy
GOLL4	GOL	PN N2	Transportation
ITAU4	ITAUBANCO	PN *EJ	Banks and Financial Intermediaries
ITSA4	ITAUSA	PN ES	Banks and Financial Intermediaries
KLBN4	KLABIN S/A	PN	Wood and Paper
LAME4	LOJAS AMERIC	PN	Consumer Discretionary
LIGT3	LIGHT	ON *	Electrical Energy
LREN3	LOJAS RENNER	ON NM	Consumer Discretionary
NATU3	NATURA	ON NM	Consumer Staple
NETC4	NET	PN N2	Media
PCAR5	P.ACUCAR-CBD	PN N1	Consumer Staple
PETR4	PETROBRAS	PN	Oil and Gas
PRGA3	PERDIGAO S/A	ON NM	Consumer Staple
PTIP4	IPIRANGA PET	PN *	Chemical and Petrochemical
RDCD3	REDECARD	ON NM	Banks and Financial Intermediaries
RSID3	ROSSI RESID	ON NM	Real State
SBSP3	SABESP	ON *	Water Utilities
SDIA4	SADIA S/A	PN	Consumer Staple
TAMM4	TAM S/A	PN N2	Transportation
TBLE3	TRACTEBEL	ON *	Electrical Energy
TCOC4	TELE CTR OES	PN *	Telecom
TCSL4	TELE CL SUL	PN *ED	Telecom
TLCP4	TELE LEST CL	PN *	Telecom
TLPP4	TELESP	PN *	Telecom
TMAR5	TELEMAR N L	PNA*	Telecom
TMCP4	TELEMIG PART	PN *	Telecom
TNEP4	TELE NORD CL	PN *EDS	Telecom
TNLP4	TELEMAR	PN *	Telecom
TRPL4	TRAN PAULIST	PN *	Electrical Energy
UBBR11	UNIBANCO	UNT N1	Banks and Financial Intermediaries
UGPA4	ULTRAPAR	PN N1	Holdings
USIM5	USIMINAS	PNA	Steel and Metallurgy
VALE5	VALE R DOCE	PNA	Mining
VCPA4	V C P	PN *ED	Wood and Paper
VIVO4	VIVO	PN EJ	Telecom

Source: BM&FBovespa.

A3: EQUITIES CODES CHANGES DURING THE ESTIMATION PERIOD

Table A2: Equities Code Changes During the Estimation Period

Original Bovespa Code	New Bovespa Code	Month of Change	Reason(s)
CESP4	CESP6	Jun-06	Issuance of shares for the company`s capitalization and adoption of more stringent corporate governance standards;
ELPL4	ELPL5	May-06	Financial and corporate restructuring involving the controlling shareholders;
LIGH3	LIGT3	Feb-06	Implementation of "Desverticalization" Project, including the incorporation of Light - Serviços de Eletricidade S.A. ("Light SESA") pela Light S.A.
PLIM4	NETC4	Apr-06	More direct associating between the code of the company and its name, improving the identification of the shares
TSPP4	VIVO4	May-06	VIVO´s shares reestructuring. The goal is to simplify the corporate structure and operational by the merger of the companies controlled by VIVO. It follows the subsidiaries that were incorporated: Telergipe Celular S.A., Telebahia Celular S.A., Telerj Celular S.A., Telest Celular S.A., Celular CRT S.A., Telesp Celular S.A. and Tele Centro Oeste Celular S.A. and its subsidiaries Telegoiás Celular S.A., Telemat Celular S.A., Telems Celular S.A., Teleron Celular S.A., Teleacre Celular S.A., Norte Brasil Telecom S.A. and TCO IP S.A.
PCAR4	PCAR5	Jun-06	Acquisition of Globex by Cia Brasileira de Distribuição.
ITAU4	ITUB4	Apr-06	Merger - ITAU-UNIBANCO.

Source: Relevant Facts - BM&FBovespa.

A4: COMPOSITION OF ELECTRICITY BENCHMARKS: IEE VS MSCI UTILITIES

Table A3: Electricity Index (IEE) Composition

Composition for the period Sep-09 up to Dec-09

Bovespa Code	Name	% Weight in the Index	Shares in the Index
GETI4	AES Tiete SA	5.658	3300
ELET6	Centrais Eletricas Brasileiras SA	6.131	2600
CLSC6	Centrais Eletricas de Santa Catarina SA	6.061	1900
CMIG4	Cia Energetica de Minas Gerais	6.374	2300
CESP6	Cia Energetica de Sao Paulo	6.158	3200
COCE5	Cia Energetica do Ceara	6.701	2600
CPLE6	Cia Paranaense de Energia	6.672	2200
CPFE3	CPFL Energia SA	5.674	1900
TRPL4	CTEEP	5.774	1300
ENBR3	EDP - Energias do Brasil SA	6.685	2300
ELPL6	Eletropaulo Metropolitana Eletricidade d	5.676	1800
EQTL3	Equatorial Energia SA	6.115	4000
LIGT3	Light SA	6.087	2800
MPXE3	MPX Energia SA	7.856	3700
TBLE3	Tractebel Energia SA	6.126	3200
TRNA11	Transmissora Alianca de Energia Eletrica	6.253	1900

Source: BM&Fbovespa website.

Table A4: MSCI Utilities Composition (Brazil)

Composition for Oct-09

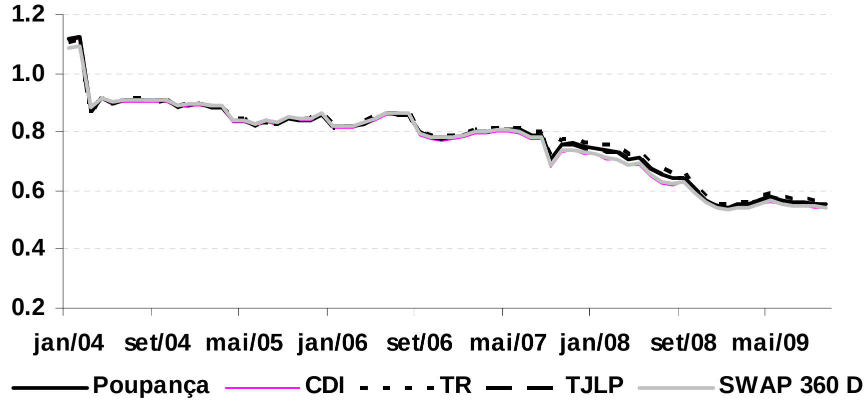
Bovespa Code	Name	% Weight in the Index
CMIG4	CIA ENERGETICA MINAS GER-PRF	21.007
ELET3	CENTRAIS ELETRICAS BRASILIER	11.799
ELET6	CENTRAIS ELETRICAS BRAS-PR B	10.216
CPFE3	CPFL ENERGIA SA	10.072
ELPL6	ELETROPAULO METROPOLI-PREF B	8.633
CPLE6	CIA PARANAENSE DE ENERGI-PFB	7.338
SBSP3	CIA SANEAMENTO BASICO DE SP	7.194
TBLE3	TRACTEBEL ENERGIA SA	6.475
CESP6	CIA ENERGETICA DE SP-PREF B	6.331
ENBR3	EDP - ENERGIAS DO BRASIL SA	4.029
TRPL4	CIA DE TRANSMISSAO DE ENE-PF	3.453
GETI4	AES TIETE SA-PREF	3.453
TOTAL		100.000

Source: http://us.ishares.com/home.htm.

A5: EVOLUTION OF ELECTRICITY BENCHMARKS BETAS USING MSCI BRAZIL AS A MARKET PORTFOLIO

Chart A1: IEE OLS Estimated Betas

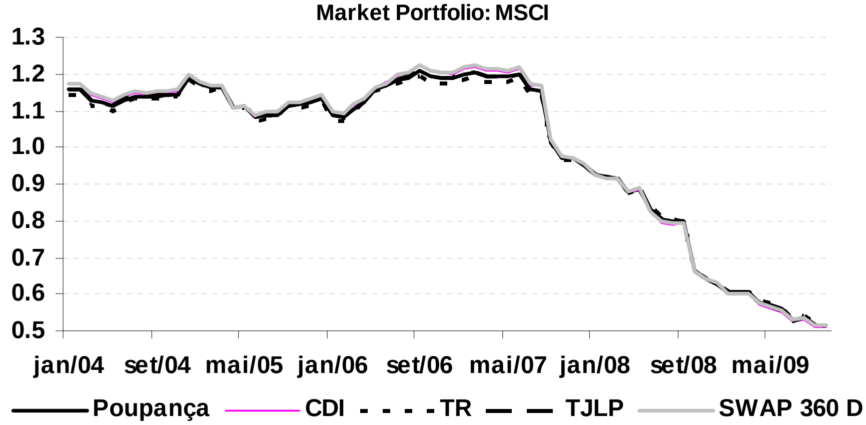
Market Portfolio: MSCI



Source: Bloomberg and Central Bank of Brazil.

Chart A2: MSCI Utilities OLS Estimated Betas

Market Portfolio: MSCI



Source: Bloomberg and Central Bank of Brazil.

A6: COMPOSITION OF TELECOMMUNICATIONS BENCHMARKS: ITEL VS MSCI TELECOM

Table A5: Telecommunication Index (ITEL) Composition

Composition for the period Sep-09 up to Dec-09

Bovespa Code	Name	% Weight in the Index	Shares in the Index
BRTO4	Brasil Telecom SA	13.980	257690.76
BRTO3	Brasil Telecom SA	2.341	26367.09
GVTT3	Global Village Telecom Holding SA	15.896	89889.50
TNLP4	Tele Norte Leste Participacoes SA	15.630	129013.73
TNLP3	Tele Norte Leste Participacoes SA	4.208	29898.43
TLPP3	Telecomunicacoes de Sao Paulo SA	2.996	24146.29
TLPP4	Telecomunicacoes de Sao Paulo SA	5.015	36482.24
TMAR5	Telemar Norte Leste SA	5.221	25934.85
TCSL3	Tim Participacoes SA	3.122	149387.69
TCSL4	Tim Participacoes SA	8.597	558417.32
VIVO4	Vivo Participacoes SA	22.993	134705.01
TOTAL		100.000	

Source: BM&Fbovespa website.

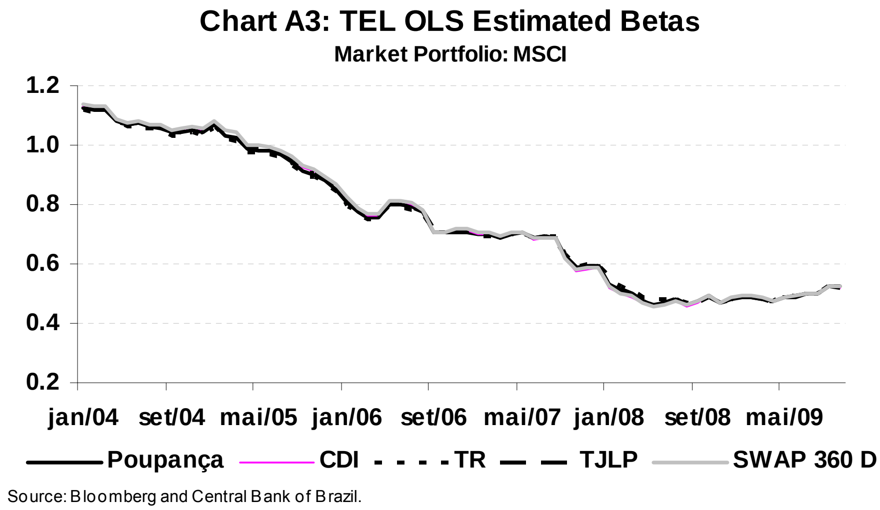
Table A6: MSCI Telecommunications Services Composition

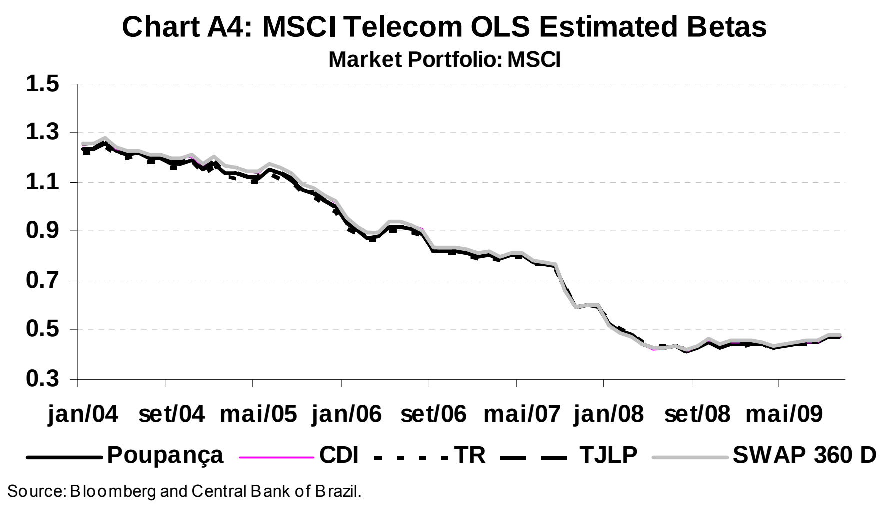
Composition for Oct-09

Bovespa Code	Name	% Weight in the Index
GVTT3	GVT HOLDING SA	28.293
BRTP4	BRASIL TELECOM PART SA-PR	22.927
TCSL4	TIM PARTICIPACOES SA	17.073
TNLP3	TELE NORTE LESTE PART	16.098
BRTO4	BRASIL TELECOM SA - PREF	15.610
TOTAL		100.000

Source: http://us.ishares.com/home.htm.

A7: EVOLUTION OF TELECOMMUNICATIONS BENCHMARKS BETAS USING MSCI BRAZIL AS A MARKET PORTFOLIO





A8: ARE BETAS OF REGULATED SECTORS LOWER THAN IN OTHER SECTORS? A SECTOR LEVEL ANALYSIS

The purpose of this section is to provide another alternative to test the robustness of the results of the paper. In this Appendix, we test betas of regulated sectors against the unregulated ones. Here we look at sector indexes instead of at individual stocks as in the main body of the thesis. That is, we test equation (5) again using the same market portfolios and risk free assets.

In this case, we use the MSCI Brazil sectorial benchmarks, which consists of ten sectors, namely: Financials, Energy, Consumer Staples, Utilities, Consumer Discretionary, Materials, Health Care, Telecommunications, Information Technology, and Industrials, to check, if the average beta for the utilities (electricity), Telecommunications and all regulated sectors have lower betas than other sectors.

The results are consistent with those of the article. Table A7 shows that the betas of the utilities' sector are not smaller than the others for the February, 1999 – October, 2009 period.

Table A8 shows the estimated betas for telecommunications services. All betas are positive and significant at 1% significance confidence level, i.e., on average, the betas of each sector are statistically higher than unregulated, opposite to that predicted by theory and is evidence of regulatory risk in the sector.

Finally, considering the combined regulated sectors together, regulatory risk exists in the whole economy as it is not possible to accept the hypothesis that the betas of all regulated sectors together (Table 9) are lower than in other sectors. Again, these results are consistent with those of paper.

Table A7: Are the betas of the regulated sectors lower than those of other sectors? Sector Level

Electricity

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+} \gamma_1 D_i + \gamma_{2t}\, Time\ Controls_t + \gamma_{3iSector}\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each MSCI setor estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one for the MSCI Utilities Sector and zero otherwise, γ_{2t} is the *t*-dimensional parameter vector associated with a time-trend, γ_{3t} is the *i*-dimensional parameter vector associated with sector controls and v_{it} is the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients. The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.7844 ***	0.7913 ***	0.7918 ***	0.7807 ***	0.7789 ***
	(0.0992)	(0.0964)	(0.0969)	(0.0962)	(0.0937)
MSCI Utilities	-0.0342	-0.0393	-0.0343	-0.0369	-0.0382
	(0.0329)	(0.0320)	(0.0322)	(0.0320)	(0.0311)
Number of Observations	967	967	967	967	967
Number of groups	9	9	9	9	9
χ^2 **(Wald)**	292.82	299.3	301.93	300.63	313.8
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.7892 ***	0.7862 ***	0.7932 ***	0.7780 ***	0.7815
	(0.0983)	(0.0952)	(0.0962)	(0.0964)	(0.0930)
MSCI Utilities	-0.0293	-0.0396	-0.0347	-0.0377	-0.0334
	(0.0327)	(0.0316)	(0.0320)	(0.0320)	(0.0309)
Number of Observations	967	967	967	967	967
Number of groups	9	9	9	9	9
χ^2 **(Wald)**	297.35	306.35	301.07	302.42	317.73
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

Table A8: Are the betas of the regulated sectors lower than those of other sectors? Sector Level

Telecommunications

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+}\gamma_1 D_i + \gamma_{2t}\, Time\ Controls_t + \gamma_{3iSector}\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each MSCI setor estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one for the MSCI Telecommunications Services Sector and zero otherwise, γ_{2t} is the *t*-dimensional parameter vector associated with a time-trend, γ_{3i} is the *i*-dimensional parameter vector associated with sector controls and v_{it} is the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients. The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.8820 ***	0.8834 ***	0.8874 ***	0.8760 ***	0.8674
	(0.1179)	(0.1173)	(0.1149)	(0.1170)	(0.1157)
MSCI Telecom. Services	0.3527 ***	0.3552 ***	0.3536 ***	0.3566 ***	0.3547
	(0.0391)	(0.0390)	(0.0382)	(0.0389)	(0.0384)
Number of Observations	967	967	967	967	967
Number of groups	9	9	9	9	9
χ^2 **(Wald)**	386.5	381.85	403.53	384.99	384.06
p-value	0.000	0.000	0.000	0.000	0.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.8811 ***	0.8786 ***	0.8886 ***	0.8809 ***	0.8716 ***
	(0.1171)	(0.1163)	(0.1138)	(0.1162)	(0.1146)
MSCI Telecom. Services	0.3580 ***	0.3549 ***	0.3541 ***	0.3550 ***	0.3525 ***
	(0.0389)	(0.0386)	(0.0378)	(0.0386)	(0.0381)
Number of Observations	967	967	967	967	967
Number of groups	9	9	9	9	9
χ^2 **(Wald)**	396.08	392.21	413.12	394.66	393.05
p-value	0.000	0.000	0.000	0.000	0.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

Table A9: Are the betas of the regulated sectors lower than those of other sectors? Sector Level

All Regulated Sectors (MSCI Utilities and MSCI Telecommunications Services)

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+} \gamma_1 D_i + \gamma_{2t}\, Time\ Controls_t + \gamma_{3iSector}\ Controls + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Random Effect panel. The dependent variables β_{it}^{est} are the CAPM betas for each MSCI setor estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the dummy variable that assumes value one for All Regulated Sectors (including MSCI Financials, MSCI Utilities and MSCI Telecommunications) and zero otherwise, γ_{2t} is the t-dimensional parameter vector associated with a time-trend, γ_{3t} is the i-dimensional parameter vector associated with sector controls and v_{it} is the erratic term. The dummy controls for time and equities have not been reported. The values in brackets are standard deviations associated with the coefficients. The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.6889 ***	0.6958 ***	0.6966 ***	0.6871 ***	0.6844 ***
	(0.2221)	(0.2250)	(0.2212)	(0.2245)	(0.2235)
All Regulated	0.3274	0.3278	0.3296	0.3289	0.3261
	(0.2753)	(0.2811)	(0.2760)	(0.2802)	(0.2800)
Number of Observations	1096	1096	1096	1096	1096
Number of groups	10	10	10	10	10
χ^2 **(Wald)**	39.9	40.08	38.55	39.62	39.45
p-value	1.000	1.000	1.000	1.000	1.000
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	0.6926 ***	0.6925 ***	0.6976 ***	0.6853 ***	0.6866 ***
	(0.2221)	(0.2247)	(0.2213)	(0.2240)	(0.2200)
All Regulated	0.3322	0.3264	0.3297	0.3270	0.3276
	(0.2757)	(0.2811)	(0.2767)	(0.2793)	(0.2749)
Number of Observations	1096	1096	1096	1096	1096
Number of groups	10	10	10	10	10
χ^2 **(Wald)**	38.94	38.22	37.93	38.28	38.38
p-value	1.000	1.000	1.000	1.000	1.000

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

A9: ARE BETAS OF REGULATED SECTORS AFFECTED BY AD-HOC REGULATION CHANGES? A SECTOR LEVEL ANALYSIS

We undertook the same tests for equation (8) using the sectors of the MSCI Brazil instead of individual stocks. The results are again consistent with those of the paper when looking at the New Regulatory Framework for Brazilian Electricity Sector measured by the March 16, 2004 dummy variable. That is, betas around this period are even higher compared to the other periods.

Table A10: Are the betas of regulated sectors affected by adhoc regulation changes?

Electricity

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_0 + \gamma_1 D^{Event} + \gamma_{2t} Trend + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Least Squares Dummy Variables Method (LSDV), which consists basically of OLS controlling the temporal and cross-section considering such controls in the variance-covariance matrix. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 is the parameter associated with the adhoc regulatory change, γ_{2t} is the *t*-dimensional parameter vector associated with a time-trend. and v_{it} is the erratic term. The time controls for time has not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	1.0427 ***	1.0086 ***	1.0316 ***	1.0186 ***	1.0003 ***
	(0.0580)	(0.0547)	(0.0566)	(0.0555)	(0.0531)
Dummy March-16, 2004	0.4681 ***	0.4246 ***	0.4487 ***	0.4389 ***	0.4112 ***
	(0.0360)	(0.0328)	(0.0350)	(0.0335)	(0.0310)
Number of Observations	129	129	129	129	129
F(2, 126)	123.23	122.69	119.49	124.85	128.61
Prob F	0.000	0.000	0.000	0.000	0.000
R-squared	0.198	0.186	0.189	0.192	0.188
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	1.0325 ***	1.0086 ***	1.0307 ***	1.0312 ***	1.0090 ***
	(0.0573)	(0.0547)	(0.0569)	(0.0574)	(0.0529)
Dummy March-16, 2004	0.4524 ***	0.4246 ***	0.4484 ***	0.4615 ***	0.4224 ***
	(0.0362)	(0.0328)	(0.0353)	(0.0344)	(0.0307)
Number of Observations	129	129	129	129	129
F(2, 126)	116.32	122.62	117.74	128.39	134.76
Prob F	0.000	0.000	0.000	0.000	0.000
R-squared	0.190	0.186	0.188	0.198	0.191

* Statistically significant at 10%.
** Statistically significant at 5%.
*** Statistically significant at 1%.

The two dummies used in regressions for telecommunications show different patterns compared to those in the paper (Table A11). The first dummy tries to capture effects of introduction of the new Telecommunications Sector index (IST) on June 18, 2003. The results were similar to those obtained in the main part of the paper. That is, on average, the beta remained the same for both periods.

The second dummy tries to capture the effects of the approval of the New Interconnection Rates. This time, however, the results were exactly opposite of those obtained paper. That is, on average, betas around December 20, 2005 are lower than those for the rest of the sample. One possible reason for this anomaly could stem from the fact the measure went into effect at the same time as the IST, which had already been released by Anatel. In part, sectoral indexes may have already incorporated the effect of the IST into prices and eventually dominates the effects of the New Interconnection Rates.

Table A11: Are the betas of regulated sectors affected by adhoc regulation changes?

Telecommunications

This Table presents the results of the regressions: $\beta_{it}^{est} = \gamma_{0+}\gamma_1 DEvent + \gamma 2DEvent + \gamma_{3t} Trend + v_{it}$ estimated from February, 1999 up to October, 2009.

This equation was estimated using the Least Squares Dummy Variables Method (LSDV), which consists basically of OLS controlling the temporal and cross-section considering such controls in the variance-covariance matrix. The dependent variables β_{it}^{est} are the CAPM betas for each stock estimated in the first step by Kalman Filter. γ_0 is the parameter associated with the constant term, γ_1 and γ_2 are the parameter associated with the adhoc regulatory change, γ_{3t} is the *t*-dimensional parameter vector associated with a time-trend. and v_{it} is the erratic term. The time controls for time has not been reported. The values in brackets are standard deviations associated with the coefficients.The table is divided in two parts: the first shows the results using the betas estimated in the first step considering the Ibovespa as the market portfolio, while in the second the betas were estimated using the MSCI Brazil. For each of these market portfolios, we used five risk free assets for robustness, the CDI, the Poupança, the Swap 360D, the TJLP and the TR, respectively.

	Market Portfolio: Ibovespa				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	1.6571 ***	1.6499 ***	1.6500 ***	1.6531 ***	1.6436 ***
	(0.0838)	(0.0867)	(0.0802)	(0.0866)	(0.0878)
Dummy June-18, 2003	-0.0161	-0.0643	-0.0165	-0.0624	-0.0790
	(0.1777)	(0.1844)	(0.1727)	(0.0866)	(0.1815)
Dummy December-20, 2005	-0.3327 **	-0.3182 **	-0.3220 **	-0.3201 **	-0.3016 **
	(0.1313)	(0.1356)	(0.1295)	(0.1366)	(0.1350)
Number of Observations	129	129	129	129	129
F(3, 125)	14.36	13.04	14.53	13.12	12.71
Prob F	0.000	0.000	0.000	0.000	0.000
R-squared	0.197	0.187	0.200	0.188	0.185
	Market Portfolio: MSCI Brazil				
	CDI	**Poupança**	**Swap 360D**	**TJLP**	**TR**
Constant	1.6436 ***	1.6509 ***	1.6495 ***	1.6532 ***	1.6420
	(0.0878)	(0.0870)	(0.0800)	(0.0869)	(0.0878)
Dummy June-18, 2003	-0.0790	-0.0660	-0.0162	-0.0648	-0.0813
	(0.1815)	(0.1859)	(0.1722)	(0.1857)	(0.1834)
Dummy December-20, 2005	-0.3016 **	-0.3194 **	-0.3215 **	-0.3214 **	-0.3024
	(0.1350)	(0.1364)	(0.1292)	(0.1373)	(0.1351)
Number of Observations	129	129	129	129	129
F(3, 125)	12.71	12.96	14.56	13.04	12.63
Prob F	0.000	0.000	0.000	0.000	0.000
R-squared	0.185	0.186	0.200	0.187	0.184

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.