

# EMPLOYMENT GENERATION IN BRAZILIAN COFFEE REGIONS<sup>1</sup>

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**ABSTRACT:** Due to the specific characteristics of coffee production in each of the main Brazilian states which produce arabica (*Coffea arabica*) and robusta (*Coffea canephora*) coffee, a better understanding of the structural links between the production and processing of coffee in these states and the national economy can provide a framework for implementing public policies essential for planning coffee production and increasing the sector's competitiveness. This study analyzes employment creation in coffee production and processing in the major Brazilian producing regions, based on an inter-regional input-output model covering 44 different sectors in the seven main coffee-producing states - Minas Gerais, Espírito Santo, São Paulo, Paraná, Bahia, Rondônia, and other states - for a total of 308 sectors. The results indicate that robusta coffee production generates more total employment per currency unit, and that the arabica production sector is the fourth largest generator of employment among the 44 sectors nationwide. The results for each state emphasized the importance of coffee production and processing for the national and state economies.

**Key-words:** public polic, input-output model, regional development, rural employment, coffee sector.

## GERAÇÃO DE EMPREGO NAS REGIÕES PRODUTORAS DE CAFÉ DO BRASIL

**RESUMO:** Devido às características específicas da produção de café em cada um dos principais estados brasileiros produtores de café arábica (*Coffea arabica*) e café robusta (*Coffea canephora*), uma melhor compreensão das relações estruturais entre a produção e a industrialização do café, naqueles estados e na economia nacional, pode fornecer subsídios para implementação de políticas públicas, essenciais para planejar a produção de café e aumentar a competitividade setorial. Portanto, este estudo analisou a geração de emprego na produção e na industrialização do café nas principais regiões produtoras do Brasil, baseado em um modelo inter-regional de insumo-produto, com sete regiões, que representam os principais estados produtores de café - Minas Gerais, Espírito Santo, São Paulo, Paraná, Bahia, Rondônia e outros estados - com 44 setores cada um, em um sistema de 308 setores. Os resultados indicaram que a produção de café robusta é o setor que gera mais empregos (totais) por unidade monetária, e que o setor de produção de café arábica é o quarto maior gerador de empregos, dentre os 44 setores considerados para o país. Os resultados para cada um dos estados indicaram que a produção agrícola e a indústria do café são muito importantes para as economias estaduais, bem como para a economia nacional como um todo.

**Palavras-chave:** políticas públicas, modelo de insumo-produto, desenvolvimento regional, emprego rural, setor cafeeiro.

**JEL Classification:** R15, R58, Q18.

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## 1 - INTRODUCTION

The coffee crop was introduced in Brazil at the beginning of the eighteenth century, and its production is now dispersed over a large part of the national territory. The migratory character of coffee production remains from the colonial era, and has resulted in important geographical shifts and structural changes in Brazilian coffee production. While 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 has resulted not only in different producing regions and types of coffee, but also in different structures of production, technology, and competitiveness (BLISKA et al., 2009).

In the states of Minas Gerais, São Paulo, and Bahia the cultivation of the arabica bean (*Coffea Arabica*) is predominant, while robusta beans (*Coffea canephora* - Conillon variety) predominate in Espírito Santo and Rondônia; these are used mainly in mass-market coffee or in blends with arabica coffee.

For many decades, coffee was Brazil's chief export, and despite the reduction of its share in the total it remains very important for the country, especially from the social point of view. It is grown on at least 370,000 rural properties, 70% of them family farms, distributed across over 2,000 municipalities and seventeen states of the Federation. Furthermore, manual harvesting of the beans accounts for the great part of agricultural employment, as well as for up to 50% of the costs of coffee production.

Coffee production chains exhibit distinct structural and technological characteristics in each producer state, but in most regions the prevailing production systems are based on intensive labor, especially during the harvest period which can extend from May to September depending on the region and climate.

Due to these varying characteristics, this

study aims to improve the understanding of the structural relationships between the coffee production and processing sectors and the national economy. Another goal is to offer guidance for implementing public policies, planning coffee plantations and increasing the competitiveness of Brazilian coffee in general.

## 2 - METHODOLOGY

To analyze the behavior of the coffee production and processing sectors in each of the main Brazilian producing regions and their importance within their respective state economies and other sectors of the national economy - especially in terms of the generation and expansion of employment - an inter-regional input-output model was built for the year 2002 (GUILHOTO; SESCO FILHO, 2005)<sup>8</sup>. This system is composed of seven regions, with 44 sectors each for a total of 308, and is consistent with the production structure of the Brazilian economy as reflected in the 2007 reformulation of the System of National Accounts (IBGE, 2007a).

The survey of structures and technical coefficients of production for 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 framework on which to build the inter-regional input-output model, with seven regions representing these six major producer states plus the category "RBR," which includes other Brazilian states where coffee production is not significant or where there is no coffee production at all.

For the survey, a structured questionnaire was administered, developed in partnership with experts from the Instituto de Economia Agrícola (Agricultural Economics Institute), linked with the

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<sup>8</sup>When this study began, the input-output matrix of the IBGE for 2005 was unavailable, so the inter-regional model for the coffee industry was built on the 2002 inter-regional model for Brazil.

Agriculture and Supply Secretariat of the State of São Paulo and Embrapa (Coffee Division), based on published information on the costs of coffee production in Brazil. Different models used by cooperatives, universities, consultants in the industry and the Companhia Nacional de Abastecimento (National Supply Company) were adjusted.

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

The input-output model, in its original formulation, assumes that the relative price of the system remains constant. 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 international prices, among others - a construction of sophisticated computable general equilibrium models would be required to analyze those effects, which is beyond the scope of this work. As this study focuses on the 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, raw quantities, 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, harvesting machines, and other) was also solicited by the questionnaire. Indications of change in any of these variables resulted in the correction of the value used in the opening of the input-output matrices, based on estimate(s) made by interviewee(s) about the rate of change in their respective regions between 2002 and the date the questionnaire was given. That is, an estimate of the values and prices in 2002 was performed.

The data obtained via questionnaires was compared with secondary data provided by government agencies, research institutes, and cooperatives

related to the coffee sector. The value of coffee production in each producing region was estimated based on 2002 prices. Estimates of prices paid and received by producers in 2002 were also used to help estimate profits.

This paper specifically examines the direct, indirect and induced effects of employment generation, and the effects of Type I and Type II employment multipliers for the sectors and countries that compose the system, as detailed below.

The vector "employed persons" of the national input-output matrix was taken directly from the new system of national accounts based on the National Survey by Household Sample - PNAD (IBGE, 2007b) to open up sectors related to coffee. For regionalization or construction of an inter-regional input-output system, data from PNAD (IBGE, 2007b) was used as the basis for opening of the sector "employed persons," along with other specific sources about coffee cultivation.

## 2.1 - Theoretical Background

The intersectoral flows in a specific economy are determined by technological and economic factors, and these flows can be described by the following system (GUILHOTO, 2011):

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

where  $X$  is a  $(n \times 1)$  vector for the value of the total production in each sector;  $A$  is a  $(n \times n)$  matrix of the technical coefficients of production; and  $Y$  is a  $(n \times 1)$  vector for values for 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 final demand over total production, and thus over employment, imports, wages and others.

## 2.2 - Induced Effect Model

The employment effects can be classified into three types: a) a direct employment effect, which determines how many jobs are generated by a given sector as its production is increased; b) an indirect employment effect, which determines how many jobs are generated in all the other sectors as the production of a given sector is increased; and c) an induced employment effect, which determines how many jobs are generated as a result of increased household consumption as a consequence of rises in income, given the increase in direct, indirect, and induced employment.

To estimate the induced effect, i.e., the effect that the increase in employment would have on total production in the economy given the consumption of newly-employed people, one can make family consumption and family income endogenous in the model, so instead of  $A$  we 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 for the income coefficient in each sector and  $(H_c)$  is a  $(n \times 1)$  vector for the families' consumption coefficients.

The new vectors of production and final demand would thus be given, respectively, by  $(\bar{X}, (n+1) \times 1)$  and by  $(\bar{Y}, (n+1) \times 1)$ , which 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

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

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

## 2.3 - Production Multipliers

From the multiplier results it is possible to measure the direct and indirect effects that a change in final demand has on production, income, employment and other indicators (MILLER; BLAIR, 1985). From the Leontief inverse matrix ( $B$ ), defined above, the Type I production multipliers for each economic sector are 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 Type II production multiplier, which takes into consideration the induced effect, is given by

$$\bar{P}_j = \sum_{i=1}^n \bar{b}_{ij} \quad (10)$$

$$j = 1, \dots, n$$

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

## 2.4 - Coefficients and Employment Generation

To estimate the employment multipliers, one must first estimate 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 before.

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), for both 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 between employment coefficient, coefficient of employment multiplication (or multiplier) and coefficient of employment generation (or generator), the results obtained by applying the proposed methodology are summarized in Table 1. However, the results for Brazil as a whole, as well as the results obtained for the regions that make up the inter-regional system, are presented in tables 1 to 9.

**Table 1 - Effect of an Increase of R\$1 Million<sup>1</sup> on Coffee Production**

Brazil and Brazilian coffee regions		Employment generation				Multiplier effect		
		Direct	Indirect	Induced	Total	Rank <sup>2</sup>	Type I <sup>3</sup>	Type II <sup>4</sup>
Brazil as a whole	Arabica	121	14	71	207	4	1.12	1.71
	Robusta	192	20	74	286	1	1.11	1.49
	Industry	6	91	67	164	8	15.91	4
Brazilian coffee regions								
Minas Gerais	Arabica	117	14	83	214	2	1.12	1.84
	Industry	7	86	78	171	7	12.66	23.26
Espírito Santo	Arabica	142	13	77	233	3	1.09	1.64
	Robusta	177	17	76	270	1	1.09	1.52
	Industry	7	116	69	192	4	18.44	28.83
São Paulo	Arabica	93	9	62	164	3	1.10	1.77
	Industry	6	69	59	133	8	13.23	23.69
Paraná	Arabica	154	19	66	238	1	1.13	1.55
	Industry	4	90	68	162	6	22.11	37.93
Bahia	Arabica	180	33	109	321	6	1.18	1.79
	Robusta	232	40	131	404	3	1.17	1.74
	Industry	7	90	99	197	20	13.75	27.76
Rondônia	Robusta	193	35	119	346	2	1.18	1.80
	Industry	9	147	107	263	5	17.53	29.58
Other states	Arabica	201	22	71	294	2	1.11	1.46
	Robusta	293	39	63	395	1	1.13	1.35
	Industry	8	89	70	167	8	11.97	5

<sup>1</sup>R\$: Real - Brazilian currency, in constant prices of 2002.

<sup>2</sup>Order in relation to the 44 sectors that comprise the Brazilian economy as a whole.

<sup>3</sup>Type I multiplier: determines how many jobs are created, directly and indirectly, from the creation of a new post in a particular productive sector.

<sup>4</sup>Type II multiplier: adds to the Type I employment multiplier the new employment resulting from the increase in the population's income due to the greater quantity of direct and indirect employment.

Source: Results of the inter-regional input-output model applied in the study.

**Table 2 - Brazil: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>**

Sectors	Employment generation				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
<b>Arabica</b>	<b>121</b>	<b>14</b>	<b>71</b>	<b>207</b>	<b>4</b>	<b>1.12</b>	<b>1.71</b>
<b>Robusta</b>	<b>192</b>	<b>20</b>	<b>74</b>	<b>286</b>	<b>1</b>	<b>1.11</b>	<b>1.49</b>
Other agricultural products	125	26	73	224	3	1.21	1.79
Mineral extraction	12	17	51	79	31	2.48	6.89
Oil and gas	1	21	50	72	38	22.82	76.02
Non-metallic mineral	23	20	55	98	23	1.88	4.29
Steel	3	18	48	68	41	7.59	25.13
Non-ferrous metallurgy	5	17	48	69	40	4.69	15.18
Other metallurgical products	20	14	56	90	25	1.73	4.58
Machinery and equipment	10	17	53	81	28	2.76	8.18
Electrical equipment	8	17	51	77	35	3.07	9.33
Electronic equipment	5	20	46	70	39	4.63	13.10
Cars, trucks and buses	2	27	51	80	29	13.34	36.67
Parts and other vehicles	7	17	51	76	36	3.37	10.44
Wood and furniture	35	28	59	123	17	1.79	3.48
Cellulose, paper and printing	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
Oil refining	1	18	39	57	43	24.75	75.72
Various chemical	6	21	48	74	37	4.83	13.45
Pharmacy and veterinary	6	20	53	79	32	4.17	12.61
Plastic articles	12	17	48	77	34	2.41	6.31
Textile industry	32	33	58	123	16	2.01	3.80
Articles of clothing	75	33	68	177	5	1.44	2.35
Manufacture of shoes	30	40	60	130	15	2.34	4.33
<b>Coffee industry</b>	<b>6</b>	<b>91</b>	<b>67</b>	<b>164</b>	<b>8</b>	<b>15.91</b>	<b>26.84</b>
Processing of other vegetables	7	76	61	144	13	12.28	21.38
Slaughtering	7	99	65	171	6	14.68	23.73
Dairy industry	11	81	64	156	10	8.35	14.13
Manufacture of sugar	10	72	63	145	12	8.25	14.64
Manufacture of vegetable oils	1	100	63	165	7	87.45	142.12
Other food products	16	59	59	134	14	4.75	8.47
Other industries	30	19	56	105	22	1.65	3.53
Public utility services industries	4	10	50	64	42	3.70	16.74
Building	42	19	61	123	18	1.46	2.92
Trade	74	11	74	158	9	1.14	2.15
Transport	29	18	64	111	21	1.59	3.76
Communications	6	18	54	77	33	4.01	13.11
Financial institutions	6	12	62	80	30	3.00	13.55
Services to families	55	21	70	147	11	1.39	2.65
Business services	36	16	70	123	19	1.45	3.38
Leasing	4	2	44	51	44	1.62	12.86
Government	28	13	80	120	20	1.45	4.29
Private non-market services	149	19	77	245	2	1.13	1.64

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 3** - Minas Gerais State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>

Sectors	Employment generation					Multiplier effect	
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
<b>Arabica</b>	<b>117</b>	<b>14</b>	<b>83</b>	<b>214</b>	<b>2</b>	<b>1.12</b>	<b>1.84</b>
<b>Robusta</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>0.00</b>	<b>0.00</b>
Other agricultural products	72	35	80	188	4	1.49	2.60
Mineral extraction	10	16	66	92	37	2.54	8.81
Oil and gas	1	25	68	94	36	35.89	129.84
Non-metallic mineral	26	21	69	116	22	1.83	4.51
Steel	3	20	60	83	41	7.65	28.05
Non-ferrous metallurgy	7	19	64	90	38	3.72	12.81
Other metallurgical products	21	16	70	108	24	1.75	5.02
Machinery and equipment	14	20	69	103	25	2.44	7.30
Electrical equipment	10	20	66	96	32	3.00	9.71
Electronic equipment	7	26	63	97	31	4.66	13.47
Cars, trucks and buses	2	30	57	90	39	17.75	49.37
Parts and other vehicles	8	21	67	95	33	3.48	11.48
Wood and furniture	53	31	76	160	10	1.58	3.01
Cellulose, paper and printing	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
Oil refining	1	22	50	72	43	37.11	118.91
Various chemical	6	25	64	95	34	4.98	15.16
Pharmacy and veterinary	7	22	70	99	28	4.28	14.52
Plastic articles	15	22	63	100	27	2.47	6.71
Textile industry	36	36	72	144	14	2.00	4.00
Articles of clothing	91	38	82	211	3	1.41	2.32
Manufacture of shoes	60	49	73	182	6	1.81	3.04
<b>Coffee industry</b>	<b>7</b>	<b>86</b>	<b>78</b>	<b>171</b>	<b>7</b>	<b>12.66</b>	<b>23.26</b>
Processing of other vegetables	10	60	73	143	15	7.02	14.37
Slaughtering	8	73	75	156	11	10.17	19.68
Dairy industry	14	80	68	162	9	6.81	11.75
Manufacture of sugar	10	54	74	138	16	6.15	13.18
Manufacture of vegetable oils	1	93	73	167	8	79.66	141.34
Other food products	19	58	70	147	13	4.05	7.73
Other industries	40	22	73	135	19	1.56	3.38
Public utility services industries	4	10	69	83	40	3.34	18.95
Building	41	20	76	136	18	1.48	3.33
Trade	87	7	90	184	5	1.08	2.12
Transport	24	18	75	118	21	1.76	4.85
Communications	6	18	71	95	35	3.89	15.28
Financial institutions	7	13	78	98	30	2.89	14.07
Services to families	51	23	80	153	12	1.45	3.03
Business services	36	18	83	137	17	1.49	3.80
Leasing	3	3	72	78	42	1.85	23.82
Government	28	12	88	128	20	1.43	4.61
Private non-market services	155	19	83	257	1	1.12	1.66

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 4** - Espírito Santo State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>

Sectors	Employment generation					Multiplier effect	
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
<b>Arabica</b>	<b>142</b>	<b>13</b>	<b>77</b>	<b>233</b>	<b>3</b>	<b>1.09</b>	<b>1.64</b>
<b>Robusta</b>	<b>177</b>	<b>17</b>	<b>76</b>	<b>270</b>	<b>1</b>	<b>1.09</b>	<b>1.52</b>
Other agricultural products	41	41	43	125	12	2.01	3.07
Mineral extraction	10	9	52	71	31	1.93	6.98
Oil and gas	1	19	47	67	36	18.57	63.05
Non-metallic mineral	18	20	52	90	24	2.15	5.13
Steel	2	15	42	59	42	7.44	25.57
Non-ferrous metallurgy	5	15	43	63	40	4.11	12.92
Other metallurgical products	18	14	50	82	26	1.78	4.53
Machinery and equipment	11	16	47	74	30	2.45	6.65
Electrical equipment	9	15	44	68	33	2.71	7.73
Electronic equipment	5	15	34	55	43	3.91	10.36
Cars, trucks and buses	3	21	37	60	41	9.13	23.19
Parts and other vehicles	7	15	43	64	38	3.24	9.73
Wood and furniture	46	31	56	133	10	1.66	2.87
Cellulose, paper and printing	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
Oil refining	1	13	30	43	44	22.60	71.41
Various chemical	6	18	41	65	37	3.81	10.32
Pharmacy and veterinary	5	20	50	75	29	4.73	14.08
Plastic articles	10	14	40	64	39	2.37	6.23
Textile industry	33	33	53	119	17	2.00	3.59
Articles of clothing	64	37	61	162	7	1.57	2.53
Manufacture of shoes	61	48	53	162	8	1.78	2.66
<b>Coffee industry</b>	<b>7</b>	<b>116</b>	<b>69</b>	<b>192</b>	<b>4</b>	<b>18.44</b>	<b>28.83</b>
Processing of other vegetables	10	49	49	108	20	5.82	10.58
Slaughtering	6	97	67	170	5	17.96	29.58
Dairy industry	11	51	48	111	18	5.77	10.26
Manufacture of sugar	7	49	52	109	19	7.70	14.80
Manufacture of vegetable oils	1	101	62	164	6	124.42	199.81
Other food products	15	55	54	124	14	4.70	8.31
Other industries	28	20	50	97	22	1.70	3.48
Public utility services industries	4	12	51	67	34	3.78	15.27
Building	48	17	60	125	13	1.35	2.61
Trade	73	10	75	158	9	1.13	2.16
Transport	23	14	64	102	21	1.61	4.35
Communications	5	15	60	80	27	3.99	15.59
Financial institutions	7	13	68	88	25	2.85	12.53
Services to families	44	21	66	132	11	1.47	2.97
Business services	36	16	69	121	16	1.44	3.37
Leasing	3	3	61	67	35	1.90	19.79
Government	30	12	80	123	15	1.39	4.02
Private non-market services	147	20	70	237	2	1.13	1.61

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.



**Table 5** - São Paulo State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>

Sectors	Employment generation					Multiplier effect	
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
<b>Arabica</b>	<b>93</b>	<b>9</b>	<b>62</b>	<b>164</b>	<b>3</b>	<b>1.10</b>	<b>1.77</b>
<b>Robusta</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>0.00</b>	<b>0.00</b>
Other agricultural products	64	17	64	145	5	1.27	2.28
Mineral extraction	13	15	39	66	35	2.14	5.12
Oil and gas	1	19	40	60	40	29.22	87.74
Non-metallic mineral	20	19	48	87	22	1.92	4.30
Steel	3	16	42	60	39	6.94	22.57
Non-ferrous metallurgy	5	16	42	64	37	3.96	11.77
Other metallurgical products	18	14	50	82	24	1.79	4.60
Machinery and equipment	11	16	48	76	26	2.48	6.80
Electrical equipment	8	16	46	70	31	2.91	8.39
Electronic equipment	6	18	40	64	36	4.17	11.02
Cars, trucks and buses	2	25	46	72	27	12.36	33.48
Parts and other vehicles	7	17	46	69	32	3.33	9.81
Wood and furniture	39	24	50	113	14	1.62	2.93
Cellulose, paper and printing	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
Oil refining	1	16	34	51	42	25.53	76.32
Various chemical	5	21	45	71	29	5.08	13.96
Pharmacy and veterinary	6	20	45	72	28	4.38	11.96
Plastic articles	11	16	43	71	30	2.43	6.22
Textile industry	27	33	51	111	16	2.21	4.07
Articles of clothing	68	32	58	158	4	1.47	2.31
Manufacture of shoes	45	38	52	134	6	1.84	2.99
<b>Coffee industry</b>	<b>6</b>	<b>69</b>	<b>59</b>	<b>133</b>	<b>8</b>	<b>13.23</b>	<b>23.69</b>
Processing of other vegetables	8	65	57	130	9	9.63	17.15
Slaughtering	6	54	57	117	12	9.85	19.11
Dairy industry	11	49	55	115	13	5.41	10.40
Manufacture of sugar	8	49	55	112	15	6.76	13.33
Manufacture of vegetable oils	1	109	62	171	2	118.28	185.24
Other food products	15	56	52	123	11	4.70	8.17
Other industries	31	19	48	98	20	1.62	3.18
Public utility services industries	3	10	40	53	41	4.15	17.09
Building	42	15	53	110	17	1.36	2.61
Trade	62	10	61	134	7	1.16	2.15
Transport	28	13	55	95	21	1.47	3.47
Communications	6	13	44	63	38	3.42	11.34
Financial institutions	5	10	52	67	34	3.00	13.19
Services to families	49	20	58	127	10	1.41	2.59
Business services	29	14	61	103	19	1.48	3.59
Leasing	4	2	33	38	43	1.64	10.90
Government	25	10	71	107	18	1.42	4.26
Private non-market services	122	17	68	207	1	1.14	1.69

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 6 - Paraná State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>**

Sectors	Employment generation				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
<b>Arabica</b>	<b>154</b>	<b>19</b>	<b>66</b>	<b>238</b>	<b>1</b>	<b>1.13</b>	<b>1.55</b>
<b>Robusta</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>0.00</b>	<b>0.00</b>
Other agricultural products	95	23	68	186	3	1.24	1.95
Mineral extraction	23	22	47	92	23	1.95	4.01
Oil and gas	1	25	46	72	35	20.29	55.75
Non-metallic mineral	18	19	50	88	24	2.07	4.88
Steel	3	18	44	64	41	7.76	24.13
Non-ferrous metallurgy	8	17	46	71	36	3.28	9.31
Other metallurgical products	24	16	53	93	22	1.67	3.85
Machinery and equipment	6	18	50	74	34	3.99	12.28
Electrical equipment	7	16	47	71	37	3.46	10.54
Electronic equipment	7	20	41	68	39	3.72	9.28
Cars, trucks and buses	2	27	47	76	31	13.38	35.21
Parts and other vehicles	10	17	48	75	32	2.78	7.62
Wood and furniture	24	27	55	106	19	2.12	4.43
Cellulose, paper and printing	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
Oil refining	1	18	37	56	42	20.88	61.22
Various chemical	10	22	43	75	33	3.29	7.79
Pharmacy and veterinary	11	23	52	86	25	3.16	7.97
Plastic articles	14	15	42	71	38	2.10	5.13
Textile industry	37	30	49	116	17	1.81	3.15
Articles of clothing	80	33	61	175	5	1.41	2.17
Manufacture of shoes	23	42	55	119	16	2.84	5.25
<b>Coffee industry</b>	<b>4</b>	<b>90</b>	<b>68</b>	<b>162</b>	<b>6</b>	<b>22.11</b>	<b>37.93</b>
Processing of other vegetables	6	66	57	129	13	11.89	21.41
Slaughtering	10	100	65	175	4	11.01	17.49
Dairy industry	19	73	60	152	7	4.76	7.86
Manufacture of sugar	16	61	60	137	11	4.87	8.66
Manufacture of vegetable oils	1	83	59	143	9	74.53	126.55
Other food products	13	56	55	124	14	5.26	9.46
Other industries	25	20	51	96	21	1.82	3.85
Public utility services industries	3	6	55	64	40	3.49	25.13
Building	35	16	60	111	18	1.45	3.14
Trade	53	15	67	136	12	1.28	2.54
Transport	22	20	58	99	20	1.91	4.60
Communications	7	23	51	80	28	4.33	11.81
Financial institutions	7	13	59	79	29	2.99	11.86
Services to families	52	23	66	141	10	1.45	2.74
Business services	59	19	66	145	8	1.33	2.45
Leasing	4	2	44	50	43	1.58	13.14
Government	33	16	74	123	15	1.48	3.71
Private non-market services	138	19	72	230	2	1.14	1.66

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 7 - Bahia State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>**

Sectors	Employment generation					Multiplier effect	
	Direct	Indirect	Induced	Total	Rank	Type I	Type II
<b>Arabica</b>	<b>180</b>	<b>33</b>	<b>109</b>	<b>321</b>	<b>6</b>	<b>1.18</b>	<b>1.79</b>
<b>Robusta</b>	<b>232</b>	<b>40</b>	<b>131</b>	<b>404</b>	<b>3</b>	<b>1.17</b>	<b>1.74</b>
Other agricultural products	352	23	150	525	1	1.07	1.49
Mineral extraction	22	20	120	162	27	1.88	7.25
Oil and gas	2	35	102	138	39	17.70	66.46
Non-metallic mineral	49	19	133	202	16	1.38	4.08
Steel	3	22	110	135	41	8.86	47.40
Non-ferrous metallurgy	3	19	117	139	38	6.58	41.75
Other metallurgical products	16	12	135	163	25	1.77	10.13
Machinery and equipment	15	17	128	160	29	2.14	10.50
Electrical equipment	12	20	124	156	32	2.68	13.23
Electronic equipment	9	28	106	143	36	4.24	16.66
Cars, trucks and buses	2	36	90	129	43	16.75	55.61
Parts and other vehicles	12	21	122	155	33	2.81	13.19
Wood and furniture	54	27	141	222	14	1.50	4.14
Cellulose, paper and printing	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
Oil refining	1	24	67	91	44	30.28	113.40
Various chemical	8	29	102	138	40	4.63	17.54
Pharmacy and veterinary	5	17	133	155	34	4.15	29.47
Plastic articles	10	21	104	135	42	3.16	13.75
Textile industry	40	19	141	199	18	1.47	5.01
Articles of clothing	104	23	148	275	9	1.22	2.64
Manufacture of shoes	13	27	138	178	23	3.15	14.12
<b>Coffee industry</b>	<b>7</b>	<b>90</b>	<b>99</b>	<b>197</b>	<b>20</b>	<b>13.75</b>	<b>27.76</b>
Processing of other vegetables	11	146	130	287	8	14.48	26.47
Slaughtering	6	189	136	331	4	31.41	53.25
Dairy industry	6	129	111	246	11	21.20	38.69
Manufacture of sugar	14	111	129	253	10	9.06	18.42
Manufacture of vegetable oils	2	202	126	330	5	111.16	180.18
Other food products	19	71	110	200	17	4.74	10.56
Other industries	45	16	136	196	21	1.35	4.39
Public utility services industries	5	14	120	139	37	3.59	25.96
Building	50	26	112	188	22	1.52	3.78
Trade	132	7	154	294	7	1.05	2.22
Transport	48	24	127	198	19	1.50	4.15
Communications	6	22	130	158	31	4.85	27.48
Financial institutions	7	12	142	162	26	2.68	21.98
Services to families	70	24	138	232	12	1.34	3.31
Business services	65	14	150	229	13	1.21	3.53
Leasing	4	2	144	150	35	1.46	36.83
Government	40	17	147	204	15	1.43	5.14
Private non-market services	239	17	148	404	2	1.07	1.69

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 8 - Rondônia State: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>**

Sectors	Employment generation				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
<b>Arabica</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>0.00</b>	<b>0.00</b>
<b>Robusta</b>	<b>193</b>	<b>35</b>	<b>119</b>	<b>346</b>	<b>2</b>	<b>1.18</b>	<b>1.80</b>
Other agricultural products	105	20	117	242	6	1.19	2.30
Mineral extraction	8	26	82	115	38	4.29	14.66
Oil and gas	1	34	95	130	29	61.43	228.39
Non-metallic mineral	45	34	92	171	18	1.74	3.77
Steel	2	25	76	103	42	14.35	55.25
Non-ferrous metallurgy	4	26	84	114	40	7.58	28.71
Other metallurgical products	17	24	94	135	27	2.39	7.87
Machinery and equipment	20	28	89	137	25	2.43	6.96
Electrical equipment	9	28	85	122	35	4.14	13.68
Electronic equipment	5	36	83	124	34	8.63	26.12
Cars, trucks and buses	3	43	82	128	31	16.01	44.67
Parts and other vehicles	5	29	85	118	37	6.89	24.38
Wood and furniture	57	42	97	196	9	1.73	3.43
Cellulose, paper and printing	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
Oil refining	1	25	55	80	43	46.51	147.68
Various chemical	5	33	83	121	36	7.77	24.80
Pharmacy and veterinary	4	32	93	129	30	8.60	30.92
Plastic articles	11	28	75	115	39	3.45	10.03
Textile industry	65	54	93	212	7	1.84	3.27
Articles of clothing	150	46	90	287	3	1.31	1.91
Manufacture of shoes	19	49	85	153	21	3.61	8.18
<b>Coffee industry</b>	<b>9</b>	<b>147</b>	<b>107</b>	<b>263</b>	<b>5</b>	<b>17.53</b>	<b>29.58</b>
Processing of other vegetables	12	78	104	194	10	7.45	15.97
Slaughtering	6	105	83	194	12	17.26	30.12
Dairy industry	8	87	80	175	15	12.06	22.31
Manufacture of sugar	14	68	98	181	14	5.97	13.12
Manufacture of vegetable oils	2	102	100	204	8	57.17	111.97
Other food products	13	68	90	172	17	6.07	12.80
Other industries	27	32	93	151	22	2.18	5.65
Public utility services industries	5	19	89	113	41	5.20	24.83
Building	33	24	101	158	20	1.71	4.73
Trade	147	4	132	282	4	1.03	1.93
Transport	42	22	106	170	19	1.52	4.02
Communications	7	23	105	135	26	4.07	18.25
Financial institutions	8	13	117	138	24	2.59	16.64
Services to families	56	24	114	194	11	1.43	3.46
Business services	51	11	124	187	13	1.22	3.66
Leasing	5	1	120	126	33	1.16	25.95
Government	35	14	125	174	16	1.40	5.00
Private non-market services	228	17	121	366	1	1.07	1.61

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

**Table 9 - Rest of Brazil: Employment Generation and Multiplier Effect by Millions of R\$<sup>1</sup>**

Sectors	Employment generation				Rank	Multiplier effect	
	Direct	Indirect	Induced	Total		Type I	Type II
<b>Arabica</b>	<b>201</b>	<b>22</b>	<b>71</b>	<b>294</b>	<b>2</b>	<b>1.11</b>	<b>1.46</b>
<b>Robusta</b>	<b>293</b>	<b>39</b>	<b>63</b>	<b>395</b>	<b>1</b>	<b>1.13</b>	<b>1.35</b>
Other agricultural products	148	27	75	250	4	1.19	1.69
Mineral extraction	12	20	50	82	31	2.72	7.06
Oil and gas	1	22	50	72	38	25.08	80.37
Non-metallic mineral	26	20	57	102	23	1.78	4.01
Steel	3	18	50	70	40	7.83	27.26
Non-ferrous metallurgy	3	17	47	67	41	6.04	19.72
Other metallurgical products	22	14	60	95	24	1.65	4.38
Machinery and equipment	8	17	55	81	32	3.05	9.59
Electrical equipment	8	18	54	79	35	3.23	10.04
Electronic equipment	5	20	46	71	39	5.26	15.13
Cars, trucks and buses	3	28	57	88	27	11.75	33.51
Parts and other vehicles	7	17	53	76	36	3.50	11.25
Wood and furniture	35	27	61	123	20	1.76	3.48
Cellulose, paper and printing	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
Oil refining	1	19	40	60	43	22.85	69.92
Various chemical	5	21	50	76	37	5.01	14.50
Pharmacy and veterinary	7	19	57	83	30	3.88	12.38
Plastic articles	13	19	52	84	28	2.43	6.41
Textile industry	37	35	59	131	15	1.94	3.55
Articles of clothing	78	33	71	182	5	1.43	2.34
Manufacture of shoes	25	40	61	126	17	2.58	4.99
<b>Coffee industry</b>	<b>8</b>	<b>89</b>	<b>70</b>	<b>167</b>	<b>8</b>	<b>11.97</b>	<b>20.55</b>
Processing of other vegetables	6	77	62	144	13	14.67	25.66
Slaughtering	7	107	66	180	6	16.21	25.52
Dairy industry	10	86	65	161	10	9.85	16.56
Manufacture of sugar	12	73	65	150	12	6.87	12.09
Manufacture of vegetable oils	1	113	65	179	7	84.89	133.38
Other food products	16	62	61	140	14	4.82	8.55
Other industries	27	19	58	104	22	1.69	3.83
Public utility services industries	4	11	48	64	42	3.69	14.98
Building	42	21	62	126	18	1.51	2.96
Trade	78	11	76	165	9	1.14	2.11
Transport	32	20	65	117	21	1.63	3.66
Communications	6	21	53	80	34	4.52	13.25
Financial institutions	6	13	61	80	33	3.04	12.61
Services to families	60	22	73	155	11	1.36	2.58
Business services	42	19	70	131	16	1.44	3.11
Leasing	5	3	40	48	44	1.56	10.36
Government	28	14	81	123	19	1.50	4.43
Private non-market services	162	20	79	261	3	1.12	1.61

<sup>1</sup>R\$: Real - Brazilian currency in constant prices of 2002.

Source: Results of the inter-regional input-output model applied in the study.

### 3.1 - Results for Brazil

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

### 3.2 - Multipliers, Generators and Descriptive Analysis of the Input-Output Matrix

The direct, indirect and induced effects of employment generation and Type I and Type II multipliers of the input-output matrix that was built to analyze the sectors directly related to coffee are presented in table 1 (the value of employment-generating effects are expressed in Brazilian Reais, at constant 2002 rates).

The five sectors that generate the most employment (total) per 1 million reais are: "Robusta Coffee," "Non-market private services," "Other Agricultural Products," "Arabica Coffee," and "Articles of clothing".

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

### 3.3 - The Employment Generator

The direct, indirect and induced coefficients of employment generation are related to the amount of jobs and their monetary value (also expressed in Reais in constant prices, millions of real jobs by 2002).

The total effect of an increase of one million reais on the production of arabica and robusta coffee

is respectively 207 and 286 (Table 1). That is, an increase of one million reais in the production of arabica coffee generates an increase of 121 direct jobs, 14 indirect and 71 induced, for a total of 207 jobs. A similar increase in robusta production also generates 192 direct jobs, 20 indirect and 74 induced, for a total of 286 jobs.

In the nineteenth century, the coffee crop was considered an activity of great social importance due to the generation of employment in farming and industry. The Brazilian coffee agribusiness is now internalized, employing new techniques of production, post-harvest, processing and marketing - such as the launch of new genetically superior materials, density of cultivation, irrigation use, introduction of mechanical harvesting and the spread of good harvest and post-harvest practices - which have had positive impacts on productivity and quality of the final product. Nevertheless, the results of the input-output analysis indicate that arabica and robusta coffee crops remain labor-intensive.

Mechanical harvesting is limited to a small portion of the arabica crop, according to the limitations imposed by the soil slope of certain producing regions, such as southern Minas Gerais. It also depends 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 some regions of São Paulo State. Even on medium size farms, the use of mechanical harvesting is often possible only through outsourcing, machinery rental or joint purchasing via cooperatives or farmers associations. Small farms sometimes make use of vibrator machines which use a system of "fingers" to help remove the fruit, which reduces the need for labor, but not in the same proportion as the larger equipment. Since up to 70% of Brazilian producers have less than 50ha of coffee planted, the use of labor on these farms is still strong.

Robusta coffee's greater importance for employment generation can be explained by the increased difficulty in harvesting it mechanically. The

robusta fruit are more firmly attached to the branches than arabica, and an efficient system of mechanical harvesting for robusta coffee is not yet available.

Regarding the coffee industry, it was found that this sector showed the 8th-highest rate of employment generation among the 44 sectors of the economy, higher than the position obtained by other traditional sectors of Brazilian agribusiness such as "sugar manufacturing," "vegetable oils" and "dairy," and also higher than sectors such as shoes, chemicals and pharmaceuticals.

### 3.4 - The Employment Multiplier

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

The analysis of the multiplier is more difficult than the analysis of employment generation, because this parameter comes from the ratio of the two factors cited. The denominator - the coefficient of generation of direct and indirect employment or total - is divided by the coefficient of employment.

The intensity of relations between sectors is the main point of this analysis. Imagine, for example, an increase in the demand for alcohol. As a result, cane sugar production will also see a long-term increase. At the same time, there will also be an increase in the production of machines used in that sector, agricultural implements, buildings and so on. This process is known as a multiplier.

This multiplier effect, which is limited only to the demand for intermediate inputs, is called the Type I multiplier. However, the effects are also repeated on the side of primary inputs, in a different way: an increase in demand for manpower will mean that there is an increase in families' purchasing power, thus generating an increased demand for

these final products. This will result in a further increase in activity of the producing sectors, which in turn will increase demand for various types of inputs, including manpower, which will cause a further increase in purchasing power, causing an increase in household final demand and so on, until the system reaches equilibrium. This increase in employment caused by increased demand in household consumption is called the induced effect (Type II multipliers).

As previously mentioned, the division by its coefficient generator generates direct multipliers, indicating how many direct and indirect jobs are generated for every directly-created job. Specifically, the Type I multiplier is the ratio between the generation of direct and indirect employment by the coefficient of employment created, whereas the Type II multiplier is the ratio of total employment by the coefficient of employment created. Mathematically, a low value of the type 1 multiplier means that either the employment coefficient is high, the generator of direct and indirect employment is low or the two facts together; the reverse is also true.

The results presented in Table 1 indicate that the robusta and arabica coffee sectors have the two smallest effects among the 44 sectors of the economy. In contrast, the coffee industry as a whole presents the 4th-largest multiplier effect, which again indicates the importance of coffee agribusiness for the Brazilian economy. These results indicate that the of arabica and robusta coffee production sectors are important in generating a large volume of employment - direct, indirect and induced - by unit currency produced in the final demand (expressed in reais), compared to other sectors of the national or state economies.

However, these sectors are not able to multiply the number of jobs upon creation of a new post in the industry, nor to generate further employment from the increase of income of the population resulting from the creation of new employment.

By comparison, the "vegetable oils" manufacturing sector has the highest Type I employment multiplier (87.45) of the economy (Table 2), followed

by "oil refining" (24.75), "oil and gas industry" (22.82) and finally the "coffee industry" (15.91). The arabica and robusta coffee sectors have Type I multipliers equal to 1.12 and 1.11, respectively.

With respect to the Type II multiplier, the coffee industry has the 5th-highest. The sector with the highest Type II multiplier is "vegetable oils" (142.12), followed by "oil and gas industry" (76.02), "oil refining" (75.72), "cars, trucks and buses" (36.67) and, finally, the "coffee industry" (26.84).

### 3.5 - Results for Brazilian States

This section presents the results of the coefficient of direct employment; the direct, indirect and induced employment generation; and the values of employment multipliers for the sectors and states of the system in 2002. The importance of employment generation and employment multipliers were analyzed in states where the sectors related to coffee play a significant role.

The results indicate that the robusta, arabica and coffee industry sectors are generally among these with the largest employment generators in Brazil by currency unit of final demand and we emphasize that the value of those generators stems mainly from its induced effects (Tables 1 and 2). Therefore, public policies that stimulate those production sectors should contribute to increased employment, or at least for its maintenance. In the states where the coffee sector has major participation, the employment generating effect provides a singular focus towards other sectors (Tables 3 to 9).

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 sectors are, respectively, second and seventh among the largest generators of employment during the period (Tables 1 and 3).

In the State of Espírito Santo, the coffee sectors are among the five largest generators of total employment (Tables 1 and 4): first place for robusta,

third for arabica, and fourth 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 is home to a large number of coffee roasting and solubilizing industries. In addition, coffee is frequently present on its farms, most of which are small or family-owned, and harvest mechanization is not significant.

In São Paulo state, only the coffee industry and arabica sectors stand out, since there is no production of robusta coffee in that state (Tables 1 and 5). The arabica sector is the third-largest employment generator among 44 sectors of the state, while the coffee industry sector (roasting and solubilizing) is the eighth-largest employment generator in the state. Despite the diversity of São Paulo's industries, which represent many sectors in the state economy, there is a concentration of coffee roasting, grinding and solubilizing businesses in this state.

In the state of Paraná, arabica was the sector that generated the greatest part of total employment in 2002, which highlights the importance of *Coffea arabica* there (Tables 1 and 6): arabica and coffee industry sectors are respectively first and sixth among largest generators of employment during the period of the study. This result reflects the land structure of the two main coffee production regions in Paraná - the "Norte Velho," represented by the region of Jacarezinho, and "Norte Novo," represented by the region of Cornélio Procopio - where properties between 4 and 8 ha are predominant, characterized by high density production systems, an intermediate technological level, and above all family labor, except in periods of harvest, when the demand for hired labor increases.

The "Robusta" sector is also noteworthy in the following states: Bahia (Tables 1 and 7), 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 (Tables 1 and 8); and also in the Rest of Brazil (Tables 1 and 9), because in all other Brazilian states



the cultivation of robusta coffee presents the biggest employment generator.

#### 4 - CONCLUSIONS

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

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

The results also indicated that for Minas Gerais State, the "Arabica" and "Coffee industry" sectors respectively showed the second and seventh largest coefficients for the generation of total employment in the period. In other words, in the state responsible for 50% of national coffee production, public policies directed to the coffee sector should be carefully examined before being implemented, because they may cause significant effect on employment generation and consequently on the state economy as a whole.

In Espírito Santo State, the sectors related to coffee are among the five largest generators of total employment: "Robusta" first, "Arabica" third, and "Coffee industry" fourth. Therefore, policies related to coffee production and processing may have significant social and economic impact in this state. In São Paulo, which produces only arabica coffee, the production and industry sectors are in the third and eighth position, respectively, in terms of employment generation. This is a surprising result, due to the high degree of industrialization in the state, in-

cluding 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 in terms of employment generation. The "Robusta" sector stands out in Bahia (third greatest), Rondônia (second) and Rest of Brazil (greatest).

These results highlight the importance of farming and the coffee industry for the overall well-being of state and national economies. More importantly, the results indicate that the impact of the implementation of public policies that affect the arabica and robusta producing sectors and the industrialization (or solubilization, roasting and grinding) sector should be significant on the employment generation in both state and national economies.

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