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Working Paper

Following up on smallholder farmers and supermarkets

GlobalFood Discussion Papers, No. 23

Provided in Cooperation with:
Research Training Group (RTG) 1666: "GlobalFood" - Transformation of Global Agri-Food Systems, University of Göttingen

Suggested Citation: Andersson, Camilla I. M.; Kiria, Christine G.; Qaim, Matin; Rao, Elizaphan J. O. (2013) : Following up on smallholder farmers and supermarkets, GlobalFood Discussion Papers, No. 23, Georg-August-Universität Göttingen, Research Training Group (RTG) 1666 - GlobalFood, Göttingen,
https://doi.org/10.22004/ag.econ.158142

This Version is available at:
https://hdl.handle.net/10419/90618

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RTG 1666 GlobalFood

Transformation of Global Agri-Food Systems:
Trends, Driving Forces, and Implications for Developing Countries

Georg-August-University of Göttingen

GlobalFood Discussion Papers

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September 2013

RTG 1666 GlobalFood · Heinrich Düker Weg 12 · 37073 Göttingen · Germany
www.uni-goettingen.de/globalfood

ISSN (2192-3248)

Following up on smallholder farmers and supermarkets

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Abstract

In many developing countries, supermarkets are expanding rapidly. This also affects farmers' marketing options. Previous studies have analyzed welfare effects for smallholders with cross-section data. Here, we use panel data and a differencing approach to study supply chain dynamics and better account for unobserved heterogeneity in impact assessment. The analysis focuses on vegetable producers in Kenya. Participation in supermarket channels is associated with large income gains, which have further increased over time. However, many farmers are not able to enter supermarket channels, or they have dropped out due to various constraints. Specific support is needed to avoid widening income disparities.

Key words: supermarkets, small farms, household income, panel data, Africa, Kenya

JEL codes: L24, O12, O13, Q12, Q13, Q18

Acknowledgements

Financial support by the German Research Foundation (DFG) is gratefully acknowledged.

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Introduction

The global food chain is in rapid transition. In developing countries in particular, income increases, urbanization, and wider use of mass media have led to changes in lifestyle and diets for many segments of the population. The subsequent increase in demand for readily available food of high quality and variety has spurred a large-scale expansion of supermarkets (Reardon et al., 2003; Minten, Randrianarison, and Swinnen, 2009; Mergenthaler, Weinberger, and Qaim, 2009; Michelson, Reardon, and Perez, 2012). In fact, the expansion of supermarkets has been of such a scale that the phenomenon is often referred to as a 'supermarket revolution' (Reardon and Gulati, 2008; Reardon et al., 2009). This revolution has raised questions about the wider implications for poverty. Several recent studies have analyzed whether poor smallholder farmers are able to supply supermarkets, and – if they are – what impacts this has on various aspects of household welfare (e.g., Hernández, Reardon and Berdegué, 2007; Neven, et. al. 2009; Rao and Qaim, 2011). The results suggest that farmers mostly benefit from supplying supermarkets, but that it is often difficult for smallholders to enter these new, high-value supply chains.

One important shortcoming of previous studies on supermarket participation is that they mainly rely on cross-section, observational data. This means that the reliability and accuracy of estimated impacts hinge on either the assumption that participation is determined by variables that are fully observed by the researcher or that the instruments employed are valid.[1] Here, we address this shortcoming by using panel data collected from smallholder vegetable farmers in Kenya. In particular, we employ a differencing approach to better account for possible selection bias and test the robustness of previous impact studies. A second drawback with cross-section data is that the dynamics of supermarket participation cannot be analyzed. Who joins, stays, and leaves supermarket supply chains over time? What

[1] One exception is Michelson (2013), who used a difference-in-difference estimator to analyze impacts of supermarket participation on household productive assets. However, the data about past asset ownership of supermarket suppliers was collected through a farmer recall, which is less accurate than a real panel data base.

are the determinants of these dynamics and what are the effects on household welfare? Do initial gains for farmers persist or do they fade through supply chain adjustments? These are important questions, because supermarkets are still on the rise in many developing countries. Using the panel data from Kenya we address such questions too.

Our findings suggest that the impact results from previous studies are robust. We show that supermarket participation is associated with a large income increase also when controlling for unobserved heterogeneity. Furthermore, we find that asset endowment is an important determinant of the supply chain dynamics; less endowed farmers are more likely to drop out of supermarket supply chains, while better endowed farmers are more likely to join. Also, the experience of neighbors seems to play an important role for farmers' marketing decisions. When it comes to the impact of the supply chain dynamics, our results suggest that newcomers to supermarket channels experience an income boost, that the difference in income between supermarket participants and non-participants increases rather than decreases over time, and that dropping out of supermarket channels entails an income loss.

The rest of this article is organized as follows. In the next section, we discuss the existing literature and describe the supermarket revolution. Based on this literature, we also derive some theoretical expectations with respect to participation and impact dynamics. Subsequently, we describe the data and the different vegetable supply channels in Kenya, before presenting and discussing the econometric approaches and estimation results. The article ends with a concluding section.

Background

Literature Review

Starting from the early-1990s, supermarkets have gained market shares in many developing countries at remarkable speed. Reardon and Gulati (2008) divide this expansion of supermarkets into three distinct waves. The first wave took off in much of in South America,

East Asia, and South Africa, where supermarkets increased their market shares from a modest 10% of retail sales in 1990, to around 50-60% in the mid-2000s. The second wave started in in the mid-1990s in Mexico, Central America, and much of Southeast Asia, where supermarkets increased their market shares from 5-10% to 30-50% by the mid-2000s. The third wave began in the late-1990s in China, India, and Vietnam; by the mid-2000s the sales of supermarkets in these countries was growing at annual rates of 30-50%. Reardon, Timmer, and Berdegué (2008) further recognize a fourth wave taking off in eastern and southern Africa, where supermarket shares are still small but growing significantly. In Kenya, for instance, the supermarket sector has grown at an annual rate of 19% over the past few years (Kenya National Bureau of Statistics, 2012).

Supermarkets differ from traditional markets in many ways that also affect procurement channels and marketing options for farmers. The basic concept is that produce of certain quality can be sold to consumers continuously. For supermarkets in developing countries, this concept is often difficult to accomplish by sourcing from traditional wholesale markets, where supply is not always reliable in terms of quantity and quality. Hence, especially for horticultural produce, new procurement systems were established in many developing countries, involving specialized supermarket traders, centralized procurement through distribution centers, and the use of "preferred suppliers" who are able to meet the requirements on quality and consistent supply (Reardon, Timmer and Berdegué, 2008). Often, these preferred suppliers are farmers who are contracted by supermarkets through written or verbal agreements, as is also the case in Kenya (Neven and Reardon, 2004; Rao, Brümmer, and Qaim, 2012).

The scale of the spread of supermarkets in the developing world together with the new set of requirements for suppliers has spurred a growing body of literature studying whether or not smallholder farmers can be successfully included in these new supply chains. Of particular interest for this article are the studies about participation in the Kenyan horticulture sector by

Neven et al. (2009) and Rao and Qaim (2011). Neven et al. (2009) conclude that many smallholders face a capital vector threshold that prevents them from participation in supermarket channels. This vector includes physical capital (irrigation, transport, cellphones etc.), financial capital, human capital, and organizational capital. In line with this finding, Rao and Qaim (2011) show that supermarket participants are more likely to have larger farms, own means of transportation, better education, and off-farm income sources; many have also participated in an NGO program that specialized on linking smallholder farmers to high-value markets. Similar results were found elsewhere. Moustier et al. (2010) acknowledge the importance of farmer organizations for supermarket participation in Vietnam; Blandon et al. (2009) highlight the key role of transaction costs and collective action in Honduras; Hernández, Reardon and Berdegué (2007) stress the importance of assets for participation in Guatemala, and Michelson (2013) emphasizes the significant role of geographic location as well as access to water and transportation for participation in Nicaragua. Although these studies offer important insights about determinants of participation at one point in time, they do not provide information about participation dynamics, such as factors influencing farmers' decisions to drop out of supermarket channels or join at a later stage.

When it comes to the impact of supermarket participation on household welfare, previous studies have generally found very positive results. For Kenya, Rao and Qaim (2011) showed that participation increases average household income of vegetable farmers by 48%, resulting from higher prices and higher productivity achieved by supermarket suppliers. Michelson (2013) found significant positive impacts of supermarket participation on asset holdings in Nicaragua, and Minten, Randrianarison and Swinnen (2009) revealed positive effects on income stability and seasonality smoothening in Madagascar. One exception to these overwhelmingly positive results is the study by Hernández, Reardon and Berdegué (2007), who reported roughly the same profits for supermarket and traditional channel suppliers in Guatemala, due to much higher expenditures for inputs in the new supply chain.

As always in impact assessment studies, researchers trying to establish the treatment effect of supermarket participation run into the classical evaluation problem: what would have been the outcome for supermarket participants if they had not participated? The mentioned studies used different approaches to address this problem. Rao and Qaim (2011) used an endogenous switching regression model, assuming that participation in a special NGO market linkage program and availability of public transport would affect income only indirectly through the supermarket participation link. Michelson (2013) employed a difference-in-difference approach, for which assumptions are less restrictive, but her data accuracy may potentially be lower due to long recall periods in the farmer survey. Minten, Randrianarison and Swinnen (2009) studied perceived impacts among farmers, thus using a subjective outcome measure. Finally, Hernández, Reardon and Berdegué (2007) compared net incomes between supermarket and traditional channel suppliers without controlling for possible unobserved heterogeneity. In sum, the validity of previous impact results hinges on a number of assumptions. In their review paper, Reardon et al. (2009) discuss potential issues with cross-section data and suggest panel data analysis to estimate impacts more consistently.[2]

In this article, we use a panel data set collected in two rounds with several years in-between (2008 and 2012). This allows us to follow the same farmers over time and study changes in income as these farmers join or leave supermarket channels. Thus, we can control for selection on unobserved time-invariant variables without relying on the validity of instruments. Furthermore, the panel data allow us to analyze how possible income differences between supermarket and traditional channel suppliers develop over time.

[2] Potential endogeneity problems in econometric studies were also acknowledged by Stokke (2009), who used numerical simulations in a structural framework to analyze supermarket impacts.

Research Questions and Expectations

We are particularly interested in two research questions that were not sufficiently addressed in previous studies. First, what factors influence the dynamics of smallholder participation in supermarket channels? Second, what are the impacts of these dynamics on household income?

Concerning the first question, we would expect the same capital vector threshold that was found to determine initial participation to influence participation dynamics as well. However, additionally we expect a learning process where farmers gain experience from supplying different markets and adjust their participation decisions accordingly. This would imply that farmers who have been successful in supplying supermarkets are more likely to stay in that channel, while their less successful colleagues are more likely to drop out. Besides learning from own experience, farmers tend to learn from their neighbors. If neighbors are supplying supermarkets, farmers have additional options to observe and learn about suitable production methods. Furthermore, farmers may coordinate activities with their neighbors to overcome some of the participation obstacles. Coordination of activities could for example refer to joint transport to market, shared investments in expensive equipment, or pooling of financial assets.

Learning and adjustment may also occur on the side of supermarkets and their specialized traders. For instance, it has often been found that supermarkets prefer to source from large or medium-sized farmers (Louw et al., 2007; Neven et al., 2009). When these farmers grow in number and capacity, supermarkets may decide to source less from smallholder farmers. Hence, over time some features may become more important for participation than others; features that do not necessarily need to coincide with the most important determinants for participation at the outset.

Concerning the second question on impact dynamics of supermarket participation, one could expect that the returns on supplying two different markets should converge over time. Early participants may experience a large gain, but the profits are likely to shrink when

competition increases through additional market entrants. This would also mean that the income effects of switching between traditional markets and supermarkets would reduce over time. However, these expectations only hold when there are no market entry barriers and farmers can switch between markets at relatively low cost. As mentioned above, supermarkets have certain requirements in terms of quality and consistency, which are more difficult to meet for farmers with a low asset base. If market entry barriers are important, differences in returns between market channels may persist or even increase over time.

There might also be barriers to exiting the supermarket channel. Investments in production technology needed for supplying supermarkets can affect the success of farmers when they return to the traditional market. If the investment has led to a technological upgrade that is beneficial also in other markets, switching back is not necessarily related to a decrease in profit. However, if the investment implies a high cost that cannot easily be covered by the returns received on the traditional market, dropout famers might actually be worse off than their colleagues who never entered the supermarket channel.[3] Such aspects will be analyzed below for the empirical example of vegetable farmers in Kenya.

Data and Descriptive Statistics

Household Panel Survey

Data for this study were collected in Kiambu District, Central Province of Kenya. Kiambu is mainly an agricultural district with high-potential land. About 70% of the population is involved in agriculture, and the vast majority (about 90%) of the farmers are smallholders producing maize, beans, and potatoes for subsistence. The major cash crops in the region are tea, coffee, and horticultural crops. When it comes to vegetables, farmers produce both exotic vegetables like kale and spinach, and indigenous species like amaranthus and black

[3] This could lead to a so-called lock-in effect as described by Wilson (1986), Glover and Kusterer (1990), Key and Runsten (1999), Singh (2002), and Simmons (2005).

nightshade. Kiambu is located in relative proximity to Nairobi; even before the spread of supermarkets, this district was one of the main vegetable-supplying regions for the capital city. The two biggest supermarket chains now sourcing vegetables from Kiambu are Nakumatt and Uchumi, which are both Kenyan owned. Foreign owned retail chains so far play a much smaller role in Kenya (Rao, Brümmer, and Qaim, 2012).

The first round of data was collected in 2008. At that time, 402 vegetable farmers in Kiambu District were interviewed using a structured questionnaire. The farmers were selected with a stratified random sampling procedure, differentiating between supermarket and traditional channel suppliers. Supermarket farmers were selected from lists of suppliers obtained from supermarkets and supermarket traders. In order to get a sufficient number of observations, all farmers on these lists in the district were selected. Farmers supplying traditional markets were randomly selected from 31 administrative locations in four out of the five divisions in Kiambu. These divisions and locations were selected to cover the main vegetable-growing areas. Statistical information about coverage of vegetable production was obtained from the District Agricultural Office.

The second round of data collection was conducted in 2012. Despite significant efforts, some of the farmers from the first round could not be met again. Ten households had stopped vegetable cultivation altogether. Each missing household was replaced by another randomly selected vegetable-growing household in the same village. However, in this article we only employ data from farmers who were surveyed in both rounds; a balanced panel is required for the differencing approach that is further explained below. Thus, we have a sample of 336 farm households with complete information for 2008 and 2012.

Farm and Household Characteristics

Descriptive statistics of farm and household characteristics used in this analysis are shown in table 1 by marketing channel. We differentiate between high-value markets (HVM) and

traditional markets (TM). The majority of the farmers in HVM supply vegetables to supermarkets, either directly or through specialized traders. This involves verbal agreements on quantity, price, and time of delivery. A few HVM farmers also sell their vegetables to companies and institutions (e.g., hotel chains). As the agreements between farmers and these companies and institutions are similar to the agreements with supermarkets, including both in the same HVM category is justified. HVM suppliers sometimes also sell certain quantities of vegetables in traditional markets, for instance when the harvested amount at a particular time exceeds the agreement with supermarkets. Yet, almost all HVM suppliers in a particular year sold the majority of their vegetables in high-value markets. In contrast, all TM suppliers in a particular year sold their vegetables only in traditional markets.

[Table 1 about here]

Sample households are typical smallholders with an average farm size of around 2 acres. Some of the variables shown in table 1 deserve further explanation. In order to measure potential neighborhood effects, we use a variable capturing the number of farmers supplying HVM out of the five nearest neighbors in terms of geographic proximity. The five nearest neighbors are derived from GPS coordinates measured at the farmers' homestead.[4] Furthermore we want to capture the importance of special initiatives to facilitate participation in high-value market. In the study area, there was an NGO operating with a special focus on enabling farmers to supply supermarkets. The NGO had various related activities, such as negotiating market access for farmer groups with supermarkets, providing training on how to meet the delivery standards of supermarkets, and assistance in terms of invoice discounting. We captured farmers' own participation in this NGO market linkage program, and also their neighbors' participation, again using GPS coordinates as described above. As can be seen in table 1, participation in this program decreased significantly between 2008 and 2012, which is mainly due to the NGO not offering many of the services to farmers in the study area

[4] This was done by using the *nearstat* command in Stata.

anymore. Whether this is due to funding constraints or a shift in NGO priorities is unknown to us.

In general, the descriptive statistics in table 1 show that farmers supplying HVM are better endowed than farmers supplying TM in terms of education, land size, access to transportation, and off-farm employment. They also have more neighbors supplying HVM and have higher average household and per capita incomes. Household incomes, expressed in Kenyan shillings (Ksh), were calculated by including all farm enterprises and off-farm economic activities of household members over a 12-months period. All monetary values for 2012 were deflated to 2008, in order to make the income for the two survey rounds comparable.[5]

Participation Dynamics

In this section, we first describe the dynamics of HVM participation in our sample and discuss reasons for market channel choices as subjectively stated by farmers before analyzing determinants of these dynamics more formally with econometric models. Table 2 shows how market participation evolved between 2008 and 2012. In 2008, out of all 336 farm households, 115 had supplied HVM. Four years later, almost half of the former HVM suppliers had dropped out of this supply channel. At the same time, only 7% of the former TM suppliers had switched to HVM by 2012.

[Table 2 about here]

Reasons for Supplying Specific Markets

In order to better understand these dynamics, all farmers were asked about their subjective reasons for selling vegetables in a particular market. Farmers' answers are summarized in

[5] For deflating, we used the annual weighted average consumer price index obtained from the Kenya National Bureau of Statistics (http://www.knbs.or.ke/consumerpriceindex.php).

Table 3.We differentiate between current HVM suppliers and current TM suppliers. Current HVM suppliers include HVM stayers (those that supplied HVM in both survey rounds) and newcomers that had switched to HVM after 2008. Current TM suppliers include TM stayers (those that supplied TM in both survey rounds) and HVM dropouts that have switched back after a temporary supply to HVM. Table 3 reveals an interesting pattern with significant differences. Both HVM stayers and newcomers were more likely to state market assurance and price related aspects – such as high, stable, and reliable price – as major reasons for supplying to their channels. Farmers supplying TM, on the other hand, were more likely to state other reasons as important, such as the ability to negotiate the price with the buyer, prompt payment, and less strict quality standards. It also seems that lack of alternative marketing options and lack of means of transportation are reasons for supplying TM.

[Table 3 about here]

As a major focus of previous studies was on participation in supermarket channels, we were also interested in the reasons stated by current TM suppliers for not supplying supermarkets. These answers are summarized in Table 4. Farmers who had previously supplied supermarkets often stressed time, labor, and transport constraints, as well as their own inability to supply consistently, as main reasons for not supplying supermarkets in 2012. In contrast, among those who never supplied supermarkets, the most frequent answer was difficulty to get the initial contract, followed by their inability to supply consistently, and the high time requirement. A higher labor requirement in the supermarket channel was also pointed out by Rao and Qaim (2013). This is particularly related to more time-intensive post-harvest operations required by supermarkets, such as cleaning and bundling the vegetables. Moreover, vegetables have to be delivered to supermarkets or special collection centers. As these transactions are usually managed by farmers themselves, the opportunity cost of own time resources can be sizeable.

[Table 4 about here]

In summary, these findings suggest that HVM have advantages over TM in terms of price and market assurance. It also seems that difficulties for farmers to get the initial contract, as well as various constraints in terms of time, transport, and technical ability to produce according to the standards, are major reasons for not supplying HVM. This implies that individual farm and household characteristics are likely determinants of the participation dynamics.

Econometric Approach

We now turn to the econometric analysis of the determinants of the participation dynamics. As a first step, we study the conditional probability of supplying HVM in 2012, given the observed market channel in 2008. That is, we estimate $P(HVM_{2012} = 1 \,|HVM_{2008} = 1)$ and $(HVM_{2012} = 1 \,|HVM_{2008} = 0)$. This gives us an indication of the underlying reasons for why some farmers stayed in HVM channels while others left, and why some farmers joined HVM channels while others stayed in TM. This analysis is conducted by dividing the farmers into two subsamples based on their chosen supply channel in 2008 and estimating a separate probit model for each subsample.

As a second step, in order to get a broader picture, we estimate the unconditional probability of the different decision paths simultaneously with a multinomial logit model, which is specified as:

$$(1) \qquad p_{ij} = P(D_i = j) = \begin{cases} \frac{exp(x_i\beta_j)}{1+\sum_{m=1}^{3} exp(x_i\beta_m)}, if\ j = 1,2,3 \\ \frac{1}{1+\sum_{m=1}^{3} exp(x_i\beta_m)}, if\ j = 4 \end{cases}$$

where *j*=1 for HVM stayers, *j*=2 for HVM dropouts, *j*=3 for HVM newcomers, and *j*=4 for TM stayers. x_i is a set of explanatory variables specific to each household or farmer *i*, and β is

a set of parameters to be estimated. We focus on the marginal effect of the change in an explanatory variable on the probability of falling into a certain category as compared to falling into any of the other categories, given by $\frac{\partial p_{ij}}{\partial x_i} = p_{ij}(\beta_j - \sum_l p_{il}\beta_l)$. These marginal effects give us an indication of what types of farmers we can expect to end up in each category over time.

Regression Results

The marginal effects from the conditional probit models are shown in table 5. The probability of staying in HVM (as opposed to leaving HVM) increases with household size and the operator being a woman. Both effects may be explained by the higher time requirements in HVM. Households with more members tend to have more family labor available, while women may have lower opportunity costs of time due to fewer options to earn income in the off-farm sector. The probability of staying in HVM also increases with access to electricity and the number of neighboring farmers supplying HVM in 2012. As discussed above, if neighbors also supply HVM, farmers can better coordinate joint activities and thus reduce transaction costs. With respect to the farmers that were supplying TM in 2008, the probability of joining HVM increases with off-farm employment and also with the number of neighboring farmers supplying HVM in 2012.

[Tables 5 and 6 about here]

The marginal effects from the multinomial logit model are shown in table 6. They largely confirm the same pattern. The probability of being a HVM stayer (as compared to falling into any of the other categories) increases with off-farm employment, access to electricity, ownership of a means of transportation, and the number of neighboring farmers supplying HVM both in 2008 and 2012. At the same time, the probability of being a TM stayer decreases with education, off-farm employment, access to electricity, and the number of neighboring HVM suppliers in 2008.

The probability of falling into the HVM dropout category increases with education, and it decreases with household size, which is probably again related to the higher time requirements in HVM. Better educated farmers tend to have higher opportunity costs of time. Interestingly, the probability of dropping out also increases with the number of neighbors who participated in the NGO market linkage program in 2008. This program was important for many farmers to join HVM in the early period, so that participants who depended on this support were frustrated about the downsizing of most NGO activities in their area.[6]

Impact of Participation

Econometric Approach

In order to estimate the impact and impact dynamics of supermarket participation on income we set up two different models. In the first model, we test whether previous cross-section results about the impact of supermarket participation are robust when using panel data and a first-difference approach. The model is specified with the change in household income between 2008 and 2012 as dependent variable and the change in HVM participation as treatment variable. Furthermore, we include the changes in relevant farm and household characteristics as additional control variables:

$$(2) \qquad y_{2012} - y_{2008} = \alpha + \beta(z_{2012} - z_{2008}) + \gamma(HVM_{2012} - HVM_{2008}) + e_t$$

This model has the advantage that all unobserved and time-invariant heterogeneity is removed, because it exploits the within-household variability in the variables. The coefficient γ in this model tells us the overall impact of HVM participation and can hence be seen as the robustness check of previous studies that used cross-section data.

[6] We did not include farmers' own participation in the NGO program in the model, because this is expected to be endogenous.

In the second impact model, we focus more on the dynamics of participation, analyzing whether the gains from HVM participation persist over time, whether newcomers also benefit from income gains, and what it means economically to drop out of the HVM channel. We therefore modify the model in equation (2) and include dummy variables for HVM stayers (D_1), HVM dropouts (D_2) and HVM newcomers (D_3):

$$(3) \qquad y_{2012} - y_{2008} = \alpha + \beta(z_{2012} - z_{2008}) + \gamma_1 D_1 + \gamma_2 D_2 + \gamma_3 D_3 + e_t$$

The coefficients for the three dummy variables in this model represent the impact of being in the particular category on the change in income as compared to TM stayers, which is the reference category. γ_1 indicates whether the spread in income between HVM and TM increases or decreases over time for farmers that remain in their particular category. γ_2 is the effect of dropping out in comparison to never having entered the HVM; additionally, it is interesting to look at $(\gamma_1 - \gamma_2)$, which provides the income effect of dropping out in comparison to staying in the HVM. Finally, γ_3 represents the income effect of joining the HVM as a newcomer as compared to staying in the traditional market.[7]

Regression Results

The estimation results for both impact models are shown in table 7. The first model, shown in column (1), indicates that, overall, supermarket participation has a large positive and significant effect on household income. This confirms results from previous studies, suggesting that the earlier results do not suffer from uncontrolled selection bias. The magnitude of the coefficient shows that supermarket participation increases annual income by

[7] The model was also estimated using a multivariate treatment regression in order to control for selection on time-variant unobserved variables. However the results proved to be highly sensitive to the number of draws and are therefore not reported here.

almost 185 thousand Ksh, which corresponds to 59% of the sample mean income. This is even higher than the 48% increase that was found by Rao and Qaim (2011).

[Table 7 about here]

The results from the second impact model, shown in column (2) of table 7, also suggest that HVM participation causes positive income effects and that these effects have actually further increased over time. The coefficient for HVM stayers indicates that the income of farmers who constantly supplied HVM increased by 148 thousand Ksh more between 2008 and 2012 than the income of farmers who constantly supplied TM. This result clearly contradicts the hypothesis of income convergence between the two markets and points at the existence of significant switching costs and related market entry barriers.

The coefficient for HVM newcomers indicates that those who manage to overcome the entry barriers experience a large income boost. The newcomer gain of 350 thousand Ksh is larger than the effect for HVM stayers. This is plausible because the model explains income changes between 2008 and 2012. HVM stayers had already realized significant gains when they first entered this channel in or before 2008; these earlier gains are not included in the model estimates. The results in table 7 also suggest that dropping out of the HVM leads to an income loss. Compared to the reference group of TM stayers, the effect is not significant. But dropouts lose significantly compared to staying in the HVM channel, suggesting that the exit decision is not due to economic superiority.

Conclusion

In this article, we have studied whether the previously found positive welfare effects for smallholder farmers participating in supermarket channels are robust when using a panel data approach. The results indicate that this is indeed the case: for smallholder vegetable farmers in Kenya, supermarket participation is associated with a large and positive income boost. Furthermore, there is no indication that the gains in high-value markets have started to level

off. On the contrary, the income difference between participants and non-participants seems to have been increasing over time. The results also suggest that the gains are directly linked to participation in supermarket channels and cannot be sustained when switching back to traditional markets.

With respect to participation dynamics, many of the previous supermarket suppliers have dropped out. This decision is not based on economic superiority of traditional channels but on participation constraints in high-value markets. Low asset endowment, limited capability to produce according to the required standards, and limited access to transportation, which are typical initial market entry barriers, continue to be constraints over time. The higher time requirements in supermarket channels were also found to be a limiting factor, especially for households with fewer family members and higher opportunity costs of time. These constraints are also important reasons for farmers' decisions to switch back to traditional markets.

These results call for some broader reflection. Although the gains from supermarket participation remain substantial, many smallholders are not able to supply these markets continuously. This may be even more so when supermarket procurement systems gradually expand to less advantaged areas. Thus, the supermarket revolution may contribute to further rising income disparities and marginalization, unless ways are found to better link smallholder farmers to these emerging markets. In order to reduce entry barriers and increase the chances of staying in the high-value market, the infrastructure and institutional setup need to be strengthened in a pro-poor way. In the study area in Kenya, there was an NGO facilitating farmer participation in supermarket channels through various activities. This program was effective in the beginning, but more recently the NGO activities were reduced, which also contributed to farmers dropping out of supermarket channels. We do not know the reasons for the reduced NGO activities in the study area. Still, from a policy perspective it is important to

ensure that market linkage support is sustainable, so that smallholder farmers can benefit from the new opportunities of emerging high-value markets also in the long run.

References

Blandon, J., S. Henson, and J. Cranfield. 2009. Small-Scale Farmer Participation in New Agri-Food Supply Chains: Case of the Supermarket Supply Chain for Fruit and Vegetables in Honduras. *Journal of International Development* 21: 971–984.

Glover, D., and K. Kusterer. 1990. Small Farmers, Big Business: Contract Farming and Rural Development. London: Macmillan.

Hernández, R., T. Reardon, and J. Berdegué. 2007. Supermarkets, Wholesalers, and Tomato Growers in Guatemala. *Agricultural Economics* 36(3): 281-290.

Kenya National Bureau of Statistics. 2012. Economic Survey Report. Nairobi, Kenya.

Key, N., and D. Runsten. 1999. Contract Farming, Smallholders, and Rural Development in Latin America: The Organization of Agroprocessing Firms and the Scale of Outgrower Production. *World Development* 27(2): 381-401.

Louw, A., H. Vermeulen, J. Kirsten, and H. Madevu. 2007. Securing Small Farmer Participation in Supermarket Supply Chains in South Africa. *Development Southern Africa* 24(4): 539-551.

Mergenthaler, M., K. Weinberger, and M. Qaim. 2009. The Food System Transformation in Developing Countries: A Disaggregate Demand Analysis for Fruits and Vegetables in Vietnam. *Food Policy* 34(5): 426-436.

Michelson, H.C. 2013. Small Farmers, NGOs, and a Walmart World: Welfare Effects of Supermarkets Operating in Nicaragua. *American Journal of Agricultural Economics* 95(3): 628-649.

Michelson, H., T. Reardon, and F. Perez. 2012. Small Farmers and Big Retail: Trade-Offs of Supplying Supermarkets in Nicaragua. *World Development* 40(2): 342-354.

Minten, B., L. Randrianarison, and J.F.M. Swinnen. 2009. Global Retail Chains and Poor Farmers: Evidence from Madagascar. *World Development* 37(11): 1728-1741.

Moustier, P., P.T.G. Tam, D.T. Anh, V.T. Binh, and N.T.T. Loc. 2010. The Role of Farmer Organizations in Supplying Supermarkets with Quality Food in Vietnam. *Food Policy* 35: 69–78.

Neven, D., M.M. Odera, T. Reardon, and H. Wang. 2009. Kenyan Supermarkets, Emerging Middle Class Horticultural Farmer, and Employment Impacts on the Rural Poor. *World Development* 37(11): 1802-1811.

Neven, D. and T. Reardon. 2004. The Rise of Kenyan Supermarkets and the Evolution of their Horticulture Product Procurement Systems. *Development Policy Review* 22 (6): 669-699.

Rao, E.J.O. and M. Qaim. 2013. Supermarkets and Agricultural Labor Demand in Kenya: A Gendered Perspective. *Food Policy* 38: 165-176.

Rao, E.J.O. and M. Qaim. 2011. Supermarkets, Farm Household Income, and Poverty: Insights from Kenya. *World Development* 39(5): 784–796.

Rao, E.J.O., B. Brümmer, and M. Qaim. 2012. Farmer Participation in Supermarket Channels, Production Technology, and Efficiency: The Case of Vegetables in Kenya. *American Journal of Agricultural Economics* 94(4): 891–912.

Reardon, T., C.B. Barrett, J.A. Berdegué, and J.F.M. Swinnen. 2009. Agrifood Industry Transformation and Small Farmers in Developing Countries. *World Development* 37(11): 1717-1727.

Reardon, T. and A. Gulati. 2008. The Supermarket Revolution in Developing Countries - Policies for "Competitiveness with Inclusiveness. IFPRI Policy Brief 2 (June), International Food Policy Research Institute, Washington.

Reardon, T., C.P. Timmer, and J.A. Berdegué. 2008. The Rapid Rise of Supermarkets in Developing Countries: Induced Organizational, Institutional and Technological Changes in Agri-Food Systems. In *The Transformation of Agri-Food Systems: Globalization, Supply Chains and Smallholder Farmers*, ed. E.B. McCullough, P.L. Pingali, and K.G. Stamoulis, 189-206. Rome: FAO.

Reardon, T., C.P. Timmer, C.B. Barrett, and J.A. Berdegué. 2003. The Rise of Supermarkets in Africa, Asia and Latin America. *American Journal of Agricultural Economics* 85(5): 1140-1146.

Singh, S. (2002). Contracting Out Solutions: Political Economy of Contract Farming in the Indian Punjab. *World Development* 30(9): 1621-1683.

Stokke, H.E. 2009. Multinational Supermarket Chains in Developing Countries: Does Local Agriculture Benefit? *Agricultural Economics* 40(6): 645-656.

Wilson, J. 1986. The Political Economy of Contract Farming. *Review of Radical Political Economics* 18(4): 47-70.

Table 1. Sample Descriptive Statistics

	HVM 2008		TM 2008		HVM 2012		TM 2012	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age of operator (years)	47.24	12.94	50.33	14.73	49.45	12.32	50.50	13.50
Male operator (dummy)	0.93	0.26	0.89	0.31	0.78	0.42	0.62	0.49
Education of operator (years of schooling)	10.29	3.16	8.62	4.13	10.48	3.21	9.10	3.61
Land size (acres)	1.99	2.34	1.46	1.74	2.10	2.75	1.43	2.14
Own livestock (dummy)	0.83	0.37	0.82	0.38	0.87	0.34	0.85	0.35
Off-farm employment (dummy)	0.61	0.49	0.44	0.50	0.84	0.37	0.67	0.47
Use of advanced irrigation technique (dummy)	0.88	0.33	0.71	0.45	0.90	0.31	0.73	0.45
Household size (number)	3.47	1.65	3.52	1.85	4.62	1.71	4.23	1.76
Own means of transportation (dummy)	0.23	0.42	0.09	0.28	0.19	0.40	0.05	0.21
Access to public transportation (dummy)	0.88	0.33	0.80	0.40	0.94	0.25	0.79	0.41
Access to tarmac road (dummy)	0.46	0.50	0.50	0.50	0.60	0.49	0.45	0.50
Access to piped water (dummy)	0.31	0.47	0.36	0.48	0.45	0.50	0.31	0.46
Access to electricity (dummy)	0.79	0.41	0.71	0.45	0.91	0.29	0.69	0.46
Participation in NGO market linkage program (dummy)	0.36	0.48	0.15	0.36	0.13	0.34	0.04	0.20
Kikuyu/Westland region (dummy)	0.63	0.49	0.37	0.48	0.68	0.47	0.39	0.49
Limuru region (dummy)	0.04	0.20	0.36	0.48	0.06	0.25	0.31	0.46
Number of HVM neighbors	2.90	1.65	1.02	1.34	2.31	1.57	0.72	1.13
Number of neighbors participating in NGO market linkage program	1.71	2.11	0.84	1.57	-	-	-	-
Household income (thousand Ksh per year)	405.37	375.15	208.98	207.26	657.95	828.59	253.68	365.99
Per capita household income (thousand Ksh per year)	154.35	199.66	75.62	94.35	153.12	189.71	71.69	130.00
Number of observations	*115*		*221*		*77*		*259*	

Note: HVM means suppliers to high-value markets; TM means suppliers to traditional markets. Monetary values for 2012 have been deflated to 2008.

Table 2. Dynamics of Participation in High-Value Markets

2008	2012
Farmers supplying HVM (N=115)	Farmers continuing to supply HVM (N=61)
	Farmers dropping out of HVM (N=54)
Farmers supplying TM (N=221)	Farmers starting to supply HVM (N=16)
	Farmers continuing to supply TM (N=205)

Note: HVM means high-value markets; TM means traditional markets.

Table 3. Reasons Stated for Supplying a Specific Market (Proportion of Farmers)

	Current HVM suppliers		Current TM suppliers		Difference in proportion between current HVM and TM suppliers
	HVM stayers	HVM newcomers	HVM dropouts	TM stayers	
Buyer offers a high price	0.73	0.54	0.28	0.31	0.38***
Buyer pays a stable price	0.45	0.15	0.04	0.08	0.32***
Buyer does not change price arbitrarily	0.34	0.31	0.02	0.04	0.29***
Can negotiate price with the buyer	0.09	0.08	0.44	0.43	-0.34***
Buyer pays promptly	0.48	0.39	0.57	0.67	-0.19***
Buyer provides assured demand	0.73	0.54	0.28	0.29	0.41***
Buyer is less strict on product quality	0.04	0.00	0.07	0.1	-0.06*
No worry about spoilage after selling	0.11	0.00	0.17	0.24	-0.14**
Have long standing trading relationship	0.36	0.23	0.19	0.1	0.21***
Buyer is well known in the village	0.07	0.15	0.09	0.08	0.00
Have no alternative market (buyer)	0.04	0.00	0.26	0.16	-0.15***
Have no means of transportation	0.00	0.15	0.17	0.13	-0.11**
To save time	0.02	0.08	0.26	0.18	-0.16***
Number of observations	*56*	*13*	*54*	*205*	

Note: A reason is only listed if at least 10% of farmers in any group mentioned this reason.
*** p<0.01. ** p<0.05. * p<0.1

Table 4. Reasons Stated for Not Supplying Supermarkets (Proportion of Farmers)

	Farmers who previously supplied supermarkets	Farmers who never supplied supermarkets
The do not pay promptly	0.21	0.09
Timing of payment unreliable	0.02	0.00
High price variation	0.00	0.00
Price agreement unreliable	0.00	0.00
Price too low	0.05	0.00
They purchase too small quantities	0.14	0.02
Standards too strict	0.17	0.17
Rejection rate too high	0.07	0.02
Quality agreement unreliable	0.02	0.00
It is difficult to get the initial contract	0.07	0.82
I am unable to supply required quantity consistently	0.33	0.34
I have too much spoilage	0.33	0.02
They cheat on spoilage	0.10	0.00
Reliable means of transport required	0.43	0.26
Too time consuming / labor demanding	0.52	0.27
Too capital intensive	0.11	0.20

Table 5. Conditional Probit Model Estimates

	$P(HVM_{2012}=1 \mid HVM_{2008}=1)$		$P(HVM_{2012}=1 \mid HVM_{2008}=0)$	
	Marginal effects	Standard errors	Marginal effects	Standard errors
Male operator	-0.35**	0.17	0.03	0.06
Education of operator	-0.02	0.02	0.00	0.00
Age of operator	0.00	0.00	0.00	0.00
Household size	0.06**	0.03	0.00	0.01
Off-farm employment	0.07	0.08	0.06*	0.04
Land size	0.01	0.03	0.01	0.01
Use of advanced irrigation techniques	0.19	0.14	0.07	0.05
Own livestock	0.02	0.11	0.02	0.05
Access to electricity	0.30**	0.13	0.07	0.06
Own means of transportation	0.17	0.12	-0.04	0.06
Access to public transportation	0.14	0.14	0.00	0.06
Access to tarmac road	0.10	0.09	0.06	0.04
Access to piped water	0.08	0.09	0.06	0.04
No. of HVM neighbors 2008	0.01	0.03	0.00	0.02
No. of HVM neighbors 2012	0.07**	0.03	0.05**	0.02
No. of neighbors in NGO market linkage program 2008	-0.05	0.03	0.00	0.01
Limuru region	-0.09	0.23	-0.04	0.06
Kikuyu/Westlands region	-0.09	0.15	-0.05	0.05
Number of observations	*115*		*221*	
Pseudo R2	*0.27*		*0.34*	

*** p<0.01. ** p<0.05. * p<0.1

Table 6. Multinomial Logit Model Estimates

	HVM stayer		HVM dropout		HVM newcomer		TM stayer	
	ME	SE	ME	SE	ME	SE	ME	SE
Male operator	-0.03	0.07	0.06	0.08	0.00	0.03	-0.03	0.11
Education of operator	0.01	0.01	0.02***	0.01	0.00	0.00	-0.03***	0.01
Age of operator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Household size	-0.01	0.01	-0.03***	0.01	0.00	0.00	0.04**	0.02
Off-farm employment	0.07**	0.04	0.02	0.04	0.03	0.02	-0.12**	0.06
Land size	0.00	0.01	0.01	0.01	0.00	0.00	-0.01	0.02
Use of advanced irrigation techniques	0.07	0.06	-0.03	0.06	0.03	0.03	-0.07	0.09
Own livestock	0.03	0.05	0.00	0.06	0.00	0.02	-0.04	0.09
Access to electricity	0.12**	0.06	0.01	0.05	0.04	0.03	-0.17**	0.09
Own means of transportation	0.10**	0.05	0.03	0.06	-0.01	0.03	-0.11	0.09
Access to public transportation	0.06	0.06	0.01	0.05	0.02	0.04	-0.08	0.09
Access to tarmac road	0.04	0.04	-0.02	0.05	0.01	0.02	-0.03	0.07
Access to piped water	0.01	0.04	-0.05	0.05	0.04**	0.02	0.00	0.07
No. of HVM neighbors 2008	0.04***	0.02	0.06***	0.02	0.00	0.01	-0.10***	0.03
No. of HVM neighbors 2012	0.03**	0.02	-0.02	0.02	0.02*	0.01	-0.03	0.03
No. of neighbors in NGO program 2008	0.00	0.01	0.03*	0.02	0.00	0.01	-0.03	0.02
Limuru	-0.13*	0.08	-0.10	0.09	0.00	0.04	0.24**	0.12
Kikuyu/Westlands	0.00	0.06	0.05	0.07	-0.01	0.03	-0.04	0.10
Number of observations	*336*							
Pseudo R2	*0.31*							

Note: ME means marginal effects; SE means standard errors.
*** p<0.01. ** p<0.05. * p<0.1

Table 7. Model Estimates for Change in Household Income

	(1)		(2)	
	Coefficients	Standard errors	Coefficients	Standard errors
Change in HVM	184.59***	59.58		
HVM stayer			147.98**	69.53
HVM dropout			-100.63	73.66
HVM newcomer			349.90**	122.19
Change in age of operator	2.06	2.93	1.57	2.93
Change in gender of operator	-61.89	59.21	-69.04	59.05
Change in education of operator	5.58	8.93	5.29	8.93
Change in land size	65.12***	18.14	63.60***	18.39
Change in livestock ownership	143.30**	66.15	138.71**	65.90
Change in off-farm employment	95.94**	43.40	103.02**	43.22
Change in use of advanced irrigation technology	1.29	56.78	4.98	56.46
Change in household size	12.27	12.71	10.71	12.65
Change in ownership of means of transportation	-5.74	75.60	4.76	75.32
Constant	40.82	33.79	-8.25	38.97
Number of observations	*336*		*336*	
R2	*0.11*		*0.13*	

Note: HVM means high-value market. The dependent variable is the change in household income between 2008 and 2012, measured in thousand Ksh.
*** p<0.01. ** p<0.05. * p<0.1