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AGRICULTURAL CREDIT INTEREST RATE EQUALIZATION POLICY: A GROWTH SUBSIDY?

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1 - Introduction

Macroeconomic policies adopted in Brazil over the latest decade have transferred resources from farmers to consumers, thereby reducing the farming sector's stock of capital and increasing unemployment, poverty, and income concentration (Teixeira and Carvalho, 2004). To improve farmer access to credit and redress income distribution disparities, the interest rate on loans made to agricultural sector entities has been artificially reduced over the last decade. A great majority of this reduction is a result the Brazilian Interest Rate Equalization System (IRES). About 30% of the total loans available to farmers by the Brazilian Central Bank are impacted by IRES. Losses to banks that lend at below market interest rates to IRES qualified agricultural entities are reimbursed by the Brazilian government.

In the 1970s, rural credit subsidies increased farmer income and land ownership concentration in the agriculture sector, which lead to the justifiable criticism that this government intervention benefited a specific population group while the costs were borne by the entire Brazilian population. The credit subsidies were also criticized for their distributive and allocative inefficiencies.

Theory and empirical works supporting these criticisms only address the subsidies' direct effects and ignore indirect effects that arise from the linkage between the sector receiving the subsidy and the economy's others sectors. According to Hirschman's Theory of Unbalanced Growth, increasing activity in one sector demands that production factors also increase, thereby stimulating investment in ancillary sectors: a chain reaction in which development of one sector stimulates the development of others.

Unbalanced Growth can occur naturally or can be encouraged by external factors and generates direct and indirect effects often promoting growth in a country's GDP, which can be

greater than the subsidy itself. The Brazilian government's bias toward stable rural employment and reducing rural emigration has led to programs directly benefiting the Brazilian agriculture sector and would have a economic reasoning.

In spite of a general weakening of Brazilian government economic intervention and the unsatisfactory results from earlier interventions in the agricultural sector, policies that transfer large amounts of resources to farmers continue to exist in many countries (Coelho, 2001). According to Taylor (1994), incentives directed toward agricultural sector, especially when they cause rural income to increase, can have a positive impact on non-agricultural sectors and drive economic development. The objective of the current research is to determine the impacts of IRES expenditures on Brazilian GDP, taking into consideration both direct and indirect effects.

This work is organized as follows: Section 2 presents the empirical framework; Section 3 presents the results and their discussion; and Section 4 offers our conclusions.

2 – Methodology¹

This paper measures the direct and indirect effects of Brazilian government IRES expenditures using income multipliers from the 1995 IBGE Input-Output table. IRES makes subsidized credit available to farmers for the purchase of production factors, considered to be variable factors (seeds, fertilizers, pesticides and lime), based on a production costs spreadsheet, and for investment in durable production factors, such as tractors, machinery, vehicles, etc. This method permits calculations to reflect the amount of total IRES subsidized credit as it is distributed among the sectors which supply the agriculture sector, acting as a demand shock. The amount spent by agriculture for products from other economic sectors is determined using figures from the Brazilian Rural Credit Statistical Yearbook, published by the Banco Central do Brasil (Bacen), from 1995 to 2000.

¹ This section is based on Haddad (1989).

The direct effects of the demand shocks on each sector are obtained by computing the technical coefficients from the I-O table sectorial flow, which generates the technical coefficients matrix (A). It is assumed a linear relationship between the acquisitions of a sector and its production gross value exists, such that the technical coefficients are given by

$$a_{ij} = \frac{x_{ij}}{X_j} , \quad (1)$$

where a_{ij} is the proportion of the product of sector i , demanded as an input by the sector j (x_{ij}) and the production gross value of sector j (X_j).

Wages, capital and taxes constitute Gross Domestic Product in the IO table. The direct effects of income (m_j) represents the distribution of the income and is calculated by

$$m_j = \frac{V_j}{X_j} , \quad (2)$$

where V_j represents wages, capital and taxes.

To calculate the direct and indirect effects coefficients of a demand shock on income, or the income multipliers, r_j , a global effects matrix must be obtained, that is, the Leontief Inverse Matrix, $[I-A]^{-1}$, which is computed by the inversion of the difference between the Identity Matrix (I) and the matrix of technical coefficients (A). Multiplying the row vector of the direct effect of the demand shock on income, m_j , by the global effects matrix, the direct and indirect effects of the demand shock on income coefficients, r_j , are obtained

$$r_j = [m_j]^T \times [I - A]^{-1} , \quad (3)$$

where r_j represents the direct and indirect effects coefficients.

Income multipliers are obtained by multiplying the direct and indirect effects on the Gross Domestic Product with demand shocks (Table 1).

Table 1. Direct and indirect effects of the Interest Rate Equalization System

	Sector 1	Sector 2	...	Sector j	Total
Demand	D_1	D_2	...	D_j	$\sum D_j$
Taxes	$r_{I1} \times D_1$	$r_{I2} \times D_2$	...	$r_{Ij} \times D_j$	$\sum r_{ij} \times D_j$
Wages	$r_{S1} \times D_1$	$r_{S2} \times D_2$	...	$r_{Sj} \times D_j$	$\sum r_{sj} \times D_j$
Capital	$r_{C1} \times D_1$	$r_{C2} \times D_2$	...	$r_{Cj} \times D_j$	$\sum r_{cj} \times D_j$
Total effect	$\sum r_{i1} \times D_1$	$\sum r_{i2} \times D_2$	...	$\sum r_{ij} \times D_j$	$\sum r_{ij} \times D_j$
% Relating to demand	$(\sum r_{i1} \times D_1) / D_1$	$(\sum r_{i2} \times D_2) / D_2$	...	$(\sum r_{ij} \times D_j) / D_j$	$(\sum r_{ij} \times D_j) / D_j$

The I-O table used in this research is from the Brazilian Geography and Statistical Institute for 1995 (IBGE, 2006). The Fertilizers and Pesticides segments were separated from the Chemical sector (Braga, 1999), and the Lime segment was separated from the Not-Iron Minerals sector. Although retaining the same coefficients as the original sector, the agricultural sector was separated into Family Farm (FF) and Commercial Farm (CF) segments. This division assumes that Family Farms are assumed to be less than 100ha as based on the value of production (Guanzirolli, 1994). This paper uses data from Bittencourt (2003), who evaluated the cost of IRES to the government. It is the Brazilian Ministry of Finance that determines the amount to be spent by the government on IRES.

3 – Results

Family Farm (FF) demands and the direct and indirect effects of these demands on GDP are shown in Table 2. The FF agriculture segment spent R\$ 677.88 million on Fertilizer sector products, which had a R\$ 38.36 million impact on tax collection, a R\$ 130.69 million impact on wages, and a R\$ 138.40 million impact on capital service payment. The total effect of this demand for fertilizer on Brazilian GDP is R\$ 307.95 million, or 45.4% of the total direct spending on fertilizer by members of the Family Farm category. The Table's last column shows the total Family Farm category demand of R\$ 1,651.19 million, which generated an increase on GDP of R\$ 851.73. In sum, each dollar of Family Farm demand was found to cause an increase of R\$ 0.51 in Brazilian GDP. This impact is

distributed as an increase in tax collection of R\$ 82.36 million (5.0%), and increase of R\$ 296.86 million (18%) for wages, and an increase of R\$ 472.51 million (28.6%) for capital.

Commercial farm (CF) demand is shown in Table 3 and the results are analogous to those of the FF. The main difference between the CF and the FF is in the amount of demand: total FF demand is R\$ 1,651.19 million while total CF demand is R\$ 4,723.12. CF demand increases GDP 56.6%, adding the following amounts to the GDP sectors: R\$ 276.49 million (5.9%) for taxes, R\$ 793.48 million (16.8%) for wages, and R\$ 1,602.35 (33.9%) for capital.

Table 2. Direct and indirect effects of Family Farm demand on the Gross Domestic Product, 2002/03 (R\$ million).

	1	2	3	4	5	6	7	Total
Demand	308.26	99.10	42.74	2.77	677.88	520.44	-	1,651.19
Taxes	10.43	5.93	2.66	0.13	38.86	24.35	-	82.36
Wages	77.18	11.18	10.20	0.16	130.69	67.44	-	296.86
Capital	218.22	25.41	17.07	0.42	138.40	72.99	-	472.51
Total effect	305.83	42.53	29.93	0.72	307.95	164.77	-	851.73
% Relating to demand	99.20	42.90	70.00	25.90	45.40	31.70	-	51.60

1 – Family Farm*; 2 – Lime; 3 – Machines; 4 – Vehicles; 5 – Fertilizers; 6 – Pesticides; 7 - Construction

* The demand of this sector includes seeds, and animals.

Table 3. Direct and indirect effects of the Commercial Farm demand on the Gross Domestic Product, 2002/03 (R\$ million).

	1	2	3	4	5	6	7	Total
Demand	625.43	280.23	914.11	41.18	1,434.43	1,069.59	358.14	4,723.12
Taxes	23.75	16.78	56.83	2.01	82.22	50.04	44.87	276.49
Wages	90.12	31.62	218.28	2.39	276.55	138.60	35.91	793.48
Capital	536.18	71.86	365.10	6.25	292.87	150.00	180.12	1,602.38
Total effect	650.05	120.26	640.21	10.65	651.64	338.64	260.90	2,672.35
% Relating to demand	103.9	42.9	70.0	25.9	45.4	31.7	72.9	56.6

1 – Commercial Farm*; 2 – Lime; 3 – Machines; 4 – Vehicles; 5 – Fertilizers; 6 – Pesticides; 7 – Construction

* The demand of this sector includes seeds and animals.

The increase in GDP caused by CF demand is similar to that caused by FF demand because the methodology used to disaggregate the agriculture sector (production value) keeps the same coefficients for both sectors. The small difference is explained by the distribution of demand based on credit allocation.

Spending on variable factors and spending on investment impact GDP differently. Table 4 shows these values for the FF. The main difference between FF spending on variable factors and spending as investment is seen in the capital sector. Expenditure on investment increases capital rent by 56.2%; while expenditure on variable factors increases capital rent by 23.6%. The impacts of these two types of spending are different because of the demand distribution: 65.0% of FF investment expenditure goes to the family farm sector itself and 16.7% is demanded for Machines (Castro, 2004). Of all credit for capital spending, 81.7% goes to these two segments, which is high proportion of capital devoted to direct production costs. It was found that FF spending on variable factors causes a smaller impact on GDP (45.7%) than investment spending (83.5%), because the major amount of the investment

spending goes to the Family Farm and Machines segments that have the largest impact on GDP increases (Table 2).

Table 4 – Family Farm Interest Rate Equalization System expenditure impacts on the Brazilian Gross Domestic Product by expense, 2002/03.

	Total Spending		Spending on Variable Factors		Spending on Investment	
	R\$ million	%	R\$ million	%	R\$ million	%
Demand	1,651.19	100.0	1,395.00	100.0	256.19	100.0
Taxes	82.36	5.0	71.53	5.1	10.83	4.2
Wages	296.86	18.0	237.66	17.0	59.20	23.1
Capital	472.51	28.6	328.66	23.6	143.84	56.2
Total effect	851.73	51.6	637.85	45.7	213.87	83.5

Table 5 shows the results for CF broken down in to spending on investments and spending on variable factors. The results are similar to those calculated for the FF, but the impact of capital spending and the total effect on GDP are smaller than those of the FF, again because of the distribution of demand among spending segments.

For the FF, government IRES expenditure and the impacts of this spending on Brazilian GDP are shown in Table 6. In 2002/03, R\$ 487.01 million of IRES spending to subsidize the family farmer increased Brazilian GDP R\$ 851.73 million, implying that each R\$ spent on IRES increased GDP R\$ 1.75. Spending on variable factors was found to have a multiplier of 2.19. In addition, agriculture sector spending caused a direct effect on government tax collections that represented 16.9% of IRES expenditures, reaching 24.5% for spending on variable factors.

Table 5 – Commercial Farm Interest Rate Equalization System expenditure impacts on the Brazilian Gross Domestic Product by expense, 2002/03.

	Total Spending		Spending on Variable Factors		Spending on Investment	
	R\$ million	%	R\$ million	%	R\$ million	%
Demand	4,723.12	100.0	2,679.00	100.0	2,044.12	100.0
Taxes	276.49	5.9	138.50	5.2	137.99	6.8
Wages	793.48	16.8	427.48	16.0	366.00	17.9
Capital	1,602.38	33.9	671.83	25.1	930.55	45.5
Total effect	2,672.35	56.6	1,237.82	46.2	1,434.54	70.2

Table 6 – Family Farm Interest Rate Equalization System expenditures effect on Gross Domestic Product, 2002/03 (R\$ million).

	Expenditure with IRES (1)	Impacts on GDP (2)	Impacts on tax collection (3)	Multiplier <u>2/1</u>	<u>3/1</u> %
Total	487.01	851.73	82.36	1.75	16.9
Spending on Variable Factors	291.59	637.85	71.53	2.19	24.5
Investment	195.42	213.87	10.83	1.09	5.5

For the CF, government IRES expenditure and the impacts of this spending on Brazilian GDP are shown in Table 7. In 2002/03, the Brazilian government's expenditure of R\$ 748.08 million on IRES caused GDP to increase R\$ 2,672.35, a 3.57 multiplier, and tax collections to increase 37%. Tax collections on spending for variable factors compensated for 74.0% of IRES expenditures to subsidize the purchase of CF variable factors.

Table 7. Commercial Farm Interest Rate Equalization System expenditures effect on Gross Domestic Product, 2002/03 (R\$ million).

	Expenditure with IRES (1)	Impacts on GDP (2)	Impacts on tax collection (3)	Multiplier <u>2/1</u>	<u>3/1</u> %
Total	748.08	2,672.35	276.49	3.57	37.0
Variable Factors					
Spending	187.05	1,237.82	138.50	6.62	74.0
Investment	561.03	1,434.54	137.99	2.56	24.6

Due to the cost of the IRES program (the difference between the market interest rate and the rate paid by the IRES assisted borrower), the multipliers and the tax collection increases are smaller for IRES subsidized investment expenditures than for IRES subsidized variable factor expenditures, even though the total effects of the investment expenditure are larger (Tables 4 & 5). IRES cost is equivalent to 20.9% of the credit offered to family farms for variable factor purchases but 67.3 % of the credit offered for investment spending (Table 8). Therefore, the higher the cost of the IRES subsidy, the lower the amount of resources available to borrowers.

The costs to IRES for assistance to commercial farms are less than for assistance to family farms because commercial farms pay a higher interest rate than the family farmer on IRES subsidized loans. Thus, the same amount spent with through IRES frees a greater credit volume for use by commercial farms than for use by family farms (Table 8). Reduced IRES costs make it possible for the program to subsidize 14.33 times the cost for credit applied to the purchase of variable factors by commercial farms and 3.84 times the cost for credit applied to CF investment spending. For FF, increased IRES costs per unit of borrowing reduce the amount of available IRES subsidized credit to 4.78 times IRES costs for credit applied to variable factor spending and 1.49 times IRES costs for credit applied to investment expenditures. We found that this disparity in the subsidized interest rate is the main reason

that IRES expenditures to subsidize commercial farms have a greater impact on GDP than IRES expenditures to subsidize family farms.

Table 8. Amount of credit available and its relationship to the cost of the Interest Rate Equalization policy for Family Farm and Commercial Farm, 2002/03 (R\$ million).

	Available	Expenditure	Total	Spread	
	(1)	with IRES (2)	<u>2/1</u>		<u>1/2</u>
FF – Variable Factors	1,395.00	291.60	20.9	11.1	4.78
FF - Investments	509.00	342.40	67.3	26.8	1.49
Total / Weighed -					
Average	1,904.00	634.00	33.3	15.3	3.00
CF – Variable Factors	2,679.00	186.97	7.0	6.7	14.33
CF - Investments	2,665.00	694.51	26.1	24.0	3.84
Total / Weighed -					
Average	5,344.00	881.47	16.5	15.3	6.06

4 – Conclusions

Each *real* spent by IRES on family farm generates R\$ 1.75 increase in Brazilian GDP and each *real* spent by IRES on commercial farm generates a R\$ 3.57 increase in Brazilian GDP. The program's benefits, measured by an increase of Brazilian GDP, are greater than its costs. Increased tax collection also compensates for government expenditures on IRES: 16.9% of IRES expenditures on the family farm and 37.0% of IRES expenditures on the commercial farm are returned in the form of tax collection.

The impacts of IRES expenditures on Brazilian GDP were similar for both family and commercial farms because the disaggregation of these two sectors was based on the value of FF production while keeping the same production function. To determine the actual coefficients for the FF and CF, more accurate analyzes are needed. Further research is

suggested to evaluate others Brazilian government policies for the agriculture sector, such as investigations into price supports, the effect of rural credit subsidies in the 1970s, and the impact of infrastructure investment, especially transportation infrastructure.

The multiplier effect of IRES subsidized credit applied to the commercial farm is double that for IRES subsidized credit applied to the family farm because IRES costs for commercial farm credit subsidies are lower per *real* loaned than those for loans to the family farm. However, since the multiplier effect is positive for both farming segments, IRES generates a major increase in Brazilian GDP above program costs. As IRES spending on both the commercial and the family farm has a positive effect on GDP, selective application of program assistance can also be used to reduce the income disparity that exists in the Brazilian agricultural sector. So, not only can IRES be used to redistribute income among sectors, it could be a policy of income redistribution within one sector.

5 - References

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