

Locational analysis of socioeconomics and tax aspects on soybean production in Mato Grosso

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Abstract

This paper has as main intent to evaluate the soybean production considering aspects such capacity of work generation, income, and the ICMS collected on Mato-grossenses cities. It is common knowledge that there are plenty of papers on the subject, but, not all aspects were studied or even correlated. The methodology proposed on this paper correlates the soybean production income with the work generation and ICMS collected, through a local specialization index that usually is used to delimitate to localization of some economic activity. This indicator, graphically plotted, allows us to identify if there is any abnormality in the structure of collection or in formal employment. Specifically in the case of Mato Grosso, 44 municipalities were selected as specialized and as expected, the graph of income was more stable, while the employment and revenue showed most significant changes, identifying situations that may suggest distortion of the record of employees and payment of ICMS. With regard to employment, some municipalities had a very high specialization in the register of employees, which clashes with the generation of income, but that confirms the formalization of employment. The same does not occurs with the collection of ICMS, where many municipalities recorded a higher specialization of the income and others lower and both situations cause problems in the revenue distribution for the regions. Although it is a systemic fact, the allocation of public resources is compromised and the regional inequalities may be being encouraged by government itself.

Keywords: Employment. ICMS. Income. Mato Grosso. Soybean.

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Introduction

Agriculture has seen significant changes in Mato Grosso, mainly driven by the changes in the technological pattern used in the fields. The so-called "Green Revolution" has allowed the state to achieve a high level of production in recent years due to the genetic improvement made with the new cultivars (PRIMAVESSI, 1997).

In addition to genetic improvements, according to Pereira (1995), the growth of agricultural production, especially soybeans, the main product in Mato Grosso exports portfolio, is due to the modernization of agriculture, which adopted a model of change in its technical basis. Mato Grosso has moved from a process of cultivation in agriculture, whose bases were rudimentary techniques, to one that adopts intensively machines, equipment, inputs and pesticides.

Adding to this context, some institutional changes came to shape a new landscape of Brazilian agribusiness. In the recent years, the trade liberalization, followed by the deregulation of markets, the reforms in agricultural policy and the consolidation of economic blocks just build a competitive model of field production, with needs for economies of scale, considering significant investments in technology (JANK; NAS-SAR, 2000).

The state of Mato Grosso accompanied the new productive structure and began to excel in the production of various crops, being the soybeans grain cultivation the main point regarding to agricultural exploitation. Given the ease in promoting the chain of activities, due to its cultivation and processing, soy has expanded its coverage area in the state, spreading by virtually all regions, with positive effects on living standards.

Moreover, some aspects of the soybean production remain the out of the main discussion. Although there is already a significant number of studies on such activity in all Brazilian regions, when considering the low income internalization of and the tax revenue, there is not a deep evaluation of the mechanisms related to the system of reporting those information.

In this line of thinking, we sought through a locational analysis tool identify some aspects related to the specialization on tax collecting and to the job register. The intention is to identify if there is some dysfunction in the systems responsible for the formalization of employment and the payment of ICMS in Mato Grosso. However, prior to the main discussion, this paper present an overview of the activity, a discussion of the conceptual basis and the tools used.

Soybean production in Mato Grosso

Mato Grosso is one of the leading producers of commodities in Brazil, with great emphasis on soybeans, corn and cotton. As can be seen in Table 1, in 2009 the state was responsible for half of the Brazilian production of cotton, reaching the figure of 1.7 billion reais. Following, in terms of participation in production, soybeans from Mato Grosso represents 27.7% of national production, being computed in more than 10 billion reais.

Table 1 - Temporary crop production in Mato Grosso, 2009

Main cultures	Brazil R\$ million	Mato Grosso R\$ million	Participation %
Soybean	37.988.045	10.515.367	27,7%
Corn	15.032.484	1.840.492	12,2%
Cotton	3.458.444	1.734.067	50,1%
Sugar cane	24.634.948	628.997	2,6%
Rice	7.070.978	417.434	5,9%
Bean	4.436.430	212.089	4,8%

Source: IBGE, 2012.

Corn generates an income similar to cotton, but its participation is only 12.2%. Sugar cane, rice and beans following in the list of main crops produced, however, their representation, as well as the income generated does not have the same magnitude, but are important due to issues of food security.

For soybeans, the area harvested in Mato Grosso was 5.8 million hectares in 2009, which represented 26.8% of the area occupied by the activity in Brazil. Through the data in Table 2, it is still possible to see that the local productivity of 3.1 tons per hectare is higher than the national productivity of only 2.1. This factor accounts for the largest representation in the quantity produced, whose record was 31.3% in 2009.

Table 2 - Soybean production in Brazil and Mato Grosso, 2009

Discrimination	Brazil	Mato Grosso	%
Harvested area (Hectares)	21.750.468	5.831.468	26.8
Quantity produced (Tons)	57.345.382	17.962.819	31.3
Productivity (Tons/Hectares)	2,6	3,1	-

Source: IBGE, 2012.

The soybean production is spread over almost all regions of Mato Grosso. The data in Table 3 confirm the average state production informed, considering that the main producing municipalities present similar indicators.

Table 3 - Main municipalities soybean producers in Mato Grosso, 2009

Municipalities	Harvested area (hectares)	Production (toneladas)	Produt. Ton/ha
Sorriso	590.000	1.840.800	3,1
Sapezal	362.234	1.112.783	3,1
Nova Mutum	330.000	1.049.400	3,2
Campo Novo do Parecis	311.500	967.208	3,1
Diamantino	279.119	879.225	3,2
Nova Ubiratã	240.000	734.400	3,1
Lucas do Rio Verde	223.500	704.025	3,2
Primavera do Leste	220.000	660.000	3,0
Querência	180.600	574.308	3,2
Itiquira	180.000	540.000	3,0
Campos de Júlio	181.193	529.084	2,9
Ipiranga do Norte	161.250	493.425	3,1
Campo Verde	145.000	461.100	3,2
Brasnorte	146.440	424.676	2,9
Santa Rita do Trivelato	140.000	420.000	3,0
Santo Antônio do Leste	118.800	392.040	3,3
Vera	110.000	356.400	3,2
Tapurah	114.714	351.025	3,1
Sinop	105.000	346.500	3,3
Nova Maringá	93.666	303.478	3,2
Canarana	90.230	270.690	3,0
Alto Garças	84.000	252.000	3,0
Tabaporã	82.000	246.000	3,0
São José do Rio Claro	85.420	230.634	2,7
Rondonópolis	72.000	223.200	3,1
Paranatinga	70.700	202.768	2,9
Novo São Joaquim	62.560	195.187	3,1
Gaúcha do Norte	60.000	189.240	3,2
General Carneiro	55.250	182.325	3,3

Source: IBGE, 2012.

The biggest area for soybean production in Mato Grosso is in the municipality of Sorriso, which with about 590.000 hectares produced 1.8 million tons. Keeping the same average, the second largest producer is Sapezal, with 362.000 hectares and 1.1 million tons.

Although the production of soybeans has significant numbers, it does not occur with the employment of labor and tax revenues for the sector. Due to high technological intensity required to achieve scale gains, the demand for workers has not so intense in Mato Grosso and soybeans, primarily responsible for the regional trade surplus represents only 4.7% of employment, as record in Table 4. Still, was registered in 2009 a worker for every 197 hectares.

Concerning to the collection of taxes, the record presents a succinct representation of 7.2% of the total ICMS collected in Mato Grosso (Table 4). These are important issues, given that soy cultivation generates an income high when compared to other activities of the state, but does not maintains the same representation translated into jobs and revenue.

Table 4 - Production, storage and employability of soy, 2009

Discrimination	Produção R\$ million	Employment	ICMS R\$ million
Soybean	10.515.367	29.566	238.435
Mato Grosso Total	57.294.190	622.459	3.296.494
Participation %	18,4	4,7	7,2

Source: IBGE, 2012.

When evaluating these peculiarities of soy in Mato Grosso, considering what already explained, it would be interesting to analyze the relationship between the income generated, the formalization of employment and revenues of ICMS. Since the soy culture has significant representation in the local socioeconomics dynamics, an analytical base supported by models of regional analysis fits more adequately the purpose of this study.

Conceptual and methodological issues

The theories of location have the premise that every company chooses the location that offers the highest expected profit. Therefore, the territorial space cannot be treated only as a place where there is interaction of productive factors and balance the centripetal forces of agglomeration and centrifugal of disintegration, but as the area of

attraction and aggregation that nurture the development of regional economies (SANTANA, 2005).

This discussion permeates this work, emphasizing the focus of the German economist Alfred Weber, whose installation of industries occurs where the costs of transporting raw materials and/or final products are minimal and agglomeration factors are present. For Weber (1929), transportation costs are decisive in determining the preferences of location, being derived from a function that relates the physical weight to be transported to the distance to be traveled (DALLEMOLE, 2007).

With a secondary basis Weber (1929) cites labor as a factor that influences the regional location. There are places where labor is cheaper, this factor should be related to transport costs for obtaining a new composition of the minimal costs that will indicate a new locational and regional tendency (DALLEMOLE, 2007).

This is possible because the inter-regional relationship automatically generates an interdependence, making the whole regional operates as a system with dominant structures, little affected by regional imbalances. This means that there are regional centers and peripheries, with different levels of concentration and agglomeration (DALLEMOLE, 2007).

These centers can be converted into pole regions, from the economic spaces with a high degree of agglomeration power, of which there are functional force fields emanating from effects concentrators or dispersers. When the hubs effects are greater there is a tendency of concentration of economic activity in these spaces, which will become the regions poles or potential (DALLEMOLE, 2007).

The pole regions are likely to cause economic growth and may be responsible for the development. When they cause growth, there is increase of income and these spaces are characterized as poles of growth. When structural changes occur throughout the region these spaces are called development poles (PERROUX, 1967).

Regarding the distribution of productive activity in space, considering the aspects mentioned, there is a link towards concentration in certain regions. In the case of soybean production in Mato Grosso, there is this concentration, which is the generation of employment, income and collection of ICMS.

No matter what region, the production of soybean occurs similarly in all spaces. This means that the technology used from planting to harvest is similar regarding the need for inputs, labor, pesticides and the yield per hectare, which will reflect a similarity in the gross income and, in turn, in collection of ICMS. The ICMS calculation considers trade relations in which there is the circulation of goods as a result of applying a rate that results in ownership by the state of a percentage on the sales or book value highlighted in these transactions.

Fits to do the registration of the complementary law nº 87/96, known as Kandir Law, which speaks about the ICMS and, among the issues addressed in this, what stands out most is the exemption of this tax of products (semi prepared primary or industrialized) and services for export. Some form of tax incentives to encourage export-oriented productive sectors, in order to create opportunities for national products to gain competitiveness in foreign markets and promote trade balance. Because it is a generic law, its incidence occurs homogeneously, regardless of what is the region.

Once clarified some of the main locational aspects considered, the selected alternative for the identification of areas specialized in the production of soybeans is the use of methodologies employed in spatial analyzes of regional economy. Specifically for this study, primed by the estimate of Normalized Concentration Index (NCI, in portuguese ICN), which enables the identification of cities specialized in soybean production throughout the state. This methodology makes use of a weighting of three indices related to the degree of local expertise, the comparison of the municipal production relation to the state production weighted by production structure divided by the productive structure of the State, besides of capture of the importance of municipal production in relation to state production.

The ICN is a weighted average of the location quotient (QL), the Herfindahl-Hirschman Index (IHH) and the Index of Relative Participation (PR), in which the weight of each indicator is calculated based on principal component analysis. According to Santana (2004), the first characteristic is determined by the QL, which identifies the level of expertise in a certain activity in the municipality in question:

$$Q L = \frac{E_j^i}{E_R^i}$$

The numerator shows data from the municipality, where E_j is the value production/ICMS/employment in soybeans production in the municipality j, E_j^i represents the value of production/ICMS/employment of all activities listed in municipality j. In the denominator shows the data of Mato Grosso, where the E_{IR} represents the total production/ICMS/employment in soybeans production in the state and the E_R represents the total value of production/ICMS/employment of all activities listed in that State.

It should be noted, according to Crocco (2003), a $QL > 1$ can only indicate a differentiation of productive activity, because there may be disparities between the municipalities, as well as highly representative of a company in the city. To mitigate problems of this nature integrates the IHH to the calculation of ICN:

$$IHH = \left(\frac{E_l^i}{E^i} \right) - \left(\frac{E_l}{E_R} \right)$$

The IHH allows you to compare the weight of activity i the municipality j in sector i of Mato Grosso compared to the weight of the productive structure of the municipality j in the state structure. If the value is positive, the activity of the municipality i in state j is more concentrated in this location, with greater economic power of attraction, due to their level of expertise (SANTANA, 2004).

The third component of the ICN, called Relative Participation Index, captures the importance of the activity i of the municipality j in the total represented by activity i in Mato Grosso:

$$PR = \left(\frac{E_{ij}}{E_{iR}} \right)$$

This indicator should range between zero and one, the closer to one, the greater the representation of the activity in Mato Grosso. These three indicators will subsidize the composition of Normalized Concentration Index (ICN):

$$ICN_{ij} = \theta_1 QL_{ij} + \theta_2 IHH_{ij} + \theta_3 PR_{ij}$$

The Θ weights for each of the indicators were determined by the method of principal component analysis in which the correlation matrix "shows the proportion of the variance of the total dispersion generated data cloud, representative of the attributes of agglomeration which is explained by these three indicators "(Santana, 2004). Such analysis obtained from the model variables (QL, IHH, PR) their linear combination, producing for each of the 141 municipalities the components:

$$Z_i = a_{i1} QL + a_{i2} IHH + a_{i3} PR$$

In which "a" are the weights for the municipalities i that vary subject to the condition:

$$a_{i1}^2 + a_{i2}^2 + a_{i3}^2 = 1$$

To obtain the variances associated to each component and the coefficients of linear combinations the principal components technique employs the covariance matrix of the variables, obtained by using SPSS software. The variances of the main components are the eigenvalues of this matrix, while the three coefficients a_{i1} , a_{i2} and a_{i3} are its eigenvectors. More details on the econometric model can be obtained from Crocco (2003) and Santana (2004).

To calculate the ICN used it was considered the value of soybean production, available at the Brazilian Institute of Geography and Statistics (IBGE) and the PIB

(GNP) of municipalities and Mato Grosso. Still, for the employment were used data from Value of Social Information (RAIS) and for the ICMS were used data of collection of the State Secretary of Finance of Mato Grosso (SEFAZ), all three sources for the year 2009.

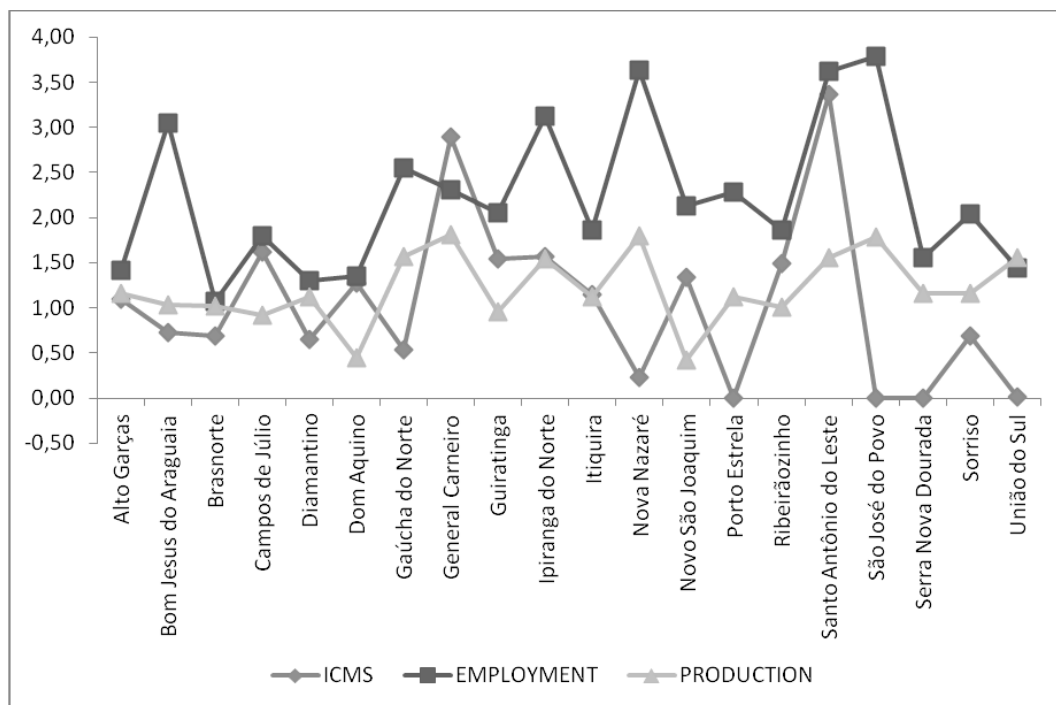
Analysis of results

With the normalization of charges, using the technique of principal components, the results obtained show a structure weighted of indicators of income, employment and collection of ICMS. As expected, due to linear growth and constant production of Mato Grosso, the representative indicator of income was stable, without significant oscillations, for municipalities that have expertise in soybean production. Considering that the employment and the ICMS are derived from income generated by the activity, we can confirm this variable as a reference and design some scenarios to correlate them, as outlined.

Because the production of soybeans spread to practically all regions of Mato Grosso, was registered a significant number of specialized municipalities, making it necessary for the purposes of plotting, the division into two groups. A graph was prepared considering the municipalities that have at least two indicators of specialization among the three estimates (Figure 1) and another that considers only one indicator (Figure 2).

According to the indicators plotted in Figure 1, we identify some peaks in Bom Jesus do Araguaia, Santo Antonio do Leste and São José do Povo, where specialization, resulting from the employment variable, clashes with the income. This may be happening due to the wrong registration of workers from neighboring municipalities, or the activity does not follow the same technological level of other regions.

Santo Antônio do Leste also clashes in the same proportions in tax collection, same dysfunction recorded in General Carneiro, Novo São Joaquim, Campos de Julio and Don Aquino. In these cases it may also be occurring error in the registry, or the inspection system can be more efficient in these municipalities. The fact is that problems of this nature do not affect the socioeconomics of these municipalities, only indicate that the system is flawed.



Source: Elaborated by authors with data from IBGE, RAIS e SEFAZ-MT, 2009.

Figure 1 - ICN of Soybean in Mato Grosso, 2009

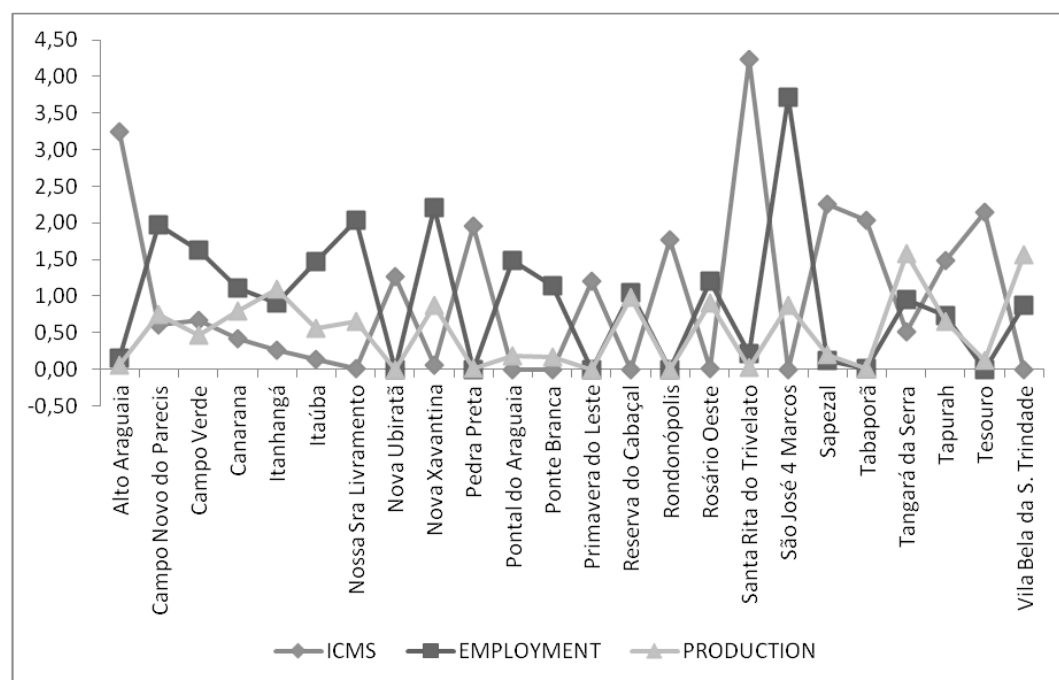
On the other hand, the collection of ICMS presents expertise that clashes with the income in the municipalities of Gaúcha do Norte, Porto Estrela, Nova Nazaré and São José do Povo, ranging contrary, however, accentuated on the last two. There are complications relevant to this dysfunction, such as the correctness of the information in the record or in the collecting system, or even the lack of this record, which may result in tax evasion.

Whatever the interpretation, there is some inconsistency in these spaces. Regardless of what is happening, we can already see a problem for these municipalities: by failing to register, means being hidden part of added value of production (or may be being collected in another city), having paid a lowest amount of taxes. The main consequence is the impact on the Municipal Participation Index (IPM), which tends to decrease, negatively impacting the allocation of the portion of ICMS that it is for them.

This behavior does not occur with the employment as shown in Figure 1, which means that the formalization of employment occurs consistently in those municipalities that have more than one specialization. It is noteworthy that this behavior also occurs in other municipalities with only one specialization (Figure 2). Overall, the employment variable presents some peaks in specialization, which only reflects some

dysfunction in the system, but for being always on the same level or over income, indicates that there is no informal activity in any of the specialized spaces or, at least is minimally constant and not representative. It should be noted that this indicator does not reflect the intensity of the use of labor, but that this remains consistent in all spaces.

The specialization also presents some peaks in the collection of ICMS, as was recorded in cities with more than one specialization. With the most significant identifies the cities of Alto Araguaia and Santa Rita do Trivelato, followed by Nova Ubiratã, Pedra Preta, Primavera do Leste, Rondonópolis, Sapezal, Tabaporã and Tesouro, however, with less intensity. The interpretation follows the same consistency, other words, what is happening is misregistration of ICMS in these spaces, which are not originated from the same, with a view that clashes with the expertise resulting from income. This is reassuring for those municipalities that are receiving a larger share of the ICMS, however, at the expense of others who are losing.



Source: Elaborated by authors with data from IBGE, RAIS e SEFAZ-MT, 2009.

Figure 2 - ICN of soybean in Mato Grosso, 2009

However, as in the cities with two specializations, there are regions where the specialization indicator of ICMS does not follow or exceeds the income. In Nova Xavantina, Reserva do Cabaçal, Rosario Oeste, São Jose dos Quatro Marcos, Tangara da Serra and Vila Bela da Santíssima Trindade the specialization of the tax collection

clashes with the income, indicating that the record of ICMS presents some disability. The consequences are the same presented to another group of municipalities, other words, there are flaws in the system, by allowing the ICMS to not be recorded in the appropriate region of production, which will be deprived of the portion of ICMS transfer that is rightfully theirs.

Final comments

The applied methodology revealed that the system of employment record and the control of the tax collection do not reach the desired efficiency. However, there were no significant anomalies related to the productive sector of soybeans. It is worth mentioning a few local problems for those municipalities in which the record of commercialization of the production is not covered in its entirety.

The fact that the specialization of employment in most cases exceeds the income only attests that the employment generated by the activity is consistently formalized. Only when this fails to occur is that there is a concern about the possibility of informal activity, which was not identified.

In the case of ICMS, both situations require attention, either by municipalities or the government of Mato Grosso. We identified some municipalities whose specialization indicator in ICMS collection showed a contrary tendency to that of income, and in some cases considerably lower. Because it is a fixed portion of that income with the same percentage for all regions, the situation points to a dysfunction in the collecting system, because it is allowing the ICMS to not be recorded in its fullness in the place of origin. The main problem is the consequence for these municipalities, as will result in reduction of its IPM, resulting in loss of revenue originated from the reduction of transfer of ICMS

However, the opposite is not desirable for the state, because the fact of registration of ICMS above what would occur implies improper appropriation of tax that should be registered in other cities, which will be penalized at the time of receiving the transfer. If this occurs in a space around a concentrator region, the consolidation of income redistribution may favor the center-periphery relationship, supported by the system.

In case of consolidation centers there is a tendency that these relationships are also strengthened with the dysfunction in the collection. The in regional analysis point of view, it is a trivial factor, which will have significant importance in driving the development of these spaces. Over time and capacity of the centrifugal forces may arise development poles and new centers on the same periphery.

Finally, this study does not attempt to resolve any problems in the system of formal employment or tax revenue, but only indicate the areas where the process does not occur efficiently. To know exactly the facts are responsible for those dysfunctions it is necessary to occur a specific study in these municipalities, a factor of relevant importance in view that the redistributed resources are not sufficient to meet the demand of themselves.

ANÁLISE LOCACIONAL DOS ASPECTOS SOCIOECONÔMICOS E FISCAIS DA PRODUÇÃO DE SOJA EM MATO GROSSO

Resumo

Este estudo tem como escopo central avaliar a atividade produtiva da soja, considerando sua capacidade de geração de emprego, renda e arrecadação de ICMS para os municípios mato-grossenses. Já é notória a existência de uma significativa bibliografia voltada a estudos sobre soja, contudo, nem todos os aspectos foram abordados ou correlacionados. A metodologia proposta correlaciona a renda do segmento, a geração de emprego e a arrecadação de ICMS, por meio de um indicador de especialização local, utilizado em estudos para delimitar a localização de atividades econômicas. Esse indicador, plotado graficamente, permite identificar se há alguma anomalia na estrutura de arrecadação ou na formalização do emprego. Especificamente no caso de Mato Grosso, 44 municípios foram selecionados como especializados e, conforme o esperado, o gráfico da renda se mostrou mais estável, ao passo que o do emprego e da arrecadação apresentaram variações mais significativas, identificando situações que podem sugerir distorções no registro de empregados e recolhimento de ICMS. No que se refere ao emprego, alguns municípios apresentaram uma especialização no registro de empregados muito elevada, que destoa da geração de renda, mas que confirma a formalização do emprego. O mesmo não acontece com a arrecadação de ICMS, em que muitos municípios registraram uma especialização superior à da renda e outros inferior, sendo que ambas as situações acarretam em problemas de distribuição de receita para as regiões. Apesar de se tratar de um fato sistêmico, a alocação de recursos públicos fica comprometida e as desigualdades regionais podem estar sendo fomentadas pela própria administração pública.

Palavras-chave: Emprego. ICMS. Mato Grosso. Renda. Soja.

ANÁLISIS LOCACIONAL DE LOS ASPECTOS SOCIOECONÓMICOS Y FISCALES DE LA SOYA EN MATO GROSSO

Resumen

Este estudio tiene como objetivo central evaluar la actividad productiva de la soya, considerando su capacidad de generación de colocación, renta y recaudación de ICMS para los municipios de Mato Grosso. Ya es notoria la existencia de una significativa bibliografía devotada a estudios sobre soya, sin embargo, ni todos los aspectos fueron abordados o correlacionados. La metodología propuesta correlaciona la renta del segmento, la generación de colocación y la recaudación de ICMS, por medio de un indicador de especialización local, utilizado en estudios para delimitar la localización de actividades económicas. Este indicador, plotado gráficamente, nos permite identificar si hay alguna anomalía en la estructura de recaudación o en la formalización de la colocación. Específicamente en el caso de Mato Grosso, 44 municipios fueron seleccionados como especializados y como esperado, el gráfico de la renta se mostró más estable, mientras que el de la colocación y de la recaudación presentaron variaciones más significativas, identificando situaciones que pueden sugerir distorsiones en el registro de empleados y recogimiento de ICMS. En lo que se refiere a la colocación, algunos municipios presentaron una especialización en el registro de empleados muy elevada, que discuerda de la generación de renta, pero que confirma la formalización de la colocación. El mismo no acontece con la recaudación de ICMS, en que muchos municipios registraron una especialización superior la de la renta y otros inferiores, siendo que ambas las situaciones acarrear en problemas de distribución de receta para las regiones. A pesar de tratar de un hecho sistêmico, la asignación de recursos públicos queda comprometida y las desigualdades regionales pueden estar siendo fomentadas por la propia administración pública.

Palabras-llave: Colocación. ICMS. Mato Grosso. Renta. Soya.

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