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Brazilian Data Base for the Global Forest Sector Model

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BRAZILIAN DATA BASE FOR
THE GLOBAL FOREST SECTOR MODEL

Alfredo Iusem

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FOREWORD

The objective of the Forest Sector Project at IIASA is to study long-term development alternatives for the forest sector on a global basis. The emphasis in the Project is on issues of major relevance to industrial and governmental policy makers in different regions of the world who are responsible for forestry policy, forest industrial strategy, and related trade policies.

The key elements of structural change in the forest industry are related to a variety of issues concerning demand, supply, and international trade of wood products. Such issues include the development of the global economy and population, new wood products and substitution for wood products, future supply of roundwood and alternative fiber sources, technology development for forestry and industry, pollution regulations, cost competitiveness, tariffs and non-tariff trade barriers, etc. The aim of the Project is to analyze the consequences of future expectations and assumptions concerning such substantive issues.

The research program of the Project includes an aggregated analysis of long-term development of international trade in wood products, and thereby analysis of the development of wood resources, forest industrial production and demand in different world regions. The analysis is carried out employing a global forest sector model for which this article represents the Brazilian data.

Markku Kallio
Project Leader
Forest Sector Project

CONTENTS

BRAZILIAN DATA BASE FOR THE GLOBAL FOREST SECTOR MODEL

Alfredo Iusem

1. INTRODUCTION

The Global Trade Model (GTM) developed by the Forest Sector Project at IIASA [8] includes Brazil as one of the regions in its geographical aggregation.

Though Brazilian participation in the world market of forest products is still minor, it is widely recognized that the country has the potential for a large increase in such participation. On the production side, the huge expansion of planted areas during the seventies opened the way for the gradual substitution of exotic species (pinus and eucalyptus) for natural forest trees (e.g. araucaria), which will conclude with the virtual elimination of commercial exploitation of the natural subtropical forest by the end of the century. This expansion will make it possible for Brazil to become a large exporter of sawnwood, pulpwood and paper. At the same time, several aspects in the current situation of the forest sector cast some doubts on its ability to fulfill such prospects. They range from serious bottlenecks at some critical points (e.g. transportation) to the very severe consequences of the recession Brazil has been going through since the early eighties, whose effects on the forest sector will last for a long time, even assuming that the economy starts its recovery quite soon. Financial resources for capacity expansion have been curtailed, low relative prices of wood have caused large plantations to remain unexploited, and the introduction of technological innovation has been delayed.

On the demand side, the high rates of increase for all forest products observed during the seventies turned into virtual stagnation at the beginning of the current decade. Since demand for several products is highly

correlated to the performance of the economy at large, different forecasts of the time location of the turning point and the speed of the subsequent recovery led to widely different pictures of the demand side by the end of the time horizon of GTM.

In the following sections the data base for the Brazilian region of the GTM is presented. The data were obtained from published sources and consultations with experts and producers. The assistance of Dr. Joldes Muniz Ferreira (IPF/USP/ESALQ) and Dr. Roberto Samanez Mercado and his team at IF/UFFRJ was vital for the completion of this work.

The appendix contains the list of abbreviations used together with their expanded meaning in Portuguese and their English translation.

2. GENERAL SOCIOECONOMIC INDICATORS

These time series have been used for estimation of demand functions and production costs of forest products (Table 1).

3. CONSUMPTION OF FOREST SECTOR PRODUCTS

3.1 Fuelwood

There are no reliable estimates of fuelwood consumption. This is due partly to the fact that most fuelwood does not go through organized market channels, either because it is cut directly by the consumer from natural forests (e.g. most rural consumption for residential use) or because plantations used exclusively for fuelwood are part of the agricultural or industrial enterprises which use the fuel. Nevertheless, fuelwood represents, in volume, the largest end use of forest products in Brazil. Table 2 shows estimates of fuelwood consumption calculated by the National Energy Balance. These figures are indirectly estimated and subject to an error perhaps as high as 40%. It is believed that they are more likely to overestimate rather than underestimate real consumption.

There are also some data available on fuelwood which goes through market channels. They correspond to firewood sold by silvicultural enterprises registered with the IBDF (Brazilian Institute for Forest Development). They are subject to errors possibly of the same order of magnitude as the data in Table 1, though in this case underestimation is more likely (Table 3).

3.2 Other Forest Sector Products

Data on paper products consumption are highly reliable. Data on sawnwood and panels, adjusted versions of FAO estimates are of a lower quality. They have been revised by IBDF and further adjusted following the opinion of forest experts. The split between coniferous and nonconiferous sawnwood is subject to some degree of controversy (Table 4).

TABLE 1. Demand functions and production costs of forest products.*

Year	(1) GNP	(2) EXR	(3) DEF	(4) CPI	(5) IPI	(6) MAI	(7) PRC	(8) PUC	(9) POP	(10) RUR	(11) ILR	(12) LAB	(13) WAG	(14) OIP	(15) ELP	(16) NPP	(17) TVU
1960	56	.229	.125		21.7				70.3	55.3	46.7	22.7		3.9			9.6
1961	82	.279	.172		23.9				72.3	54.0	46.0	23.3		7.6			11.9
1962	126	.387	.261		25.8				74.4	52.8	45.2	24.0		9.9		3.6	13.7
1963	218	.617	.458		25.9				76.5	51.7	44.5	24.6		18.3		7.2	15.1
1964	417	1.234	.872		27.2				78.7	49.9	43.7	25.2	.332	33.2		10.4	16.9
1965	653	1.893	1.368		25.9		432		81.0	49.5	42.9	25.9	.551	57.9		22.	19.4
1966	909	2.220	1.889		28.5		611		83.3	48.4	42.2	26.6	.802	72.2		44	21.8
1967	1188	2.663	2.421		29.3		836		85.7	47.4	41.4	27.3	1.031	66.1		72	24.4
1968	1596	3.396	3.010		33.2		1104		88.2	46.3	40.6	28.0	1.216	67.3		72	29.0
1969	2058	4.076	3.634		37.3		1345		90.8	45.4	39.9	28.8	1.596	75.4		100	34.3
1970	2595	4.594	4.353		41.1		1512	236	93.4	44.4	39.1	29.5	1.974	84.6	67	100	40.0
1971	3401	5.287	5.241		46.0		1950	298	96.1	43.2	38.4	30.7	2.457	107.4	78	140	46.1
1972	4298	5.934	6.134	6.831	51.8		2487	378	98.9	42.1	37.7	32.0	3.107	135.7	98	200	53.0
1973	5477	6.126	7.061	7.696	60.1	64.3	3230	498	101.7	40.9	37.0	33.3	3.842	154.9	107	240	62.3
1974	7500	6.790	9.086	9.821	65.6	68.9	4619	664	104.6	39.7	36.2	34.6	4.984	225.1	131	400	72.0
1975	9840	8.126	11.60	12.67	69.3	71.4	6487	992	107.7	38.5	35.5	36.0	7.064	312.3	184	500	79.6
1976	14822	10.670	16.39	17.97	77.9	78.9	10257	1539	110.8	37.3	34.8	37.5	10.61	484.8	236	660	87.7
1977	21680	14.138	23.40	25.83	81.0	80.7	15137	2108	114.0	36.1	34.1	39.0	15.87	720.4	322	1000	97.0
1978	30616	18.063	32.45	35.82	86.9	86.9	25589	2964	117.3	34.9	33.4	40.5	23.13	965.7	448	1168	114.3
1979	48910	26.870	49.93	54.70	92.7	92.9	37669	4849	120.6	33.7	32.6	42.1	35.86	1823.0	689	1460	123.2
1980	102720	52.699	100.0	100.0	100.0	100.0	76198	9343	124.1	32.4	31.9	43.8	68.91	6636.9	1110	2880	
1981	206320	93.015	213.0	205.6	94.6	91.4			127.9	31.2	31.2	45.6	99.65	18396.2	1931	6120	
1982	395580	179.390	413.0	406.9	92.7	85.6			131.8	30.0	30.5	47.5	230.2	31840.0	4308	12680	

*See next page for explanation of abbreviations.

Explanation and sources

1. GNP: Gross National Product (Cruzeiros/capita). Source: CE (June 1970, Dec. 1979, Dec. 1980, Mar. 1982).
2. EXR: Exchange Rate (Cruzeiros/Dollar). Source: CE (Oct. 1968, Dec. 1974, Jan. 1984).
3. DEF: GNP Deflator (%, 1980 = 100.0). We have taken the IGP (General Price Index), an aggregation of wholesale, consumer, agricultural and services prices, plus construction costs, considered as the most reliable inflation indicator. Source: CE (Oct. 1968, Dec. 1974, Jan. 1984).
4. CPI: Consumer Price Index (%, 1980 = 100.0) Source: CE (Jan 1984).
5. IPI: Index of General Industrial Production (%, 1980 = 100.0) Source: CE (June 1970, Dec. 1979, Dec. 1980, Mar. 1982).
6. MAI: Index of Manufacturing Activity (%, 1980 = 100.0). Source CE. (Mar. 1973, Mar. 1983).
7. PRC: Total Private Consumption (Cruzeiros/capita/year) Source: CE (Dec. 1981, Feb. 1981).
8. PUC: Total Public Consumption (Cruzeiros/capita/year) Source: CE (Dec. 1981, Feb. 1981).
9. POP: Population (million heads). Source: IBGE. Censo Demográfico, 1960, 1970, 1980. J. Lyra Madeira and C. Cardoso da Silva Simoes. "Estimativas preliminares da população urbana e rural segundo as unidades da Federação" R. Bras. Estat. 33 (129) 3-11 (Jan./Mar. 1972).
10. RUR: Share of rural population in total (%). Source: IBGE. Censo Demográfico, 1960, 1970, 1980. J. Lyra Madeira and C. Cardoso da Silva Simões. "Estimativas preliminares da população urbana e rural segundo as unidades da Federação" R. Bras. Estat. 33 (129) 3-11 (Jan./Mar. 1972).
11. ILR: Illiteracy rate (%) Source: IBGE: Censo Demográfico 1960, 1970, 1980.
12. LAB: Labor force (million heads). Source: IBGE. Censo Demográfico 1960, 1970,1980. M.H.T.F. Henriques "Projeções da população total segundo algumas alternativas de crescimento demográfico e projeções da população economicamente ativa segundo o atual nivel de emprego" IPEA. May 1983.
13. WAG: Wage per Work Hour (Cruzeiro/work-hour). The data in this column were based on data for total salaries paid by industry divided by total workforce in 1970 and 1975 interpolated and extrapolated with indices of variation of industrial salaries. Indices for 1965-1969 correspond to industrial workers in Rio de Janeiro; indices for 1970-1982 correspond to industrial workers nationwide. Based on 2200 work hours per year. Source: CE (Sept. 1968, Dec. 1974, Feb. 1984). IBGE. Censo Industrial (Vol. Produção Física. Brasil) 1970, 1975.
14. OIP: Oil Prices (Cruzeiros/ton). Year average price of BPF (the type of fuel oil used as fuel by industry). Source: PETROBRAS Anuarios Estatísticos 1976-1980. CNP. Anuario Estatístico 1982.

15. ELP: Electricity Price (Cruzeiros/MWH) Average price paid by industry on January 1st each year. Source: Regulations of MME.
16. NPP: Annual newspaper subscription price. Data correspond to Jornal do Brasil (Rio de Janeiro). Source: JB Jan. 1st (1962-1982).
17. TVU: Number of TV units per capita. Stocks computed from production data based on a seven-year lifetime. Source: ABINEE, Anuario Estatístico (1965-1979). M. Aroucas "Equipamentos do setor Residencial Brasileiro". COPPE/UFRJ. May 1983.

TABLE 2. Fuelwood consumption by end use (in 10^6 m^3).

Year	Total	Charcoal	Residential	Agricultural	Industrial
1970	338	51	207	41	37
1971					
1972					
1973	365	67	213	41	40
1974	387	84	216	42	43
1975	408	101	219	43	45
1976	416	90	221	51	51
1977	408	89	215	51	51
1978	405	89	210	51	52
1979	416	103	205	51	53
1980	436	124	200	52	58
1981	429	113	201	52	60
1982	440	124	199	52	62

Source: MME Balanço Energético Nacional. 1983.

TABLE 3. Firewood sold by silvicultural enterprises.

Year	Quantity (10^6 m^3)	Price (Cruzeiro/m^3)
1975	30	28
1976	28	41
1977	30	54
1978	34	81
1979	36	145
1980	31	233

Source: IGBE. Silvicultura (Vol. 1, 2, 3) 1980

TABLE 4. Consumption of forest products.

Year	(1) Sawnwood Conif. (10^6 m^3)	(2) Sawnwood Nonconif. (10^6 m^3)	(3) Veneer (10^6 m^3)	(4) Plywood (10^6 m^3)	(5) Particle-board (10^6 m^3)	(6) Fiber-board (10^6 m^3)	(7) Newsprint (10^6 ton)	(8) Other Printing + Wrtg paper (10^6 ton)	(9) Household and Sanitary Paper (10^6 ton)	(10) Packaging Papers + Board (10^6 ton)
1962							.201	.133	.026	.383
1963							.207	.142	.028	.408
1964							.212	.122	.031	.433
1965	2.339	2.132	.073	.180	.010	.126	.219	.101	.035	.404
1966	2.591	2.217	.090	.192	.019	.125	.225	.128	.033	.489
1967	3.013	2.498	.104	.216	.042	.120	.231	.157	.037	.505
1968	3.092	2.480	.106	.224	.042	.163	.238	.231	.038	.552
1969	3.546	2.809	.099	.243	.081	.180	.245	.251	.044	.589
1970	3.929	3.032	.082	.294	.112	.225	.252	.271	.058	.702
1971	3.859	3.087	.101	.373	.162	.241	.271	.344	.059	.776
1972	3.754	2.761	.135	.538	.262	.281	.306	.393	.062	.838
1973	3.139	2.949	.166	.583	.312	.260	.302	.419	.089	1.083
1974	2.914	4.031	.162	.604	.359	.289	.268	.607	.097	1.317
1975	3.962	5.603	.141	.604	.407	.392	.216	.493	.106	1.064
1976	4.511	6.380	.153	.628	.458	.520	.293	.490	.125	1.367
1977	4.984	7.318	.190	.618	.541	.630	.300	.608	.142	1.424
1978	5.246	7.727	.190	.598	.541	.685	.297	.618	.164	1.618
1979	5.521	7.892	.229	.584	.550	.760	.371	.686	.199	1.911
1980	5.918	8.401	.304	.666	.645	.843	.295	.757	.229	2.147
1981							.313	.648	.225	1.823
1982							.347	.708	.241	2.032

Sources: Columns (1)-(6): FAO. Yearbook of Forest Products (1965-1980)
IBDF/COPLAN. Diagnóstico do Mercado de Madeira e Derivados (Vol. 1) 1978
BB/CACEX. Comércio Exterior-Exportaçao (1977-1980)
CIEF. Comércio Exterior do Brasil. Importaçao (1977-1980)

Columns (7)-(10): ANFPC. Relatório Estatístico 1980, 1982

4. PRICES OF FINAL PRODUCTS OF THE FOREST SECTOR

Time series of consumer prices for final products of the forest sector are available (in index form) only for two big aggregates: mechanical wood and paper. For a more disaggregated analysis, we have used as a proxy unitary production value (ratio between value of production and quantity produced) for selected products considered as representatives of the classes in the GTM classification. Such unitary production values can be considered close approximations to wholesale prices (Table 5).

5. DEMAND FUNCTIONS

On the basis of the historical series presented in the previous sections, demand functions were estimated for the individual products considered in the GTM as well as for the aggregated categories "ALL MECHANICAL WOOD" and "ALL PAPER". Tests with different combinations of socioeconomic variables and functional forms showed that all macroeconomic information could be satisfactorily represented by the GNP. Introduction of other ones, like urbanization rate or illiteracy rate, provided no additional explanatory power. Also, the experiments showed that the adjustment attained with a Cobb-Douglas function was not improved through the use of more complicated functional forms. So the demand model was specified as:

$$\ln g_i = \alpha_i \ln p_i + \beta_i \ln y + \gamma_i \qquad (1)$$

where:

g_i = quantity consumed of product i (in 10^6 m^3 for mechanical wood and 10^6 metric tons for paper)

p_i = price of product i (80'US$/$m^3$ for mechanical wood, (80'US$/ton for paper)

y = GNP (10^9 80' US$)

Prices and GNP were deflated to 1980 cruzeiros using column 3 in Table 1 and then converted into 1980 dollars at the rate of 52.699 cruzeiros per dollar (Table 6).

Values in the first line in each box for the columns α_i, β_i, γ_i show the estimated elasticities, i.e. the values of α_i, β_i, γ_i estimated from equation (1). Values in the 2nd line in each box are the corresponding t-values for the regression. An asterisk indicates that the estimated elasticity is not statistically meaningful, as indicated by the t-values. In other words demand for such products does not seem to be driven by prices (0 elasticity). From the point of view of GTM, demand for such products (panels, household paper and packaging paper) should be considered as exogenously determined (with a time profile which depends on the GNP projection corresponding to each scenario). In the case of panels, an alternative would be to use the price elasticity estimated for the category "ALL MECHANICAL WOOD" whose value (-.75) is reasonable and statistically meaningful.

TABLE 5. Consumer prices of forest products.

Year	(1) Conif. Sawnwood (CR/m^3)	(2) Non-conif. Sawnwood (CR/m^3)	(3) Veneer (CR/m^3)	(4) Plywood (CR/m^3)	(5) Particle-Board and Fiberboard (CR/m^3)	(6) Newsprint paper (CR/ton)	(7) Other printing + writing paper (CR/ton)	(8) Household and sanitary paper (CR/ton)	(9) Packaging papers + board (CR/ton)	(10) All mechanical Wood Index (%, 1980 = 100)	(11) All paper Index (%, 1980 = 100)
1965		30			61	238			455		
1966		40			78	284			632		
1967		55	204	193	127	342			850		
1968		81	271	272	156	398			894		
1969		130	303	311	206	455			1038	3.69	3.88
1970	162	147	312	521	203	635	1204	1389	1267	3.80	4.82
1971										4.98	5.99
1972										7.42	6.80
1973	553	392	609	577	480	1199	2132	2683	2238	10.6	8.12
1974	807	486	967	1347	592	2192	3921	5364	3715	13.1	12.9
1975	905	624	1010	1912	752	3114	3623	6902	3810	14.3	15.1
1976	1153	825	1507	2487	1266	3688	4385	7248	5170	17.8	18.0
1977	1479	1164	1863	2788	1611	4906	5764	10077	6984	24.7	25.1
1978	2098	1358	2374	4369	2105	6829	7806	14193	10181	35.3	33.7
1979	3764	2429	3994	6166	3286	9785	9404	21143	14913	50.2	51.5
1980										100.	100.
1981										275.	207.
1982										456.	429.

Sources: Columns (1)-(9): IBGE. Censo Industrial (Vol. I: Produção Física, Brasil) 1970, 1975

IBGE Pesquisa Industrial. 1965-1969, 1973, 1974, 1976-1979.

Columns (10), (11): CE (Mar 1971, Jun. 1971, Feb. 1984)

TABLE 6. Demand functions estimation

Products	No. of observations q_i	No. of observations p_i	α_i	β_i	γ_i
Sawnwood (Coniferous)	16	8	-.85	1.17	-.492
			(-8.03)	(10.02)	
Sawnwood (Nonconiferous)	16	13	-.77	1.75	-3.861
			(-3.88)	(9.95)	
Veneer	16	11	(.34)*	.78	-7.567
			(.76)	(6.00)	
Plywood	16	11	(.08)*	1.14	-6.969
			(.32)	(6.11)	
Particleboard	16	13	(2.57)*	2.24	-25.067
			(1.01)	(5.80)	
All mechanical wood	16	14	-.75	1.08	-3.103
			(-7.34)	(19.56)	
Newsprint	21	13	-.46	.50	-1.082
			(-3.17)	(5.92)	
Printing & writing paper	21	8	(.35)*	1.31	-9.606
			(1.50)	(6.63)	
Household & sanitary paper	21	8	-.33	1.70	-8.697
			(-2.39)	(14.20)	
Packaging paper & paperboard	21	13	(.25)*	1.24	-7.749
			(1.03)	(22.47)	
All paper	21	14	(-.04)*	1.14	-5.099
			(-.17)	(16.80)	

6. FOREST RESOURCES (PLANTATIONS)

6.1 Planted Area

Table 7 shows planted areas which were subsidized by IBDF. S-CS indicates South and Center-South states (Rio Grande do Sul, Santa Catarina, Parana, São Paulo, Rio de Janeiro, Espiritu Santo e Minas Gerais). R indicates the rest of the country (Table 7).

For different reasons, only a fraction of the subsidized areas shown in Table 7 become productive. We have assumed this fraction to be 90% in the South and the Center-South and 50% in the rest of the country. We remark that more than 99% of the planted areas receive the IBDF subsidy.

Parts of the planted forests are used only for fuelwood, mainly to be used in steel factories (in recent years, other industrial sectors are planting their own fuel forests). These areas are included in the figures shown in Table 7, but they required a different treatment since their rotation plan is somewhat different. Productive areas used exclusively for fuelwood are shown in Table 8.

TABLE 7. Planted Areas (Hectares).

	Coniferous		Nonconiferous	
Year	S-CS	R	S-CS	R
1967	18158		13838	38
1968	60898		29359	889
1969	99797		52562	1239
1970	119125	780	80560	3049
1971	96062	940	119673	9379
1972	101041	18	157255	15733
1973	83459	2717	133715	27492
1974	76732	3872	147496	40845
1975	80508	13712	149137	73579
1976	67031	19990	170091	92239
1977	81417	17858	142449	51903
1978	100580	40145	170279	57789
1979	81842	36100	166639	115771
1980	64750	23900	145550	126000
1981	57920	59420	129035	100640
1982	57555	100780	133415	53400

Source: IBDF Reports (1983)

TABLE 8. Planted areas used for fuelwood (Hectares).

Year	Coniferous	Nonconiferous
1967	6197	4727
1968	12112	5938
1969	20385	11214
1970	29262	20136
1971	24687	31920
1972	26102	42877
1973	25236	44250
1974	25900	54069
1975	29791	58315
1976	26933	76294
1977	36335	68137
1978	43685	71948
1979	21735	49263
1980	18547	51204

Source: IBDF Reports (1983)

6.2 Yields

In order to estimate yields, 3 productivity levels were considered, excluding fuelwood forests. The areas in Table 7, net of fuelwood forests (Table 8) are assumed to be distributed by levels as shown in Table 9.

TABLE 9. Fraction of nonfuelwood plantation areas corresponding to each level.

Levels	I	II	III
Coniferous	.4	.3	.3
Nonconiferous	.3	.4	.3

Source: Information provided by members of the IPF (ESALQ/USP, Piracicaba) research group

Yields for each level are given in Tables 10 and 11 in stereo/hectare ($1\ m^3 = 1.38$ stereo).

Total yields of nonconiferous fuelwood plantations are assumed to be the same as nonconiferous nonfuel plantations Level III (and, of course, 100% is used as fuelwood). Coniferous fuelwood plantations are assumed to have an 18 year rotation plan (with cuts in years 6, 12 and 18) with an average yield of 233 stereo/hectare.

7. 1980 PRODUCTION AND CAPACITY

Table 12 shows 1980 production and capacity for all the items of interest for the GTM. Data on plantations were calculated from Tables 8-11 (areas in Table 8 were adjusted as indicated according to the South and Center-South vs. rest of the country split). Data on natural forests were estimated so as to fit with production of mechanical wood (given the I/O coefficients in Table 14), and are considered as reasonable estimates by forest experts. Data on pulp and paper (excluding recycled paper) came from ANFPC Relatório Estatístico (1980). Data on mechanical wood products and recycled paper were estimated with the help of the IF/UFRRJ research group (Table 12).

There is considerable disagreement on mechanical wood figures. (Pulp and paper figures, on the other hand, are very reliable). We give in Table 13 other estimates of 1980 production. FAO-IBDF/COPLAN data come from IBDF/COPLAN: Diagnóstico do Mercado de Madera e Derivados. IPF/USP data are from IPF/ESALQ/USP: Brasil Florestal (Ano 2000) (1982). We consider the estimate from IF/UFRRJ to be more reliable than the other two. We note that the consumption historical series (Table 4, Columns 1-6) are consistent with the FAO-IBDF/COPLAN estimates.

TABLE 10. Yields of nonfuel nonconiferous plantations (stereo/hectare).

Period of plantation	Cut / Level	Logs			Pulpwood			Fuelwood			Total		
		I	II	III	I	II	III	I	II	III	I	II	III
Up to 1971	1st cut (year 6)	-	-	-	124	106	90	31	27	23	153	133	113
	2nd cut (year 12)	19	17	14	82	71	61	25	22	19	126	110	94
	3rd cut (year 18)	19	17	14	82	71	61	25	22	19	126	110	94
1972-1975	1st cut (year 6)	-	-	-	138	120	102	34	30	25	172	150	127
	2nd cut (year 12)	21	18	15	89	84	67	28	24	20	138	120	102
	3rd cut (year 18)	21	18	15	89	84	67	28	24	20	138	120	102
After 1976	1st cut (year 6)	-	-	-	189	161	140	47	41	35	236	205	175
	2nd cut (year 12)	31	27	23	135	117	99	41	36	31	207	180	153
	3rd cut (year 18)	28	25	21	123	106	92	38	33	27	189	164	140

Source: Information provided by members of the IPF (ESALQ/USP, Piracicaba) research group.

TABLE 11. Yields for nonfuel coniferous plantations (stereo/hectare).

Cut \ Level	Logs			Pulpwood			Fuelwood			Total		
	I	II	III	I	II	III	I	II	III	I	II	III
1st cut (Year 8)	5	3	-	30	26	20	7	5	4	42	35	24
2nd cut (Year 10)	10	8	3	30	26	22	8	7	5	48	41	30
3rd cut (Year 12)	20	17	10	25	23	22	9	8	6	54	48	38
4th cut (Year 15)	30	27	25	20	18	11	10	9	7	60	54	43
5th cut (Year 19)	50	38	31	20	17	12	14	11	9	84	65	52
6th cut (Year 25)	380	318	228	90	65	42	94	57	54	564	460	324

Source: Information provided by members of the IPF (ESALQ/USP, Piracicaba) research group

TABLE 12. 1980 Production and capacity

	Production	Capacity
Large Trees (Plantation) (C) (10^6 m^3)	5.06	*
Large Trees (Plantation) (NC) (10^6 m^3)	1.67	*
Small Trees (Plantation) (C) (10^6 m^3)	6.76	*
Small Trees (Plantation) (NC) (10^6 m^3)	16.21	*
Natural Forest (C) (10^6 m^3)	12.27	*
Natural Forest (NC) (10^6 m^3)	29.83	*
Sawnwood (CC) (10^6 m^3)	2.50	3.80
Sawnwood (NC) (10^6 m^3)	9.50	14.60
Veneer (10^6 m^3)	.22	.34
Plywood (10^6 m^3)	.40	.60
Particleboard (10^6 m^3)	.65	1.00
Fiberboard (10^6 m^3)	.84	1.29
Mechanical Pulp (10^6 T)	.22	.25
Semi-Mechanical Pulp (10^6 T)	.15	.18
Chemical Pulp (B) (10^6 T)	1.79	2.10
Chemical Pulp (U) (10^6 T)	.93	1.10
Newsprint (10^6 T)	.11	.13
Printing & Writing (10^6 T)	.87	1.09
Household & Sanitary (10^6 T)	.23	.29
Packaging & Board (10^6 T)	2.02	2.52
Recycled Paper (10^6 T)	.87	*

TABLE 13. 1980 Production of Mechanical Wood ($10^6 m^3$)

	FAO-IBDF/COPLAN	IPF/USP	IF/UFRRJ
Sawnwood (conif.)	6.20	6.07	2.50
Sawnwood (nonconif.)	8.68	6.07	9.50
Veneer	.22		.22
Plywood	.82	.58	.40
Fiberboard	.84	.92	.84
Particleboard	.65		.65

8. INPUT-OUTPUT INFORMATION

Table 14 shows input output coefficients fit to the GTM format. Data on plantation were estimated from Tables 8-11. Data on natural forest were obtained from consultations with IF/UFRRJ. Data on mechanical wood, pulp and paper were obtained from industrial enterprises. T_1, T_2 and T_3 refer to the three technology levels considered by GTM. For the Brazilian case, we have considered T_1 and T_2 as one technology representing an average of the existing processes while T_3 represents new equipment (when data on such were available). Circled + or - signs mean missing information, the sign indicating the sign of the missing coefficient. Blanks are zeroes and circled figures indicate less reliable data. C and NC refer to coniferous and non-coniferous, respectively. Following GTM notation, large trees are those which produce logs and small trees are those which don't (Table 14).

9. COST STRUCTURE

9.1 Silvicultural Costs

These costs were estimated following the activity inputs list in "Formação, Manejo e Exploração de Florestas com Espécies de Rápido Crescimento" (IBDF, 1981). Costs of inputs were obtained directly from suppliers except for labor, which came from IE V. 13 Nos 3, 5, 8 (March, May and August 1983).

Table 15 contains a list of activities, year classes to which they apply, and cost per hectare in 80' cruzeiros.

9.2 Harvesting Costs

A similar approach was followed for harvesting costs. In Table 16 costs are given for the various harvesting activities. C I, C II, C III, NC I, NC II, NC III indicate coniferous plantation, Levels I, II and III and nonconiferous plantations Levels I, II and III, following the classification in Tables 9-11. CF and NCF indicate coniferous and nonconiferous fuelwood plantations respectively.

TABLE 14. 1980 Input-output matrix.

	Large tree (PL)		Small tree (PL)		Nat.forest		Sawnwood (C)			Sawnwood (NC)			Veneer			Plywood			Particleboard			Fiberboard		
	C	NC	C	NC	C	NC	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Logs (C)	.20				.67		-2.9	-2.9	-2.9				-	-	-	-	-	-						
Logs (NC)		.15				.90				-3.0	-3.0	-3.0												
Pulpwood + chips (C)	.63		.04		.23																			
Pulpwood + chips (NC)		.65		.54																				
Fuelwood	.17	.20	.96	.46	.10	.10	1.9	1.9	1.9	2.0	2.0	2.0		+	+	+	+	+	+					

	Mech. pulp			Semimech. pulp			Chem. pulp (B)			Chem. pulp (U)		
	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Logs (C)												
Logs (NC)												
Pulpwood + chips (C)	-2.0	-2.0	-1.52				-	-	-	-5.0	-5.0	-4.0
Pulpwood + chips (NC)				-2.63	-2.63	-2.22	-	-	-	-4.34	-4.34	-3.85
Fuelwood												

	Recycled pulp			Newsprint			Prtg & Wrtg			Household & Sanit.			Packaging & Board		
	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3	T_1	T_2	T_3
Mech. pulp				-.71	-.71	-.71							-	-	-
Semimech. pulp													-	-	-
Chemical pulp (bleached)				-.20	-.20	-.20	-.91	-.91	-.77	.-96	.-96	-.96	-	-	-
Chemical pulp (unbleached)													-	-	-
Other fibers															
Recycled pulp				-	-	-	-	-	-	-	-	-	-	-	-
Recycled paper	-	-	-												

TABLE 15. Silvicultural costs by activity.

	Conifer		Nonconifer	
	Year Classes	Cost 80' Cr/ha	Year Classes	Cost 80' Cr/ha
Land clearing	0	6547	0	6547
Road construction	0	2367	0	2367
Lime application	-	-	0	2646
Light harrowing	0	2210	0	2210
Planting trench preparation	0	327	0	327
Fertilization	-	-	0	3273
Irrigation(1)	0	437	0	437
Planting	0	4805	0	4136
Replanting(2)	0	301	0	301
Eradication of ants 1	0, 8, 11, 15, 19, 25	737	0, 6, 12, 18	737
Eradication of ants 2	1, 9, 12, 16, 20	368	1, 7, 13	368
Eradication of ants 3	2, 7, 10, 14, 17, 18, 21-24	124	2, 4, 7-10, 13-16	124
Mechanized cleaning of stands	2, 3	262	1	262
Semimechanized cleaning of stands	1 (twice)	693	0, 1	693
Road maintenance	1-25	683	1-18	683
Firebreak maintenance	1-25	347	1-18	347
After cut cleaning	-	462	7, 13	462

(1) Applies to 20% of plantations.
(2) Applies to 15% of plantations.

TABLE 16. 1980 Cost structure of harvesting transportation

Activity	Type of Plantation	Cost (80' Cr/m^3) Labor	Fuel	Machinery	Total
Felling, debranching, bucking and piling	NC I, NC II, NC III, NCF	21.8	15.1	28.0	64.9
Mechanical debarking	NC I, NC II, NCF	20.4	11.0	13.2	44.6
Primary transportation	NC I, NC II, NCF	2.7	6.1	7.1	15.9
Mechanical loading	NC I, NC II, NCF	1.5	5.7	6.9	14.1
Manual debarking and primary transportation	NC III	69.3	-	-	69.3
Manual loading	NC III,	5.3	-	-	5.3
Felling and bucking	CI, CII, CIII, CF	14.0	6.3	11.7	32.0
Debranching and piling	CI, CII, CF	23.1	-	-	23.1
Primary transportation	CI, CII, CF	8.8	19.9	22.5	51.2
Mechanical debarking	CI, CII, CIII, CF	14.7	10.8	13.1	38.6
Mechanical loading	CI, CII, CF	1.9	7.3	8.8	18.0
Manual debranching pulling and piling	C III	41.6	-	-	41.6
Manual loading	C III	41.6	-	-	41.6

9.3 Mechanical Wood Production

Table 17 gives the cost structure for coniferous sawnwood and plywood (it was not possible to estimate similar costs for other products or for the pulp and paper industries). The information was provided by private manufacturers.

TABLE 17. 1980 Cost structure for sawnwood and plywood (80' Cr/m^3)

	Coniferous sawnwood	Plywood
Interest & depreciation	111	3446
Labor	746	1478
Electricity and fuels	174	2145
Chemicals	39	1282
Packaging materials	93	-
Maintenance	20	612
General overhead	193	1505
Other costs	38	250
Wood (excluding fuelwood)	1320	5276

9.4 Input Costs

9.4.1 Energy

Table 18 gives 1980 energy inputs for mechanical wood. Table 19 provides the energy mix for the years 1979-1981, when the second oil shock took place. Data for both tables are based on CNP estimates.

An alternative source for pulp and paper (ANFPC, Relatorio Estatístico, 1980) gives the following percentages:

OIL: 57.3, FUELWOOD: 20.00; ELECTRICITY: 17.2, COAL: 5.5

Table 20 shows the cost of energy inputs for 1980-1983. OIL and ELECTRICITY costs are from columns 14 and 15 in Table 1. COAL cost (6 GCAL/Ton, 25% ashes) are from: CNP: 'Anúario Estatístico 1983).

9.4.2 Labor costs

Table 21 gives labor costs, in current cruzeiros/working hour. Social costs (about 20%) are not included. Data for "mechanical wood industries" include all "forest industry" workers, most of whom are closer to agricultural workers and have lower salaries. "Pulp and paper" data are better approximations for more advanced mechanical wood industries (e.g. panels).

Data for "all industrial workers" have the same source as column 13 in Table 1. Data for "mechanical wood workers" were obtained from: IBGE, Pesquisa Industrial (1981-1982), dividing total payroll by number of workers (based on 2200 work hours/year). Data for "pulp and paper workers" comes from ANFPC, "Anúario Estatístico" (1980-1982). Data for "forest industry workers" are a weighted average of "mechanical wood workers" and "pulp and paper workers".

9.4.3 Wood inputs

Table 22 gives wood cost at mills in 1983 estimated with the help of the IF/UFRRJ research group.

9.5 Transportation

In Brasil Forestal, Ano 2000 (IPF/ESQALQ/USP, 1982) transportation costs for wood in 1980 were estimated as

$$c = .0584\, h + .0636$$

where c is the cost in 80' US$/m^3 and h the haul in km. A very rough approximation for the average haul indicates 75 km for nonconiferous and 125 km for coniferous. On this basis, a reasonable estimate of transportation marginal cost as a function of quantity transported, based on a radial expansion, gives

$$p = \begin{cases} .64\sqrt{q} + .06 & \text{for nonconiferous} \\ 1.49\sqrt{q} + .06 & \text{for coniferous} \end{cases}$$

TABLE 18. 1980 Energy inputs for mechanical wood production

	Oil (liters/ton)	Electricity (KWN/ton)	Fuelwood (m^3/ton)
Plywood	185	73	.50
Veneer	131	73	.20
Particleboard	124	73	.53
Fiberboard	257	73	-

TABLE 19. Energy mix for mechanical wood and pulp and paper.

	Pulp and paper			Mechanical wood		
	1979	1980	1981	1979	1980	1981
Oil	68.95	61.36	47.15	88.31	82.31	64.36
Gas	.02	.00	.00	.25	.29	.33
Fuelwood	10.88	17.03	19.96	6.56	12.50	30.53
Electricity	15.56	16.13	18.35	4.88	4.90	4.77
Coal	4.59	5.48	14.53	.00	.00	.00
Total	100.00	100.00	100.00	100.00	10.00	100.00

TABLE 20. Costs of fuels (current cruzeiros).

		1980	1981	1982	1983
Electricity	(Cr/KWh)[1]	1.11	1.93	4.31	9.81
Oil	(Cr/ton)[2]	6637	18396	31840	47000
Coal	(Cr/ton)[1]	886	2214	5557	11205

[1]Prices for January 1st
[2]Year averages

TABLE 21. Labor costs (current cruzeiros/working hour)

	1980	1981	1982
all industrial workers	68.9	99.6	230.2
forest industry workers	60.0	86.2	200.2
pulp and paper workers	106.9	154.7	356.9
mechanical wood workers	44.3	64.1	148.0

TABLE 22. Wood costs at mills in 1983.

	80' Cr/m^3
Pine logs	3120
Eucalyptus logs	700
Pine pulpwood	1560
Eucalyptus pulpwood	350

where p is the cost in 80' US$/ m^3 and q is the quantity transported in $10^6 m^3$.

9.6 Summary of Production Costs

We present here a summary of the cost estimates of the previous paragraphs converted into 1980 US $/ ha .

9.6.1 Silvicultural (80' US$ /ha)

Coniferous:	37
Nonconiferous:	49

9.6.2 Harvesting (80' US$/$m^3$)

Nonconiferous:	2.7
Coniferous (Levels 1, 2 and fuelwood):	3.9
Coniferous (Level 3):	2.9

9.6.3 Transportation (80' US $/$m^3$)

Coniferous:	4.4
Nonconiferous:	7.4

9.6.4 Mechanical wood production (80' US $ / m^3)

	Fixed costs	Variable costs	Total
Coniferous sawnwood	2.1	24.7	26.8
Plywood	65.4	138.2	205.6

10. EXPORTS

Table 23 gives the ten main importers of Brazilian forest sector products together with the quantity imported and the transportation cost.

Quantities were obtained from BB/CACEX Comércio Exterior, Exportação (1980). Transportation costs by road were taken from Brasil Florestal. Ano 2000 (IPF/ESALQ/USP, 1982). Transportation costs by ship were estimated from Freight conference data provided by SUNAMAM for 1984. They were adjusted to 1980 assuming a 15% real increase between 1980 and 1984. Bunker taxes, 5% for agent commission and 318 Cr/ton for dock charges are included.

TABLE 23. Export quantities and transportation costs

Sawnwood and panels			Pulp		
Country	Quantity 10^3 tons	Cost 80' Cr/ton	Country	Quantity 10^3 tons	Cost 80' Cr/ton
USA (from Santos)	115	4737	Belgium	214	5262
USA (from Belem)	115	4737	Japan	204	7621
Argentina (*)	76	6990	Norway	120	6045
West Germany	68	3392	USA	101	4859
England (from Santos)	65	3879	Argentina	41	3791
Venezuela (*)	50	3756	Italy	37	4968
Netherlands	39	3392	England	37	5673
Canada	39	4737	West Germany	33	5262
South Africa	38	5214	Netherlands	30	5262
England (from Belem)	35	3836	China	13	7241

Paper			Roundwood and chips		
Country	Quantity 10^3 tons	Cost 80' Cr/ton	Country	Quantity 10^3 tons	Cost 80' Cr/ton
Nigeria	36	5435	Japan	6	6432
Argentina	27	3411			
Hong Kong	11	7179			
India	8	4815			
Ecuador	8	3931			
Paraguay (*)	7	4680			
Australia	7	7462			
Iran	6	4815			
England	6	4829			
Lebanon	5	6015			

(*) road transportation

11. SUBSIDIES AND TARIFFS

Government action involving the forest sector acts mainly through incentives to silvicultural activities and subsidies and barriers in the foreign trade sector.

All plantations are subsidized by IBDF through very low interest credit using the scale indicated in Table 24 (information provided by forest experts from IF/UFRRJ).

Foreign trade incentives and barriers are much harder to quantify. A minimum subsidy on all exported goods of 11% of FOB value applies. In addition, special incentives are used for specific products and destinations. Also, a large set of specific regulations, many of them enacted or reinforced during the last few years as a consequence of the hard currency crises, tends to discourage imports. A few general qualitative regulations are:

No sawnwood imported

No sawnwood exported

Even these regulations are sometimes overruled by special bilateral trade agreements. In 1980, for instance, 60000 tons of sawnwood were imported from Paraguay and 6000 tons of roundwood were exported to Japan.

12. FUTURE PERSPECTIVES

During the seventies, projections of the future behavior of the Forest sector assumed a large expansion of planted areas and a constant high rate of GNP increase. Based on the projections made in "Brasil Forestal, Ano 2000" (IPF/ESALQ/USP) which include highly disaggregated forecasts for different products, end uses, etc., we have constructed two optimistic scenarios.

Scenario 1 assumes 260000 ha/year planted from 1985 on and 50% increase over current yields for forests planted after 1985.

Scenario 2 assumes 500000 ha/year planted from 1985 on and current yields.

Both scenarios should assume 8% increase per year in GNP and capacity (with 1985 figures equal to 1980 for both capacity and GNP)

However, the recession in the early eighties has made these forecasts excessively optimistic, as can be seen from recent plantation area (Table 25).

Many experts feel that such a stagnation picture could persist for quite a long time. Based on such gloomy expectations we have built two pessimistic scenarios, 3 and 4. Both assume 120000 ha/yr planted up to 1990 and 200000 ha/yr later on. Scenario 4 assumes that current yields will be maintained, while scenario 5 assumes a yield increase, obtained by changing the share of levels (see Tables 9-11) as shown in Table 26.

Using the year structure and yields of currently existing forests (Table 9-11) plus the hypothesis of the four scenarios, we set time profiles for I/O coefficients for plantations and available volumes shown in Table 27, where LC, LNC, SC and SNC refer to large coniferous, large nonconiferous,

small coniferous and small nonconiferous trees respectively (see section 8 for the definition of large and small trees). Other I/O coefficients (including those for natural forests) are kept constant along time in the four scenarios. Available volume from natural forests are expected to have the time profile shown in Table 28, in all the four scenarios.

Scenarios 3 and 4 may be overly pessimistic. A "middle of the road" scenario could be built by averaging the four preceding scenarios (both I/O coefficients and available volumes) and assuming that both GNP and capacity expand at an annual rate of 5%.

TABLE 24. Silvicultural Subsidies (1984 data in 80' Cr/ha)

Nonconiferous:	Implantation only	Implantation & maintenance
with land clearing	21819	28832
without land clearing	15174	26495
Coniferous (average):	11688	

TABLE 25. Recent plantation areas (10^6 ha).

	Approved plantation area			Expected productive plantation area		
	Pinus	Eucalyptus	Total	Pinus	Eucalyptus	Total
1980	.089	.272	.360	.070	.194	.264
1981	.117	.330	.347	.082	.167	.248
1982	.158	.186	.345	.102	.147	.249
1983	.074	.091	.164	.052	.067	.119

Source: IBDF Reports (1983)

TABLE 26. Share of yield levels for scenarios 3 and 4 after 1985. Both scenarios should assume that GNP and capacity increase 1% a year from 1985 to 1990 and 2% a year after 1990.

Scenario 3				Scenario 4			
Levels	I	II	III	Levels	I	II	III
Coniferous	.4	.3	.3	Coniferous	.7	.3	.0
Nonconiferous	.3	.4	.3	Nonconiferous	.7	.3	.0

TABLE 27. I/O Coefficients and available volume ($10^6 m^3$) for scenarios 1-4.

Scenario 1	1985				1990				1995				2000				2005				2010			
	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC
Logs (C)	.35				.38				.58				.55				.54				.60			
Logs (NC)		.14				.14				.14				.12				.14				.14		
Pulp & chips (C)	.49				.45				.26				.29				.30				.24			
Pulp & chips (NC)		.66		.56		.66		.46		.66		.48		.68		.46		.66		.43		.66		.43
Fuelwood	.16	.20	1.00	.44	.16	.20	1.00	.54	.16	.20	1.00	.52	.16	.20	1.00	.54	.16	.20	1.00	.57	.16	.20	1.00	.57
Available volume	7.39	8.43	9.07	33.49	11.28	21.17	15.70	45.67	37.45	14.79	16.18	44.12	38.68	30.93	20.07	45.53	36.11	44.02	20.26	49.15	55.84	44.02	20.26	49.15

Scenario 2	1985				1990				1995				2000				2005				2010			
	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC
Logs (C)	.35				.38				.52				.52				.51				.59			
Logs (NC)		.14				.14				.14				.14				.14				.14		
Pulp & chips (C)	.49				.45				.32				.32				.33				.25			
Pulp & chips (NC)		.66		.56		.66		.50		.66		.49		.66		.49		.66		.44		.66		.44
Fuelwood	.16	.20	1.00	.44	.16	.20	1.00	.50	.16	.20	1.00	.52	.16	.20	1.00	.51	.16	.20	1.00	.56	.16	.20	1.00	.56
Available volume	7.39	8.43	9.07	33.49	11.28	21.17	20.88	53.01	42.08	14.79	18.31	50.89	41.31	37.82	29.38	54.28	41.26	42.25	26.75	59.43	73.19	42.25	26.75	59.43

Scenario 3	1985				1990				1995				2000				2005				2010			
	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC
Logs (C)	.35				.38				.62				.59				.57				.56			
Logs (NC)		.14				.14				.14				.14				.14				.14		
Pulp & chips (C)	.49				.45				.22				.25				.27				.28			
Pulp & chips (NC)		.66		.56		.66		.35		.66		.37		.66		.50		.66		.49		.66		.46
Fuelwood	.16	.20	1.00	.44	.16	.20	1.00	.65	.16	.20	1.00	.63	.16	.20	1.00	.50	.16	.20	1.00	.51	.16	.20	1.00	.54
Available volume	7.39	8.43	9.07	33.49	11.28	21.17	14.32	21.85	34.44	14.79	11.58	20.30	32.07	17.25	12.34	23.51	27.82	20.31	9.40	23.78	26.49	24.39	10.65	25.19

Scenario 4	1985				1990				1995				2000				2005				2010			
	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC	LC	LNC	SC	SNC
Logs (C)	.35				.38				.63				.60				.59				.56			
Logs (NC)		.14				.14				.14				.14				.14				.14		
Pulp & chips (C)	.49				.45				.21				.24				.25				.28			
Pulp & chips (NC)		.66		.56		.66		.33		.66		.35		.66		.48		.66		.46		.66		.44
Fuelwood	.16	.20	1.00	.44	.16	.20	1.00	.67	.16	.20	1.00	.65	.16	.20	1.00	.52	.16	.20	1.00	.54	.16	.20	1.00	.56
Available volume	7.39	8.43	9.07	33.49	11.28	21.17	14.32	20.96	33.94	14.79	11.66	19.41	31.22	16.46	12.46	22.14	26.35	18.42	9.52	22.72	22.92	22.06	10.77	23.83

TABLE 28. Natural forest available volume ($10^6 m^3$). (All scenarios)

	1985	1990	1995	2000	2005	2010
Coniferous	9.0	6.0	4.0	3.0	1.0	0.0
Nonconiferous	21.0	14.0	11.0	7.0	4.0	0.0

APPENDIX: List of Institutional Abbreviations

ABINEE	Associação Brasileira de Industrias Eletro-Eletrônicas (Brazilian Association of Electric and Electronic Industries)
ANFPC	Associação Nacional de Fabricantes de Papel e Celulose (National Association of Paper and Pulp manufacturers)
BB	Banco do Brasil (Bank of Brazil)
CACEX	Carteira de Comércio Exterior (Foreign Trade Department)
CE	Conjuntura Econômica (Economic Conjuncture, Monthly Journal)
CIEF	Coordenacão do Sistema de Informação Econômico-Fiscais (Coordination of the System of Economic-Financial Information)
CNP	Conselho Nacional de Petróleo (National Petroleum Council)
COPLAN	Comissão de Planejamento (Planning Commission)
COPPE	Coordenação de Programas de Pós-Graduacão em Engenharia (Coordination of Post-graduate Engineering Programs)
ESALQ	Escola Superior de Agricultura Luiz de Queiroz (Agricultural Graduate School Luiz de Queiros)
FAO	Food and Agriculture Organization
IBDF	Instituto Brasileiro de Desenvolvimento Florestal (Forest Development Brazilian Institute)
IBGE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
IE	Informações Econômicas (Economic Information, Monthly Journal)
IF	Instituto de Florestas (Forest Institute)

IPEA	Instituto de Planejamento Econômico e Social (Social and Economic Planning Institute)
IPF	Instituto de Pesquisas Florestais (Forest Research Institute)
JB	Jornal do Brasil (Rio de Janeiro newspaper)
MME	Ministério des Minas e Energia (Mines and Energy Ministry)
PETROBRAS	Petróleos Brasileiros (Brazilian Petroleum).
SUNAMAM	Superintendência Nacional da Marinha Mercante (National Department for the Merchant Navy.
UFRJ	Universidade Federal de Rio de Janeiro (Rio de Janeiro University)
UFRRJ	Universidade Federal Rural de Rio de Janeiro (Rio de Janeiro Rural Federal University)
USP	Universidade de São Paulo (São Paulo University)

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