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ENERGY CONSUMPTION AND SOCIAL CHANGE

by

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A B S T R A C T

A study is made to analyze the effects of a drastic income redistribution in the energy consumption of different fuels in Brazil. Conclusions are reached that although total energy consumption is not very sensitive to income redistributions (and therefore social change) significant interfuel changes will be necessary.

Brazil has a very shewed income distribution as can be seen in Table I which gives the income per family in 1974; this Table was organized from data obtained by ENDEF (National Study of Family Expenses) conducted by the Statistics Bureau[1]. Only 3% of the families had a global expense[2] greater than 30 minimum wage units[3] (WU) but this small population group was responsible for 25% of total expenditures made that year.

Family expenditures were converted by us into energy expenditures (including both "direct" and "indirect" energy expenses) using energy coefficients[4] obtained by the well known techniques of input-output matrixes. The results can be seen in Figure 1 which indicates that families with different expenses use energy in widely different patterns. In the lowest expenses group consumption of energy is mainly in the form of fuelwood (56%) and petroleum derivatives (30%), with a low consumption of electricity (9%); in families with global expenses greater than 10 WU the share of petroleum derivatives increases to 59% and electricity represents 16%.

It is very likely that the income distribution observed in 1974 will not remain static over the years. Social equity considerations will work in the direction of a better distribution, in addition to the effect of the increase in the bargaining power of the low income group. How will these social changes affect energy consumption? Will it means increased petroleum consumption aggravating Brazil's balance of payement's problem?

In order to answer these questions we assumed an extreme income redistribution leading to a concentration of all income in the 3 categories with expenses between 3.5 and 10 WU as shown in Table II, keeping the energy consumption patterns of these groups inaltered. Figure 2 shows the new distribution as compared to the 1974 one.

Qualitatively it is clear that the assumed redistribution will lead low income family groups to a higher consumption of petroleum derivatives and electricity as well as a reduction of the consumption of petroleum derivatives of higher income groups.

Quantitative results are shown in Tables III and IV which give direct and indirect energy consumption in different groups for the following four energy sources: petroleum derivatives, electricity, fuelwood and "others" (mainly charcoal and coke).

A careful reading of these Tables indicates that:

I - The redistribution assumed will lead to a total increase in energy consumption of 9%; direct energy consumption will increase 2% and indirect consumption 14%.

II - Total consumption of petroleum derivatives (46% of all energy consumption in 1974) will increase 6% due mainly to an increase in indirect energy consumption in the form of manufactured goods by the lower income groups of the population; direct consumption of petroleum derivatives will decrease 12% (33% decrease in gasoline compensated by an increase of 52% in liquefied petroleum gas (LPG) consumption).

III - Electricity consumption (25% of the total in 1974) will increase 24% (48% in direct consumption and 10% in indirect consumption); the reason for this increase is the access of the lower income groups to household electric devices.

IV - Fuelwood consumption (24% of the total in 1974) will increase 6%; indirect consumption will increase 21% but direct consumption will decrease 3%.

V - Consumption of "others" will decrease 8% (26% in direct consumption and 3% in indirect consumption).

As a conclusion one can state that even an extreme income redistribution will not affect greatly energy consumption in general in Brazil and not even the consumption of petroleum derivatives. Energy shortage, therefore, should not be a main obstacle to income redistribution and subjacent social changes.

TABLE I

Expenses Class (W.U.)	number of families		Expenses	
	x 10^6	%	10^9 Cr$	%
0 - 1	2.2	(11.6)	6.7	(1%)
1 - 2	4.0	(21.1)	26.7	(5%)
2 - 3.5	4.1	(21.6)	50.0	(10%)
3.5 - 5	2.5	(13.2)	48.4	(90%)
5 - 7	2.0	(10.5)	54.1	(10%)
7 - 10	1.5	(8.0)	57.9	(11%)
10 - 15	1.2	(6.3)	65.7	(12%)
15 - 20	0.5	(2.6)	37.8	(7%)
20 - 30	0.5	(2.6)	55.1	(10%)
> 30	0.5	(2.6)	130.8	(25%)
TOTAL	19.0	(100%)	533.2	(100%)

TABLE II

Expenses (W.U.)	number of families x 10^6
3.5 - 5	5
5 - 7	9
7 - 10	5
TOTAL	19

TABLE III - ENERGY EXPENSES (10^{12}kcal) - BRAZIL 1974-ENDEF

Expenses Class (W.U.)	0-1	1-2	2-3.5	3.5-5	5-7	7-10	>10	TOTAL
petroleum derivatives								
direct	1.2	3.5	5.5	5.3	7.1	9.4	50.8	82.8
indirect	2.3	9.2	16.8	15.9	16.8	16.7	60.6	138.3
total	3.5	12.7	22.3	21.2	23.9	26.1	111.4	221.1
electricity								
direct	0.1	0.8	3.3	4.6	5.7	5.7	15.7	35.9
indirect	1.0	4.1	7.7	7.1	7.6	7.7	31.0	66.2
total	1.1	4.9	11.0	11.7	13.3	13.4	46.7	102.1
fuelwood								
direct	5.6	16.1	19.5	11.3	7.1	4.5	6.8	70.9
indirect	1.1	4.0	6.5	5.3	5.2	4.7	13.6	40.4
total	6.7	20.1	26.0	16.6	12.3	9.2	20.4	111.3
others								
direct	0.4	1.4	1.5	0.7	0.3	0.2	0.2	4.7
indirect	0.1	0.7	1.4	1.4	1.7	1.9	9.7	16.9
total	0.5	2.1	2.9	2.1	2.0	2.1	9.9	21.6
TOTAL								
direct	7.3	21.8	29.8	21.9	20.2	19.8	73.5	194.3
indirect	4.5	18.0	32.4	29.7	31.3	31.0	114.9	261.8
total	11.8	39.8	62.2	51.6	51.5	50.8	188.4	456.1
Number of families (10^6)	2.2	4.0	4.1	2.5	2.0	1.5	2.7	19.0
Average expenses (W.U.)	0.68	1.48	2.69	4.19	5.89	8.31	23.93	6.16

TABLE IV - EXPENSES REDISTRIBUTION (10^{12}kcal) - BRAZIL 1974

Expenses Class (W.U.)		3.5-5	5-7	7-10	TOTAL	Comparison 10^{12}kcal	Comparison %
petroleum derivatives							
	direct	10.8	31.5	30.7	73.0	- 10	- 12%
	indirect	31.9	74.5	54.1	160.5	+ 22	+ 16%
	total	42.7	106.0	84.8	233.5	+ 12	+ 6%
electricity							
	direct	9.3	25.5	18.5	53.3	+ 17	+ 48%
	indirect	14.4	33.8	25.0	73.2	+ 7	+ 10%
	total	23.7	59.3	43.5	126.5	+ 24	+ 24%
fuelwood							
	direct	22.7	31.7	14.8	69.2	- 2	- 3%
	indirect	10.7	23.1	15.3	49.1	+ 8	+ 21%
	total	33.4	54.8	30.1	118.3	+ 6	+ 6%
others							
	direct	1.4	1.6	0.6	3.6	- 1	- 26%
	indirect	2.9	7.4	6.2	16.5	- 1	- 3%
	total	4.3	9.0	6.8	20.1	- 2	- 8%
TOTAL							
	direct	44.2	90.3	64.6	199.1	+ 4	+ 2%
	indirect	59.9	138.8	100.6	299.3	+ 37	+ 14%
	total	104.1	229.1	165.2	498.4	+ 41	+ 9%
Number of families (10^6)		5.1	9.0	5.0	19		
Average expenses (W.U.)		4.19	5.89	8.31	6.16		

FIG. 1 – EXPENSES OF TOTAL ENERGY BY FAMILY (BRAZIL 1974)

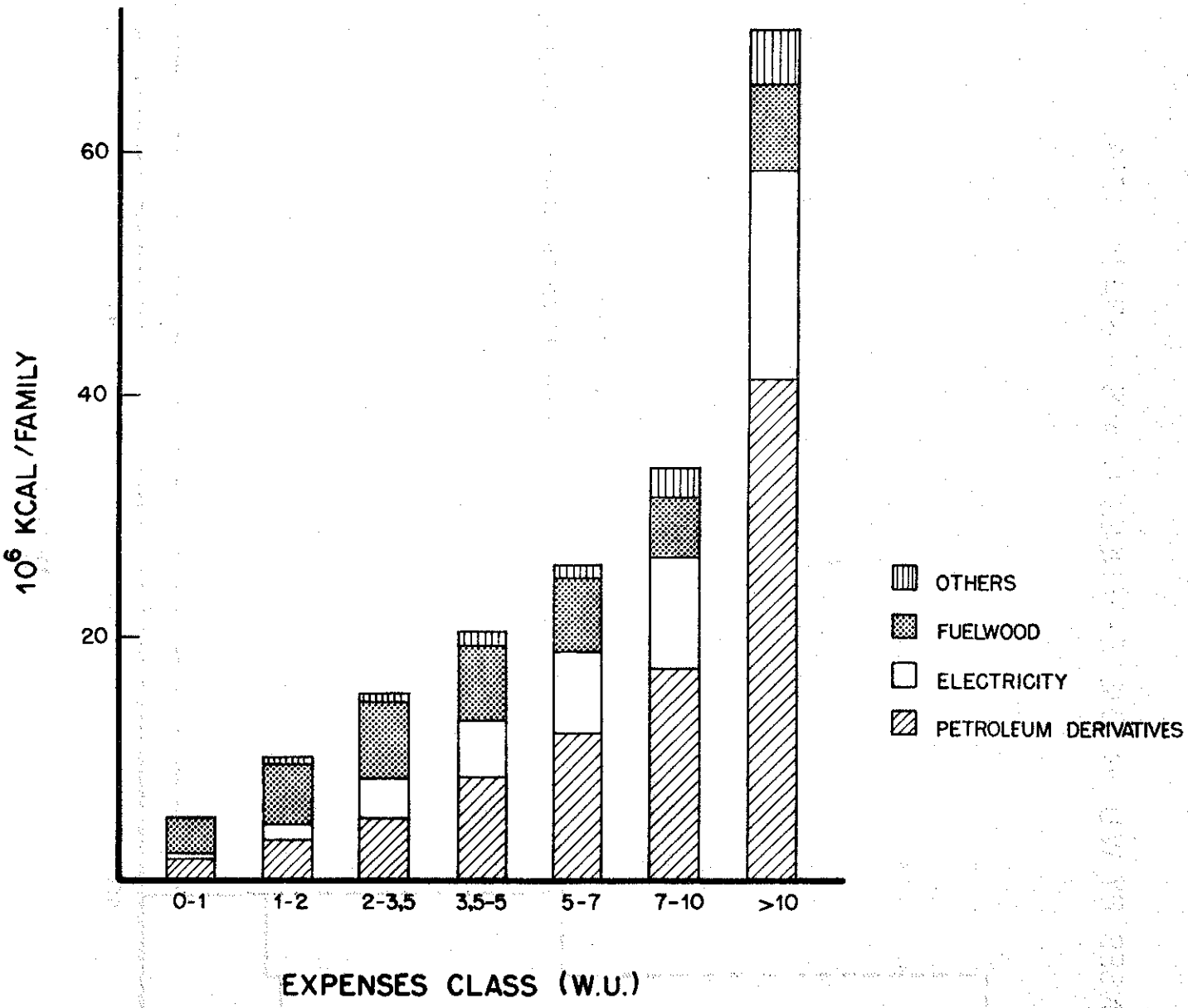
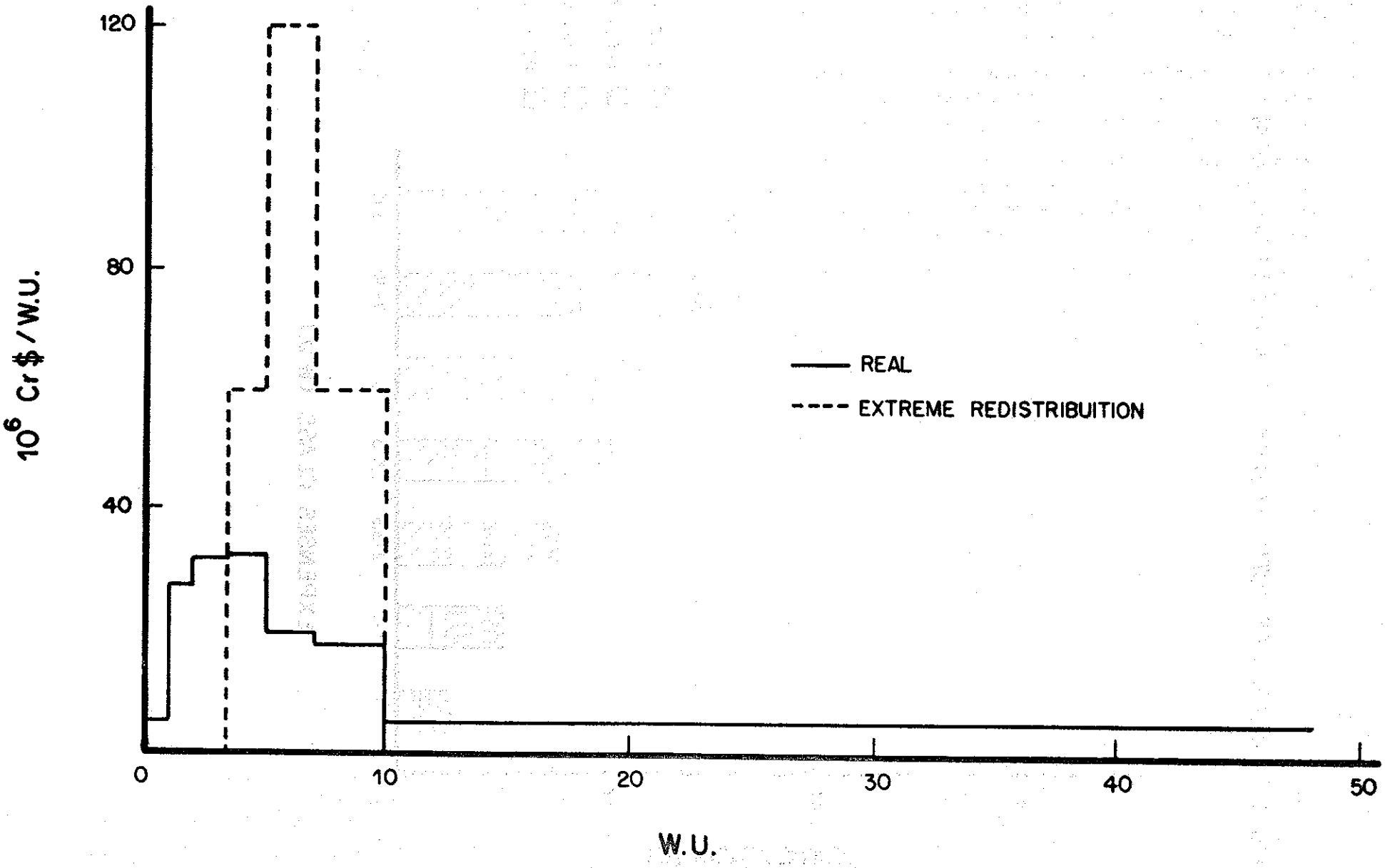


FIG. 2 – EXPENSES BY W.U. IN THE EXPENSES CLASS – BRAZIL 1974.



NOTES AND REFERENCES

1. ENDEF - National Study of Family Expenses. Instituto Brasileiro de Geografia e Estatística.

2. "Global expense" means all expenses - monetary and non monetary - realized by a given family in the acquisition of goods and services of any kind including taxes.

3. "Minimum wage unit" (WU) represents the yearly minimum wage for an adult (48 hours of work per week); it is fixed by law in Brazil. In august 1974 one WU corresponded to ... Cr$ 4.500.00 per year or approximately US$ 640.00.

4. Obtenção de coeficientes de intensidade de energia (direta e indireta) - Brasil 1970.
V.R. Vanin and G.M.G. Graça - Preprint IFUSP/P-322 (Instituto de Física, Universidade de São Paulo).