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Certified organic food production, financial performance, and farm size: An unconditional quantile regression approach

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ABSTRACT

Demand for organically produced foods continues to show double-digit growth. However, production of certified organic food in the US has lagged significantly. Hence it provides tremendous scope as well as a challenge for the U.S. organic food production (OFP) sector. This study investigates the impact of farmer's participation in certified OFP on farm financial performance. Using a 2012 nationwide farm-level survey and an unconditional quantile regression (UQR) approach, we find a significant heterogeneous effect of certified OFP across quantiles of farm financial performance measures (i.e., total sales and net cash farm income). Findings show that participation in certified OFP is positive and varies across the unconditional total sales quantile. The marginal impact of participation in certified OFP is higher for farms generating higher sales and net cash income, top three quantiles (75th and up). However, small farms tend to benefit from participation in certified OFP when we use farm sales as performance measure. Finally, UQR estimates show that gender of the operator, off-farm work, marketing contracts, and direct-to-consumer sales have a significant impact on farm financial performance.

1. Introduction

Interest in organic cropping systems has been fueled by consumer demand for crops produced without synthetic chemical inputs and with emphasis on sustainable and environmental stewardship (Dimitri and Oberholtzer, 2009). For example, in the United States, total sales of organic products increased from $11 billion in 2004 to about $28 billion in 2012 (Osteen et al., 2012; Greene, 2013). Online news sources suggest that food retailers and wholesalers in recent years, such as Whole Foods, Kroger, Walmart, Sam's Club, and Costco are experiencing significant increases in the demand and sales of organically produced (Patton and Giammona, 2015) food products. However, in the production side, growth in organic food production in the United States is relatively low. Imports from countries like Turkey, Mexico, India, Peru, and Ecuador supplied 43% of organic products to the United States. Additionally, due to lower yield and higher production costs associated, growers are reluctant to adopt organic production (Mahoney et al., 2001; Clark, 2009; Offermann and Nieberg, 2000; Uematsu and Mishra, 2012; Crowder and Reganold, 2015).

The United States Department of Agriculture (USDA) oversees organic farm businesses to make sure that organic food is produced with organic methods. The process is cumbersome. First, it takes three years of transition expenses to acquire organic certification.[1] Second, each year organic farmers must update a farm plan and complete an inspection to confirm that their practices match their records. The farmer must correct any issues to continue certification. However, programs help defray the cost of certification. For example, organic production is facilitated in the United States through a cost-share program offered by USDA[2] consisting of the National Organic Certification Cost Share Program (NOCCSP) and the Agricultural Management Assistance (AMA) Organic Certification Cost Share Program (USDA/AMS). Reviews and meta-analyses show that organic agriculture produces lower

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[1] Organic certification verifies that the farm or handling facility complies with the USDA organic regulations. Certification allows farmer to sell, label, and represent products as organic. Certification allows farmer to call the product "organic" and to use the USDA seal that consumers can trust.

[2] USDA National Organic Program, Agricultural Marketing Service (Coleman, 2012) provides a guide for organic crop producer. USDA also supports organic agriculture through the Environmental Quality Incentives Program (EQIP) Organic Initiative, which provides financial assistance to organic producers implementing conservation practices that address a broad array of resource concerns (USDA/Natural Resources Conservation Service (NRCS).

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yields compared to conventional agriculture (see De Ponti et al., 2012; Seufert et al., 2012; Ponisio et al., 2015). However, producer benefits include premium prices for their products (Smith et al., 2004; Chavas et al., 2009; Clark, 2009), access to local, regional, and international markets, protection of natural resources, and support for local economies.

Despite possible higher prices of organic products, overall adoption of certified OFP has been slow. For instance, McBride et al. (2015) report that less than 1 percent of the total acreage has allocated to organic of corn, wheat, and soybean. The low level of organic adoption is affected by relative costs and returns of organic and conventional production systems. The literature falls short in discussing the impact of adoption of certified OFP on the performance of farms and how adoption has a differential impact on the distribution of the performance measures. In an early study, Uematsu and Mishra (2012), using Agricultural Resource Management Survey (ARMS), investigated the costs and revenue of US organic producers and found that, compared to conventional growers, organic farmers experienced higher costs and income. Though the Uematsu and Mishra (2012) study provides an insight into the impact of organic farming on revenues, it uses average treatment effects. The study fails to disentangle the effect of participation in certified OFP on the distribution of farm financial performance measures, namely, the total value of farm sales (TVFS) and net cash farm income (NCFI). In particular, the authors fail to analyze the impact of certified OFP on the distribution of TVFS and NCFI, respectively.

Therefore, the objective of this study is to assess the impact of participation in certified OFP[3] on the farm financial performance of US farmers. As noted above we use two measures of farm financial performance, the total value of farm sales (TVFS) and net cash farm income (NCFI).[4] Note that unlike previous study (e.g., Uematsu and Mishra, 2012) participation in the certified OFP has a stricter definition. Specifically, participation in certified OFP means that the farmer produce and grow organic food crops in accordance with the USDA's National Organic Program (NOP) standards. Additionally, unlike previous studies that rely on average estimates or mean-based coefficients, we accounted for the entire distribution of TVFS and NCFI separately using the unconditional quantile regression (UQR) approach. The goal of the research is to provide farmers and peers with a more accurate picture of financial returns that can be attributed to certified OFP. Additionally, the research provides better financial information to agricultural lenders on which to base credit decisions; to policymakers for designing incentive programs and providing real world insights into the certified OFP and farm financial performance.

The choice of UQR is motivated by a significant degree of heterogeneity observed while plotting financial performance measures (TVFS and NCFI). Figs. 1 and 2 show violin plots of TVFS for certified organic producers compared to conventional growers, and we see a significant heterogeneity—groups of farmers clustering in upper and lower tails. Similar plots of NCFI (not presented due to space limitation) also suggested significant heterogeneity. Additionally, the UQR approach

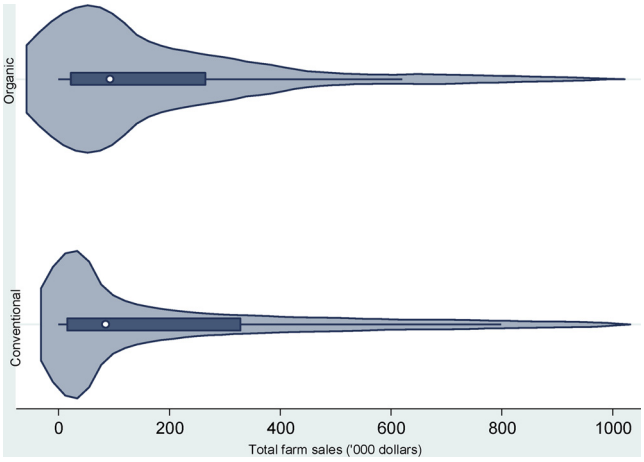

Fig. 1. Violin plot of total farm sales for organic and conventional production (farms with less than or equal to $1,000,000 in total farm sales).

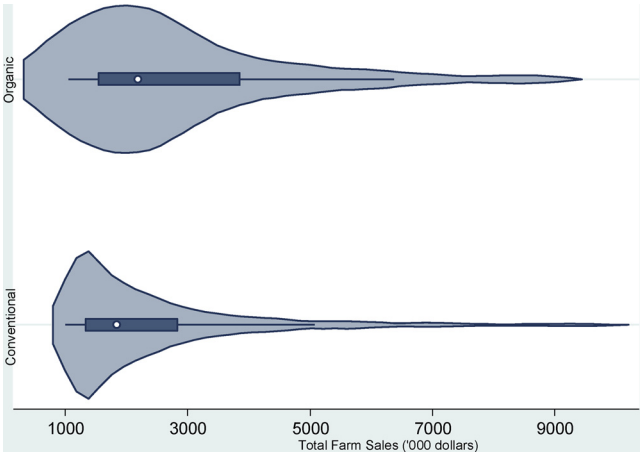

Fig. 2. Violin plot of total farm sales for organic and conventional production (farms with (more than $1,000,000 in total farm sales).

allows us to quantify the impact of organic food production at a different spectrum of farms' TVFS and NCFI. Additionally, UQR approach makes it possible to investigate the influence of a specific decision, program or policy (in our case certified organic production) on the unconditional distribution of outcomes (TVFS and NCFI in our case), irrespective of other variables.

Our study reveals the heterogeneous effect of participation in certified OFP on farm financial performance measures, TVFS and NCFI. In other words, earnings from certified OFP varies across the earnings distribution. For example, though gain in TVFS due to OFP participation is significant for very small farms (25th quantile and lower) and other large farms (75th quantile), very large farms (95th and greater quantile) benefit the most in TVFS from participation in certified OFP. Farms in 35th and 50th quantile, on the other hand, have no significant impact of participation in certified OFP on their TVFS. In the case of NCFI, findings suggest that large farms, 75th, and above quantiles, benefit the most from participation in certified OFP, while small farms, those in the 25th, 35th, and 50th quantile have low or no significant impact on NCFI.

Findings from this study could provide insights to program managers and policymakers in designing and implementation of programs that incentivize higher adoption rates for certified OFP and meeting local demand. Note that policymakers are interested in knowing the unconditional effect of policy measures on the economic well-being of farmers and consumers. Our study provides this unconditional effect due to participation in certified OFP for farms belonging to different

[3] The 2012 ARMS queried farmers regarding certified OFP. Specifically, "*In 2012, did this operation produce organic products according to USDA's National Organic Program (NOP) standards*" and "*What was the value of USDA NOP certified or exempt organically produced commodities sold from this operation in 2012*?" In our study, we used the above two hurdles to define certified organic farmers.

[4] TVFS is a gross measure of income derived from certified OFP and is a proxy for farm size. Farm size (acres) and TVFS is correlated. On the other hand, NCFI is a valid measure of profit, which are widely used in economic reports of the USDA. USDA calculates net cash income by adding crop and livestock receipts to show total receipts from farming. The value of government payments and other cash income is then added to total receipts to establish gross cash income. Gross cash expense, including interest expense, are then subtracted from gross cash income to determine NCFI (Mishra et al., 2002).