Analysis of national policy for family farming organic products trade in Brazil
ABSTRACT

The Food Acquisition Program (PAA) was created in 2003 by the Brazilian government to promote family farming and comprises actions as agricultural products distribution to people experiencing food insecurity and the formation of strategic stocks. This research aims to analyze organic food trade in PAA program context by considering the payout of organic products, the relative proportion of organic products traded and the diversity of products traded in Brazil. Thereby, analyzing the efficiency of this public policy in supporting family farmers. Our empirical results reveal that PAA program has no significant impact on the price increase of organic products on a national level. However, the additional percentage paid for organic products vary significantly among Brazilian states, with some states paying less for these products in some years while others pay more than the 30% foreseen by law. All states trade a small proportion of organic products in relation to the total products operationalized by PAA. Our results add valuable contributions to the literature by presenting evidence that smallholder organic agricultural production in Brazil is still very low and in need of stronger public actions. Besides these outcomes are also relevant for the guidance of public policies in other developing countries.

Keywords: Organic Food Market, Support Policies, Smallholders, Organics in Brazil.
INTRODUCTION

Family farming is the most common farming structure all around the world, which makes it essential for the overall agricultural sector (IFC, 2018). In several countries, smallholders are responsible for supplying more than half of the domestic market demand, mainly nutritional base crops (RAPSOMANIKIS, 2015). Therefore, it is extremely important to identify programs, policies or any other actions that might benefit these farmers and strengthen this sector.

Recently, the world population, becoming aware of the dangers of chemical fertilizers, started to pursue healthier food alternatives and organic farming gained prominence in the international market over the past few years. In the turn of the century, from 2000 to 2008, there was an increase of 20 million hectares of certified organic lands throughout the world (WILLER & KILCHER, 2010). Currently, the global organic area continues to grow, showing 57.8 million hectares in 2016, and over 71.5 mi ha in the latest global data on organic farming worldwide (IFOAM, 2020).

Studies from FiBL - Research Institute of Organic Agriculture (IFOAM, 2020) show that organic farming generated 15.1 billion euros in the world economy in 2000 and reached 96.7 billion euros in 2018, an increase corresponding to € 81.6 bi (540%) in 18 years. This creates an amazing opportunity for family farmers since it is a new market that they can target as suppliers. Smallholders’ agricultural production is characterized by having low external inputs, such as fertilizers, and mainly manual workforce, which makes it easier for these farmers to shift to an organic system. The benefits of organic smallholder production have been documented all around the world; in India, for example, Mishra et al. (2018) concluded that organic production of basmati rice substantially improved the livelihood of these farmers. Unfortunately, only 1.1% of the total agricultural area in the world is used for organic production and three quarters of the producers are located in developing countries (WILLER & LERNOUD, 2017). It is important to increase the total land area under this production system since it also has less environmental impact compared to traditional farming.

In Brazil, smallholder organic production started to be encouraged by the Food Acquisition Program (PAA - Programa de Aquisição de Alimentos) in 2004. The 2006 Agricultural Census revealed that only 1.7% of smallholders in Brazil practiced organic farming back then, which represents a very low percentage of production of healthier food with minimum environmental impact when compared with conventional farming.

The Federal Government created the Food Acquisition Program to stimulate family farming and assist the fight against hunger and poverty in Brazil. The program uses trade mechanisms that favor direct product purchase from family farmers or their organizations and stimulates production value-adding processes; furthermore, the products are destined to people experiencing food and nutritional insecurity, to provide lunch for children at public
schools and to those supported by the social assistance network and food and nutrition public facilities (BRASIL, 2014). The program’s importance lies in the price and trade guarantee, as well as in the quality of school lunch and food security of the poorest. According to the program norms, a price increase of up to 30% for agroecological or organic products is admitted in relation to conventional ones (GALINDO; SAMBUICHI; OLIVEIRA, 2013).

An evaluation of PAA carried out in 2006 in the South and Northeast regions indicated that basic education institutions receiving food from PAA enabled an increase in the availability and mainly in the quality of food consumed at schools. In addition, it was evident that PAA had other benefits, such as lower school meal costs, eliminate intermediaries and stimulate the local economy (SIDANER; BALABAN; BURLANDY, 2013). The implementation of programs such as PAA and the National School Feeding Program (PNAE - Programa Nacional de Alimentação Escolar) is intimately associated with socio-economic and productive dynamics of each city and depends on the participation of farmers’ organizations, buyers, political agents and decision-makers (PAULA FILHO; CALVI; CASTRO, 2016).

It is worth emphasizing that the Food Acquisition Program also inspired the PAA Africa (Purchase from Africans for Africa), a program which is very similar to the Brazilian one. PAA Africa started in 2012 and currently encompasses five participating countries: Ghana, Kenya, Mozambique, Senegal and Zimbabwe (OECD, 2015).

Brazil finds itself in a dynamic moment regarding dialogues about political instruments dealing with social and ecological interactions between agriculture and environment. New policies, programs, projects and actions have added even more challenging demands for policymakers when it comes to deciding on the complex set of policy options available for agro-environmental topics (ZANELLA & CARDOSO, 2011).

Researchers around the world have studied the public power intervention on organic farming and the importance of public policies and guidance in this area (FEBLES-GONZÁLEZ et al., 2011; MOSIER & THILMANY, 2016; SLAVOVA; MOSCHITZ; GEORGIEVA, 2017). This research aims to perform a quantitative analysis of organic food trade in the Food Acquisition Program context by considering payout of organic products, the relative proportion of organic products traded and the level of diversity of products traded in different Brazilian states. Outcomes of this research will reveal the impacts of this program on smallholders and if it is fulfilling its objectives. Additionally, our results can guide policymakers’ decisions and assist to strengthen family farmers and organic agricultural production.

THE IMPORTANCE OF CERTIFICATION IN ORGANIC FOOD TRADE

Organic certification provides support for farmers who do not have access to exportation markets, as well as helps the strategic development of rural populations. Moreover,
enhancing organic planting management techniques can improve productivity and increase the income of rural population (KLEEMANN; ABDULAI; BUSS, 2014).

Additionally, certified organic production can contribute to poverty reduction in several ways. Small farmers can benefit from higher profits due to additional value paid for their organic products; access to high-standard markets for certified organic products; value addition in the organic production through product processing and packing; among others (AYUYA et al., 2014).

The study conducted by Jouzi et al. (2017), highlights that the most significant advantages of organic farming for smallholders include higher resilience to environmental changes, increasing farmer’s income and reducing external input costs, while the main challenges are the certification process and market barriers.

Greater gains for small farmers will depend on their ability to compete in the market (MARKELOVA et al., 2009). Therefore, public policies are vital to aid in organic production. One example is the federal intervention of the United States on organic farming trade, which is correlated with public policy decisions (MOSIER & THILMANY, 2016). The government aids small farmers to overcome difficulties found in the global economic market, such as high transaction costs and difficulties to access other markets (KLEEMANN; ABDULAI; BUSS, 2014; MARKELOVA et al., 2009).

An effective public policy to supports small farmers’ subsistence should necessarily involve several players interested in fighting against poverty and hunger, as well as increasing food security (CHMIELEWSKA & SOUZA, 2010). Thereby, Raynolds (2004) stresses that there should be an effort to stimulate organic farming on a global scale and connect small farmers with aware consumers.

In Brazil, PAA has changed farmers’ productive and organizational processes, mainly as a result of the optimized use of resources, new investments and greater involvement of farmers into these processes. Regarding agricultural production, the introduction of products not previously negotiated in the market is observed, as well as new investment initiatives. The last resulted in an increase of croplands, product diversification, greater use of workforce input, greater quality control, among others. However, these changes are impacted by operational challenges faced by the program, such as payout delays, sanctions to producers and gaps between purchase rounds (CHMIELEWSKA & SOUZA, 2010).

**MATERIAL AND METHODS**

The data about PAA’s organic food trade was obtained from the “PAA DATA”, a web system made available by the Secretariat of Information Assessment and Management (SAGI), which is part of the Ministry of Social Development. Data contains information on
weight (in tons) and prices (in R$) for every product traded on PAA per state and whether the product is conventional or organic. We use information from 2012, 2013, 2014 and 2016. Data from 2015 were not available and those from 2011 did not discriminate the products between organic and conventional.

In order to identify whether there is a difference in the value paid for organic and conventional products, we calculated the mean percentage difference paid for organic product in relation to that conventional (DPPO) for each state, according to the following formula:

\[
DPPO(\%) = \frac{\sum_i^n \left( \frac{Price_{Org_i} - Price_{Conv_i}}{Price_{Conv_i}} \right)}{n} \times 100
\]

Data regarding organic products’ participation in PAA was obtained by calculating the relative proportion of organic products in relation to the total operationalized by the program (PPO). Both weight and amounts paid for organic products were computed and their percentage representation was calculated in relation to total products traded on PAA per state.

The level of diversification in PAA traded products was measured using Simpson’s Diversity Index (SDI), which was calculated for organic and conventional products using the following formula:

\[
SDI = 1 - \sum_{i=1}^n \left( \frac{X_i}{\sum_{i=1}^N X_i} \right)^2
\]

SDI values higher than 0 and lower or equal to 0.35 indicate a low diversification rate; higher than 0.35 and lower or equal to 0.65 indicate medium diversification and above 0.65, high product diversification (HERRERA et al., 2018). Statistical analyses were conducted using R software (R CORE TEAM, 2018).

Additionally, we applied the difference-in-difference (DiD) technique, which is a quasi-experimental design that makes use of data from treatment and control groups to obtain an appropriate counterfactual to estimate a causal effect. The DiD approach is one of the most widely used methodologies for this type of analysis and has been successfully applied in similar researches such as Cisilino et al. (2019), Ruggiero et al. (2019) and Arima et al. (2014). The method is typically used to estimate the effect of a specific intervention or treatment (the PAA program) by comparing two groups, the control (conventional farmers) and the treatment (organic farmers). The DiD approach assumes parallel trends, in other words, in the absence of the PAA program the control and treatment groups would follow similar paths in terms of their product prices outcome. The method compares the different trajectories over
time for the two groups and isolates the treatment effects while controlling for time-invariant non-observable characteristics.

We implemented it as an interaction term between time and treatment group dummy variables in a regression model.

\[ Price_{it} = \beta_0 + \beta_1 \cdot treated_{it} + \beta_2 \cdot time_{it} + \beta_3 \cdot did_{it} + \epsilon_{it} \]

Where, \( Price \) is the price of organic and conventional products; \( treated \) is a dummy that indicates the difference between conventional and organic products; \( time \) is the trend in the control group; and \( did \) is the difference in changes over time.

**RESULTS AND DISCUSSION**

The mean value of the percentage difference paid for organic products in relation to conventional ones (DPPO) was calculated for the national level and between Brazilian states in the different years (2012-2016). The mean national DPPO was positive for all years analyzed, ranging from 16 to 24.1% (Figure 1). This result shows that, on average, PAA policy operators paid an additional value for organic products, which can stimulate production in this category. Furthermore, as the policy admits that reference prices have an increase of up to 30% in relation to conventional products, there is still margin for an even greater increase of organic products prices.

Figure 1. National means of percentage difference paid for organic product in relation to the conventional (DPPO) between 2012 and 2016 in Brazil.

* Data from 2015 were not available.
In order to evaluate whether the difference between values paid for organic and conventional products in the years 2012, 2013, 2014 and 2016 were statistically significant, we applied the difference-in-difference (DiD) technique (Table 1). The following standard terminology was used to describe the sample set in the statistical analysis: control group (conventional type) and treatment group (organic type). The organic type was named “treatment group”, as it resulted from the application of the public policy adopted, and our aim is to know if this application had real effect from the analysis of variance in prices. The results are the following:

**Table 1.** Difference-in-difference (DiD) technique of prices paid for organic products and for conventional products between 2012 and 2016.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>treated</td>
<td>-0.706*** (0.120)</td>
</tr>
<tr>
<td>time</td>
<td>0.328*** (0.066)</td>
</tr>
<tr>
<td>DiD</td>
<td>0.190 (0.183)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.688*** (0.047)</td>
</tr>
<tr>
<td>Observations</td>
<td>10,283</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Note: *p<0.1; **p<0.05; ***p<0.01. Standard error in parenthesis. Data from 2015 were not available.

The DiD approach reveals no significant statistical difference of products price between the two groups. Results for 2012, 2013, 2014 and 2016 presented $p$-values $>0.1$, and $\beta_3 = 0.19$. The coefficient for “DiD” is the difference-in-differences estimator, the effect is not significant at 10% with the treatment having a positive effect.

Our results are in line with Lentz and Upton (2016) who explore the impact of the Purchase for Progress (P4P) program, which is a program similar to PAA, on smallholders in Tanzania. The P4P is an initiative of the United Nations World Food Programme (WFP) created in 2008 to support and improve smallholder’s livelihood. The program works closely with governments of 35 countries helping them purchase from smallholders to meet the needs of public institutions, such as schools and hospitals, and thus create a stable demand for these producers. The aforementioned authors applied the difference-in-differences approach and report that while small farmers who participate in the program increased their commercial farming activity compared to the group control, there was no evidence of increased income or increased crop value. Likewise, Hughes et al. (2020) employ the difference-in-differences estimator to assess the impact of an NGO effort to promote agroforestry in Kenya. The authors found a significant but modest effect of the program on agroforestry product income.
Following our analyses, when DPPO values are compared between states, there are percentage variations both between states and for the same states throughout the different years (Figure 2). In contrast to what was expected, some states paid proportionally less for organic products in relation to conventional ones in some years. That was the case for Goiás (GO), Pará (PA), Piauí (PI), Roraima (RR) and Minas Gerais (MG), that is, there was a negative difference for these states.

Figure 2. Percentage difference paid for organic products in relation to conventional products (DPPO) per state in Brazil between 2012 and 2016.

* Data from 2015 were not available.

Note: Blank states did not trade organic products, or there is no difference in price.

States in white on Figure 2 did not trade organic products in the referred year, or in a few cases, organic products mean values did not differ from those of conventional products. Further, we explore the organic product relative proportion in relation to the total of products traded by the PAA program (PPO). Results reveal that the national average participation of organic products is still very low and that it reached the highest value in 2016 (1.592 %) as shown in Figure 3.
This low proportion is in part expected given that the number of family farmers that produce organic products in Brazil is still very low. In addition, it is known that few producers who work with organic production have the certification, due to the high costs, which is a requirement to benefit from PAA policy. According to the results, organic product participation (PPO) on the total of PAA-traded products varied between states, with greater relative proportion in states from the South region. We found values higher than those in other states for the analyzed years and maximum participation values in the states of Paraná (PR) and Rio Grande do Sul (RS) (Figure 4).
Overall, the quantity of organic product in relation to total PAA-traded products per state was not uniform nor showed a pattern in the evaluated time, presenting variation for each state throughout the years. In 2012, the states of Pernambuco (PE), Paraná (PR) and Santa Catarina (SC) presented significant PPO values and stood out among Brazilian states. Nonetheless, in the following years, Pernambuco (PE) and Santa Catarina (SC) reduced their participation, while Paraná (PR) increased it.

The only Brazilian state that increased the proportion of PAA-traded organic food products in all analyzed years was Rio Grande do Sul (RS), which was between 0 and 2% in 2012 and reached 14% in 2016. Multiple factors can justify this increase of organic food participation in this state. For example, the farmers’ greater awareness regarding the diverse benefits of organic production, including higher financial return due to the long history of local policies supporting this type of production in the state, especially those involving technical assistance, which is also reinforced by non-governmental organizations’ actions.

The diversification of agricultural products traded in the PAA program was calculated using the Simpson’s Diversity Index (SDI) both for organic and conventional products. Results
for conventional products are presented in Figure 5, which reveals that the level of diversification in the PAA program was high for almost all states in the analyzed years; while it was medium for the states of Pará (PA), Alagoas (AL), Santa Catarina (SC) and Rio Grande do Sul (RS) in 2013, Acre (AC) in 2014; and low for Amapá (AP) and Federal District (DF) in 2012, Pernambuco (PE) in 2013 and Federal District (DF) in 2014/2016.

**Figure 5.** Level of diversification of conventional products as indicated by Simpson's Diversity Index (SDI) for each state, between 2012 and 2016.

Data from 2015 were not available.
As for the level of diversification of organic products traded in the PAA program as given by the SDI index (Figure 6), it was lower than that of conventional products, especially in states comprising the North and Northeast regions, except for Bahia (BA), which showed high diversification in all years. In the North region, products identified as organics are essentially derived from extractivism, and since there is no significant diversity of products classified in this category, it justifies this region’s low rates. A high diversification index of organic products was found in all analyzed years for the states of Mato Grosso (MT), Bahia (BA), Espírito Santo (ES), São Paulo (SP), Paraná (PR) and Rio Grande do Sul (RS).

Figure 6. Level of diversification of organic products as indicated by Simpson’s Diversity Index (SDI) for each state, between 2012 and 2016.

Data from 2015 were not available.

Chmielewska and Souza (2010) analyzed the PAA program and highlight that joint initiatives to support food production and food access through agricultural market options for smallholders, can simultaneously offer an important commercial possibility to these farmers and play a meaningful role in the enhancement of their market options. Similarly, Markelova et al. (2009) stress that small organic farmers face a number of challenges in accessing...
markets considering the global economic change context, and collective actions can bring several advantages to these producers. In addition, such actions can help correct some market imperfections, such as high transaction costs and lack of credit.

Resque et al. (2019) explored the PAA and PNAE public policies in the North region of Brazil and concluded that both programs have the potential to promote agrobiodiversity; however, the magnitude of its impact is largely associated with local administration of each program, which may help explain the discrepancy among states.

According to Candiotto (2017), despite the development of organic farming promotion and regulation policies, Brazil still prioritizes large farming businesses and the use of pesticides, agrochemicals and transgenics. Therefore, even with public policies such as PAA and PNAE, it is still hard to state that there is organic production with high productivity in the country. Our results corroborate that, Figure 7 shows the analysis of total quantity of organic products traded in Brazil and that the values (in tons) significantly decreased from 2012.

Figure 7. Total quantity in weight (ton) of organic products traded in Brazil in the period from 2012 to 2016.

There is clearly an oscillation in the amount traded between 2013 and 2016, which does not necessarily mean that there were no investments. Operationalization is also one of the biggest obstacles to higher performance in the production and trade of organic food through PAA. It should be noted that when we analyze these values of total amounts traded by each state, there is still a timid organic product trade, especially in the North, Northeast and Midwest regions (lighter regions of the map in Figure 8).
Figure 8. Total quantity in weight (ton) of organic products traded by each state between 2012 and 2016.

Data from 2015 were not available.

It is important to highlight the need of increasing the availability of data related to amounts invested in the purchase of products, in order to guide offers of subsidies to improve trade in different regions. In addition, it could also reveal the causes of variations in Brazil’s organic food market, which generates discontinuity to PAA. Further, greater interaction with countries in which agro-environmental policies have worked effectively becomes important, especially with those that consider economic and social instruments (ZANELLA & CARDOSO, 2011), and evidently respecting Brazil’s particularities.

CONCLUSIONS

This research performs a wide analysis of smallholders’ organic products trade by the PAA program in Brazil in both national and regional levels. We found that there was considerable variation between Brazilian states as for differential prices paid for organic products during the analyzed years. While some states paid less for these products in some years,
others paid a price surpassing the 30% foreseen by law. However, the DiD analysis revealed no significant statistical difference between the price of products produced by organic and conventional farmers. This is due to the fact of federal states do not always present the price paid for organic products higher than conventional products.

This result raises concerns regarding the effectiveness of the PAA program and the recognition of organic products value.

Regarding product diversity, conventional agricultural production is highly diversified in practically the whole country. On the other hand, organic production is more diversified only in the South region and in some states such as Mato Grosso (MT), São Paulo (SP), Bahia (BA) and Espírito Santo (ES), while it shows low diversification rates among most states in the North and Northeast regions. States trade proportionally less organic products in relation to the total PAA-operated, but in the analyzed years, the states of Rio Grande do Sul (RS) and Santa Catarina (SC) stood out with a more significant share in the organic food market. Nevertheless, organic products still have little significance in relation to conventional ones.

Our results demonstrate that the PAA program still has a lot to improve and develop. However, it is already possible to see some good results and benefits for family farmers. This is expected to motivate more farmers to adopt this production system in the next few years and increase the amount of land under organic production in Brazil. It is important to highlight that the PAA program can serve as an example for public policies in other countries worldwide, especially developing countries where most of the organic producers are located.

The specificities of each state in a country of continental dimensions bring about discontinuity and oscillations in trade, making it challenging to evaluate the Food Acquisition Program efficacy. For a more accurate evaluation, it is necessary to carry out individual analyses by considering particularities of each locality as well as the availability of more data and information about the program.

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