

FDI by Brazilian Firms into Portugal.

by

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0. Introduction.

The objective of this work is to describe a specific process of foreign direct investment -FDI- by a developing nation, the Federal Republic of Brazil, into a developed country, the Portuguese Republic, during the 1980's and early 1990's. The first step in this process will be to look for a theoretical explanation for the phenomenon. The following step will be the description of the specific phenomenon in a given time and place. The last step will be the estimation of a panel model and the performing of tests on our data to verify the adequacy of our theoretical base. The paper ends with a conclusion.

1. MNEs & FDI².

The growth in the number of multinational corporations (MNEs) and in the importance of FDI made necessary a search for explanations of these two developments. The first theoretical school to aim at that, know as "Industrial Organization School", was developed after 1960 and is based in the works of Stephen Hymer³. Hymer developed an almost full-fledged "Internalization Theory" in essentially Coasean terms⁴, in which the reasons for the very existence of firms -the existence of market imperfections, artificial or natural, when the elimination of the price allocation mechanisms inside firms enhances allocative efficiency- were

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²A MNE is defined as an enterprise involved in the control and management of productive units overseas. FDI is defined as all movement of capital -human, physical or financial or any combination of these three- that aims the control over the revenues and the management of any MNE. This implies a distinction between FDI and Portfolio Investment, which is merely financial and do not necessarily mean control over assets.

³"The International Operations of National Firms: A Study of Foreign Direct Investment", 1976, MIT Press, Cambridge, MA, USA. See also "The Large Multinational Corporations: an Analysis of Some Motives for International Integration of Business. With an Introduction by Mark Casson", in "Multinational Corporations", pp 3-31, Casson, M. (org.), Edward Elgar Publishing Limited, UK, 1990.

⁴Firms are an efficiency enhancing device in imperfect markets. See Coase, R. 1986.

determinant. The multinational enterprises would only represent the same kind of situation in the international markets. Therefore, it would not be necessary to have a specific explanation for the multinationalization and FDI phenomena, since they were really special cases of a general theory, that of a “Coasean Multi-Plant Firm” expanding overseas.

As a direct offspring of Hymer’s studies, we have the “Internalization School”, that bases its analysis and conclusions in the existence of transaction costs and externalities, with the same conclusions. Closely linked to this school we have John Dunning’s “Eclectic School”. Its main advantages over the previous ones are its attempt of consolidation of the existing literature on the subject, through the concepts of *Firm Specific Advantages* (FSA) -gains derived from the joint management of assets, of *market imperfections* -the possibility for the firm to internalize the advantage in a sustainable way- and of *Country Specific Advantages* (CSA) -location advantages for the installation of an affiliate in a given region or country.

2. Brazilian Multinationals.

Net FDI, GDP and Inflation Growth in Brazil (1971/92)

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
FDI net	1.0	19.0	36.8	57.5	111.9	183.0	146.2	125.2	194.2	157.1	162.5
GDP	11.3	11.9	14.0	8.2	5.2	10.3	4.9	5.0	6.8	9.2	-4.4
INFL	19.5	15.7	15.5	33.8	29.4	46.3	38.8	40.8	77.2	110.2	95.2
Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
FDI net	361.7	44.2	61.3	79.8	135.0	93.4	146.7	324.3	451.5	1048.8	83.6
GDP	0.6	-3.4	5.3	8.0	7.5	3.6	-0.1	3.2	-4.6	0.9	-1.0
INFL	99.7	211.0	223.8	235.1	65.0	415.8	1037.6	1782.9	1476.6	480.2	1158.0

source: FGV (1998) & Motta de Lima, A. (1998).

The history of the multinationalization process of the Brazilian firms begins in the seventies, the apex of long cycle of development initiated in the thirties: by them, Brazil was one of the ten biggest economies of the planet and the unquestionably regional power of South America. This development process would inevitably generate a number of enterprises with the managerial and technological

capabilities -their FSA- needed for a successful internationalization process. In the early seventies, the yearly outflow of Brazilian FDI was less than 1 US\$ million; by the end of the decade, it had grown almost 195 fold. In the early nineties, it surpassed US\$ one billion.

One of the first groups to go abroad was the former state monopoly in oil production and refining. Well into the seventies, this firm, together with the B.B. (Bank of Brazil), was responsible for almost all the Brazilian FDI stock abroad. Nevertheless, in this period, we witnessed the expansion of the internationalization to private construction, engineering and banking firms.

Construction and engineering firms were able to “go” international based in their accumulated know-how of the previous decades -the fast deployment of continent-wide transport and productive infra-structure- allied with their need to amortize the investments made in increased capacity planned for a growing domestic market that had meanwhile begun to lose momentum. Even the oil shocks in the 70’s did not slow this process, since the Middle East was one of their markets. They reached 22% of the total non-financial FDI for the period 80/90-with a maximum of 70.86% in 89, in a sustained growth trend since the 70s. The banking sector went abroad at first after the profits in the “rolling-over” of the Brazilian foreign debt.

In the 1980’s a violent reduction of the Brazilian growth rates, associated with extreme cyclical instability -partly caused by the several failed stabilization plans tried by the government- took place. This, together with the recovery of the world economy after 1983, enhanced the realization of FDI, used also as a preventive movement against the eventual regional segmentation of the world economy, diffusing the multinationalization movement throughout the Brazilian economy: almost every industry sector was able to generate a “national champion”.

An important feature of this process is the relative importance and instability of the financial industry flows (38% of the total FDI, during the period 1980-90), mostly for the installation of affiliates in international financial centers. Considering their cyclical sensitivity and their connection to the foreign-debt financial “roll-over”, we will concentrate our analysis in the non-financial flows.

Brazilian FDI at Industry Level (1980-1990, in US\$ Mil.)

Sector	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Capital G.	0.8	0.8	0.6	0.1	0.3	4.4	0.4	0.4		0.3	
Machinery	0.6	0.8	0.5	0.1	0.2	4.8	0.7	0.4			
Electric Equipment	0.2	0.2	0.2		0.2	0.3	0.3	0.3		0.3	
Intermediary G.	78.4	36.0	46.1	9.7	2.7	51.4	51.6	25.3	54.8	16.8	85.8
Mining	76.8	23.9	36.2	9.1	2.2	5.8	51.0	25.0	49.7		7.0
Mining (non-met.)		1.9	0.4								
Metallurgy	0.9	8.1	7.6	1.0		0.8	0.2	0.4			0.5
Auto-Parts	0.3	1.0	0.6		0.4	0.4	0.2		3.4	2.0	8.5
Paper and Cellulose								0.2	2.1	2.0	
Chemical/ Petro.	0.6	1.3	0.2	0.3		0.8	0.2	0.4		12.2	6.6
Rubber and Plastic	1.2	0.5	1.2	0.4						0.8	0.2
Consumer G.	17.3	3.8	25.4	16.1	36.3	2.1	27.3	39.4	8.7	2.6	1.2
i) Durable G.	2.5	7.7	3.9	3.0			2.0	4.8	5.0	2.3	0.9
-Home Appliances	2.1	7.5	3.7					0.5	5.0	2.7	
-Motor Vehicles	0.4	0.2	0.1	3.0			2.0	4.7	0.4	0.1	0.9
ii) Non Durable G.	14.7	23.2	21.6	13.2	36.3	2.1	23.3	34.7	3.7	0.3	0.3
Textiles	0.5	1.2						4.9	3.7		
Garment & Apparel		0.5	0.2		0.2			0.2		0.1	
Agro-Business	14.2	21.8	21.4	13.2	36.6	2.1	1.0	3.3	0.8	0.2	
Communication	0.3						15.3	0.9			0.3
Construction	0.5	12.4	13.3	6.2	0.5	0.2	0.9	0.2	0.1	212.8	13.4
Trading	1.2	4.3	5.5	1.9		0.4	34.3	2.9	1.5	39.4	0.7
Services	1.9	3.7	4.5	5.5		0.5	0.9	1.4	3.2	0.7	0.8
Others	1.1	12.2	3.9	0.8	0.3	0.1	14.8	2.3	41.5	28.5	13.4
Financial Services	56.9	62.4	261.4	4.5	3.5	2.8	4.9	21.6	36.8	4.7	242.7
TOTAL	157.1	162.6	361.7	44.2	61.3	79.8	135.0	93.4	146.7	304.3	357.2

source: Motta de Lima, A. (1998).

Is easy to see the importance of the flows from the intermediate goods sector (38% of the total non-financial FDI). That mirrors its weight in the Brazilian economy and also the might of the state owned oil and mining companies -Petrobrás and CVRD. In a distant second place, we have the metallurgic industry, also mostly state-owned at that period. The flows from the consumption goods sector (15% of the non-financial FDI), on its turn, reflect the importance of the agricultural sector, by then implanting warehouses and offices abroad, as a support to an export surge. In all these industries, Brazil clearly has significant comparative advantages in terms of natural endowments that were internalized by the firms, allied to legal distortions that allowed for market power in the mining and oil industries.

Occasional substantial outflows from other industries are also recorded: the auto-parts industry in 88, the wholesale and retail sector in 86, the chemical industry in 1989/90, the communications sector in 86 and weapons during the 80's. These industries' investment outflows reflect advantages that cannot be really characterized as industry wide, but that are instead group or even firm specific, due to its technology -managerial or productive- or market power.

In geographical terms, by 1982 the American continent had received over 60% of the FDI stock, this figure being reduced to 38% in 92. There are some obvious reasons for this concentration. The first one is, naturally, the United States, the biggest unified market in the planet and a comparatively open one, which is also Brazil's most important trade partner; second, the Latin American countries - specially Argentina, Chile, Paraguay and Uruguay- are markets that are not just geographically close, but whose costumers have similar preferences and tastes to the Brazilian's ones⁵. Furthermore, there are evident complementarities in natural endowments among these economies. Also, the Brazilian firms enjoy political and diplomatic leverage in this region.

Around the second half of the eighties this distribution is modified by the growth of the destinations "Tax Heavens" and "Others". The flows to tax heavens -an intermediary station to another place- grew from 14% to 46% of the total stock, reaching 86% in 1991, a year that also saw a growth of 232% of the total FDI outflow, in a clear reaction to the internal instability that ensued in the wake of the failure of a stabilization plan; in 1989 these flows had already reached 70% of the total, due to a possibly victory of the socialist left in that year's presidential elections.

⁵It is a classical behavior on the early stages of a multinationalization process to minimize risks limiting the first experiences to similar, close nations. This factor will also played a role in the Brazilian FDI in Portugal.

FDI by Country of Destiny (1962-1992, in US\$ mil.)

Country	1962/82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
USA	539.97	17.39	20.94	75.32	56.38	34.25	54.97	23.60	104.0	74.24	65.61
Cayman I.	27.54	18.36	36.08	0.13	32.12	51.89	45.47	216.77	168.58	902.96	-10.01
U. K.	38.86	2.98	3.19	0.39	1.29	1.36	42.30	3.43	130.03	12.13	-0.55
Portugal	5.87	0.00	0.00	0.12	0.59	0.45	0.13	63.48	39.80	29.72	-5.07
Argentina	71.95	0.03	0.15	2.00	0.00	0.16	0.02	1.79	1.06	7.90	20.57
Neth. Ant.	78.57	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.01
Paraguay	57.41	1.37	0.00	0.00	0.19	0.00	0.00	0.00	0.84	1.48	0.06
R. F. A.	14.95	0.02	0.10	0.18	0.29	2.22	0.16	0.07	0.00	0.10	0.11
Uruguay	36.12	0.00	0.00	0.00	0.00	0.04	0.00	0.08	0.15	0.00	-0.57
Panama	23.00	0.37	0.00	1.00	0.05	0.15	1.00	0.01	0.02	0.00	0.60
Luxem.	17.02	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.45	0.00	-0.70
Switzer.	2.16	0.00	0.00	0.00	0.00	0.09	0.00	9.95	0.00	0.00	0.02
Others	261.12	4.82	0.79	1.13	44.08	2.78	2.62	4.09	3.57	20.27	7.52
TOTAL	1174.52	45.71	61.25	80.28	134.99	93.38	146.66	324.28	451.5	1048.8	83.61

source: BACEN (Banco Central da República Federativa do Brasil).

4. Brazilian FDI in Portugal.

Portugal, Brazil's former colonial mother-country, specially after its adhesion to the European Union (EU), was clearly the European destination that witnessed the greatest increase of FDI. The average for the period 86/91 is almost 88 times bigger then the one for the period 62/85. The two available series on Brazilian FDI in Portugal differ. The reasons to explain this are two: first, ICEP's -the Portuguese Foreign Investment Institute- series is for *authorized*, not actual investment: it consistently overshoots the BACEN's -Brazilian Central Bank- figures (excluding 85 and 86); second, part of the Brazilian FDI may have come from international money markets or tax heavens.

Brazilian FDI in Portugal (In US\$ Mil.)

	1962/82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
BACEN	5,869,	0	0	118.	594.	448.	125.	63,481,	39,799,	29,724,	-5,069,
ICEP	-	-	-	104.	461.45	1,793.	336.562	97,507,	92,210,	56,874,	38,671,

The inflows, despite its almost exponential growth during the eighties, were not very large; they are also concentrated in a handful of projects. Moreover, it was fairly short-lived: it peaked in 1989 -year in which the Interbank Treaty of Mutual Investments (ITMI)⁶ was in effect- and it becomes a *net* outflow of over 5 million dollars already in 1992. The reasons for this were the violent fall of total Brazilian FDI -it reached a mere 8% of 1991's amount in 92, a violent fall, even if the 91 values were inflated by capital flight due to cyclical instability-, the cyclical downturn of the Portuguese and European economies in the early 1990's and a strategic turn towards Latin America, specially after the creation of MERCOSUL (Common Market of The Southern Cone) and of the stabilization of these economies, the ending of the preventive wave of FDI caused by the fears of a "Fortress Europe" after 1992, and also the fact that the pool of Brazilian firms that were candidates to invest in an economy like the Portuguese was already depleted⁷.

The FDI's sector distribution -based in the ICEP's and ITMI data- was concentrated in the distribution, construction and financial industries. These are domestic demand-led, low export sectors. The investment in them was therefore not planned for a EU-wide market (but it could be used as "learning ground" for some of the features of this larger market).

Brazilian firms in Portugal number around four dozen, all private, and the total and distribution of the inflows are almost totally determined by the actions of a handful of big firms. Specifically, the distribution industry flows mirrors the actions of the Pão de Açúcar Group, while the flows to the construction industry reflect the moves from the CNO and Andrade Gutierrez, and to a lesser extent, from Montreal and Wrobel groups. The flows to the banking industry are mostly linked to the actions of the Itaú Bank, and the totals for the manufacturing industry reflect the

⁶The ITMI, signed by the Central Banks of both countries, aimed to facilitate FDI flows. To achieve that, US\$ 400 millions worth of credits in their respective national currencies were prepared. Until its end, in December, 1989, only 91.6 US\$ millions were used (part of these investments were actually made in 1990), for 16 investment projects from Brazilian enterprises (of these, 4 had 73% of the total), with the following sector distribution: construction, 42%; financial sector, 26%; trading, 22%; chemical industry, 10%.

⁷The groups of firms and industries change in time, but in each given moment there will be only a specific set of enterprises capable of "going abroad", and "dead times" between each new configuration may exist.

inflows of the petrochemical industry in 89/90 and the auto-parts industry in 91/92. Finally, we have flows linked to telecommunications (TV Globo).

5. Estimation of Firm-specific Components.

In this item we'll try to estimate the firm-specific components (pooled and individual) for the firms in our sample that determine the realization of FDI. The data on capital outflows from specific firms used in this exercise is taken from the BACEN (Banco Central da República Federativa do Brasil, Central Bank of the Federal Republic of Brazil). This data is classified and the publication of the individual figures strictly controlled. The additional data on the firms is taken from FGV's (Fundação Getúlio Vargas) publications on Brazil's 500 biggest companies, based on the companies published accounts. Data from the companies' holding, instead on individual firms, was used when this was deemed necessary.

The final series used encompassed 30 firms in 14 different industrial sectors (financial services companies were excluded, due to the specific motivations of their FDI outflows), for the period 1980-89. The data used for the enterprises are Net Fixed Assets, Sales and Net Profits/Net Assets (representing endogenous advantages derived from size and market power; sustainable profitability is assumed to be a proxy for endogeneized sustainable advantages). We expect all this variables to be positively correlated with FDI.

5.1 - The Pooled Component of the Sample

The first equation estimated was an unbalanced panel, given by the following specification

$$FDI_{it} = \alpha_{it} + \beta_{it} NFA_{it} + \chi_{it} S_{it} + \delta_{it} P_{it} + \varepsilon_{it} ,$$

were $i = 1, \dots, 30$; e $t = 1, \dots, 10$, and being the variables NFA (Net Fixed Assets), S (Sales), P (Net Profits/Net Assets), in a pooled structure, were all the coefficients are constant among sample units (the differences in time and between individuals are captured by the error component), which is equivalent to a traditional OLS, with all the usual assumptions, given by

$$FDI_{it} = \alpha + \sum_{k=2}^K \beta_k x_{kit} + \varepsilon_{it}$$

and being the results the following:

N° of Usable Obs.: 260; Degrees of Freedom: 237
Standard Error: 13047.446673
 R^2 : 0.130515; R^2 centered: 0.103969
Durbin-Watson Statistic: 1.970887

Variable	Coefficient	Standard Error	Statistic T	Significance
NFA	0.075564853	0.031217834	2.42057	0.01624909
S	0.002398147	0.009956600	0.24086	0.80987182
P	9.362732142	40.406422833	0.23171	0.81696013

the regression's explanatory power is fairly low, and only the NFA is significant (but all variables are positive, as expected). There is no sing of auto correlation.

The test of other specifications of this model does not substantially change the results above. Since the results of these specifications are not satisfactory -in spite of the fact that the explanatory variables representing firm size generally had positive results⁸ - possibly due to the fact that the assumption of across the board homogeneity of the coefficients is too strong. Therefore, we'll try now a modelization that does not use this assumption.

5.2 - The Individual Component of the Sample

We will use on our panel data the technique developed by Zellner to estimation and hypothesis testing of the data units' individual specific component (See Zellner, 1962) in simultaneous seemingly unrelated equations' systems, know as SUR systems.

The estimation of a system of simultaneous equations makes sense if we assume that the disturbances in these different equations at any given moments are likely to reflect some common non-measurable or omitted factor. In our case, the general state of the economy -variable often not explicitly included in regressions of a micro-dimension analysis- probably will have similar effects in the FDI functions of the firms in our sample. This kind of correlation among the disturbances in a given time t is know as contemporaneous correlation, and its existence renders the simultaneous estimation of the system more efficient, since the estimation technique uses additional available information.

This proceeding implies the relaxing of one of the basic assumptions of the classic OLS -Ordinary Least Squares- being the less restrictive model resulting know as GLS, Generalized Least Squares. More restrictive forms like the OLS can be

⁸Earlier modelizations (Horst, T.; 1972; Vernon, R., 1971) came to the same results: possible explanations for the firm size's significance are that size dilutes the fixed costs associated with FDI, and that it's also a proxy for endogeneized sustainable advantages.

thought of as special cases of this model.

The general form of this model for our sample is given by

$$\begin{array}{rclclcl} FDI_{FIRM_{1t}} & = & \alpha_{11} + & \beta_{12} NFA_{1t,1} + & \chi_{13} S_{1t,2} + & \delta_{14} P_{1t,3} + & \epsilon_{1t} \\ FDI_{FIRM_{2t}} & = & \alpha_{21} + & \beta_{22} NFA_{2t,1} + & \chi_{23} S_{2t,2} + & \delta_{24} P_{2t,3} + & \epsilon_{2t} \\ \vdots & & \vdots & \vdots & \vdots & \vdots & \vdots \\ FDI_{FIRM_{30t}} & = & \alpha_{301} + & \beta_{302} NFA_{30t,1} + & \chi_{303} S_{30t,2} + & \delta_{304} P_{30t,3} + & \epsilon_{30t} \end{array}$$

were $t = 1, \dots, 10$.

Using the usual matrix algebra notation

$$\gamma_i = X_i \beta_i + \epsilon_i, \text{ where } i = 1, \dots, M \text{ (M=30)}.$$

γ_i and ϵ_i are coefficient vectors of (Tx1) dimensions, β_i of (K_ix1) dimensions, and X_i is a matrix of (TxK_i) dimensions, that is

$$\begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \vdots \\ \gamma_M \end{bmatrix} = \begin{bmatrix} X_1 & & & \\ & X_2 & & \\ & & \ddots & \\ & & & X_M \end{bmatrix} * \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_M \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \vdots \\ \epsilon_M \end{bmatrix}$$

or,

$$\gamma = X\beta + \epsilon$$

were γ , β and ϵ are coefficient vectors of, respectively, (MTx1), (Kx1) and (MTx1) dimensions, and X is a matrix of (MTxK) dimensions, with $K = \sum_{i=1}^M K_i$.

Our assumptions are:

- i) $E[\epsilon_{it}] = 0$, that is, all the disturbances have a zero mean;

$$\text{ii) } \left. \begin{aligned} \text{var}(\boldsymbol{\varepsilon}_{1t}) &= \text{E}[\boldsymbol{\varepsilon}_{1t}^2] = \boldsymbol{\sigma}_1^2 = \boldsymbol{\sigma}_{11} \\ \text{var}(\boldsymbol{\varepsilon}_{2t}) &= \text{E}[\boldsymbol{\varepsilon}_{2t}^2] = \boldsymbol{\sigma}_2^2 = \boldsymbol{\sigma}_{22} \\ &\vdots \\ \text{var}(\boldsymbol{\varepsilon}_{30t}) &= \text{E}[\boldsymbol{\varepsilon}_{30t}^2] = \boldsymbol{\sigma}_{30}^2 = \boldsymbol{\sigma}_{3030} \end{aligned} \right\},$$

that is, in a given equation the disturbance variance is constant over time, but each equation can have a different variance;

iii) $\text{cov ar}(\boldsymbol{\varepsilon}_{it} \boldsymbol{\varepsilon}_{jt}) = \text{E}[\boldsymbol{\varepsilon}_{it} \boldsymbol{\varepsilon}_{jt}] = \boldsymbol{\sigma}_{ij}$, were $i, j = 1, \dots, 30$; that is, contemporaneous correlation exist;

iv) $\text{cov ar}(\boldsymbol{\varepsilon}_{it} \boldsymbol{\varepsilon}_{js}) = \text{E}[\boldsymbol{\varepsilon}_{it} \boldsymbol{\varepsilon}_{js}] = 0$, to $t \neq s$ e $i, j = 1, \dots, 30$; that is, autocorrelation does not exist.

The covariance matrix of the complete disturbance vector $\boldsymbol{\varepsilon}$ is

$$\Phi = \text{E}[\boldsymbol{\varepsilon} \boldsymbol{\varepsilon}'] = \begin{bmatrix} \boldsymbol{\sigma}_{11} I_T & \boldsymbol{\sigma}_{12} I_T & \cdots & \boldsymbol{\sigma}_{1M} I_T \\ \boldsymbol{\sigma}_{21} I_T & \boldsymbol{\sigma}_{22} I_T & \cdots & \boldsymbol{\sigma}_{2M} I_T \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{\sigma}_{M1} I_T & \boldsymbol{\sigma}_{M2} I_T & \cdots & \boldsymbol{\sigma}_{MM} I_T \end{bmatrix} = \boldsymbol{\Sigma} \otimes I_T, \text{ were}$$

$$\boldsymbol{\Sigma} = \begin{bmatrix} \boldsymbol{\sigma}_{11} & \boldsymbol{\sigma}_{12} & \cdots & \boldsymbol{\sigma}_{1M} \\ \boldsymbol{\sigma}_{21} & \boldsymbol{\sigma}_{22} & \cdots & \boldsymbol{\sigma}_{2M} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{\sigma}_{M1} & \boldsymbol{\sigma}_{M2} & \cdots & \boldsymbol{\sigma}_{MM} \end{bmatrix}$$

being the matrix $\boldsymbol{\Sigma}$ symmetric ($\sigma_{ij} = \sigma_{ji}$), and assumed non-singular and, consequently, positive definite.

The estimate of the coefficients matrix in a GLS - $\boldsymbol{\beta}$ - is given by

$$\boldsymbol{\beta} = (\boldsymbol{X}' \boldsymbol{\Phi}^{-1} \boldsymbol{X})^{-1} \boldsymbol{X}' \boldsymbol{\Phi}^{-1} \boldsymbol{y} = [\boldsymbol{X}' (\boldsymbol{\Sigma}^{-1} \otimes \boldsymbol{I}) \boldsymbol{X}]^{-1} \boldsymbol{X}' (\boldsymbol{\Sigma}^{-1} \otimes \boldsymbol{I}) \boldsymbol{y}$$

To compare, the estimator for the OLS coefficients - b - is given by

$$b = (X'X)^{-1} X' r$$

In two cases, there's no efficiency gain in using β : when there is no contemporaneous correlation and when the explanatory variables are identical for all equations.

In practice, since the real covariance matrix is unknown, we use an estimate of the real matrix - $\hat{\Sigma}$ -, to generate the estimated matrix of the coefficients - $\hat{\beta}$ -. This estimator is asymptotically efficient and its distribution is asymptotically normal, and both the theoretical and empirical results indicate it's efficient and no-biased when compared with OLS estimator.

Since both our econometric packages (the TSP -Time Series Processor- and the RATS -Regression Analysis of Time Series-) were unable to process an unbalanced SUR, our sample was reduced from 30 to 16 firms that had even time series (10 years, in the 1980-89 period).

Before the estimation, we made a test to verify the existence of contemporaneous correlation in our equation's system. We used a modified version of the Lagrange Multiplier test, the Breusch-Pagan Test. The null and alternative hypotheses for this test are

$$-H_0: \sigma_{12} = \dots = \sigma_{1516} = 0$$

-H₁: at least one of the covariances is non-zero.

The statistic is given by

$$\lambda = T \sum_{i=2}^M \sum_{j=1}^{i-1} r_{ij}^2,$$

where r_{ij}^2 is the squared correlation

$$r_{ij}^2 = \frac{\hat{\sigma}_{ij}^2}{\hat{\sigma}_{ii}^2 \hat{\sigma}_{jj}^2}$$

being the null hypotheses rejected for the sample if λ , that has an asymptotic

distribution χ^2 with $M(M-1)/2$ degrees of freedom, is greater than the critical value from a $\chi^2_{(120)}$ distribution for the chosen significance level. The result of our test is $\chi^2_{(120)} = 88.00632$, being the null hypotheses rejected for a significance level of 5%.

Also the testing of a set of J linear restrictions upon the coefficients - or Wald's Test⁹ -, given by

$$\hat{g} = (R\hat{\beta} - r)'(R\hat{C}R')^{-1}(R\hat{\beta} - r) \rightarrow \chi^2_{(J)},$$

that has as null and alternative hypothesis, respectively,

$$H_0: R\beta = r; \quad H_1: R\beta \neq 0$$

and being the null hypotheses rejected for values of $\hat{g}$ greater than the critical value of the distribution $\chi^2_{(J)}$ for a pre-chosen significance level. The result for this test is $\chi^2_{(4)} = 82.410183 > 14.8603$, rejecting the null hypotheses of homogeneity of the coefficient for a significance level of 0.005%, and once more backing the choice of SUR modelization.

From the results¹⁰ of these regressions (see coefficients for the individual firms next page) we may attempt some preliminary conclusions: *the FDI may have*

⁹The imposition of homogeneity between the equations vectors of coefficients, given by $B_1 = \dots = B_M$, makes possibly to verify if the utilization of aggregated data from our micro-level data units -firms- leads or not to an aggregation bias (See Zellner, 1962). Since our sample is really not a random one, and since we're interested in the estimation of its individuals' specific characteristics, we believe there is (it's, therefore, a conditional inference problem).

¹⁰Before the estimation, a test was performed to verify the existence of contemporaneous correlation in our equation's system. We used a modified version of the Lagrange Multiplier test, the Breusch-Pagan Test. The null and alternative hypotheses for this test are $H_0: \sigma_{12} = \dots = \sigma_{1516} = 0$; H_1 : at least one of the covariances is nonzero. The statistic is given by $\lambda = T \Sigma_{l=2}^M \Sigma^{l-1}_{j=1} r^2_{ij}$, where r^2_{ij} is the squared correlation, given by $r^2_{ij} = \sigma^2_{ij} / \sigma^2_{ii} \sigma^2_{jj}$ being the null hypotheses rejected for the sample if λ , that has an asymptotic distribution χ^2 with $M(M-1)/2$ degrees of freedom, is greater than the critical value from a $\chi^2_{(120)}$ distribution for the chosen significance level. The result of our test is, $\chi^2_{(120)} = 88.01$, being the null hypotheses rejected for a significance level of 5%.

Also the testing of a set of J linear restrictions upon the coefficients -or Wald's Test, since our sample

been made by the firms in our sample as a reaction to a shrinking and unstable home market, and it happened at the same time as a downward adjustment of the domestic productive capacity (and this was more a net reduction caused by cyclical downturn than a substitution of home by overseas production, considering the several and severe import restrictions that existed at the time), existing, therefore, even at firm level, a strong cyclical component at the FDI. However, the profitability's role is much more difficult to characterize in general terms. It seems to be linked to the specific market, technological and regulatory configurations of each industry.

is not a random one, and since we're interested in the estimation of its individuals' specific characteristics, we expect an aggregation bias -, given by $g^{\wedge} = (R\beta^{\wedge\wedge} - r)' (RCR')^{-1} (R\beta^{\wedge\wedge} - r)^d \rightarrow \chi^2_{(j)}$, that has as null and alternative hypothesis, respectively, $H_0: R\beta = r$; $H_1: R\beta \neq 0$ and being the null hypotheses rejected for values of g greater than the critical value of the distribution $\chi^2_{(j)}$ for a pre-chosen significance level. The result for this test is $\chi^2_{(4)} = 82.41 > 14.86$, rejecting the null hypotheses of homogeneity of the coefficient for a significance level of 0.005%, and once more backing the choice of SUR modeling attempt.

Firm/Variable	C	NFA	S	P
Coefficient	23021.11547*	0.02794	-0.0347*	1871.35251*
Coefficient	205.7455208*	-0.0083636*	0.0075189	-3.437127*
Coefficient	3445.77145*	-0.223285*	0.008512	-110.32103*
Coefficient	2104.624095	0.465149	-0.126369**	198.961413**
Coefficient	-502.3699727*	0.0097532*	0.0103488	3.5458503
Coefficient	68.6014337	-0.0936629	0.0241865*	-2.525175
Coefficient	20.46917902**	0.00266596	-0.00270238**	0.46375232*
Coefficient	2368.15539*	1.63955**	0.170113**	55.126392*
Coefficient	295.9551894*	-0.6054201*	0.0298751*	-4.5167126*
Coefficient	708.297043	-0.045426*	0.041226	193.831673*
Coefficient	124212.9536*	-8.2127*	-0.3332	-2838.438*
Coefficient	975.4984878	-0.1030261*	-0.0768398*	217.2403526*
Coefficient	198.5351601	-0.042792	0.0021969	48.2375046
Coefficient	17.06437768	0.00563498	0.00281152	-1.92627838
Coefficient	119.8310276**	-0.0382388	-0.0005179	0.428282
Coefficient	47.2436978*	-0.01687826*	-0.00156787	*4.69939356

*: significant at 5%; **: significant at 10%.

6. Conclusion.

Our results do not support the predominance of the firm-specific component in the determination to make FDI. These results can be due to limitations in the data available to characterize the firm components and of the sample itself. The more systematically significant variables used were linked to size -a result compatible with ones from previous works, being possible explanations that the factor size reduces fixed costs associated with the FDI, and that size acts as a proxy for other characteristics of the firm. We also found indications of a downward adjustment of the domestic productive capacities, possible due to the cyclical recession, not to substitution of domestic production by imports. The rule of profitability in the process is unclear: it seems to depend on technology, market configuration and regulatory framework that are specific to each sector. In a preliminary estimation of an alternative aggregate model, we found indications of a cyclical component as determinant of the aggregated totals of foreign investment made during the period. Our results could be an element of refusal to the proposed theoretical base. Since our sample of firms, besides being small and period-specific, is made up of firms that were already MNEs, an alternative explanation to our results could be that the cyclical component determined the decision to invest abroad *in this specific case*, but only the firms with FSAs were able to use the overseas markets as an alternative to their home-markets.

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