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EMPLOYMENT GENERATION IN BRAZILIAN COFFEE REGIONS

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Due to the specific characteristics of coffee production on each of the main Brazilian states producers of arabica (*Coffea arabica*) and robusta coffee (*Coffea canephora*), a better understanding of the structural links between production and industrialization of coffee on those states and the national economy can provide subsidies for implementation of public policies, essential to plan the coffee production and increase the sector competitiveness. Therefore, this study analyzed the employment generation in production and coffee industrialization in the major Brazilian production regions, based on an inter-regional input-output model, with seven regions, which represent the main coffee-producing states - Minas Gerais, Espírito Santo, São Paulo, Paraná, Bahia and Other States - with 44 sectors each, in a system of 308 sectors. The results indicated that the production of robusta coffee is the sector that generates more employments (total) per currency unit, and that arabica production sector is the fourth largest generator of employments, among the 44 sectors considered for the country. The results for each state emphasized the importance of farming and coffee industry for national and state economies.

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1. INTRODUCTION

The coffee crop was introduced in Brazil at the beginning of the eighteenth century. Nowadays its production is dispersed on a large part of the national territory. The migratory character/ aspect of the coffee production remains from the colonial era, and resulted in relevant geographical shifts and structural changes in the Brazilian coffee production. While the coffee production is widespread in the country, it is currently concentrated in six states: Minas Gerais, Espírito Santo, São Paulo, Paraná, Bahia and Rondônia. The diversity of social, cultural and, especially, environmental conditions – such as soil, topography, altitude, latitude and rainfall indices - in each of those states, resulted not only in different producing regions and types of coffee, but also in different structures of production, technology and competitiveness.

Thus, in the states of Minas Gerais, São Paulo and Bahia the culture of *Coffea arabica*, known as arabica coffee, is predominant, while in the states of Espírito Santo and Rondonia dominates the culture of *Coffea canephora*, generally known as robusta coffee (Conillon variety), that is used mainly in the coffee industry or in blends with arabica coffee.

For many decades, coffee was the main product of Brazilian exports, and despite the reduction of its share in those exports, is still very important for the country, especially on the social aspect. It is present in at least 370 thousand rural properties, 70% of them with familiar character, distributed in 2000 municipalities, in 17 States of the Federation. Furthermore, the manual harvesting accounts for great part of agricultural employment, and for up to 50% of the costs of their production.

Each one of those producing states presents segments of their respective coffee production chains with distinct structural and technological levels. However, in most producing regions the prevail production systems is based on coffee intensive labor,

especially during the harvesting, that can extend from May to September, due the region and climate.

Due to technological and structural characteristics of the coffee sector, in each region of arabica and robusta coffee, where seasonal and intensive use of labor occurs, this study aims to provide subsidies to improve the understanding of structural relationships between coffee production and industrialization sectors and the national economy.

Another goal is to provide subsidies for implementation of public policies, planning of the coffee park and to increase the competitiveness of the national coffee in general.

2. METODOLOGY

To analyze the behavior and current importance of the sectors of agricultural production and industrialization of coffee for each of the main Brazilian producers, for their respective state economies and other sectors of national economy, regarding to generation and expansion of employments, it was built an inter-regional input-output model, for the year 2002. This system has seven regions and 44 sectors per region, a total of 308 sectors, and it is consistent with the productive structure of the Brazilian economy, which is reflected in the reformulation of the System of National Accounts, occurred in 2007.

The survey of structures and technical coefficients of/ for production of arabica and robusta coffee, in the main producer states - Minas Gerais, Espírito Santo, São Paulo, Paraná, Bahia and Rondônia - was conducted between September 2005 and August 2006. This survey was used as a parameter to build the inter-regional input-output model, with seven regions, representing, respectively, those six major producer states and the region RBR, which include other Brazilian states where coffee production is not significant or there is no coffee production at all.

For the survey, a structured questionnaire was administered, developed in partnership with experts from the Institute of Agricultural Economics - IEA and Embrapa Café, based on published information on costs of coffee production in Brazil. Different models used by cooperatives, universities, consultants in the industry and the National Supply Company - CONAB (in Portuguese abbreviation) were adjusted.

The structures of production cost were used to extract the sector of coffee production (beans) from the other sectors of agricultural production in the matrix inter-regional original - called "Agriculture". The sector of coffee industrialization was already dissociated from the other sectors of the agricultural products industrialization.

The input-output model, in its original formulation, assumes that the relative price of the system remain constant. Due/ based on that assumption, the effects simulated in the system are obtained in terms of quantity. As price-effects may have different consequences, depending on their cause - in the case of coffee, loss of harvest, variations in costs of inputs, changes in the international prices, among others - a construction of sophisticated models of computable general equilibrium would be required to analyze those effects, which escapes the scope of this work. As this study focuses on structural analysis of the coffee sector, the input-output model is more reasonable, particularly for long-term analysis, concerned with the structure of production processes.

To reduce the impact of lag time between the data collected - such as prices, quantities of raw and wages - some information on the changes in levels of inputs and machinery used in the period 2002/2005 (fertilizer, pesticides and other chemical inputs / tractors, mowing machines and other) were also raised in the applied questionnaire. Indications of change in any of these variables resulted in correction of the value used in the opening of the input-

output matrices, based on the estimative(s) of the interviewee(s), regarding to the rate of change in the respective region, between 2002 and the date of questionnaire application. That is, an estimate of the values and prices in 2002 was performed.

The data obtained via questionnaires were compared with secondary data provided by government agencies, research institutes and cooperatives related to the coffee sector. The values of production of coffee in each producing region were estimated based on 2002 prices. To estimate the profits were also used estimates of prices paid and received by producers in 2002.

This paper specifically examined the direct, indirect and induced effects of employment generating/ or generation?, and the effects of employment multiplier, Type I and Type II, for the sectors and countries that compose the system, detailed below.

The vector "busy people" of the national input-output matrix was taken out directly from the new system of national accounts, which was based on the National Survey by Household Sample (PNAD - IBGE, 2002) to open up sectors related to coffee. For regionalization, that is, construction of an inter-regional input-output system, data from PNAD (IBGE, 2002) were used as the basis for opening of the sector "occupied people", beside other specific sources about the culture of coffee/ or coffee cultivation?.

The vector "employed persons" of the national input-output matrix was taken out directly from the new system of national accounts, which was based on the National Survey by Household Sample (PNAD - IBGE, 2002) to open up sectors related to coffee.

Theoretical background

The intersectorial flows in a specific economy are determined by technological and economic factors, and these flows can be described by the following system:

$$AX + Y = X \quad (1)$$

where X is a $(n \times 1)$ vector, with the value of the total production in each sector; A is a $(n \times n)$ matrix with the technical coefficients of production (Leontief, 1951); and Y is a $(n \times 1)$ vector with values for the final demand. In this model, the final demand vector can be treated as exogenous to the system, such that the level of total production can be determined by the final demand, i.e.

$$X = BY \quad (2)$$

$$B = (I - A)^{-1} \quad (3)$$

where B is a $(n \times n)$ matrix of the Leontief inverse.

From equation (3) it is possible to evaluate the impact of the final demand over total production, and from there, over employment, imports, wages, and others.

Induced effect model

The employment effects can be classified into three types: a) direct employment effect, that determines how many employments are generated by a given sector when its production is increased; b) indirect employment effect, that determines how many employments are generated in all the other sectors when the production of a given sector is increased; and c) induced employment effect, that determines how many employments are generated as a result of households' consumption, in consequence of rise in their income, given the increase of direct, indirect and induced employments.

To estimate the induced effect, i.e., how much the increase in employment would generate, for instance, over total production in the economy, given the consumption of the newly employed people, one can make the family consumption and family income endogenous in the model, and we instead A we will have:

$$\bar{A} = \begin{bmatrix} A & H_c \\ H_r & 0 \end{bmatrix} \quad (4)$$

where \bar{A} is the new matrix of technical coefficients with size $((n+1) \times (n+1))$, and (H_r) is a $(1 \times n)$ vector with the income coefficient in each sector and (H_c) is a $(n \times 1)$ vector with the families' consumption coefficients.

As so, the new vectors of production and final demand would be given, respectively, by $(\bar{X}, (n+1) \times 1)$, and by $(\bar{Y}, (n+1) \times 1)$, that would be represented as

$$\bar{X} = \begin{bmatrix} X \\ X_{n+1} \end{bmatrix} \quad (5)$$

$$\bar{Y} = \begin{bmatrix} Y^* \\ Y^*_{n+1} \end{bmatrix} \quad (6)$$

where \bar{B} is a $((n+1) \times (n+1))$ matrix of the Leontief inverse, taking into consideration the induced effect, and the Leontief system would be represented as

$$\bar{X} = \bar{B}\bar{Y} \quad (7)$$

$$\bar{B} = (I - \bar{A})^{-1} \quad (8)$$

Production multipliers

From the multipliers results it is possible to measure the direct and indirect effects of a change in the final demand over productions, income, employment and others (Miller and Blair, 1985). From the Leontief inverse matrix (B) , defined above, we have that the

production multipliers of Type I, for each economic sector, is given by

$$MP_j = \sum_{i=1}^n b_{ij} \quad j = 1, \dots, n \quad (9)$$

where MP_j is the production multiplier for each j sector and b_{ij} is an element of matrix B .

The production multiplier of type II, that takes into consideration the induced effect, is given by

$$\begin{aligned} \bar{P}_j &= \sum_{i=1}^n \bar{b}_{ij} \\ j &= 1, \dots, n \end{aligned} \quad (10)$$

where \bar{P}_j is the production multiplier for sector j and \bar{b}_{ij} is an element of matrix \bar{B} .

Coefficients and employment generation

To estimate the employment multipliers, one first go by estimating the coefficients of employment, given by

$$w_j = \frac{e_j}{x_j} \quad (11)$$

where w_j is the coefficient of employment in sector j , e_j is the total employment in sector j , and x_j is the level of production in sector j .

The total employment of type I (E_j) and type II (\bar{E}_j), generated in sector j are given by

$$E_j = \sum_{i=1}^n w_i b_{ij} \quad (12)$$

$$\bar{E}_j = \sum_{i=1}^n w_i \bar{b}_{ij} \quad (13)$$

where b_{ij} and \bar{b}_{ij} are elements of the matrices B and \bar{B} described above.

The employment multipliers, i.e., how much employment is generated in the economy for each person employed in a given sector, is given by equations (14) and (15) below, for the cases of the type I (W_j) and type II (\bar{W}_j) multipliers

$$W_j = \frac{E_j}{w_j} \quad (14)$$

$$\bar{W}_j = \frac{\bar{E}_j}{w_j} \quad (15)$$

3. RESULTS

To facilitate the understanding of the relationship occurring among employment coefficient, coefficient of employment multiplication (or multiplier) and coefficient of employment generation (or generator), the results obtained by applying the proposed methodology are presented in tables 1 to 8.

3.1 Results for Brazil

In this section are evaluated the results obtained by multipliers and employment generation coefficients calculated for Brazil. The coefficients are interpreted in accordance with descriptive analysis performed from/ on data extracted directly from the input-output matrices. Subsequently, the results for each state are incorporated, allowing the comparison of generation and demand for labor in different sectors present in each state.

Multipliers, generators and descriptive analysis of the input-output matrix

The direct, indirect and induced effects of employment generating/ or generation?, and type I and type II multipliers, for sectors of the input-output matrix, built to analyze the sectors directly related to coffee, are presented at table 1 (the values of employment

generate effects are expressed in the Brazilian currency – Reais, in constant prices of 2002).

The five sectors that generate more employments (total), per 1 million reais, are:

"Robusta Coffee", "Non-market private services", "Other Agricultural Products", "Coffee Arabica" and "Articles of clothing".

Two parameters will be explored below: the employment generating coefficients and employment multipliers. The analysis with the employment generating coefficients will be evaluated more specifically, once it focuses on the best size and production activities and its relations with the labor market.

The employment generator

The direct, indirect and induced coefficients of employment generation are related to the amount of employments and the monetary values (also expressed in the Brazilian currency – Reais in constant prices, millions of real employments by 2002).

The total effect of an increase of one million reais on the production of arabica coffee creates/ is an increase of 121 direct employments, 14 indirect and 71 induced, , a total of 207 employments. Also generates 192 direct employments, 20 indirect and 74 induced in the case of robusta, a total of 286 employments.

In the nineteenth century coffee crop was considered an activity of great social importance, due to the generation of employments in farming and industry. However, although the Brazilian coffee agribusiness has been internalized, with new techniques of production, post-harvesting, processing and marketing - such as the launch of new genetically superior materials, the density of cultivation, the irrigation use, the introduction of mechanical harvesting and the spread of good harvest and post harvest

practices - with positive impacts on productivity and quality of the final product, the results of the input-output analysis indicate that arabica and robusta coffees still use intensive labor-work.

The mechanical harvesting is limited to small portion of arabica crop, according to the limitations imposed by the soil slope of some producing regions, such as southern state of Minas Gerais. Also depending on the existence of economies of scale, the use of mechanical harvesting is limited to medium and large farms, especially in the western region of Bahia, in the Cerrado of Minas Gerais, some areas of southern Minas Gerais and in some regions of São Paulo State. Even in medium size farms, the use of mechanical harvesting is often possible only *via* outsourcing, rental of machinery or joint purchasing, via cooperatives or farmers associations. There is equipment to help harvest in small farms - vibrators, with system of "finger" to help overthrow the grains, which reduce the use of labor, but not in the same proportion as the major machines. Since up to 70% of Brazilian producers have less than 50ha of coffee, the use of labor in these farms is still strong.

The greater importance of robusta coffee for employment generation, compared to arabica coffee, can be explained by the inability to perform the mechanical harvesting. The fruits of robusta coffee are more strongly stuck in the branches than fruits of arabica, and an efficient system of mechanical harvesting for robusta coffee is not yet available.

With respect/ Regarding to the coffee industry, it was found that this sector had the 8th-highest rate of employment generation, among the 44 sectors of the economy, higher than the position obtained by traditional sectors in the Brazilian agribusiness, such as "Manufacturing of sugar", "Vegetable oils" and "Dairy" and also higher than sectors such as shoes, Chemistry, Pharmacy.

The employment multiplier

As seen above, one can divide the employment multiplier into the following types: Type I multiplier, which determines how many employments are created directly and indirectly from the creation of a new post in a particular productive sector; and multiplier Type II, that adds to the Type I employment multiplier the employment resulting from the increase in the population income due to the greater quantity of direct and indirect employment.

As for the multiplier effects, the results presented in Table 1 indicate that the sectors of “Robusta” and “Arabica” coffee have the two smallest effects among the 44 sectors of the economy. In contrast, the coffee industry presents the 5th-largest multiplier effect, which again indicates the importance of coffee agribusiness for the Brazilian economy.

Therefore, the results indicated that the sectors of production of arabica and robusta coffee are important in generating a large volume of employments, direct, indirect, and induced, by unit currency produced in the final demand, expressed in reais, compared to other sectors of the Brazilian economy or state economies.

However, these sectors are not able to multiply the number of employments when you create a new working post in the industry, or are not able to generate employment from the increase of income of the population resulting from the creation of new employments.

3.2 Results for Brazilian states

In this section, results of the coefficient of direct employment, the direct, indirect and induced employment generating, and the values of employment multipliers for the sectors and states of the system in 2002 are presented. That is, the importance of

employment generating and employment multipliers, were analyzed, in states where the sectors related to coffee have significant participation.

Basically, the results indicate that the sectors “Robusta”, “Arabica” and “Coffee Industry” are generally among these with the largest employment generators in Brazil, by the currency unit in final demand, and we emphasize that the values of those generators stems mainly from its induced effects.

Therefore, public policies that stimulate those production sectors should contribute to the employment increase, or at least for its maintenance.

In the states where the coffee sector has great participation, the employment generating effect provides a singular focus forward/ or towards? to the other sectors. In the State of Minas Gerais, the largest Brazilian producer of arabica coffee, accounting for about 50% of the total volume produced, the employment generator (total) of the “Arabica” and “Coffee Industry”, are, respectively, the second and seventh, between the largest generators of employment in the period.

In the State of Espírito Santo, coffee sectors are among the five largest generators of total employments: first place for “Robusta”, third for “Arabica” and fourth place for “Coffee industry”. This result is consistent with socioeconomic indicators for that State, because Espírito Santo is the largest Brazilian producer of robusta coffee, a large exporter, and has large number of coffee roasting and soluble coffee industries . In addition, coffee is frequently present in its farms, most of them are small or family business, and the harvest mechanization is not significant.

In São Paulo State only the sectors of “Coffee industry” and “Arabica” stand out, since there is no production of robusta coffee in that State. The "Arabica" sector is the third

largest employment generator among 44 sectors of the state, while the sector "Coffee Industry" (roasting and solubilizing) is the eighth largest employment generator in the state. Despite the diversity of Sao Paulo industries, which represent many sectors of the state economy, there is a concentration of industry, for roasting and grinding of coffee in this state, as well as solubilizing industries.

In the State of Paraná, "Arabica" was the sector that generated most part of total employment in 2002, highlighting the importance of *Coffea arabica* for this state. This result reflects the land structure of the two main regions of coffee production in the Paraná State - the "Norte Velho", represented by the region of Jacarezinho and "Norte Novo", represented by the region of Cornélio Procópio - where dominate properties between 4 and 8 ha, high density production system, intermediate technological level, and above all, family labor, except in periods of harvest, when the demand for hired labor increases.

The "Robusta" sector also stands out in the following States: Bahia, the third largest Brazilian producer of robusta coffee, with the 3rd largest employment generator; Rondônia, the second largest Brazilian producer of robusta, the 2nd largest employment generator in the state; and also in Rest of Brazil, because in all the other Brazilian states, the cultivation of robusta coffee presents the biggest/ largest employment generator.

CONCLUSIONS

In summary, the analysis of the matrix for Brazil show us that the production of robusta coffee is the sector that generates more employments (total) per 1 million of reais, while production of arabica coffee is the fourth largest employment generator, among 44 sectors considered.

Regarding the employment multipliers, Type I and Type II, the coffee industry had the fifth largest multiplier among the 44 sectors, but there are no indications that the production of arabica and robusta coffee is significant as employment multiplier, from the creation of a new employment, or from increasing the income of the population due to the creation of a new employment.

The results also indicated that for Minas Gerais State, the generators of total employment of "Arabica" and "Industry coffee" are, respectively, the second and seventh largest coefficients in the period. That is, in the state responsible for 50% of national coffee production, the public policies directed to the coffee sector should be carefully examined before being implemented effectively, because they may cause significant effect on the employment generation and, consequently, on the state economy.

In the Espírito Santo State, the sectors related to coffee are among the five largest generators of total employments: "Robusta" first, "Arabica" third and "Coffee industry" in the fourth. Therefore, policies related to the coffee production and industrialization may cause significant social and economic impacts in this state.

In São Paulo, that produces only arabica coffee, the coffee sector and industry are, respectively, in the third and eighth position on the employment generation. This is a surprising result, due to the high degree of industrialization, involving very important sectors such as production and industrialization of sugar and alcohol, livestock, citrus, dairy products and vegetable oils.

In Paraná State, an arabica producer, characterized by small family farms, the coffee sector is the most important sector regarding employment generation. The "Robusta" sector stands out in Bahia (third largest), Rondônia (second) and Rest of Brazil (the first).

These results highlight the importance of farming and the coffee industry for both economies, state and national as a whole.

However, more importantly, the results indicate that the impact of the implementation of public policies that act on sectors of agricultural production of coffee, arabica and robusta, and the sector of industrialization (or solubilization, roasting and grinding) should be significant on the employment generation in both economies, state and national as a whole.

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Table 1. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Brazil.

Sectors	Employment generating				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
Arabica coffee	121	14	71	207	4	1,12	1,71
Robusta coffee	192	20	74	286	1	1,11	1,49
Other agriculture and related services	125	26	73	224	3	1,21	1,79
Non-metallic mineral industries	12	17	51	79	31	2,48	6,89
Oil and gas	1	21	50	72	38	22,82	76,02
Non-metallic mineral industries	23	20	55	98	23	1,88	4,29
Steel industries	3	18	48	68	41	7,59	25,13
Non-ferrous metal metallurgy	5	17	48	69	40	4,69	15,18
Other metallurgic industries	20	14	56	90	25	1,73	4,58
Machinery and tractors industries	10	17	53	81	28	2,76	8,18
Electric equipment industries	8	17	51	77	35	3,07	9,33
Electronic equipment industries	5	20	46	70	39	4,63	13,10
Automobiles, trucks and buses industries	2	27	51	80	29	13,34	36,67
Motors and parts of vehicles industries	7	17	51	76	36	3,37	10,44
Wood and furniture industries	35	28	59	123	17	1,79	3,48
Pulp and paper industries	11	24	57	92	24	3,28	8,57
Rubber industry	10	21	51	81	27	3,17	8,45
Chemical elements	4	32	50	85	26	8,96	21,48
Refined petroleum	1	18	39	57	43	24,75	75,72
Chemical industries	6	21	48	74	37	4,83	13,45
Pharmaceutical and medicine industries	6	20	53	79	32	4,17	12,61
Plastic industries	12	17	48	77	34	2,41	6,31
Textile industries	32	33	58	123	16	2,01	3,80
Clothing industries	75	33	68	177	5	1,44	2,35
Footwear industries	30	40	60	130	15	2,34	4,33
Coffee industries	6	91	67	164	8	15,91	26,84
Other vegetables processing	7	76	61	144	13	12,28	21,38
Meat industries	7	99	65	171	6	14,68	23,73
Dairy products industries	11	81	64	156	10	8,35	14,13
Sugar industries	10	72	63	145	12	8,25	14,64
Vegetable oil mills	1	100	63	165	7	87,45	142,12
Other food industries	16	59	59	134	14	4,75	8,47
Miscellaneous manufacturing	30	19	56	105	22	1,65	3,53
Electricity, gas and water supply	4	10	50	64	42	3,70	16,74
Construction	42	19	61	123	18	1,46	2,92
Wholesale and retail trade	74	11	74	158	9	1,14	2,15
Transports	29	18	64	111	21	1,59	3,76
Communications	6	18	54	77	33	4,01	13,11
Financial intermediation	6	12	62	80	30	3,00	13,55
Personal services	55	21	70	147	11	1,39	2,65
Business services	36	16	70	123	19	1,45	3,38
Real estate	4	2	44	51	44	1,62	12,86
Public administration	28	13	80	120	20	1,45	4,29
Private households with employed persons	149	19	77	245	2	1,13	1,64

Source: Research results.

Table 2. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Minas Gerais.

Sectors	Employment generating				Multiplier effect		
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
Arabica coffee	117	14	83	214	2	1,12	1,84
Robusta coffee	0	0	0	0	44	0,00	0,00
Other agriculture and related services	72	35	80	188	4	1,49	2,60
Non-metallic mineral industries	10	16	66	92	37	2,54	8,81
Oil and gas	1	25	68	94	36	35,89	129,84
Non-metallic mineral industries	26	21	69	116	22	1,83	4,51
Steel industries	3	20	60	83	41	7,65	28,05
Non-ferrous metal metallurgy	7	19	64	90	38	3,72	12,81
Other metallurgic industries	21	16	70	108	24	1,75	5,02
Machinery and tractors industries	14	20	69	103	25	2,44	7,30
Electric equipment industries	10	20	66	96	32	3,00	9,71
Electronic equipment industries	7	26	63	97	31	4,66	13,47
Automobiles, trucks and buses industries	2	30	57	90	39	17,75	49,37
Motors and parts of vehicles industries	8	21	67	95	33	3,48	11,48
Wood and furniture industries	53	31	76	160	10	1,58	3,01
Pulp and paper industries	13	25	73	111	23	2,88	8,50
Rubber industry	11	24	66	102	26	3,08	8,87
Chemical elements	3	30	65	98	29	11,90	35,38
Refined petroleum	1	22	50	72	43	37,11	118,91
Chemical industries	6	25	64	95	34	4,98	15,16
Pharmaceutical and medicine industries	7	22	70	99	28	4,28	14,52
Plastic industries	15	22	63	100	27	2,47	6,71
Textile industries	36	36	72	144	14	2,00	4,00
Clothing industries	91	38	82	211	3	1,41	2,32
Footwear industries	60	49	73	182	6	1,81	3,04
Coffee industries	7	86	78	171	7	12,66	23,26
Other vegetables processing	10	60	73	143	15	7,02	14,37
Meat industries	8	73	75	156	11	10,17	19,68
Dairy products industries	14	80	68	162	9	6,81	11,75
Sugar industries	10	54	74	138	16	6,15	13,18
Vegetable oil mills	1	93	73	167	8	79,66	141,34
Other food industries	19	58	70	147	13	4,05	7,73
Miscellaneous manufacturing	40	22	73	135	19	1,56	3,38
Electricity, gas and water supply	4	10	69	83	40	3,34	18,95
Construction	41	20	76	136	18	1,48	3,33
Wholesale and retail trade	87	7	90	184	5	1,08	2,12
Transports	24	18	75	118	21	1,76	4,85
Communications	6	18	71	95	35	3,89	15,28
Financial intermediation	7	13	78	98	30	2,89	14,07
Personal services	51	23	80	153	12	1,45	3,03
Business services	36	18	83	137	17	1,49	3,80
Real estate	3	3	72	78	42	1,85	23,82
Public administration	28	12	88	128	20	1,43	4,61
Private households with employed persons	155	19	83	257	1	1,12	1,66

Source: Research results.

Table 3. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Espírito Santo.

Sectors	Employment generating				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
Arabica coffee	142	13	77	233	3	1,09	1,64
Robusta coffee	177	17	76	270	1	1,09	1,52
Other agriculture and related services	41	41	43	125	12	2,01	3,07
Non-metallic mineral industries	10	9	52	71	31	1,93	6,98
Oil and gas	1	19	47	67	36	18,57	63,05
Non-metallic mineral industries	18	20	52	90	24	2,15	5,13
Steel industries	2	15	42	59	42	7,44	25,57
Non-ferrous metal metallurgy	5	15	43	63	40	4,11	12,92
Other metallurgic industries	18	14	50	82	26	1,78	4,53
Machinery and tractors industries	11	16	47	74	30	2,45	6,65
Electric equipment industries	9	15	44	68	33	2,71	7,73
Electronic equipment industries	5	15	34	55	43	3,91	10,36
Automobiles, trucks and buses industries	3	21	37	60	41	9,13	23,19
Motors and parts of vehicles industries	7	15	43	64	38	3,24	9,73
Wood and furniture industries	46	31	56	133	10	1,66	2,87
Pulp and paper industries	9	27	54	91	23	3,98	9,94
Rubber industry	11	16	43	70	32	2,50	6,40
Chemical elements	3	27	47	77	28	9,30	23,52
Refined petroleum	1	13	30	43	44	22,60	71,41
Chemical industries	6	18	41	65	37	3,81	10,32
Pharmaceutical and medicine industries	5	20	50	75	29	4,73	14,08
Plastic industries	10	14	40	64	39	2,37	6,23
Textile industries	33	33	53	119	17	2,00	3,59
Clothing industries	64	37	61	162	7	1,57	2,53
Footwear industries	61	48	53	162	8	1,78	2,66
Coffee industries	7	116	69	192	4	18,44	28,83
Other vegetables processing	10	49	49	108	20	5,82	10,58
Meat industries	6	97	67	170	5	17,96	29,58
Dairy products industries	11	51	48	111	18	5,77	10,26
Sugar industries	7	49	52	109	19	7,70	14,80
Vegetable oil mills	1	101	62	164	6	124,42	199,81
Other food industries	15	55	54	124	14	4,70	8,31
Miscellaneous manufacturing	28	20	50	97	22	1,70	3,48
Electricity, gas and water supply	4	12	51	67	34	3,78	15,27
Construction	48	17	60	125	13	1,35	2,61
Wholesale and retail trade	73	10	75	158	9	1,13	2,16
Transports	23	14	64	102	21	1,61	4,35
Communications	5	15	60	80	27	3,99	15,59
Financial intermediation	7	13	68	88	25	2,85	12,53
Personal services	44	21	66	132	11	1,47	2,97
Business services	36	16	69	121	16	1,44	3,37
Real estate	3	3	61	67	35	1,90	19,79
Public administration	30	12	80	123	15	1,39	4,02
Private households with employed persons	147	20	70	237	2	1,13	1,61

Source: Research results.

Table 4. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, São Paulo.

Sectors	Employment generating				Multiplier effect		
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
Arábica coffee	93	9	62	164	3	1,10	1,77
Robusta coffee	0	0	0	0	44	0,00	0,00
Other agriculture and related services	64	17	64	145	5	1,27	2,28
Non-metallic mineral industries	13	15	39	66	35	2,14	5,12
Oil and gas	1	19	40	60	40	29,22	87,74
Non-metallic mineral industries	20	19	48	87	22	1,92	4,30
Steel industries	3	16	42	60	39	6,94	22,57
Non-ferrous metal metallurgy	5	16	42	64	37	3,96	11,77
Other metallurgic industries	18	14	50	82	24	1,79	4,60
Machinery and tractors industries	11	16	48	76	26	2,48	6,80
Electric equipment industries	8	16	46	70	31	2,91	8,39
Electronic equipment industries	6	18	40	64	36	4,17	11,02
Automobiles, trucks and buses industries	2	25	46	72	27	12,36	33,48
Motors and parts of vehicles industries	7	17	46	69	32	3,33	9,81
Wood and furniture industries	39	24	50	113	14	1,62	2,93
Pulp and paper industries	10	24	50	84	23	3,31	8,18
Rubber industry	10	22	49	80	25	3,31	8,39
Chemical elements	3	22	43	68	33	7,92	21,30
Refined petroleum	1	16	34	51	42	25,53	76,32
Chemical industries	5	21	45	71	29	5,08	13,96
Pharmaceutical and medicine industries	6	20	45	72	28	4,38	11,96
Plastic industries	11	16	43	71	30	2,43	6,22
Textile industries	27	33	51	111	16	2,21	4,07
Clothing industries	68	32	58	158	4	1,47	2,31
Footwear industries	45	38	52	134	6	1,84	2,99
Coffee industries	6	69	59	133	8	13,23	23,69
Other vegetables processing	8	65	57	130	9	9,63	17,15
Meat industries	6	54	57	117	12	9,85	19,11
Dairy products industries	11	49	55	115	13	5,41	10,40
Sugar industries	8	49	55	112	15	6,76	13,33
Vegetable oil mills	1	109	62	171	2	118,28	185,24
Other food industries	15	56	52	123	11	4,70	8,17
Miscellaneous manufacturing	31	19	48	98	20	1,62	3,18
Electricity, gas and water supply	3	10	40	53	41	4,15	17,09
Construction	42	15	53	110	17	1,36	2,61
Wholesale and retail trade	62	10	61	134	7	1,16	2,15
Transports	28	13	55	95	21	1,47	3,47
Communications	6	13	44	63	38	3,42	11,34
Financial intermediation	5	10	52	67	34	3,00	13,19
Personal services	49	20	58	127	10	1,41	2,59
Business services	29	14	61	103	19	1,48	3,59
Real estate	4	2	33	38	43	1,64	10,90
Public administration	25	10	71	107	18	1,42	4,26
Private households with employed persons	122	17	68	207	1	1,14	1,69

Source: Research results.

Table 5. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Paraná.

Sectors	Employment generating				Multiplier effect		
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
Arabica coffee	154	19	66	238	1	1,13	1,55
Robusta coffee	0	0	0	0	44	0,00	0,00
Other agriculture and related services	95	23	68	186	3	1,24	1,95
Non-metallic mineral industries	23	22	47	92	23	1,95	4,01
Oil and gas	1	25	46	72	35	20,29	55,75
Non-metallic mineral industries	18	19	50	88	24	2,07	4,88
Steel industries	3	18	44	64	41	7,76	24,13
Non-ferrous metal metallurgy	8	17	46	71	36	3,28	9,31
Other metallurgic industries	24	16	53	93	22	1,67	3,85
Machinery and tractors industries	6	18	50	74	34	3,99	12,28
Electric equipment industries	7	16	47	71	37	3,46	10,54
Electronic equipment industries	7	20	41	68	39	3,72	9,28
Automobiles, trucks and buses industries	2	27	47	76	31	13,38	35,21
Motors and parts of vehicles industries	10	17	48	75	32	2,78	7,62
Wood and furniture industries	24	27	55	106	19	2,12	4,43
Pulp and paper industries	8	25	51	84	26	3,99	10,24
Rubber industry	11	21	47	79	30	2,87	7,06
Chemical elements	4	29	48	82	27	9,06	22,34
Refined petroleum	1	18	37	56	42	20,88	61,22
Chemical industries	10	22	43	75	33	3,29	7,79
Pharmaceutical and medicine industries	11	23	52	86	25	3,16	7,97
Plastic industries	14	15	42	71	38	2,10	5,13
Textile industries	37	30	49	116	17	1,81	3,15
Clothing industries	80	33	61	175	5	1,41	2,17
Footwear industries	23	42	55	119	16	2,84	5,25
Coffee industries	4	90	68	162	6	22,11	37,93
Other vegetables processing	6	66	57	129	13	11,89	21,41
Meat industries	10	100	65	175	4	11,01	17,49
Dairy products industries	19	73	60	152	7	4,76	7,86
Sugar industries	16	61	60	137	11	4,87	8,66
Vegetable oil mills	1	83	59	143	9	74,53	126,55
Other food industries	13	56	55	124	14	5,26	9,46
Miscellaneous manufacturing	25	20	51	96	21	1,82	3,85
Electricity, gas and water supply	3	6	55	64	40	3,49	25,13
Construction	35	16	60	111	18	1,45	3,14
Wholesale and retail trade	53	15	67	136	12	1,28	2,54
Transports	22	20	58	99	20	1,91	4,60
Communications	7	23	51	80	28	4,33	11,81
Financial intermediation	7	13	59	79	29	2,99	11,86
Personal services	52	23	66	141	10	1,45	2,74
Business services	59	19	66	145	8	1,33	2,45
Real estate	4	2	44	50	43	1,58	13,14
Public administration	33	16	74	123	15	1,48	3,71
Private households with employed persons	138	19	72	230	2	1,14	1,66

Source: Research results.

Table 6. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Bahia.

Sectors	Employment generating				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
Arábica coffee	180	33	109	321	6	1,18	1,79
Robusta coffee	232	40	131	404	3	1,17	1,74
Other agriculture and related services	352	23	150	525	1	1,07	1,49
Non-metallic mineral industries	22	20	120	162	27	1,88	7,25
Oil and gas	2	35	102	138	39	17,70	66,46
Non-metallic mineral industries	49	19	133	202	16	1,38	4,08
Steel industries	3	22	110	135	41	8,86	47,40
Non-ferrous metal metallurgy	3	19	117	139	38	6,58	41,75
Other metallurgic industries	16	12	135	163	25	1,77	10,13
Machinery and tractors industries	15	17	128	160	29	2,14	10,50
Electric equipment industries	12	20	124	156	32	2,68	13,23
Electronic equipment industries	9	28	106	143	36	4,24	16,66
Automobiles, trucks and buses industries	2	36	90	129	43	16,75	55,61
Motors and parts of vehicles industries	12	21	122	155	33	2,81	13,19
Wood and furniture industries	54	27	141	222	14	1,50	4,14
Pulp and paper industries	16	31	131	177	24	2,99	11,39
Rubber industry	16	29	116	161	28	2,85	10,18
Chemical elements	7	37	114	159	30	6,36	22,80
Refined petroleum	1	24	67	91	44	30,28	113,40
Chemical industries	8	29	102	138	40	4,63	17,54
Pharmaceutical and medicine industries	5	17	133	155	34	4,15	29,47
Plastic industries	10	21	104	135	42	3,16	13,75
Textile industries	40	19	141	199	18	1,47	5,01
Clothing industries	104	23	148	275	9	1,22	2,64
Footwear industries	13	27	138	178	23	3,15	14,12
Coffee industries	7	90	99	197	20	13,75	27,76
Other vegetables processing	11	146	130	287	8	14,48	26,47
Meat industries	6	189	136	331	4	31,41	53,25
Dairy products industries	6	129	111	246	11	21,20	38,69
Sugar industries	14	111	129	253	10	9,06	18,42
Vegetable oil mills	2	202	126	330	5	111,16	180,18
Other food industries	19	71	110	200	17	4,74	10,56
Miscellaneous manufacturing	45	16	136	196	21	1,35	4,39
Electricity, gas and water supply	5	14	120	139	37	3,59	25,96
Construction	50	26	112	188	22	1,52	3,78
Wholesale and retail trade	132	7	154	294	7	1,05	2,22
Transports	48	24	127	198	19	1,50	4,15
Communications	6	22	130	158	31	4,85	27,48
Financial intermediation	7	12	142	162	26	2,68	21,98
Personal services	70	24	138	232	12	1,34	3,31
Business services	65	14	150	229	13	1,21	3,53
Real estate	4	2	144	150	35	1,46	36,83
Public administration	40	17	147	204	15	1,43	5,14
Private households with employed persons	239	17	148	404	2	1,07	1,69

Source: Research results.

Table 7. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Rondônia.

Sectors	Employment generating				Multiplier effect		
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
Arábica coffee	0	0	0	0	44	0,00	0,00
Robusta coffee	193	35	119	346	2	1,18	1,80
Other agriculture and related services	105	20	117	242	6	1,19	2,30
Non-metallic mineral industries	8	26	82	115	38	4,29	14,66
Oil and gas	1	34	95	130	29	61,43	228,39
Non-metallic mineral industries	45	34	92	171	18	1,74	3,77
Steel industries	2	25	76	103	42	14,35	55,25
Non-ferrous metal metallurgy	4	26	84	114	40	7,58	28,71
Other metallurgic industries	17	24	94	135	27	2,39	7,87
Machinery and tractors industries	20	28	89	137	25	2,43	6,96
Electric equipment industries	9	28	85	122	35	4,14	13,68
Electronic equipment industries	5	36	83	124	34	8,63	26,12
Automobiles, trucks and buses industries	3	43	82	128	31	16,01	44,67
Motors and parts of vehicles industries	5	29	85	118	37	6,89	24,38
Wood and furniture industries	57	42	97	196	9	1,73	3,43
Pulp and paper industries	11	36	99	146	23	4,19	13,01
Rubber industry	19	29	79	127	32	2,58	6,84
Chemical elements	5	39	87	131	28	8,92	26,46
Refined petroleum	1	25	55	80	43	46,51	147,68
Chemical industries	5	33	83	121	36	7,77	24,80
Pharmaceutical and medicine industries	4	32	93	129	30	8,60	30,92
Plastic industries	11	28	75	115	39	3,45	10,03
Textile industries	65	54	93	212	7	1,84	3,27
Clothing industries	150	46	90	287	3	1,31	1,91
Footwear industries	19	49	85	153	21	3,61	8,18
Coffee industries	9	147	107	263	5	17,53	29,58
Other vegetables processing	12	78	104	194	10	7,45	15,97
Meat industries	6	105	83	194	12	17,26	30,12
Dairy products industries	8	87	80	175	15	12,06	22,31
Sugar industries	14	68	98	181	14	5,97	13,12
Vegetable oil mills	2	102	100	204	8	57,17	111,97
Other food industries	13	68	90	172	17	6,07	12,80
Miscellaneous manufacturing	27	32	93	151	22	2,18	5,65
Electricity, gas and water supply	5	19	89	113	41	5,20	24,83
Construction	33	24	101	158	20	1,71	4,73
Wholesale and retail trade	147	4	132	282	4	1,03	1,93
Transports	42	22	106	170	19	1,52	4,02
Communications	7	23	105	135	26	4,07	18,25
Financial intermediation	8	13	117	138	24	2,59	16,64
Personal services	56	24	114	194	11	1,43	3,46
Business services	51	11	124	187	13	1,22	3,66
Real estate	5	1	120	126	33	1,16	25,95
Public administration	35	14	125	174	16	1,40	5,00
Private households with employed persons	228	17	121	366	1	1,07	1,61

Source: Research results.

Table 8. Direct, indirect and induced effects of employment generation, and type I and type II multipliers, expressed in the Brazilian currency – Reais, constant prices of 2002, Other States.

Sectors	Employment generating				Multiplier effect		
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
Arábica coffee	201	22	71	294	2	1,11	1,46
Robusta coffee	293	39	63	395	1	1,13	1,35
Other agriculture and related services	148	27	75	250	4	1,19	1,69
Non-metallic mineral industries	12	20	50	82	31	2,72	7,06
Oil and gas	1	22	50	72	38	25,08	80,37
Non-metallic mineral industries	26	20	57	102	23	1,78	4,01
Steel industries	3	18	50	70	40	7,83	27,26
Non-ferrous metal metallurgy	3	17	47	67	41	6,04	19,72
Other metallurgic industries	22	14	60	95	24	1,65	4,38
Machinery and tractors industries	8	17	55	81	32	3,05	9,59
Electric equipment industries	8	18	54	79	35	3,23	10,04
Electronic equipment industries	5	20	46	71	39	5,26	15,13
Automobiles, trucks and buses industries	3	28	57	88	27	11,75	33,51
Motors and parts of vehicles industries	7	17	53	76	36	3,50	11,25
Wood and furniture industries	35	27	61	123	20	1,76	3,48
Pulp and paper industries	12	24	58	94	25	3,06	8,02
Rubber industry	9	21	53	84	29	3,27	9,06
Chemical elements	5	33	51	89	26	7,47	17,60
Refined petroleum	1	19	40	60	43	22,85	69,92
Chemical industries	5	21	50	76	37	5,01	14,50
Pharmaceutical and medicine industries	7	19	57	83	30	3,88	12,38
Plastic industries	13	19	52	84	28	2,43	6,41
Textile industries	37	35	59	131	15	1,94	3,55
Clothing industries	78	33	71	182	5	1,43	2,34
Footwear industries	25	40	61	126	17	2,58	4,99
Coffee industries	8	89	70	167	8	11,97	20,55
Other vegetables processing	6	77	62	144	13	14,67	25,66
Meat industries	7	107	66	180	6	16,21	25,52
Dairy products industries	10	86	65	161	10	9,85	16,56
Sugar industries	12	73	65	150	12	6,87	12,09
Vegetable oil mills	1	113	65	179	7	84,89	133,38
Other food industries	16	62	61	140	14	4,82	8,55
Miscellaneous manufacturing	27	19	58	104	22	1,69	3,83
Electricity, gas and water supply	4	11	48	64	42	3,69	14,98
Construction	42	21	62	126	18	1,51	2,96
Wholesale and retail trade	78	11	76	165	9	1,14	2,11
Transports	32	20	65	117	21	1,63	3,66
Communications	6	21	53	80	34	4,52	13,25
Financial intermediation	6	13	61	80	33	3,04	12,61
Personal services	60	22	73	155	11	1,36	2,58
Business services	42	19	70	131	16	1,44	3,11
Real estate	5	3	40	48	44	1,56	10,36
Public administration	28	14	81	123	19	1,50	4,43
Private households with employed persons	162	20	79	261	3	1,12	1,61

Source: Research results.