1980's and of 15.2% in the 1990-1995 period [11]. In 1998 Brazil's economy felt the impacts of the so called Asian crises, and in 2008 the great international financial crises happened. Due to the deceleration of the GDP in 2011 it is quite possible that other fiscal measures will be adopted by the government, in an attempt to stimulate the level of economic activity, especially those related to the increase in credit for 2012 and the years ahead.

The econometric results obtained in other studies related to investments themes, and its determinants in Brazil and in other countries are presented in Table 1. They summarize the works used as a foundation for the empirical research of this article.

The study of investment behavior, specifically in the private sector, results from the fact that this is a typically endogenous variable and from the observation that the adoption of specific economic actions in the market will increase the relative importance of private investments in the creation of aggregated capital. Particularly important dimensions of this problem are related to measuring the effects of macroeconomic instability on the levels of investments in the private sector, and the identification of the type of relationship that exists between public investment and private investment.

3 Materials and Methods

The quantitative research used explain the theoretical regression model and also to test the existence of stationarity and the co-integration between the used time series data. The used econometric method is the panel data with fixed effects.

Panel Data or longitudinal data are characterized by observations with two dimensions which are often time and space. These data contains information enabling a better research about the dynamics variables change, making it possible to consider the effect of unobserved variables. Another important aspect is the improvement in the parameter inference that was studied, since they provide more degrees of freedom and a greater variability in the sample, when compared with the data in cross-section or time series, which refines the efficiency of econometric estimators. [8], [9] presents a more detailed analysis of the advantages in using the Panel Data.

Generally, the panel data covers a small period of time, due to the high cost of obtaining new information or information unavailability in the past. As the estimated parameters are asymptotically consistent, it is desirable to have a large number of observations. Accordingly, when the covered time period is small, the property of consistency will be satisfied if the number of subjects is large. The following section presents the general model for panel data and fixed effects model used in this study.

3.1 General Model for Panel Data and Fixed Effects Model

$$y_{it} = \beta_{oit} X_{1it} + \cdots + \beta_{kit} X_{kit} + \varepsilon_{it} \quad (1)$$

In this notation, the subscript *i* denotes the different individuals and the subscript *t* the time period being analyzed. The β_0 refers to the intercept parameter and β_k refers to the angular slope coefficient correspondent to the k^{th} explanatory variable of the model.

In this general model, the intercept and response parameters are different for each individual and for each time period. There are, therefore, more unknown parameters than observations, not being possible, in this case, to estimate their parameters.

Thus, it is necessary to specify assumptions about the general model in order to make it operational. Among the models that combine time series data and cross-section, three are the most used: Seemingly Unrelated Regressions Models (SUR), Random Effects Models and Fixed Effects Models. Being, the latter applied in this research.

Table 1 Comparison of the macroeconomic variables used in Brazil and abroad

Methods and Variables	Luporini & Alves (2010)	Santos & Pires (2007)	Ferreira (2005)	Serven (2002)	Rossiter (2002)	Melo & Rodrigues Júnior (1998)	Rocha & Teixeira (1996)
Sampled country	Brazil	Brazil	Brazil	61 Countries	USA	Brazil	Brazil
OLS	X	-	X	-	-	X	X
Private investment	X	X	X	X	X	X	X
Tributes	-	X	X	-	-	-	-
Util. of Ind. Cap.	X	-	X	-	X	-	-
Credit	X	-	X	X	X	-	-
Public Investment	X	X	X	X	X	X	X
I_pb/Y (--)	-	-	-	X	-	-	-
Relative Prices of Capital Goods	-	X	X	-	-	X	X
Inflation (Uncertainty)	X	-	X	X	-	X	-
GDP	X	X	X	-	X	X	X
Cost of Capital (r)	X	-	X	X	-	X	-
Dummies	-	-	-	-	-	-	-
External Debt	X	-	-	-	-	-	-
R^2	0.92092	-	0.9521	N/D	N/D	0.89	0.85
Log Variables	Yes (Except r)	Yes	Yes (Except r)	Yes (Except r)	Yes	Yes (Except r)	Yes

Source: Authors.

The fixed effects model aims to control the effect of omitted variables that vary between individuals and remain constant over time. For this, it is assumed that the intercept varies from individual to individual, but is constant over time, whereas the response parameters are constant for all subjects and for all time periods. According to [7], the model assumptions are:

$$\beta_{0it} = \beta_{0i} \quad \beta_{1it} = \beta_1 \cdots \beta_{kit} = \beta_k \quad (2)$$

The fixed effects model is therefore, given by:

$$y_{it} = \alpha_i + \beta_1 X_{1it} + \cdots + \beta_k X_{kit} + \varepsilon_{it} \quad (3)$$

In this model, the intercept is a fixed and unknown parameter that captures the differences between individuals that are in the sample. Thus, the inferences made about the model are only about individuals, which provide the data.

It is possible to make a specification of the fixed effects model using dummy variables to represent the intercepts for each specific individual. In this case, the general equation is defined as:

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \cdots + \beta_k X_{kit} + \gamma_1 D_{1i} + \gamma_2 D_{2i} + \cdots + \gamma_n D_{ni} + \varepsilon_{it} \quad (4)$$

Where, D_{ni} represents a binary variable for each individual and is equivalent to one when $i = n$ and zero, otherwise.

However, this equation shows a binary variable for each individual, resulting in the problem of perfect multicollinearity. To clear up multicollinearity we should omit a binary variable. Thus, the model proposed by [21] will be written as:

$$y_{it} = \beta_0 + \beta_1 X_{1it} + \cdots + \beta_k X_{kit} + \gamma_2 D_{2i} + \cdots + \gamma_n D_{ni} + \varepsilon_{it} \quad (5)$$

The fixed effects model is the best option to model the panel data when the intercept α_i is correlated with the explanatory variables in any time period. In addition, as the intercept of this model is treated as a fixed parameter, it is also desirable to use fixed effects when the observations are obtained from the entire population and you want to make inferences for individuals that have the data.

The applied econometric model is intended to test the hypothesis that the series of private sector investment, the gross value of industrial production sector, public administration's investment, interest rate, among others are co-integrated, which allows the modeling of the long-term private investment behavior. Through an empirical study, we will seek to identify whether there is a role in inhibiting private investment played by macroeconomic instability and by government investment, during the proposed period.

To explain the sectorial private investment, the following data were chosen to integrate the functional form: the Gross Sectorial Industrial Production Value, Sectorial Industrial Capacity Use, Government Investment, and Actual Interest Rates, a proxy for Credit Availability, External Restrictions and Foreign Exchange.

Due to the above-exposed, the following generic theoretical model is proposed:

Invest_priv = f(VBPI, UCAP, R, Cred, FBKF, E, EE) (6)

Where:

Invest_priv = a proxy for sectoral investment spending; data refer to Fixed Assets Acquisitions (machinery and equipment) by industrial segments (the transformation Industry), in thousands of Reals, at 1995 prices;

VBPI = a proxy for the economic activity level; data refer to the Gross Industrial Production Value per industrial segment, in thousands of Reals, at 1995 prices;

UCAP = Capacity Utilization rate (%) – time series data for installed capacity utilization by industrial segment are available at Fundação Getúlio Vargas (FGV) and were made compatible for the CNAE according to information provided by the IBGE Census Bureau;

R = Actual Interest Rate (%), representing the nominal interest rate on

Bank Certificates of Deposit (BCD) as deflated by the General Price Index (IGP-DI) and annualized, provided by the Brazilian Central Bank (BCB).

Emprest_BNDES = Credit Indicator – represented by Credit disbursements made by the National Bank for Social and Economic Development (BNDES), available for each segment of the transformation industry, in millions of Reals, at 1995 prices;

FBKF = Government Investment – represented by the Fixed Capital – Gross Formation – Public Administration series, in millions of 1995 Reals, applying the GDP deflator as computed by the data available from the IBGE Census Bureau/ National Accounts System;

EE = External Restriction – the proxy used is the annual Debt Service/GDP (%) series provided by DEPEC-BCB, Central Bank of Brazil (BCB);

E = Actual Foreign Exchange Rate;

D1 = Dummy control variable for international crises periods.

From the previous expression, the following general econometric model was estimated for the period between 1996 and 2010, with the variables expressed in natural logarithms (except for actual interest rates) such as to directly derive variable elasticities:

$$\text{LogInvest\_priv}_t = \beta_0 + \beta_1\text{LogVBPI}_{it-1} + \beta_2\text{LogUCAP}_{it} + \beta_3 R_{it} + \beta_4\text{LogCred}_{it-1} + \beta_5\text{LogFBKF}_{it-1} + \beta_6\text{LogE}_{it-1} + \beta_7\text{LogEE}_{it-1} + \beta_8\text{LogEE}_{it-1} + \beta_9 D1 + \varepsilon_t \quad (7)$$

In which ε_t is a random disturbance.

The period under analysis is justified by the fact that sectoral data are limited due to changes in CNAE nomenclature and by the unavailability of more recent data.

For the estimates, the data used were from the Brazilian Institute of Geography and Statistics [10], which are available in the Annual Industrial Survey and are broken down by sector, according to the national classification of economic activities (CNAE) for the period of 1996 to 2010. This periodization is due to data availability of PIA, which, since 1996, has changed the classification in terms of the division of activities and sampling methodology.

Table 2 presents twenty sectors of the Brazilian manufacturing industry, according to the division of activities, and their CNAE classification, which identifies the industrial sectors (See Appendix I).

4 Results

For the econometric analysis, all variables, except the real interest rate, were log-linearized using the natural logarithm. The usual estimation methods and inference assume that these variables are stationary. The non-stationarity of a stochastic process is due to the existence of a unit root or stochastic trend in autoregressive process (AR) that generates the variable, and tests on the unit root hypothesis, in order to help to evaluate the presence (or absence) of stationarity in the variables used in these estimations.

As in the study time series, the existence of a unit root in panel data may cause estimated econometric relations to become spurious. To avoid this problem, variables were tested for the Levin unit root, Lin and Chu (LLC), Im, Pesaran and Smith (IPS), Fisher ADF and Fisher PP. The test LLC assumes the existence of a common root unit, such that ρ_i is the same for all cross-sections, or all industrial sectors (where the autocorrelation coefficient is $\alpha = \rho - 1$). The tests IPS, Fisher-ADF and Fisher-PP, assume that the coefficient ρ_i may vary according to the industrial sector in question, characterized by the combination of individual unit root tests, by deriving a panel specific result. The number of lags in each case was determined by Schwarz's information criterion (SC).

Table 3 In Level Stationarity tests Results for Variables in the Private Investment Model

Commo Unitary Root	Individual Unitary Root				
	LLC	IPS	Fisher ADF	Fisher PP	Integration Order
LnInv_Priv	-7.99735	-5.28965	97.5515	98.5050	I(0)
LnVBPI	-8.97971	-7.01750	38.7194	50.5891	I(0) ou I(1)
LnUCAP	-2.51453	-1.83171	60.6368	57.6345	I(0)
R	-7.29845	-3.98498	86.2369	84.3733	I(0)
LnFBKF	-17.7031	-5.2271	65.7267	71.8654	I(0)
LnCred	-8.4546	-3.3782	44.3610	51.1962	I(0)
LnE	-1.9957	-0.0058	33.8701	36.5349	I(0)
LnEE	-11.4360	-5.4583	91.0413	101.0560	I(0) ou I(1)

The analysis, presented in Table 3, indicates that most of the series are stationary, in other words, do not present a unit root. For some variables, however, such as exchange rate and industrial production, the tests confirm the absence of a unitary common root, but do not eliminate the possibility of an individual unit root, which means that the average of each panel *t*-statistics indicates that the series can be non-stationary.

In the case of the VBPI variable, a possible explanation for this is the heterogeneity between the industrial sectors, which naturally have quantitative and qualitative distinct data. It also suggests the existence of an individual unit root. However, as industrial production exhibits temporal tendency, based on tests LL and Fisher PP, we choose to use the variable in level.

Regarding the macroeconomic variables (R, FBKF, E, EE), the results for the considered period (1996 -2010) indicate that these are stationary, not showing neither common unit root nor individual. The only exception made is with relation to the exchange rate series (E), which needs to be differentiated to become stationary.

Initially, to identify the feasibility of using the panel data methodology, the models are estimated by Ordinary Least Squares (OLS), with all the pooled units (pool cross-section or pooling), in other words, without taking into account the possible specific sector's effects.

The existence of specific factors in each sector can be tested by the hypothesis that there are significant individual effects in the regression through a joint restrictions F test. If the value of the F's statistic exceeds the critical value, there are evidences that specific sectoral effects are present in the estimated model [6].

The F test (Ho: fixed effects = 0) results suggest that using the panel data methodology provides relevant information gain, and in this case, the OLS estimation (pooling) may generate biased results. As the panel data methodology is the most appropriate, the issue now is to choose the estimation method for fixed effects (FE) or random effects (RE).

In this case, in which the used data are not random extractions from a larger sample, the fixed effects model is the most appropriate estimation method. Furthermore, in the fixed effects model, the estimator is robust to the omission of relevant explanatory variables that do not vary over time, and even when the random effects' approach is valid, the estimator of fixed effects is consistent, only less efficiently. Therefore, the estimation by fixed effects appears to be the most appropriate for sector investment models.

The investment equations are estimated by fixed effects and are robust to the presence of multicollinearity between variables, estimated by the Generalized Least Squares' method (GLS) with weighting for individuals (industry sectors), which makes the model also robust to the heteroscedasticity between the individuals' error terms. Moreover, standard deviations were calculated by the White matrix (period) making them robust to the serial correlation and heteroscedasticity in the model´s time dimension. The results are presented in Table 4.

The results in Table 4 indicate that the quantitative variables, Gross Value of Industrial Production (LogVBPI) and utilization of industrial capacity

(LogUCAP) were relevant in explaining private investment. The signs found for the estimated coefficients were positive.

The coefficient for real interest rate (R) is positive which is contrary to the theory of investment. However, the magnitude of the coefficient is close to zero, indicating that changes in the levels of real interest rates for the period 1996 to 2010 do not affect the decision making private sector investment.

Table 4: Investment Sectorial Equations

Estimation by Fixed Effects - Dependent Vabriable: Private Investiment 1996-2010							
Explanatory Variables (1)	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7
C	-12.5731	-14.4577	-15.9587	-12.6178	-12.2551	-19.071	-17.757
	[-0.3120]	[-0.2579]	[-0.1788]	[-0.4179]	[-0.8675]	[-09718]	[-1.172]
	(0.7570)	(0.7981)	(0.8592)	(0.6788)	(0.3921)	(0.3392)	(0.2509)
LnVBPI(-1)	1.0619	1.1104	1.0608	1.6108	1.0622	1.1262	0.8993
	[3.0732]	[3.5707]	[3.0361]	[3.0476]	[3.4756]	[3.8041]	[3.6193]
	(0.0042)	(0.0011)	0.0047	0.0046	(0.0015)	(0.0007)	(0.0012)
LnUCAP	1.8673	2.1943	1.8866	1.8665	1.8769	2.2629	2.2345
	[0.6921]	[0.1461]	[0.6581]	[0.7677]	[1.0372]	[0.5824]	[0.7956]
	(0.4937)	(0.8847)	(0.5152)	(0.4482)	(0.3074)	(0.5647)	(0.4329)
R	0.0232	0.0215	0.0258	0.0229	0.0204	0.0256	0.0322
	[1.5618]	[1.7484]	[1.4729]	[1.6920]	[1.7061]	[1.9003]	[2.0886]
	(0.1279)	(0.090)	(0.020)	(0.1004)	(0.0977)	(0.0674)	(0.0460)
LnCred(-1)		0.4900				0.2393	0.2763
		[1.7212]				[1.3930]	[1.5217]
		0.0949				(0.1742)	(0.1393)
LnFBKF (-1)			0.3376			0.4529	0.6076
			[0.2179]			0.9280	[1.1694]
			(0.8289)			0.3610	(0.2521)
LnE(-1)				-0.0238		-0.8437	-0.3793
				[-0.8581]		[-0.289]	[-0.733]
				(0.3972)		(0.7744)	0.4693
LnEE(-1)					-0.3542	-0.4698	-0.5134
					[-1.7488]	[-1.833]	[-2.026]
					0.0899	(0.0770)	(0.0523)
Dummy							-0.2978
							[-0.891]
							(0.3803)
R-squared	0.9204	0.9272	0.9206	0.9222	0,9274	0.9370	0.9387
Adjusted R-squared	0.9084	0.9135	0.9057	0.9077	0.9138	0.9174	0.9168
S.E. of Regression	0.3382	0.3286	0.3432	0.3396	0.3281	0.3211	0.3222
Log Likelihood	-9.8066	-8.0800	-9.7776	-9.3629	-8.0265	-5.2633	-4.7175
DW stat	1.2576	1.4946	1.2753	1.2955	1.2964	1.6326	1.5897
Prob (F-statiscs)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

(1) t-statistics in brackets, followed by p-values in parentheses.

Despite the theoretical importance of the investment opportunity cost, the difficulty of finding negative and significant coefficient for this variable is abundantly reported in the literature [3]. In the Brazilian case, the result found for the interest rates effect upon private investment can be explained by the common practice of Brazilian companies resorting to their own retained earnings to fund their investments. Another possible explanation for the result is that the interest rate may be related to the low availability of funds.

The importance of credit availability on the private investment is confirmed in Equation 2 (EQ2). The results show that increases in credit supply through the increases of BNDES's credit disbursements system intended for industrial sectors, increase the investment in subsequent periods, unveiling the importance of offering long-term financing lines funded with stable amounts, and designed to finance the private sector's investment projects.

The impact of public investment on the private sector's investment is tested in the Equation 3 (EQ3). The variable public investment coefficient (FBKF) is significant and has a positive sign, indicating that public investment tends to complement private investment.

The estimated coefficient for the exchange rate is negative (see EQ4 in Table 4), suggesting that a more depreciated exchange rate discourages the import of capital goods, at least in the short term, and increases the financial commitments of companies' external indebtedness.

In relation to external debt, the Equation 5 (EQ5) indicates the existence of a negative relationship between investment and external debt services. In recent years, the existence of external constraints may have limited private sector's investment. This can be explained by the increase of the private sector's external debt in the 1990s and the decrease of the public sector's participation in the fundraising and financing investment programs.

The Equation 6 (EQ6) tests all the variables together, but without the dummy variable control. The signs are coherent with the theory and they were the same if compared with the equations that were tested with each variable separately.

Finally, a variable control was included in the estimated Equation 7 for periods of economic instability, represented by a Dummy (D1), which assumes unit values for the years 1997 (Asian Crisis), 1998 (Russian crisis), 1999 (Argentina Crisis and Brazilian Exchange Rate Devaluation) and 2008 (World Crisis) and zero for periods without crisis. It is observed, from the results, a negative coefficient which indicates a negative effect on private investment variable.

4.1 Coefficients with Fixed Effects

To evaluate the specificities of each sector, we estimated the magnitude of sectoral fixed effects. Each estimated sector coefficient corresponds to the pure effect of each sector, that is, the difference in the average investment of a particular sector, compared to the annual average for the sector, which is not due to the variations in the dependent variables [6]. Thus, the coefficient represents the actual investment related to the specific factors of each industry sector, regardless the included variables in the model.

Table 5 shows the estimated coefficients sectors. It is noted that the coefficients signs vary according to the sectors, and also shows the distinctive magnitudes among the sectors and models. The sectors that have positive coefficients have invested relatively higher than other sectors during the period in question, regardless of the changes in the explanatory variables that were considered in the model. On the other hand, sectors that exhibit negative coefficients are those who, without taking into account variations in the explanatory variables, had a level of investment below the annual average per sector.

Tabela 5 Coefficients with Fixed Effects

Sectors	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7
15	0.858458	0.758991	0.852593	0.830389	0.881132	0.644522	0.597960
16	-1.477377	-1.284781	-1.426446	-1.416750	-1.504712	-1.091398	-1.089937
17	0.268283	0.255226	0.255570	0.259857	0.268896	0.233970	0.247896
18	-1.172026	-1.136179	-1.156953	-1.148507	-1.185279	-1.045358	-1.030795
19	-1.016421	-1.001485	-1.001004	-0.997517	-1.025207	-0.930483	-0.926794
20	-0.356498	-0.373803	-0.324774	-0.316142	-0.375924	-0.209512	-0.196329
21	0.815337	0.752044	0.797044	0.798238	0.820825	0.705527	0.715793
22	-0.349966	-0.210300	-0.331805	-0.328526	-0.359549	-0.157989	-0.161069
23	1.602298	1.638560	1.575055	1.567027	1.619550	1.489545	1.475811
24	0.856377	0.819212	0.846032	0.830484	0.874503	0.709110	0.676626
25	0.540872	0.548478	0.531307	0.530449	0.545114	0.507459	0.507502
26	0.280937	0.519089	0.275162	0.276563	0.281720	0.452543	0.446649
27	1.327530	1.250231	1.304057	1.296530	1.342960	1.142712	1.134296
28	-0.021863	-0.029876	-0.022579	-0.021939	-0.022197	-0.027396	-0.025343
29	0.202340	0.067000	0.156360	0.073152	0.160658	0.078905	0.214249
30	-1.581348	-1.615882	-1.574632	-1.559575	-1.597710	-1.505684	-1.470236
31	-0.171070	-0.191081	-0.173430	-0.170895	-0.172567	-0.182114	-0.174630
34	0.592623	0.532365	0.591812	0.586435	0.499989	0.380115	0.380776
35	-0.781785	-0.400374	-0.778341	-0.783552	-0.705463	-0.347895	-0.361794
36	-0.635051	-0.608970	-0.631087	-0.624206	-0.642851	-0.564619	-0.550519
R^2	0.915651	0.916269	0.916617	0.917477	0.915574	0.918429	0.919195

The results presented in Table 5 indicate that sectors 15, 17, 21, 23, 24, 25, 26, 27, 29 and 34 showed positive signs. It is observed that the intensity varies with the inclusion of the tested variables along the equations.

The case of sector 23 (Manufacture of coke, petroleum refining, production of nuclear fuels and alcohol production) which has a coefficient value of 1.602298, in the first equation, is symbolic in this aspect (see Table 5). This result can be an indication of the specifics of the petroleum industry as for investment determinant. One possible peculiarities inherent in sector 23 is the magnitude of the industry oil, which requires a significance amount of investment spending, relatively higher than those observed in the manufacturing sectors as a whole.

Moreover, the quest for self-sufficiency in oil markets by Petrobras (a government enterprise) may also have contributed to the relatively superior performance of investments in the sector.

Table 5 also indicate that sectors 16, 18, 19, 20, 22, 28, 30, 31, 35 and 36 showed negative signs. The negative sign for sector 35 (Manufacture of other transport equipment) means that it had an investment below the annual average level per sector. The negative sign can be explained by several reasons: international policies' effects (trade liberalization and exchange rate), international crises or also because of its low technological intensity.

Finally, a comparative analysis suggests that Equation 2, which tests the hypothesis of credit constraints, presents lower sectorial magnitude coefficients for sector 29. The case of sector 29 (Machinery and Equipment) is symbolic in this aspect (see Table 5). Thus, it can infer that the credit variable (EQ2), pointed out by the economic theory, as an indicator to determine investment in developing countries, is also included in the models that most explain investment in the Brazilian economy.

The Brazilian industry sectors that have reduced coefficients, close to zero, invest relatively more according to changes in the explanatory variables; in other words,

have few specific effects and are fairly well represented by the estimated models.

5 Conclusion

This study analyzed the main determinants of private investments for a twenty segments of the Brazilian manufacturing, as of a panel analysis of the period comprised between 1996 and 2010.

The estimated investment models have confirmed the relevance of the quantitative Gross Industrial Production Value and Capacity Utilization variables to explain private investment. The relationship found between the interest rate and private investment were positive and significant in the sectoral models, but the coefficient found is close to zero, suggesting that the actual interest rate increase during the years between 1996 and 2010, do not exert a negative impact over the private investment.

This empirical evidence, apparently contradicting the economic theory, may be related to this country's private investment financing conditions, which, because of the low volume of available resources, limits the businesses' investments to the use of retained earnings and bank credit.

Sectoral results also indicated that increases in the credit supply through the increases of BNDES credit system's disbursement, increased private investment in subsequent periods, confirming the hypothesis that Brazilian companies depend upon long-term funds offered by official development agencies.

The presence of instability may also be a harmful factor for investment financing, since instability creates uncertainty and hinders long-term funds sources. The negative relationship between differentiated interest rates and investment also reflects the entrepreneurs' aversion to uncertainty and instability, since the result suggests that highly volatile foreign exchange periods exert a negative effect upon the private investment. A devaluated foreign exchange rate also discourages capital goods imports and raises the financial liabilities of foreign-indebted companies, which decreases investment in the economy.

The industry-estimated coefficients (individual sectors effects of the processing industry) suggest that certain sectors, such as the industry responsible for manufacturing of other transport equipment, showed a negative sign, meaning that they had a level of investment bellow the annual average per sector. On the other hand, the other two sectors analyzed indicate that the manufacturing machinery and equipment sector and the manufacturing and assembly of motor vehicles, trailers and bodies'sectors, showed positive signs. These sectors had invested relatively more in accordance with the changes in the explanatory variables.

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References

[1] BACEN Economy and Finances. Time Series, June 3, 2012, http://www.bcb.gov.br.

[2] Bort R., *Corporate cash management handbook.* New York: Warren Gorham and Lamont RIA Group, 2004.

[3] Chirinko R.S., *Business fixed investment spending: modeling strategies, empirical results, and policy implications.* J. of Econ. Lit. (31), 1993, pp. 1875-1911.

[4] Fernandez A., *The new technologies: afinance management tool.* Actualidad Financeira 10, 2001, pp. 35-51.

[5] Ferreira J.M.G., Investiment Evolution in Brazil: An Econometric Analysis: Because there was no recovery of investment rates in the country after stabilization of inflation in 1994? In Dissertação de mestrado. FGV.EESP, 2005.

[6] Greene W H., *Econometric Analysis.* Prentice-Hall, New Jersey. 3rd Edition, 1999.

[7] Hill R. C., Griffiths W.E., Judge G. G., *Econometrics.* São Paulo: Saraiva, 1999.

[8] Hsiao C., *Analysis of panel data. Econometric Society Monographs.*

Cambridge: Cambridge University Press. No. 11, 1986.
[9] Hsiao C., *Panel Data Analysis: Advantages and Challenges.* University of Southern California. Wise Working Paper Series 0602, 2006, pp. 1-35.
[10] IBGE. *Sistema de Contas Nacionais* Consolidadas, June, 3, 2012, http://www.ibge.gov.br.
[11] IPEA, Applied Economic Researches Institute. Data available at IPEADATA, July 17, 2011, http://www.ipea.gov.br.
[12] Iturralde T., Maseda A., San José L., *The cash management routines: evidence from Spain case.* Frontiers in Finance and Economics, 2008.
[13] Lenderman D., Menéndez A.M., Perry G., Stiglitz J., *The cover of Mexican investmentafter the tequila crisis: basics economics or confidence effects?* The World Bank, September 14, 2012, http://www.lacea.org/meeting2000/DanielLederman.pdf
[14] Luporini V., Alves J., *Private investment: an empirical analysis for Brazil.* Economy and Society, 19, 2010, pp. 449-475.
[15] Melo G.M., Rodrigues Junior W., 1998. *Determinants of Private Investiment in Brasil: 1970-1995.* Texto para Discussão nº 605: IPEA – Instituto de Pesquisa Econômica Aplicada. 1-33, http://www.ipea.gov.br/pub/td/td/td_605.pdf.
[16] Parker M., *Organizational Culture and Identity.* London: Sage, 2000.
[17] Rocha C.H., Teixeira J.R., *Complementarity versus Substitution between Private and Public Investment in the Brazilian Economy:1965-1990.* Revista Brasileira de Economia 50(3), 1996, pp. 378-384.
[18] Rossiter R., *Structural cointegrationanalysis of private and public investment.* International Journal of Business and Economics 1, 2002, pp. 59-67.
[19] Santos C. H., Pires M. C. C., *Reestimativas do investimento privado Brasileiro i): qual a sensibilidade do Investimento privado "referência 1985" a aumentos na carga tributária?* Texto para discussão no 1297. Ipea, Brasilia, 2007.
[20] Serven L., *Real Exchange Rate Uncertainty and Private Investment in Developing Countries.* The World Bank, 2012, http://ideas.repec.org/p/wbk/wbrwps/2823.html
[21] Stock J.H., Watson M.W., *Econometrics.* Sao Paulo: Addison Wesley Bra, 2004.

Appendix I

Table 2. Brazilian Manufacturing Sectors

CNAE	Indústria de Transformação
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of articles of clothing and accessories
19	Preparation of leather and manufacture of leather goods
20	Manufacture of wood goods
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded
23	Manufacture of coke, petroleum refining, production of nuclear fuels

	and alcohol production
24	Manufacture of chemicals
25	Manufacture of rubber and plastic
26	Manufacture of non-metallic minerals
27	Basic metallurgy
28	Manufacture of metal products - except machinery and equipment
29	Manufacture of machinery and equipment
30	Manufacture of office machinery and computer equipment
31	Manufacture of machinery, appliances and equipment
34	Manufacture and assembly of motor vehicles, trailers and bodies
35	Manufacture of other transport equipment
36	Manufacture of furniture and miscellaneous industries