"UFSCar" Index of Effectiveness applied to the Food Purchase Program for food and nutritional safety of farming families in the hinterland of São Paulo state

Índice "UFSCar" de Efetividades do Programa de Aquisição de Alimentos para a segurança alimentar e nutricional de agricultores familiares do interior paulista

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Abstract: This work aims to develop an index to evaluate the effectiveness of Brazil's Food Purchase Program (FPP), using the perspective of food and nutritional safety (FNS) for farming families in the settlement territory of Araraquara, São Paulo, as analytical reference. To develop the index, we selected analytical variables with theoretical and methodological adherence to the concepts of FNS, FPP, and family agriculture (FA),using the statistical method of orthogonal factor rotation (Varimax). The theoretical framework—neo-institutionalism—was used to discuss the public policies for food safety, and create an analysis based on effort, reciprocity, and confidence in the construction of networks through the FPP. The level of food (in)security was evaluated by the UFSCar Index of Food Safety for family farmers. Data show that 73% of farmers who regularly access the FPP have moderate or high rates of FNS, while 93% of those who do not access the program have a moderate or low FNS index. This shows that despite institutional efforts, food unsafety is still present and must continue to be addressed in the public policy agenda.

Keywords: Public policies; Food and nutrition security; FPP; UFSCar Effectiveness Index; Rural settlements.

Resumo: *Este trabalho teve como objetivo a construção de um índice para avaliar a efetividade do Programa de Aquisição de Alimentos (PAA), tendo como referencial analítico a perspectiva da segurança alimentar e nutricional (SAN) para agricultores familiares do território de assentamentos de Araraquara-SP. Para a construção do índice, foram selecionadas variáveis analíticas com aderência teórico-metodológica aos conceitos de SAN, PAA e agricultura familiar, utilizando-se o método estatístico de rotação fatorial ortogonal – Varimax. O referencial teórico adotado foi do neoinstitucionalismo com recorte nas políticas públicas de segurança alimentar e análise a partir de variáveis de esforços, reciprocidade e confiança nas construções de redes por meio do PAA. O nível de (in) segurança alimentar foi avaliado pelo Índice UFSCar de Segurança Alimentar para agricultores familiares. Os dados revelam que 73% dos agricultores que acessam o PAA regularmente apresentam índice moderado ou alto de SAN, ao passo que 93% dos que não acessam o programa apresentam índice moderado e baixo de SAN. Isso mostra que, apesar dos esforços institucionais, a insegurança alimentar ainda está presente e deve continuar a ser enfrentada na agenda das políticas públicas.*

Palavras-chave: *Políticas públicas; Segurança alimentar e nutricional; PAA; Índice UFSCar de Efetividades; Assentamentos rurais.*

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1 Introduction

According to the UN Food and Agriculture Organization (FAO), the prioritization of the Food and Nutrition Security (FNS) agenda since 2003 has brought advances in the fight against hunger and poverty. Government policies and programs have included actions to promote sustainable agricultural models, as well as food and nutritional education (Kepple, 2014).

Public policies consist of government decisions and actions that produce specific effects in a particular field, and which play a (not always adequate) role in the solution of societal problems (Souza, 2006). One important aspect of public action evaluation is precisely the identification of its effects according to the chosen framework (Draibe, 2001).

This article has prioritized the comparative evaluation of elements that constitute the wide concept of FNS among family farmers in the territory of Araraquara, São Paulo state, using the methodology of the Rede Alimenta (Alimenta Network) of the State University of Campinas (Unicamp), which includes the Brazilian Food Insecurity Scale (BFIS), and the Federal University of São Carlos (UFSCar) Food Security Index for family farmers.

The elements of Food and Nutrition Security cover economic, social, cultural, and environmental variables or indicators, such as: food security level (BFIS), health, schooling, cooperation networks, work, income, pluriactivity, networking and social protection, self-consumption, more sustainable environmental practices, and access to credit (Almeida, 2014). The BFIS is a method of measuring the home food situation, and aims, from the perception of the subject, to capture different dimensions of this.

The object of this study was the Food Purchase Program (FPP), created in 2003 with the purpose of promoting access to food, and encouraging family farming through the purchase of food grown by small producers, with exemption from bidding, for allocation to people experiencing food insecurity (Brasil, 2015).

As suggested by Grisa et al. (2010), we sought to further study changes in food patterns from the perspective of the farm families, since most extant studies have focused on the issue of food security from the point of view of beneficiary families.

The theoretical framework adopted was neo-institutionalism, to address the public policies of food security and analysis based on effort, reciprocity, and confidence in the construction of networks through the FPP. The broad perspective of the FNS represents not only a basic human need, but also the conservation of agriculture in ways that maintain its food, environmental, and rural function,

taking into account the processes of evaluation of its effectiveness and obstacles.

FNS must be recognized as a social inclusion resource, characterized not only by access to income, but also by guaranteeing access to basic resources such as employment, education, health, and information. Diversity of income, economic pluriactivity, family self-consumption, participation in social organizations for access to information, and entry into a political decision-making network may contribute to the achievement or improvement of family farmers' FNS (Almeida et al., 2015).

The evolution of concepts and standards of food security in the world requires new descriptors in indices, in order to record the present efforts of societies to combat hunger, which can be made possible through the construction of a series of useful variables to improve policies and programs (Almeida et al., 2015). The basic axes of food and nutritional security (health, hygiene, food authenticity, environment, and solidarity) are reflected in various public policies.

In this sense, we made an attempt to consolidate a methodological construction to evaluate the obstacles and the social effectiveness both of federal government public policy programs addressing FNS, and income transfer under the management of the municipalities and their specific contours in the chosen territory for analysis, the municipality of Araraquara, São Paulo.

To this end, an FPP effectiveness index was constructed to evaluate the farming families of the territory analyzed, adopting specific characteristics for the actors, according to the UFSCar methodology. The orthogonal rotation factor analysis technique (Varimax) was used to compose the index from a set of variables and cross-relations among these variables, which have theoretical and methodological adherence to the objectives of the FPP and the farm families' FNS. The results of the UFSCar Food Security and Effectiveness Indexes of the FPP were compared, to analyse their variables and identify whether the FPP makes an effective contribution to the FNS of the farm families analyzed.

2 Theoretical foundations

2.1 Neo-institutionalism and food security: reciprocity and trust in network building through the FPP

Networked institutional environments and organizational forms represent important dimensions for the analysis of the FPP's effectiveness in generating food security among farm families. Characteristics of social relationships, such as trust, reciprocity, and sense of belonging can consolidate networks of family agriculture in localities served by the federal

government's FPP. In Brazil, the question remains whether the impact and effectiveness of public policies can reverse or alleviate degrees of food insecurity in families, and producing and non-producing individuals. The present work is based on such characteristics, highlighted by Social Neo-institutionalist authors.

By and large, Social Neo-institutionalism (SNI) is opposed to the rationalist thinking of neo-institutionalist economics and of neo-classical economics, instead establishing its focus on cultural and cognitive aspects, as well as on individual or group social relations. According to Hall & Taylor (1996), SNI arises from a cognitive approach, strongly related to the theory of organizations, postulating that norms and procedures do not emerge as an efficient response of society to the execution of tasks, but rather as cultural practices (ceremony and myths) that are similar. These constitute a process called isomorphism, or the tendency of organizations to become similar over time.

DiMaggio & Powell (1983) define three forms of isomorphism: coercive, normative, and mimetic. Mimetic isomorphism is the mimicking of procedures and structures of an organization which are perceived and disseminated as successes, in order to reduce uncertainty. Coercive isomorphism is generated in the context of exogenous regulations, such as social security and labor laws; as a consequence of the existence of an actor with regulatory power; formal or informal pressures emanating from one "key" organization to the others; or even by the cultural pressure of society itself. Normative isomorphism arises in the sectors where the professionalization of a category is well defined, or in accordance with normative structures existing in the institutional environment; in this modality, a specific professional category defines its work practices, which are disseminated through a formal education process, a basis of interpretation formatted in the universities and in networks of relationships in the professional scope.

As a product of contemporary capitalist evolution, the incidence of more sophisticated forms of cooperation and relationship in networks (local or supralocal) calls the attention of researchers to the importance of studying these forms and their implications in terms of performance and competitiveness. Especially since the 1990s, an approach has evolved based on the concept of a network, focused on phenomena characterized by cooperative relationships that induce interdependencies between agents, which generate the need for forms of collective coordination of their activities.

New possibilities for business operations emerge, including operation through cooperation networks, with its members acting independently, but coordinated (albeit sometimes temporarily), and exploring mutual complementarities and sharing information, risks, resources, and production. These possibilities are very relevant when it comes to public policy networks like FNS.

Fundamentally, the process of structuring and developing FNS policy networks includes economic factors—such as increasing the scale of purchases to reduce the average cost of purchasing food, improving the effectiveness of the program, or even reducing relationship costs—which cannot be discarded, but also social and institutional components, such as the search for legitimacy; the importance of group homogeneity; coordination mechanisms in networks; the intensities of relations; and the issues of trust, reciprocity, and belonging to maintain the network.

At times, the networking arrangement becomes a survival and success factor. Due to the increasing complexity of public policies, coordinating actors find it difficult to absorb all capacities (and in all areas) and implement a program (such as a local FPP). Cooperation provides a mechanism to overcome this difficulty. In this sense, networks present themselves as arrangements composed of several capacities, providing greater flexibility and allowing their members to concentrate on their essential competences while at the same time achieving economies of scale and scope.

On the other hand, any cooperative arrangement poses a number of challenges and obstacles in its construction and management. The sharing of knowledge, information, and experiences requires carefully building integration as well as overcoming mistrust.

One aspect of cooperative action in the form of public policy networks is the existence of formal and informal coordination mechanisms. Coordination mechanisms are presented as an important aspect of the networked program, and especially in the analyzed cases, there is a clear combination of formality and informality. The present work illustrates both coordination mechanisms more in tune with control and formalism, such as network bylaws, minutes of meetings, and rules of control; as well as informal mechanisms based on trust and reciprocity, which greatly support the effectiveness of the program for the target audience (family farmers).

3 Methodological procedures

3.1 An innovative evaluation method using new indices

In order to evaluate the effect of these policies in the constitution of food security elements of family farmers, a survey was carried out using the methodology of the research group Rede Alimenta—part of Unicamp's

Faculty of Medical Sciences—incorporating specific issues of the program selected for analysis, as proposed by the methodological framework develped by Almeida (2014).

Field research was conducted in 2015 through semi-structured interviews, which were guided by a questionnaire containing open and closed questions, with the aim of characterizing family farmers through a wide-ranging approach to food security, and of evaluating the FPP through the delimited cutout. BFIS was included in the questionnaire, which was cross-checked with a series of environmental, social, economic, and cultural categories. These included socio-demographic characteristics (family structure, schooling); income and consumption (individual and family income, agricultural and non-agricultural income, agroindustrial income, food expenses); housing conditions; nutrition (food profile, form of access to food, and illnesses associated with nutrition); agricultural and agroindustrial production profile; work and leisure; social protection networks; subsistence consumption, and others. Fifty analyses of simple variables and 30 crossovers were carried out, in an effort to innovate the methodological evaluations of this field of research.

In order to measure the level of food security of farming families, the UFSCar Index of food security for farming families was used to validate the BFIS methodology, and advance the understanding that variables other than income affect FNS conditions (Almeida et al., 2015; Cardozo, 2016).

The BFIS is a research instrument that enables the stratification of the subjects according to the following levels of food insecurity: Food Security (FS), when there is no food restriction of any nature, nor any concern about the lack of food in the future; Light Food Insecurity (LFI), when food is affected along with concern that food may be lacking in the near future; Moderate Food Insecurity (MFI), when there is a quantitative restriction on the diet of the adults in the family; and Serious Food Insecurity (ISFI), a quantitative deficiency and a high possibility of hunger among adults and children in the family (Segall-Corrêa, 2007). This scale is widely applied throughout populations in Brazil due to its internal and external consistency (Cardozo, 2016).

The "UFSCar" index of food security represents a methodological advance in the understanding of the food (in)security gradient, since it considers the specificities of a rural territorial reality based on the BFIS of the farming families studied (Almeida et al., 2015).

The factorial analysis technique was used to build the index, using a set of variables that have theoretical and methodological adherence to the FNS of farming

families: (X1) total family income; (X2) production diversification (0-no, 1-yes); (X3) level of food security according to the BFIS (0-severe, 1-moderate, 2-mild, 3-food security); (X4) participation in cooperatives (0-no, 1-yes); (X5) subsistence consumption (0-no, 1-yes); and (X6) percentage of agricultural income to total income (0-0% to 25%, 1-25% to 50%, 2-50% to 75%, 3-75% to 100%) (Almeida et al., 2015).

The focus of this article is the effect of the FPP on the food security of small farmers and their families. In order to quantitatively and qualitatively evaluate the effects and the effectiveness of the policy, an FPP Effectiveness Index was constructed and measured for the farming families of the territory studied, according to UFSCar's methodology. Factor analysis was used to build the index, based on a set of variables selected according to theoretical and methodological adherence to the families' FNS and the institutional objectives of the program, which are: to boost production with income generation; to make accessible new technologies; to promote food security; to increase production with sustainability; to promote food processing, industrialization, and income generation; to strengthen marketing networks; to encourage family farming; to foster the consumption of food produced by family farming; and to enhance social and economic inclusion.

According to Johnson & Wichern (2008), the main objective of the factor analysis technique is to describe the variability of a set of data by using a smaller number of unobservable variables, called common factors. These are related to the data set by means of a linear model, where part of the data variability is attributed to the factors themselves, and the rest attributed to the variables that were not included in the model, i.e. random error.

Specifically, the factor analysis model is given by Formula 1:

$$\left(X - \mu \right)_{(p \times 1)} = L_{(p \times m)} * F_{(m \times 1)} + \varepsilon_{(p \times 1)}, \tag{1}$$

where: μ_i = variable average; i, ε_i = ith specific factor; F_j = jth common factor; and l_{ij} = factor loading of the ith variable in the jth factor.

An important feature of this analysis is the rotation factor, which allows the researcher to rotate the factors around the origin until some other more interesting position is reached. For this purpose, an orthogonal rotation was used, which maintains the axes between the factors at 90º, called Varimax. This type of rotation concentrates on the simplification of the columns of the factor matrix, maximizing the sum of required load variances of the factor matrix. According to Johnson & Wichern (2008), this approach seeks the

best rotation of the axes so that the new matrix of factor loads has the highest number of null coefficients.

Aiming to create the aforementioned index, the following variables were considered: (X1) total agricultural income; (X2) effort to produce new products (0 - no, 1 - yes); (X3) effort to increase the quantity produced (0 - no, 1 - yes); (X4) production planning (0 - no, 1 - yes); (X5) use of inputs and new technologies (0 - no, 1 - yes); (X6) the impact of the FPP on production (0 - increases, 1 - maintains, 2 - decreases, 3 - decreases totally); and (X7) the impact of FPP on the commercialization (0 - increases, 1 - maintains, 2 - decreases altogether).

We considered those individuals who presented valid values in the 7 analyzed variables. To estimate the factor model parameters, we applied the factor analysis by main components based on the correlation matrix R of the data. The use of the correlation matrix avoids the problem of a variable with very large variance unduly influencing the determination of the factor loads.

Methodologically, family farmers' food security indices (Almeida et al., 2015) and the FPP effectiveness were formulated from the sum of the standardized factor scores, weighted by the respective percentages of explained variability of each factor analyzed. The mathematical formula resulting from this process is given by Formula 2:

$$I_m = \sum_{j=1}^{k} \frac{\lambda_j}{tr(R)} F_{jm}, \qquad (2)$$

where: I_m = value of the transformed index of the mth individual; λ_j = j^{th} characteristic root of the correlation matrix $R_{p \times p}$ of the variables used; k = number of factors chosen; F_{jm} = factor score of the mth individual, in the j factor; and tr = trace of correlation matrix $R_{p \times p}$.

In order to facilitate the comparison of the índices created, a base transformation was applied, so that the new values obtained were presented within the range of 0 to 100 (Formula 3):

$$I_m^* = \frac{(I_m - I_{min})}{(I_{max} - I_{min})} \times 100, \qquad (3)$$

where: I_m^* = value of the transformed index of the mth individual; I_m = value of the index observed in the mth individual; I_{max} = maximum index; and I_{min} = minimum index observed in the sample.

In order to determine the number of factors to be used in composing the indices, the latent root criterion was considered, which advises the selection of factors with an eigenvalue greater than 1, and the proportion of the total variability explained.

In this case, it can be noted that the considered variables are the standard ones. Algebraically distributing the mean and the deviation of each variable, we obtain the following Formula 4:

$$Index = 0.06 \times \left(\frac{X1}{653.47}\right) + 0.12 \times \left(\frac{X2}{0.49}\right) + 0.12 \times \left(\frac{X3}{0.48}\right) + \\ 0.09 \times \left(\frac{X4}{0.48}\right) + 0.09 \times \left(\frac{X5}{0.50}\right) + 0.13 \times \left(\frac{X6}{0.87}\right) + 0.11 \times \left(\frac{X7}{0.91}\right), \qquad (4)$$

By means of the coefficients it is possible to observe that the weights of the variables in the index vary between 0.06 and 0.13, and that variable X6 (Impact of the FPP in the production) contributes the highest weight, followed by X2 (Effort to produce new products), X3 (Effort to increase the amount produced), and X7 (Impact of the FPP on commercialization). Regarding variables X4 (Production planning) and X5 (Inputs and new technologies), it is noted that they make an intermediate contribution. Variable X1 (Total agricultural income) contributes least to the index value. It is worth mentioning that all variables considered have a positive contribution.

For the purposes of comparison and base change, the maximum and minimum values of the index were calculated by simulating the values for the respective variables using the data observed in the sample used (exception for Total agricultural income, where the minimum was set at R $ 0.00 and the maximum as R $ 3,000.00).

Thus, the maximum value is given when:

- X1 (Total agricultural income): R $ 3,000.00; X2 (Effort to produce new products): 1 - yes; X3 (Effort to increase the quantity produced): 1 - yes; X4 (Production planning): 1 - yes; X5 (Use of inputs and new technologies): 1 - yes; X6 (Impact of FPP on production): 3 - decreases totally, and X7 (Impact of FPP on marketing): 3 - decreases totally.

And the minimum when:

- X1 (Total agricultural income): R $ 0.00; X2 (Effort to produce new products): 0 - no; X3 (Effort to increase amount produced): 0 - no; X4 (Production planning): 0 - no; X5 (Use of inputs and new technologies): 0 - no; X6 (FPP impact on production): 0 – increases, and X7 (FPP impact on marketing): 0 - increases.

Applying these values to the index formula, we have: $I_{max} = 0,8$ e $I_{min} = -1,12$. From these values obtained, one can arrive at the following final formula of the index, expressed in the interval between 0 and 100 (Formula 5):

$$Index = \frac{100}{1.92} \times \begin{pmatrix} 0.06 \times \left(\frac{X1}{653.47}\right) + 0.12 \times \left(\frac{X2}{0.49}\right) + 0.12 \times \left(\frac{X3}{0.48}\right) + \\ 0.09 \times \left(\frac{X4}{0.48}\right) + 0.09 \times \left(\frac{X5}{0.50}\right) + 0.13 \times \left(\frac{X6}{0.87}\right) + 0.11 \times \left(\frac{X7}{0.91}\right) \end{pmatrix} \quad (5)$$

Alternatively, it is possible to categorize the final value of the index and create the following food security categories for a qualitative analysis (Figure 1).

This index can be applied in any other locality, by changing the maximum and minimum values, should the observed values differ from those considered here.

The variables allow the analysis of the FPP network—with its intention to effect a reduction in the degree of food insecurity among the family farmers of Araraquara—based on individuals' characteristics such as: effort for change, reciprocity, and trust. Efforts to change production and marketing refer to the notion of overlapping, which allows better understanding of the challenges facing the FPP policy network by considering the interaction between individuals with common and divergent interests, which in turn demand great efforts to maintain and sustain this relationship. The efforts for new gains in the network result from individual action that allows the emergence of new options to increase the network, creating conditions for the growth of public policy and for the level of belonging and social cohesion.

Reciprocity presupposes movements of resources and information between correlated points of symmetric groupings. It is a relationship where the cooperative dimension and trust value are recognized as essential for the continuity, stability, and efficiency of the interaction process. Systems of reciprocity work mainly through cooperation networks.

Finally, trust is a crucial component for relationships to succeed, and past relationships play a strong role in building trust. They affect, for example, companies marked by a history of fraud and environmental destruction, making it difficult to offset the sense of

00 – 20: Very low

20.1 – 40: Low

40.1 – 60: Moderate

60.1 – 80: High

80.1 – 100: Very high

Figure 1. Qualitative categories of food (in)security. Source: Almeida et al. (2015).

mistrust they have engendered in society, government, and supply chain partners, despite the existence of tacit agreements and/or contracts mediating these relationships.

3.2 Contextualization and critical analysis of the FPP

In 2014, Brazil was removed for the first time from the UN hunger map, a consequence of a political commitment that combined public policies to strengthen family agriculture and the social-welfare network with its income transfer programs (Garrido, 2015).

The actions to reinforce food security connected to the development of family agriculture initially appeared as commitments of the Lula Government in the Zero Hunger Project. The political intention was defined based on the 2003/2004 Harvest Plan Directives, which were converted into normative acts to create the Family Agriculture Food Purchase Program (Delgado et al., 2005).

The axes of the Zero Hunger Program are access to food, income generation, coordination, mobilization and social control, and strengthening of family agriculture, in addition to three levels of actions: structural, specific, and local policies. The FPP is contextualized within the framework of structural policies and represents the main action of the Zero Hunger Program, focused on strengthening family farming (Muller et al., 2012).

The creation of the program resulted from two important debates of the 1990s in Brazil, about the FNS and about the recognition of family agriculture, which had already gained more expression with the creation of the National Program for Strengthening Family Agriculture (PRONAF) (Grisa et al., 2009).

The FPP was created based on article 19 of Law No. 10,696, dated July 2, 2003, amended by Law No. 12,512 of October 14, 2011, and regulated by Decree No. 7,775 of July 4, 2012 (Brasil, 2003, 2011, 2012). It aims to encourage family farming; promote social and economic inclusion; foster production with sustainability, enhance food processing, industrialization, and income generation; encourage the consumption of food produced by family farming; promote access to food in sufficient quantity; improve the quality of food and the nutrition of people suffering food and nutrition issues; promote food supply through government food purchases; create public food stocks; support stockpiling by cooperatives and formal family farming organizations; and strengthen marketing networks (Brasil, 2015).

The program is managed by the Ministry of Social Development and Fight against Hunger (MDS); Ministry of Finance (MF); Ministry of Planning,

Budget and Management (MPOG); and the Ministry of Agriculture, Livestock and Supply (MAPA). The Ministry of Agrarian Development (MAD) and the Ministry of Education (MEC) are responsible for defining the measures necessary to operationalize the Program (Grisa et al., 2009).

The managers responsible for implementing the FPP are the states, municipalities, the National Supply Company (CONAB), local managers trained by farmers and their organizations (associations, cooperatives, etc.), and social-welfare entities. Provisional measure No. 726 of May 12 (Brasil, 2016), extinguished the MDA and transferred its powers to the Ministry of Social and Agrarian Development (MDSA). Social control is the responsibility of representatives of civil society: the National Council for Food and Nutrition Security (CONSEA), the National Council for Sustainable Rural Development (CONDRAF), and the School Feeding Councils (CAE) (Grisa et al., 2009).

Hence, the program purchases food produced by family farmers, exempt from any bidding process, and assigns them to people in situations of food and nutritional insecurity and those assisted by the social-welfare network, which can be carried out through the following modalities: direct purchase from family agriculture, purchase for simultaneous donation, stock formation by family agriculture, and incentives for milk production and consumption (Grisa et al., 2009).

According to a study carried out by Mattei (2007) in the southern State of Santa Catarina, the simultaneous donation modality has shown a better performance, due to the way the actions were implemented and by the very favorable expectation expressed by the interviewed actors. The Southeast region employs a balance between the direct purchase, stock formation, and purchase with simultaneous donation modalities. This region was the most stable in relation to the resources made available between 2003 and 2012, showing continuous evolution over the period (Peixoto & Oliveira, 2015).

According to Delgado et al. (2005), the FPP innovated by creating credit instruments with purchase guarantees to foster production, at the same time serving populations at risk of food instability. It presents novelties in relation to other public policies for family agriculture due to its trajectory and the actors involved (Muller et al., 2012).

The program focuses on the marketing of food from family farms in conjunction with other policies, such as school meals and food stocks and food assistance (Muller et al., 2012). In some cases, it has encouraged the diversification of production and valorization of local products as it combines supply with a diversified demand (Grisa et al., 2009).

The FPP plays a key role in the formation of institutional markets for the direct commercialization between the federal government and rural producers, so that it can promote the guarantee of the commercialization of products from family farms, thereby eliminating the figure of the middleman and promoting the FNS of people in situations of risk and vulnerability (Peixoto & Oliveira, 2015).

In general, farmers are able to employ very restricted forms of marketing, limited to individual sales to retailers and to local consumers at markets. The guarantee of sale and price advantage offered by the FPP provides an opportunity for farmers to invest in the production process (Chmielewska et al., 2010).

The program indicates new municipal strategies for the use of agricultural space, first because producing food is an inherent practice of the settled population, although it should be encouraged; and second, because food production follows the logic of rural families in the face of current internal and external conditions, namely the productive capacity of the family and the state of the market. The increase of biological varieties can serve as a way to strengthen their resistance to market variations, and even provide greater autonomy over their situation when compared to a monoculture (Duval & Ferrante, 2008).

The greatest diversity of production is found in horticultural foods, which are distributed to social-welfare entities through the modality of purchase with simultaneous donation. The variety of local and regional foods associated with seasonality has in the past been neglected due to the increase in industrial food production (Peixoto & Oliveira, 2015).

Grisa et al. (2009) state that the program also encourages agroecological or organic production, offering a price incentive of up to 30% for products with a production certificate under such management systems. However, this requires some organization in relation to the bureaucratic part, especially for farmers who do not have legal formalization or are not organized in associations or cooperatives (Peixoto & Oliveira, 2015).

According to CONAB data, in 2006, 86,543 farming families, distributed in 18 states—with a large concentration in the southern region—were affected. In general, the FPP has acted to complement the agricultural income for farmers already integrated into the means of commercialization, but for most farmers, especially those not served by conservative state policies, the FPP has been the main source of income (Peixoto & Oliveira, 2015).

In the municipality of Ipameri, Goiás, the program has been an important alternative for the survival of family production in rural areas, since product commercialization is guaranteed and delivered directly

to municipal schools, leading to a greater diversity of food for the pupils. Peixoto & Oliveira, (2015) showed that the FPP is associated with growth and the economic and social development of this territory.

In the southern state of Paraná, the program provided producers with greater security: their production was already guaranteed, with previously arranged values, leaving only the risk of weather extremes (Doretto & Michellon, 2007). Interviewed families also mentioned income increases, especially for those with a maximum income of R $ 2,500.00 per capita.

In the city of Angatuba, São Paulo state, Ferreira et al. (2014) observed that FPP positively impacted the incomes of the participating families, generating greater security and commitment to the program, while promoting family farming, and economic and social inclusion The program thereby became their main source of agricultural income .

The development of a cooperativist and associativist perspective was observed in the above-mentioned contexts, since the farmers' association acts exclusively as a marketing agent.

A study in the state of Sergipe observed that the FPP generated a potential use of existing agricultural activities, such as in new investment initiatives, which represented an increase in cultivated area; the beginning of diversification in agricultural production; greater use of labor, inputs, and equipment; and also greater quality control. However, the program has not provided access to other markets, since the program's advantages in terms of marketing possibilities are limited (Chmielewska et al., 2010).

The FPP has enabled the insertion of indigenous communities in Brazil's north as suppliers. Although still small, this measure may contribute to a broader scope of the program, by broadening knowledge generation and strengthening the public debate about the characteristics and impacts of indigenous participation in the program.

In the region of Pontal do Paranapanema, São Paulo, the FPP enables the sale of part of the food produced in the settlements in order to guarantee the supplementation of income and the diversification of production (Leal, 2015).

In Araraquara, São Paulo, there were irregularities in the management of municipal enforcement agents, which led to the interruption of the program for about two years. The FPP's contradictions demonstrate that federal public policies, if not implemented with political will by the local authority, can have their effectiveness reduced or canceled. Hence, the demand for FPP varies according to the Brazilian territorial characteristics, the famers's organizations, and the availability of infrastructure necessary to operate the program (Peixoto & Oliveira, 2015).

The prospects for the continuity of the FPP at the national level have been restricted due to the Federal Government's reorientation of institutional programs directed toward farming families. At present, according to data collected in the Araraquara Municipality of Agriculture, 90 families are participating in the FPP, which implies a reactivation of this program, which was deactivated in the previous political administration.

3.3 The research space: brief characterization of the territory and sample

The empirical space chosen for this research was the municipality of Araraquara, located in the central region of São Paulo state.

The Araraquara mesoregion presents a high degree of urbanization, high per capita income, and dynamic agriculture with a high technological standard—with a predominance of export crops such as sugarcane and orange, as well as pastures and annual crops. As such, it represents an important space for study and evaluation of policies for the countryside (Kageyama, 2003).

The major crops grown in Araraquara, as identified in the agricultural census of the Brazilian Institute of Geography and Statistics (IBGE) (2006), were orange (105,902 tons) and sugarcane (2,720,108 tons), but the quantity of food crops was much smaller—these were: corn (5,419 tons) and cassava (2,071 tons).

The territory of Araraquara has three areas of rural settlement: Monte Alegre, Horto Bueno de Andrada, and Bela Vista do Chibarro, characterizing a possible space of coexistence between family agriculture and employer agriculture (Aro, 2012).

The agricultural census of the IBGE (2006) identified 620 agricultural establishments of individual producers, occupying an area of 16,697 hectares, and 107 settled producers without definitive title-deeds, accounting for 1,435 hectares.

To calculate the sample size, we considered that all subgroups are mutually exclusive and make up the same population, which is divided into three strata—Bueno de Andrada, Monte Alegre IV, Bela Vista do Chibarro—which implies the use of the proportional stratified sampling technique (Cochran, 1953).

The sample size calculation is based on a key dichotomous question in each questionnaire applied, with the most variable context possible, that is, a 50% response for each category ($p = 0.50$). To present the results, we considered the sample error of 10% ($B = 0.10$) and a level of significance corresponding to 5% ($Z = 1.96$).

The expression of the sample size calculation for the case of stratified random sampling (Formula 6) is given below (Silva, 2001):

$$n = \frac{\sum_{i=1}^{L}\left(\dfrac{N_i^2 \, pi(1-p1)}{Wi} \right)}{N^2\left(\dfrac{B}{Z_{\alpha/2}}\right)^2 + \sum_{i=1}^{L} Ni \, pi(1-pi)} \tag{6}$$

$$Wi = \frac{Ni}{N}, ni = nwi \; e \; L = 8$$

The entire procedure assumes that the sample units are collected randomly: the population and sample of this work are summarized in Table 1.

A few extra interviews were collected to avoid a decrease in reliability should some questionnaires be answered incompletely, which would result in the loss of individual variability in a multivariate analysis.

4 Discussion and data analysis

4.1 The Food Purchase Program (FPP) in the Araraquara region/SP: an analysis based on its impact and obstacles

Among the interviewees, 38.1% accessed the FPP. Although they represent a minority, their participation is much larger than in the following other programs: the Bolsa Família Family grants scheme (PBF) (11.11%); São Paulo's Social Interest Agricultural Program (PPAIS) (11.11%); National School Feeding Program (PNAE) (3.17%); and institutional fairs (20.63%). Participation in government programs is also much more significant in the Bela Vista do Chibarro settlement than in the other settlements.

According to table 2, the main difficulties identified by the participants in the program are: difficulties meeting schedules (36.36%), very low quota value (36.4%), quantity produced (22.73%), delivery costs (18.2%), and late payments (9.1%).

The difficulties in complying with the schedules refer to the fact that the desired frequency of product delivery does not match the rhythm of small-scale agricultural production; the workers cultivate and harvest at once, whereas the program requires small weekly deliveries to meet the needs of the social assistance entities.

These hindrances refer to the discussion of the economic rationality of small producers, which differs from the premise of maximizing capital (logic of the capitalist model), since the way of life of farming families is more focused on the needs of

Table 1. Population and sample.

Settlement	Families	Sample (B=10%)	Number of interviews
Bueno de Andrada	31	17	20
Monte Alegre IV	49	27	32
Bela Vista do Chibarro	176	11	11

Table 2. Main difficulties of access to the FPP.

Variables	Yes (%)	No (%)
Quantity Produced	22.7	77.2
Met delivery schedule	36.3	63.6
Very low quota	36.4	63.6
Value does not cover delivery costs	18.2	81.8
Delay in payments	9.10	90.9

self-sufficiency, that is, the logic of social reproduction (Campoi, 2005).

The partial delivery of goods also increases the expenses of individual transportation, as the need for several weekly journeys make the delivery cost much more expensive, and the amount paid does not cover expenses. For this reason, only workers with access to collective delivery processing through a cooperative, or who can combine deliveries with their trip to sell in traditional markets, can participate fruitfully.

Hence, participation in the program is practically unfeasible for those who do not have access to traditional markets or do not participate in a cooperative, because of this difficulty with delivery costs. Delays in payments also prevent workers from starting a new crop, since many avoid crop funding due to concerns about not being able to repay the loans.

For these reasons, the FPP represents an increase in production but does not guarantee access to the markets for those producers who are not associated with a program, such as as institutional fairs, or who lack access to the conventional market.

The main improvements provided by the FPP were increased production (59.1%) and production planning (50%). The suspension of the program would reduce the production of 54.5% of the farmers participating in the program (Table 3).

Producers who diversify their production primarily do so for purposes of self-consumption (91.3%) and supplying institutional and traditional markets (50%). However, among the farmers who diversified their production, 45.65% remain in a situation of light food insecurity. Diversified production for self-consumption guarantees farmers access to various types of food

Table 3. Main improvements with FPP entry.

Variables	Yes (%)	No (%)
Increased amount produced	59.1	40.9
Began to plan production to deliver more frequently and regularly	50.0	50.0
Production increase	59.1	40.9

and allows families to cope with adverse situations (Santos & Ferrante, 2003).

As observed by Santos & Ferrante (2003), the economic feasibility of commercialization also depends on residues from production for self consumption, and vice versa. Besides the resources offered by the environment itself, such as natural soil fertility, water, and climate, agricultural production residues are used, such as straw, manure, and those from fertilisers in commercial crops.

4.2 Effectiveness index of the FPP in the region of Araraquara/SP

By and large, the effectiveness of the program was moderate for most family farmers, a factor that justifies its importance and suggests the necessity of studies to propose improvements.

The results show greater effectiveness for producers who have worked hard to diversify, increased the quantity produced, and who have made plans for these expansions. The use of new technology had little bearing on the effectiveness of the program, with just a slight improvement for the producers who introduced it. This can be explained by the fact that the most common produce are varieties of vegetables that require little production technology. The most commonly observed improvement in the use of technology by the program's participants was the use of irrigation systems (Table 4).

The FPP represents a major impact on both production and marketing. According to the interviewees, if the program were suspended, production and marketing would decrease in most cases or would even be suspended. Although some producers market the same types of products both in institutional fairs and directly to the consumer, others have their commercialization almost exclusively within the FPP's operations.

This fact draws attention to the fact that even though the FPP does not guarantee access to other markets for some of the producers, it has a strong impact even on those who have access to other means of commercialization.

These data illustrate the FPP's contributions to the development of food security in family agriculture in

Table 4. Effectiveness Index of the FPP in the region of Araraquara, São Paulo.

Variables	Index(%)	Classification
General value for effectiveness	44.14	🟡 Moderate
Effort to produce new products		
No	35.95	🟠 Low
Yes	53.97	🟡 Moderate
Effort to increase quantity produced		
No	31.46	🟠 Low
Yes	52.92	🟡 Moderate
Production planning		
No	35.41	🟠 Low
Yes	52.87	🟡 Moderate
Use of inputs or new technology		
No	43.20	🟡 Moderate
Yes	53.52	🟡 Moderate
Impact on production		
Maintains	35.19	🟠 Low
Decreases	50.70	🟡 Moderate
Totally decreases	46.03	🟡 Moderate
Impact on Commercialization		
Increases	18.49	🔴 Very Low
Mantains	35.37	🟠 Low
Decreases	53.06	🟡 Moderate
Totally decreases	45.49	🟡 Moderate

the municipality of Araraquara. However, they also show that food insecurity has not been eradicated in this rural segment, despite institutional efforts.

The results also highlight that half of FPP participants in this study presented moderate FNS and 22.7% had high or very high FNS, while only 27.3% had low FNS. In other words, 73% of the farmers who accessed the FPP regularly in the municipality had moderate or high FNS; by comparison, 93% of those who did not access the program had a moderate or low FNS (Table 5).

Tabela 5. UFSCar Index for effect of FNS on participants and non-participants in the FPP in Araraquara, São Paulo.

Index	Participants (%)	Non-participants (%)
Very high	4.50	0.00
High	18.2	7.30
Moderate	50.0	60.9
Low	27.3	29.3
Very low	0.00	2.50

This justifies the extreme importance of public policies for small farmers aimed at their insertion in markets and the guarantee of commercialization, with a view to their food security.

5 Final considerations

This study shows that, despite the progress made by public policies for food and nutritional security—predominantly in the agricultural sector—food insecurity is still present even in a rich economic region, mainly among farming families.

During the fieldwork it was observed that the family farmers of the studied region have usually fulfilled the function of the land, cultivating a diversified production and focusing on self-consumption.

The income generated and consumed by the farmers is very hard to measure, and "capitalized" producers show a higher consumption of products from their own farms than the "decapitalized" producers, a factor that influenced the perception of these workers regarding their food security.

There is controversy in the evaluation of the conditions of production/social reproduction of the family farmers. At times, efforts to produce or increase the quantity cannot be measured with a simple yes or no, and the same can be said for the other variables related to assessing food security. As a result of this controversy, there are authors who emphasize, in the relationship between farmers and municipalities, the existence of a web of social tensions in which these workers are inserted—including resistance, pressure, constraints, and good or bad political will of the government. This shows that, when it comes to rural settlements, we hardly have absolute and classificatory quantitative results.

The diversity and variation of farming families, and their needs and demands, have been corroborated, a factor that makes it particularly important to elaborate public policies capable of serving the majority of these farmers. Participation in public policies is also still small, with most emphasis being on the FPP.

The UFSCar food security index represents a great methodological advance, and confirmed the BFIS methodology. The results demonstrate the need to apply this index in diverse regions in order to provide a scientific basis for the reconceptualization and improvement of federal public policies in regional contexts.

There is a great need to expand the FPP and create of new complementary programs. Program adjustments are needed to ensure that producers are better able to adapt to delivery schedules and to minimize costs.

It is necessary to expand the program so that municipalities can acquire greater value and more diversified production by family farmers. Once capitalized, producers may feel safer to expand and diversify production, which as observed by the results of this work contribute to improved program effectiveness, minimized delivery costs, and greater food security.

Even though the FPP does not guarantee access to other markets in the territory studied, a factor that can be explained by the strong presence of commercial agriculture operations, the program represents an important increase in business of farmers who are inserted in traditional markets, and for a significant portion of them, represents the only means of commercialization.

It is necessary to improve this aspect of the policy, by creating mechanisms and technologies to ensure that family farmers thrive and can access other markets, which can also be achieved by expanding the FPP and creating complementary programs. It is a situation that requires political will at the federal and municipal levels, especially when not supported by the latest institutional measures in public policies in agriculture. However, the planning of new technologies directed to these institutional policies is already causing negative impacts on the production and commercialization of family farms, due to their demand on the national budget, and consequent cuts to programs for maintaining reciprocity, an essential element for ensuring producers' food security and sovereignty.

The data suggest that the FPP contributes to family farmers' food security, and demonstrate that food insecurity is still present and should remain a priority in institutional agendas.

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