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Analysis

Comparing the Profitability of Organic and Conventional Production in Family Farming: Empirical Evidence From Brazil

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ABSTRACT

Several studies have compared the profitability of organic and conventional producers, but present very conflicting results. Although in the majority of these papers selection bias due to observables is accounted for, the possibility of selection based on unobservables has been largely overlooked. In this paper, we compare these two types of producers using a large and unique data of about 4.2 million family farmers in Brazil. Standard propensity score matching techniques are used together with the procedure recently developed by Oster (forthcoming) to address concerns about omitted variables. Our results confirm the working hypothesis that organic producer's profits are lower than conventional ones.

1. Introduction

Organic agriculture is one of the fastest growing sectors in global industry, having grown fourfold between 2013 and 2015. In 2015, 2.4 million organic producers were reported worldwide, a 7.2% growth compared to the previous year (IFOAM, 2017). These producers are mostly concentrated in Asia (35%), Africa (30%) and Latin America (19%), in a broad array of environments (Oelofse et al., 2010). The developing countries account for > 80% of organic producers worldwide, such as India (585,000 producers), Ethiopia (203,602) and Mexico (200,039) (IFOAM, 2017).

The organic sector growth has been boosted on a global scale by a strong influence of the North American and European markets. North America alone accounts for over 50% of the global organic market (IFOAM, 2017). According to Sneddon et al. (2006), large increases in demand were observed in recent decades as a response from society to the Brundtland sustainable development model. Barham and Weber (2012), in addition to the social and environmental issues related to Brundtland's sustainability glimpses, highlight consumer preferences for organic food due to its positive health effects.

Alongside the demand benefits and incentives, the Capacity Building Task Force on Trade, Environment and Development of the United Nations argues that the adoption of organic agriculture in developing countries yields economic, environmental, social and cultural benefits (UNEP-UNCTAD, 2008). Furthermore, even in the developed world, organic agriculture has been recognized as the best system for balancing the multiple sustainability goals, as it has been attested by Lockeretz (1989), Khaledi et al. (2010) and Crowder and Reganold (2015).

Under these circumstances, it becomes necessary to investigate the potential barriers to organic farming (Khaledi et al., 2010), so that policies can be proposed. As such, part of the literature has focused on understanding the factors that influence farmers to adopt organic farming practices, including management skills, agro-climatic conditions and social considerations (Khaledi et al., 2010; Veldstra et al., 2014). There exists also a concern with the environment and the decision of adopting environmentally-friendly practices (Läpple and Van-Rensburg, 2011; Kleemann and Abdulai, 2013; Takahashi and Todo, 2013; Mzoughi, 2014); for these authors, strong ethical beliefs would strengthen the desire to become an organic producer. HØgh-Jensen et al. (2009), on the other hand, highlight ensuring livelihoods, food security and increasing incomes as the economic motivations to the transition to organic farming.

The literature is not unanimous with respect to all these questions and, with regard to income, different aspects have been considered. Crowder and Reganold (2015) and Lockeretz (1989), for instance, highlight the importance that local income generation assumes in the context of organic agriculture and its importance for sustainability, both socially and environmentally. However, while this is a good argument for leveraging public policy, it may not be enough to convince

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producers, who often make their decisions based on private incentives, as attested by Kerselaers et al. (2007) using data for Belgium.

The focus of the present analysis is not precisely to investigate the motivations to become organic, but to compare the financial performance between organic and conventional producers. A few papers have performed such comparison. For instance, Dabbert (1994), Offermann and Nieberg (2000), Stonehouse et al. (2001), Delbridge et al. (2013), and Patil et al. (2014), despite using different methods, show relatively higher profits for organic farming, either due to lower costs or price premiums. On the other hand, a set of papers find exactly the opposite. Kerselaers et al. (2007), and Kuminoff and Wossink (2010), for example, argue that organic production costs are relatively high, which affects the profitability of enterprises. Along the same lines, Lohr and Salomonssonb (2000) and Kallas et al. (2010) show that, in many situations, profitability can only be achieved when the government subsidizes the conversion costs. Additionally, organic farming incurs high labor costs and/or insurance expenses and marketing charges, which might jeopardize its economic viability even in the presence of price premiums (Rattanassuteerakul and Thapa, 2012; Uematsu and Mishra, 2012; Beltrán-Esteve and Reig-Martínez, 2014).

Nevertheless, despite the importance of the discussion and the results obtained so far in terms of economic viability, productivity, and environmental impacts, the majority of these papers fail to account for omitted variable bias (selection bias). Any observed difference between the outcomes (profit) of both types of producers may result not only from differences in the production process but from unobserved characteristics that might systematically differ between producers. For instance, farmers efficiency before conversion (Latruffe and Nauges, 2014) to organic production and/or their entrepreneurial ability is not fully observed by the econometrician, making these direct comparisons likely to be biased (Lakner and Breustedt, 2017).

Examples of papers that fail to account for omitted variables include Läpple and Van-Rensburg (2011), who used a multinomial logit model to estimate differences between late, middle and early adopters in responding to economic and non-economic factors involving the adoption of organic farming; Khaledi et al. (2010), who used a simple tobit model to identify factors that either encourage or discourage producers to adopt organic farming; Delbridge et al. (2013), who explored the economic viability of organic and conventional sheep production through stochastic efficiency analysis; and Tzouramani et al. (2011), who employed stochastic control criterium to measure the net return of farms according to property size.[1] The small set of papers that recognized the possibility of non-random selection into treatment used the propensity score matching to balance the samples of treated and control producers. These include Kassie et al. (2008), Bolwig et al. (2009), Henson et al. (2011), Blackman and Naranjo (2012), Jena et al. (2012), Ruben and Fort (2012), Uematsu and Mishra (2012), Kleemann and Abdulai (2013), Chiputwa et al. (2015), and Mazunda and Shively (2015).

Yet, under selection on unobservables (Altonji et al., 2005), methods that rely on the conditional independence assumption (CIA) are likely to be biased (Black and Smith, 2004; Heckman and Navarro-Lozano, 2004). Therefore, aiming at comparing the profitability of organic and conventional family farmers in Brazil, this study proposes not only to use a set of propensity score matching estimators (Busso et al., 2014), taken as a benchmark, but also the test the robustness of our results under selection on unobservables. In that regard, we implement the procedure recently developed by Oster (forthcoming) to estimate bounds for the treatment effect under the notion that movements in the coefficient of interest, when including and not including controls for which one is concerned about omitted variables, are informative about the remaining bias from unobservables. Mian and Sufi (2014) provide a recent application of Osters' test to analyze the robustness of the effect of housing net worth shock on non-tradable employment to omitted variables.

In addition to this introductory section, the paper is organized as follows: Section 2 presents an overview of organic agriculture in Brazil. Data, descriptive statistics and a description of the variables can be found in Section 3. Section 4 details the fundamentals of the propensity score matching method as well as all robustness tests performed. Results are presented in Section 5. Finally, the last section concludes.

2. Organic Agriculture in Brazil

Brazil is ranked fifth in the world in terms of organic agricultural land area, with approximately 750,000 ha of planted land (IFOAM, 2017). This number, however, stands for only 0.3% of total agricultural land in the country. Moreover, in a decade (2005–2015), total organic land fell back in 130 thousand ha (IFOAM, 2017), most likely due to the strength of conventional and productivist agriculture that makes the country rank first in pesticide sales worldwide. According to the Brazilian National Union of Crop Protection Products Industry,[2] pesticide sales in 2015 were US$9.6 billion and, only in 2014, > 914,000 tons of pesticides were sold in the country. Over the last ten years the world market for this sector has grown 93% whereas for Brazil the growth was 190% (ANVISA, 2017).[3]

According to the Census of Agriculture (IBGE, 2009), in 2006[4] Brazil had 90,497 organic farms,[5] out of which 74,805 (83%) were family farms. The Northeast region concentrated almost 50% of these producers.

Among the Brazilian agricultural sectors, organic production is stronger in horticulture and floriculture, with almost 9000 producers, representing 4% of the total number of establishments in the sector according to Table 1. Among the organic family farms only 3616, or 5% of them, had organic certification.

The world market for organic food handled about US$81.6 billion in 2015.[6] The highlights were the United States with US$39.7 billion, Germany with US$9.5 billion and France with US$6.1 billion (IFOAM, 2017). The modest Brazilian share in this market was of about US$800 million, corresponding to 0.71% of the global market (ORGANIS, 2017).

Despite not having a large relative market share, this market has had a remarkable growth in Brazil. According to the National Council for Sustainable Organic Production (ORGANIS, 2017), the sector grew 20% in Brazil in 2016 in comparison with the previous year. The growth rates recorded worldwide in recent years are lower, between 5% and 11%, what demonstrates a potential for consumption in the Brazilian market.

Most of the Brazilian organic production, approximately 80%, comes from family farming. However, despite being Latin America's greatest organic consumer (IFOAM, 2017), > 70% of this production is exported to Japan, the United States and the European Union (Abreu et al., 2009).

3. Data and Descriptive Statistics

3.1. Source and Characteristics of Data

This study uses microdata from the Agriculture Census of 2006,[7] the

[1] Other studies using different methods but subject to the same type of bias include Kumbhakar et al. (2009), Kallas et al. (2010), Oelofse et al. (2010), Breustedt et al. (2011), Patil et al. (2014), and Beltrán-Esteve et al. (2014).

[2] Sindiveg. Available at: http://www. Sindiveg.org.br. Accessed in March 2017.

[3] ANVISA (2017). Available at: < http://portal.anvisa.gov.br/wps/portal/anvisa/anvisa/agencia > Access in: 30 March 2017.

[4] This was the last Census whose data were made publicly available.

[5] Which stands for 1.7% of the total number of farms.

[6] To better understand the evolution, in 1999 the demand for organic food was US $15.2 billion (ORGANIC MONITOR, 2014).

[7] Data were obtained through authorized access to the Restricted Data Access Room