Social and Economic Development in Sub-Saharan Africa, and Economic Implications of EU Regulations on Agricultural Products

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
December 10, 2016

Keywords: Economic growth, Food Standard Regulation, Human Development, Microfinance, Sub-Saharan Africa, Value-added Agriculture

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Abstract

This dissertation comprises of three chapters exploring topics focussing on social and economic development, and on economic implications of EU regulations on products. Chapter One explores the contribution of value-added agriculture on economic and social development in sub-Saharan Africa (SSA). Primary commodity production and exports are the primary drivers of growth in SSA. Thus, value-added agriculture and the resulting market linkages to other sectors are limited. These limitations constrain the ability of SSA to lift its population out of poverty. To evaluate the contributors to growth, we apply the augmented Solow growth model using a system GMM approach. The two findings of this analysis are that value-added agriculture contributes substantially to GDP and overall human development in SSA and the total effect of the agricultural sector exceeds that of the non-agricultural sector, suggesting the need for developing countries in SSA to promote market linkages for economic transformation.

As the first chapter looks at important factors contributing to the economic development in sub-Saharan Africa, arguing against the primary commodity focus of SSA economies, chapter two focuses on the impact of EU food standards on bilateral trade looking at all developing countries. Specifically, this chapter examines the impact of EU standards on raw and processed food trade, separating the trade impact of standards implementing an international harmonization (ISO) to those that are not (Non-ISO). EU standards inhibiting can often be trade-inhibiting. Using Pseudo-Poisson Maximum Likelihood (PPML) fixed effects models to estimate a gravity model,

the results suggest that more standards from the International Standards Organization (ISO) on raw products inhibit trade of raw products, while EU-specific, non-ISO standards on raw products promote bilateral trade. In addition, more ISO standards on processed commodities increase the volume of trade of raw products. These results are consistent with the fact that food safety standards imposed by developed countries tend to act as barriers sometimes and sometimes as catalysts.

Unlike the two preceding topics, chapter three is an impact evaluation of microcredit participation in Tanzania, focusing on gender differences. This study evaluates the impact of membership in Savings and Credit Cooperatives Societies (SACCOS) on household outcomes. Using household data from the Tanzanian national panel survey from 2012-2013, we employ a propensity score matching to address and evaluate the impact of accessibility to credit services on the poor population in Tanzania. The main findings indicate that members in SACCOS have a higher monthly net income of 16,700 TZS (US$ 10.43) compared to those who are not members. Results also show that men members of ACCOS tend to generate a higher income than Women members. For instance, among the female sample, monthly net income is likely to be 15,600 TZS (US $9.75) more for those who joined SACCOS. However, men who are SACCOS members are likely to have a higher monthly net income of 26,500 TZS (US$ 16.55) compared to the non-SACCOS members. Overall, evidence suggests that microcredit services improve the standard of living of the people who have access to credit, especially men.

Acknowledgments

First of all, I give all glory and thanks to God, for health, strength and wisdom in completing this program. My sincere appreciation is extended to my major advisor, Professor Norbert Wilson for his support, encouragement, and guidance. Thank you, Professor, for giving me a unique opportunity to work with and learn from you. Great appreciation is also extended to my advisory committee members for agreeing to serve on my dissertation committee: Dr. Valentina Hartarska, thank you for providing insightful comments and critiques that have contributed to the completion of this work; Dr. Ash Abebe, many thanks your assistance and encouragement; Dr Nedret Bilor, thank you for your comments and critiques. Special thanks to Dr. Curtis Jolly, who never stopped trusting in me and encouraging me throughout my study period, particularly during the initial tough times when I started the program and since I came in the United States. I cannot thank you enough Dr Jolly for being an excellent mentor, father, and an extraordinary friend. May the Almighty Lord continue to bless you, your wife, Dr. Pauline Jolly and your wonderful children.

I am much indebted to Dr. Deacue Fields, who has been extremely supportive throughout my studies in the program. I cannot thank him enough for his financial support, friendship, encouragement, and also for giving me a unique opportunity to work with you in one of your projects.

I am grateful to my parents, Roger N'Dede and Mrs. Marie N'Dede, for their unconditional love, prayers and support throughout my life; words cannot express the sacrifices you have made to get me to where I am now. Again, to my beautiful mom, I really appreciate the sacrifice you made for leaving the family back home and spending all these years in the USA, in difficult times caring for my children and I until the completion of my studies. Special thanks to my siblings for their love and prayers for me. I also express my sincere thanks to my Aunt, Dr. Marceline Egnin who deserve special recognition for her guidance, moral support and contribution in making this dream a reality. To my husband, Hubert Hourizene, who has been extremely supportive throughout my stay in Auburn; thanks for your patience, love, support and understanding that persistently encouraged me throughout my study. To my amazing daughter, Ivanah-love, and son, Christ-ilan, I am really sorry for the times we missed together, but I cannot thank you enough for your love, understanding, and the joy you always give me.

Finally, I extend sincere appreciation to my colleagues, department staffs and particularly Ms. Kathleen Dowdell, for her help and assistance when I started the program.

A lot of thanks to my Auburn family, Dr Viviane Koua, Ghislain and Esther Gueye, Edgar Diomande, Anissa Hill and Hiwot Abebe for all your friendship, help, support, prayer and the fun times we have all had together.

Again and above all, TO GOD BE THE GLORY for his presence and blessings.

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Chapter 1: Contributing to Economic and Social Development in Sub-Saharan Africa through Value-Added Agriculture

1.1 Introduction

Primary commodity production and exports are the most important drivers of growth in Sub-Saharan Africa (SSA). This dependence on commodities and export of agricultural raw goods makes it difficult for the region to lift its population out of poverty. As a result, SSA continuously lags behind most regions in economic growth (Figure 1.1) and remains a region where poverty persists. Recent estimates in 2014 indicate that nearly 50% (414 millions) of the SSA population is living in extreme poverty[1]. This number, which is more than twice the number reported three decades ago (205 million), makes the poverty targets unachievable for the SSA region. Fundamentally, this slow performance, related to limited value-added agriculture and market linkages to other sectors, reveals weaknesses in the industrial sector in most SSA economies (Economic Report on Africa, 2013). The agricultural sector improvement through value-added agriculture and market linkages development can be favorable to promote economic growth, improve human development, and therefore, reduce poverty (Diao et al., 2006; Christiaensen and Demery, 2007; Christiansen et al., 2011, Dethier and Effenberger, 2012). In most SSA countries, the agricultural sector accounts for approximately 32% of GDP (World Bank, 2013), with limited value-added (Figure 1.2) and market linkages to the other sectors

[1] The World Bank defines "extreme poverty" as a standard of living of less than US $1.25 (PPP) a day (PPP stands for Purchasing Power Parities).

(Economic Report on Africa, 2013). Figure 1.3, showing value added in different sectors of the economy, displays the low level of value-added agriculture compared to others sectors among SSA countries. The potential for SSA countries to promote value added will not only help diversify agricultural products, but also help create job opportunities for its poor population and accelerating economic and social development. Given that countries that participate in high value-added products tend to benefit more from agricultural and overall economic growth (Datt and Ravallion, 1996) and have been successful in reducing poverty (World Bank, 2008), it is important for African economies to promote value-added from agricultural products. For instance, except for Brazil and Pakistan, most countries with high growth rates in agriculture value-added per capita (China, Malaysia, Vietnam, and India) have been successful in reducing poverty (World Bank, 2008). Some countries on the African continent, such as Botswana, Gabon, Mauritius and South Africa have been successful in promoting growth through agro-food processing and mostly natural resource exploitation. Only a few papers emphasize the need for SSA farmers, as well African nations, to be involved in the production of high value-added products (Irz et al., 2001 and Economic Report on Africa, 2013). The present chapter identifies value-added agriculture as a key strategy to promote economic and social development in SSA.

The recent strong economic growth in Africa has not translated into the socioeconomic development needed to improve social conditions and alleviate poverty. This result supports the fact that raw commodity production is the main driver of African economic growth, which does not generate job opportunities for poor populations. Compared to emerging economies in Asia and Latin America, most countries in SSA (Cameroon, Cote d'Ivoire, Ghana, Kenya, Nigeria, and Zambia) depend heavily on primary commodity production and exports. This dependence limits the ability of countries to generate higher incomes from value-added agriculture. For instance, only between a fifth and a quarter of cocoa production in Cote d'Ivoire and Ghana is semi-processed before export (Economic Report on Africa, 2013).

In this context, the present chapter examines the contribution of value-added agriculture to overall economic and social development in SSA. To illustrate further the importance of the value-added agriculture in low-income SSA countries, this study highlights the importance of developing market linkages in target countries. This research is relevant because of the implications for development assistance for African governments, NGOs, and the World Bank, the largest donor to African agriculture. Thus, the hypotheses are (1) an increase in value-added agriculture raises GDP, (2) market linkages influence the effect of value-added agriculture on growth; and (3) an increase in value-added agriculture promotes human development in SSA. Hence, the current chapter provides analysis that determines the importance of value-added agriculture on economic and social growth in Sub-Saharan Africa.

The chapter proceeds as follows: the first section provides the theoretical approach of the chapter. The second section reviews relevant literature providing a theoretical basis of empirical evidence on the relationship between agriculture value-added and economic growth and social development. The third section describes the methodology used to address the research question, followed by the description of data; and the final sections report the results, the conclusion and policy implications of the findings.

1.2 Literature Review

The principal aim of this chapter is to assess the effects of value-added agriculture and market linkages on economic growth in SSA. Traditional agriculture, along with primary commodity exports, has been the main driver of African economic growth. The region still has low economic performance with a weak industrial sector. Therefore, industrializing African agriculture through increased participation in growing world markets for high-value products, may not only yield employment and income benefits for poor people, but also help lower exposure to commodity price fluctuations. While per capita GDP in SSA is increasing significantly, SSA remains the poorest region in the world (World Bank, 2016). A number of studies, using cross-country analysis of the effect of agricultural and non-agricultural sectors, support the argument that improving the agricultural sector can be favorable to promote economic growth, improve human development, and therefore, reduce poverty (Diao et al., 2006; Christiaensen and Demery, 2007; Christiansen et al., 2011). For example, Garner (2006) explores the growth experiences of Sub-Saharan African countries and argues that the reasons for the poor performance of Africa have been inconsistent economic policies and other factors such as low investment rates and institutions. Bresciani and Valdes (2007) suggest three channels that link agricultural productivity to poverty reduction: labor market, farm income, and food prices. The authors question whether limited resource farms producing mainly household consumption goods can influence economic growth. With the persistent debate that poverty reduction is not effective if it only depends on one sector's growth, but also on the other sectors' performance, Christiansen and Demery (2007) report that growth from the agricultural sector is more poverty-reducing than growth from other sectors. Similarly, Irz et al. (2001) use a cross-country estimation model to investigate the impact of agricultural growth on poverty alleviation. The authors link value-added agriculture to economic growth and poverty reduction. Their study shows strong linkages between agricultural productivity and poverty alleviation. The empirical approach tests the argument that changes in agricultural growth affect not only the farm economy, but also the rural and national economies. Thirtle et al. (2003) use a similar model and show that investment in agricultural R&D raises value-added agriculture sufficiently to give satisfactory rates of return within the agricultural sector, and that increase in agricultural productivity has a substantial effect on poverty reduction.

Hence, in this chapter, we evaluate the effects of agricultural productivity from value-added agriculture, together with market linkages to other sectors on economic growth and human development. Several recent papers investigating factors fundamental to economic growth and human development have used the augmented Solow model (Hoeffler, 2002; NKurunziza and Bates, 2004; Ramsey, 2005; Ding and Knight, 2009; Ndambiri et al., 2012).

Regarding the debate on whether the augmented Solow model can account for the growth experiences of certain regions, more specifically SSA, Hoeffler (2002) finds that Africa's poor performance can fully be accounted using the augmented Solow model. Indeed, when allowing for unobserved country-specific effects and controlling for the endogeneity of regressors, the augmented Solow model can explain SSA's growth experience. Correspondingly, Ding and Knight (2009) report that China's economic growth experience is perfectly in line with the augmented Solow model, precisely when allowing for international variations in technology.

Notwithstanding the wide literature review on economic growth and poverty alleviation, none of them focuses on the poorest countries in SSA, where agriculture is essential for growth. In addition, very few cross-country analyses explore the contribution of value-added agriculture on economic and social growth. Hence, in this chapter, we attempt to fill this gap by emphasizing value-added from agriculture in low and lower-middle income countries in SSA using the augmented Solow model. The emphasis of this chapter is to determine the importance of value-added agriculture and market linkages to other sectors on economic growth and human development.

Human development is a recent concept that is inclined towards the expansion of individual freedoms to live long, healthy and creative live. It is a multidimensional concept that covers the improvement of the individual standards of living, leading directly to a healthy society, with access to education. As the experiences of many high-income, developing countries have shown, a thriving agricultural sector through value-added promotion could be a core driver of economic growth and human development in SSA countries. The United Nations Development Programme defines human development as the process of enlarging people choice (UNDP, 1990); Economic growth originating from agriculture can have a particularly strong impact in reducing poverty (FAO, 2005) and promoting human development (Ranis et al., 2000; Ranis and Steward, 2005). One aspect of this study is aimed at examining the relationship that exists between value added from agricultural sector and human development in SSA countries. Growing value-added sectors requires adequate investments in skills and technology, and remains a key challenge in the sector of agriculture for low-income countries in SSA. The inability to promote value-added in the agricultural sector means that the majority of the population in low-income countries is still working in unproductive activities that do not generate sufficient income on a regular basis (ERA, 2013). Without a strong foundation of productive employment leading to the opportunity to earn a living wage, efforts to poverty reduction and human development will still remain weak. Hence, forth, as the Human Development report (2000) suggests that it is important to put individuals at the center of development process, developing the sector of value-added agriculture is one step towards achieving human and social development.

Previous research on the topic (Thirtle et al., 2003; Christiansen and Demery, 2007), typically focuses on the importance of the sector to economic growth throughout the developing world. Very little research considers value-added agriculture for low and lower middle-income SSA countries. The specific focus on these countries is important because traditional, limited resource farmers and the output of these farmers are an important source of foreign income for these countries. Therefore, the present chapter attempts to assess the contribution of value-added from SSA's agricultural sector to its economic growth. In addition, none of the empirical work connects value-added agriculture to other sectors in the economy. Thus, this chapter offers a new dimension of this work to previous studies by investigating the impact of value-added agriculture on other sectors of the economy. At last, the present chapter looks at the input of value-added agriculture on human and social development in SSA.

1.3 Theoretical Concept

The study hinges on previous studies conducted by Bloom et al. (2004), Thirtle et al. (2003) and Mangeloja (2005) where economic growth is composed of two sources: growth from the level of inputs versus growth from total factor productivity (TFP). The generalized form of the model used in the present chapter has on the left hand side the output of gross domestic product (GDP) and on the right hand side the TFP (technological progress), and the physical capital. This model follows initially the basic Solow growth model (Solow, 1956), which is appropriate to the research question because that it captures the effects of agricultural inputs on growth. The basic model starts as the neoclassical Cobb-Douglas production function:

$$Y = F\ (A, K, L) \tag{1}$$

Based on the research interest in this chapter, Y represents gross domestic product (GDP); A is the technology level, proxied by a time trend (Solow, 1957); K is the capital stock; and L is the labor input.

According to the Solow model, output per worker instead of output per capita is more appropriate to use since not every person in a country contributes to output growth (Solow, 1957). Hence, in order to get all variables of the model expressed in per worker terms, we divide each side of the previous equation by labor (L). Thus, equation (1) is as follow:

(2) $$\frac{Y}{L} = F \left(\frac{A}{L}, \frac{K}{L}, \frac{L}{L}\right)$$

Then, the model in equation (2) becomes:

(3) $$y = f\ (a, k)$$

where y represents the total production in an economy that is the gross domestic product (GDP) per worker; a is the technology level which is proxied by a time trend (Solow, 1957); and k is the physical capital per worker.

An augmented version of the model in equation (3) gives the following form:

(4) $$y = a\ k^{\alpha}\ h^{\beta}\ (va)^{(1-\alpha-\beta)}$$

Value-added agriculture per worker (va) is incorporated in the model based on the assumption that this variable contributes to growth. In the augmented version of the Solow model, investment in human capital (h) is an important explanatory variable of growth.

However, instead of proxying investment in human capital using school enrollment like Barro and Lee (1993, 2001), we use an index of human capital per person from the Penn World Table 9.0. This index is calculated based on years of schooling (Barro and Lee, 2012) and returns to education (Psacharopoulos, 1994). Literate famers are assumed able to assimilate new methods or technologies and make use in the production process in order to increase agricultural and overall growth.

The empirical growth model, augmented with the human capital index and the contribution of value-added agriculture, in logarithmic form is as follows:

(5) $$\ln y = \ln a + \alpha\ \ln k + \ \beta \ln h + \ \gamma \ln va + \ \ln \varepsilon_1$$

with $\gamma = 1 - \alpha - \beta$.

h is the human capital per worker; and va, the contribution of value-added agriculture (table 1). Other potential variables that are important factors to economic growth (Fan et al., 2000; Thirtle et al., 2003; Bloom et al., 2004; Christiaensen and Demery, 2007) include population growth rate (*pop*), government expenditure (*goe*), trade openness (*open*), foreign direct investment (*inv*), and the share of value-added in non-agricultural sectors (*nonag*). The model that we estimate is,

$$(6) \qquad \ln y = \ln a + \alpha \ln k + \beta \ln h + \gamma \ln va + \delta \ln pop + \theta \ln goe + \rho \ln open + \sigma \ln inv + \tau \ln nonag + \ln \varepsilon_1$$

All variables are in logarithm form.

As stated earlier, another dimension of this work is forged in investigating the impact of value added agriculture on other sectors of the economy. Hence, to estimate the linkages between agricultural and non-agricultural sectors, we add to equation (6) an interaction term ($\ln va * \ln nonag$). Thus, the revised model is as follow:

$$(7) \qquad \ln y = \ln a + \alpha \ln k + \beta \ln h + \gamma \ln va + \delta \ln pop + \theta \ln goe + \rho \ln open + \sigma \ln inv + \tau \ln nonag + \omega (\ln va * \ln nonag) + \ln \varepsilon_2$$

Depending on the importance of the contribution of value-added agriculture to growth, this chapter provides a clear picture of the market linkages between value-added agriculture and the other sectors of the economy.

As mentioned in the introduction section, the final dimension of this chapter we assess the effect of value-added agriculture on human development. We estimate an OLS regression to establish the value-added agriculture on human development. Human development index (HD[2]) measuring the level of human development of a country population, is the dependent variable in our regression. HD is regressed on value-added agriculture (VAD), first lag of gross domestic product

[2] Human development index is a composite index measuring average achievement in three key dimensions of human development: A long and healthy life; knowledge; and a decent standard of living (UNDP, 2015)

per capita ($LAGGDP$), government expenditure (GOE), rural population ($RURPOP$) and corruption index ($CORR$). Hence, the following equation:

(8) $$HD = \beta_0 + \beta_1 VAD + \beta_0\, LAGGDP + \beta_0 GOE + \beta_0\, RURPOP + \beta_0\, CORR + \varepsilon_3$$

1.4 Methods

The current chapter estimates three equations to determine the importance of value-added agriculture on economic and social growth in Sub-Saharan Africa. First, a production function model by Solow (1956) of economic growth is estimated to determine the impact of value-added agriculture on economic development. Second, the production function is re-estimated to assess the influence of value-added agriculture and non-agricultural market linkages. Third, an OLS model is estimated to evaluate the impact of value-added agriculture on human development. Therefore, the empirical models are expressed as follows:

Model 1: Growth model

(9) $$\ln y_{i,t} = \ln a_{i,t} + \alpha \ln k_{i,t} + \beta \ln h_{i,t} + \gamma \ln va_{i,t} + \delta \ln pop_{i,t} + \theta \ln goe_{i,t} + \rho \ln open_{i,t} + \sigma \ln inv_{i,t} + \tau \ln nonag_{i,t} + \varepsilon_{1,i,t}$$

The second model, derived from the previous model, explains the market linkage model. Thus, the model is expressed as follows:

Model 2: Market linkages model

(10) $$\ln y_{it} = \ln a_{i,t} + \alpha \ln k_{i,t} + \beta \ln h_{i,t} + \gamma \ln va_{i,t} + \delta \ln pop_{i,t} + \theta \ln goe_{i,t} + \rho \ln open_{i,t} + \sigma \ln inv_{i,t} + \tau \ln nonag_{i,t} + \omega(\ln va_{i,t} * \ln nonag_{i,t}) + \varepsilon_{2,i,t}$$

The third model estimated in this chapter concerns the human development effect. All variables from equation 8 are in logarithms and reported in the following expression:

Model 3: Human development model

$$hd_{i,t} = \beta_0 + \beta_1 vad_{i,t} + \beta_2\, lgdpp_{i,t} + \beta_3\, goe_{i,t} + \beta_4\, rupop_{i,t} + \beta_5\, corr_{i,t} + \varepsilon_{3,i,t} \quad (11)$$

i and t represent each country and each year from 2000 to 2011, respectively. $\varepsilon_{1it}, \varepsilon_{2it}$ and ε_{3it} are errors terms for model 1, 2 and 3 respectively.

Since this chapter uses panel data, which controls for unobserved heterogeneity issue, it is important to determine if there exist some country-specific effects, and therefore, decide whether ordinary least squares (OLS) estimation is appropriate or not. The result also helps determine if the fixed effects (FE) or random effects (RE) model is more efficient in our estimation. This is done using the Breusch and Pagan Lagrange multiplier test. A high p-value indicates that OLS estimation is valid, and therefore, there is no need for the FE or the RE model. Otherwise, it is necessary to implement the Hausman test which indicates whether the FE or the RE model is more efficient. The FE model assumes time-invariant characteristics that are unique to each country and are not correlated with the error term. If chosen over the RE model, the FE model will reveal the existence of country-specific factors (geographical location, cultures, weak governances, political and social stability, climates, and others) and their impact on value-added agriculture and economic growth among SSA countries. The FE model estimation will therefore remove the effect of those time-invariant country characteristics and give the net effect of the right-hand side variable. However, if the RE model is chosen the effect of these time-invariant country characteristics will be included in the estimation.

In addition to the above tests, other basic assumptions such as homoscedasticity and autocorrelation assumptions of the models are also tested to decide the appropriate models' specification in this chapter.

1.4.1 Preliminary results and choice of the appropriate model

Appendix 1 presents the preliminary results from statistical tests, enabling the selection of the estimation methods. The Breusch and Pagan Lagrange multiplier test rejects the null hypothesis of country-specific effects ($\chi^2 = 1122.85, p < 0.01$); therefore, OLS is not appropriate. The Hausman test for RE rejects the null hypothesis ($\chi^2 = 52.46$, and $p < 0.01$). Thus, the FE model is consistent. This result implies that there exist country-specific factors that may have some influence on GDP.

Furthermore, the statistical tests for autocorrelation by Woodridge (2002) and homoscedasticity are performed. The Woodridge test for autocorrelation rejects the null of no first-order autocorrelation (F-stat = 1925.69 and p-value <0.01). The Wald test for groupwise heteroscedasticity in the FE regression model rejects the null hypothesis of constanct variance among countries ($\chi^2 = 21318.85$, and $p < 0.01$). This indicates the presence of heteroscedasticity which is addressed through the use of robust standard errors. Also, the test for over-identifying restriction is statistically significant indicating that the model is valid.

Based on previous test results and since OLS estimates are not appropriate, the generalized method moments (GMM) estimation technique seems more appropriate.

GMM allows for unobserved heterogeneity, heteroscedasticity and autocorrelation. Therefore, we use the GMM estimation by Hansen (1982) to estimate our empirical growth model. Christiansen et al. (2011), Doytch and Uctum (2011) and Bloom and Canning (2005) used the same econometric technique of growth effects and have demonstrated that GMM estimation is more reliable when dealing with the issues stated above. Estimation of panel data using GMM is based on the exogeneity assumption. One problem encountered in the estimation of the growth panel model is a violation of the exogeneity assumption. To address this issue, we could use instrumental variables (IV); however, in the presence of the heteroscedasticity problem, IV is inefficient. Therefore, GMM estimation is a more efficient econometric technique in this chapter.

1.4.2 Statistical models

Our empirical growth models based on preliminary results are expressed in the following form:

Model 1: Growth model

$$(12)\ \ln y_{i,t} = \ln a_{i,t} + \alpha \ln k_{i,t} + \beta \ln h_{i,t} + \gamma \ln va_{i,t} + \delta \ln pop_{i,t} + \theta \ln goe_{i,t} + \rho \ln open_{i,t} + \sigma \ln inv_{i,t} + \tau \ln nonag_{i,t} + \eta_{1,i} + \mu_{1,i,t}$$

Model 2: Market linkages model

$$(13)\ \ln y_{i,t} = \ln a_{i,t} + \alpha \ln k_{i,t} + \beta \ln h_{i,t} + \gamma \ln va_{i,t} + \delta \ln pop_{i,t} + \theta \ln goe_{i,t} + \rho \ln open_{i,t} + \sigma \ln inv_{i,t} + \tau \ln nonag_{i,t} + \omega(\ln v_{i,t} * \ln nonag_{i,t}) + \eta_{2,i} + \mu_{2,i,t}$$

where $\eta_{j,i}$ and $\mu_{j,i,t}$ are respectively the unknown intercepts for each country and the error terms for model 1 and model 2.

Using panel data, one or more of the regressors in the growth equations may be correlated with the error term, $\mu_{j,i,t}$. Hence, to address the problem of endogeneity, we use the dynamic panel data model estimation, which uses all lagged values as instrumental variables and relies on first-differencing transformation to eliminate the country-specific effects. Previous work demonstrates that the first-differenced GMM method can perform poorly[3] (Bond et al., 2001). Due to potential weakness in the estimator, we use the system GMM[4] estimator as an extension of the first-

[3] Lagged level variables constitute weak instruments for subsequent first-differences variables in first-differenced GMM estimation; hence, the first-difference GMM estimation by Arrelano and Bond (1991) may lead to bias and inconsistent estimates. See Bond et al. (2001) for further details.

[4] The system GMM used in this chapter is relevant for the following reasons: first, system GMM estimators by Arrelano and Bover (1995) and Blundell and Bond (1998) produces consistent and efficient estimators (Bond et al., 2001). Second, the system GMM (as well as first-differenced GMM) estimation method addresses endogeneity issues

differenced GMM estimator (Arrelano and Bover, 1995 and Blundell and Bond, 1998). The system GMM model is expressed as a system of equations (one per time period) and designed for situations with independent variables that are not strictly exogenous, fixed effects, heteroscedasticity, autocorrelation within individuals, and dependent variable that depends on its own past realization. Thus, this estimator will produce more efficient and consistent estimates. Following Blundell and Bond (1998), Hoeffler (2002) and, Nkurunziza and Bates (2004), the system GMM is the preferred model in the present study. Therefore, equations (12) and (13) can be generalized in the following panel data model:

$$(14) \qquad \Delta\ln y_{i,t} = \varphi\,\Delta\ln y_{i,t-1} + \phi\,\Delta\ln X_{i,t} + \Delta\,\mu_{i,t}$$

for i=1, …, N and t = 1, …, T, where $\Delta\mathrm{lny}_{it}$ is the log difference in real GDP per worker such that $\Delta\mathrm{lny}_{it} = (\mathrm{lny}_{i,t} - \mathrm{lny}_{i,t-1})$, $\ln y_{i,t-1}$is the logarithm of real GDP per worker at the beginning of each period, and $X_{i,t}$ is a vector of other characteristics such that in:

model 1,

$$(a) \qquad \Delta\ln X_{i,t} = \Delta\ln a_{i,t} + \alpha\,\Delta\ln k_{i,t} + \beta\,\Delta\ln h_{i,t} + \gamma\,\Delta\ln va_{i,t} + \delta\,\Delta\ln pop_{i,t} + \theta\,\Delta\ln goe_{i,t} + \rho\,\Delta\ln open_{i,t} + \sigma\,\Delta\ln inv_{i,t} + \tau\,\Delta\ln nonag_{i,t}$$

and model 2,

$$(b) \qquad \Delta\ln X_{i,t} = \Delta\ln a_{i,t} + \alpha\,\Delta\ln k_{i,t} + \beta\,\Delta\ln h_{i,t} + \gamma\,\Delta\ln va_{i,t} + \delta\,\Delta\ln pop_{i,t} + \theta\,\Delta\ln goe_{i,t} + \rho\,\Delta\ln open_{i,t} + \sigma\,\Delta\ln inv_{i,t} + \tau\,\Delta\ln nonag_{i,t} + \omega\Delta(\ln va_{i,t} * \ln nonag_{i,t})$$

As mentioned earlier, the growth models may encounter unobserved heterogeneity and endogeneity. The system GMM used in this chapter is relevant for the following reasons: first, system GMM estimation techniques by Arrelano and Bover (1995) and Blundell and Bond (1998)

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and eliminate all unobserved country-specific effects. Third, the system GMM estimation is consistent when using panel data with a large number of entities over a small number of time periods.

produce consistent and efficient estimators (Bond et al., 2001). Second, the system GMM (as well as first-differenced GMM) estimation method addresses endogeneity issues and eliminates all unobserved country-specific effects. Third, the system GMM estimation is consistent when using panel data with a large number of entities, *n*, over a small number of time periods, *t*.

Rewriting our empirical models, we get:

Model 1: Growth model

$$(15) \quad \Delta\ln y_{i,t} = \Delta\ln a_{i,t} + \varphi\ \Delta\ln y_{i,t-1} + \alpha\,\Delta\ln k_{i,t} + \beta\ \Delta\ln h_{i,t} + \gamma\ \Delta\ln va_{i,t} + \delta\ \Delta\ln pop_{i,t} + \theta\,\Delta\ln goe_{i,t} + \rho\ \Delta\ln open_{i,t} + \sigma\,\Delta\ln inv_{i,t} + \tau\,\Delta\ln nonag_{i,t} + \Delta\mu_{1,i,t}$$

Model 2: Market linkages model

$$(16) \quad \Delta\ln y_{i,t} = \Delta\ln a_{i,t} + \varphi\,\Delta\ln y_{i,t-1} + \alpha\,\Delta\ln k_{i,t} + \beta\,\Delta\ln h_{i,t} + \gamma\,\Delta\ln va_{i,t} + \delta\,\Delta\ln pop_{i,t} + \theta\,\Delta\ln goe_{i,t} + \rho\,\Delta\ln open_{i,t} + \sigma\ \Delta\ln inv_{i,t} + \tau\,\Delta\ln nonag_{i,t} + \omega\ \Delta(\ln v_{i,t} * \ln nonag_{i,t}) + \Delta\mu_{2,i,t}$$

Model 3: Human development model

$$(17) \quad hd_{i,t} = \beta_0 + \beta_1 * vad_{i,t} + \beta_2 * lgdpp_{i,t} + \beta_3 * goe_{i,t} + \beta_4 * rupop_{i,t} + \beta_5 * corr_{i,t} + \varepsilon_{3,i,t}$$

More details about the above variables are given in the following section.

1.5 Data and sources

Data are obtained from the Penn World Table 9.0, World Development Indicators (WDI, 2014), Transparency International and the United Nations Development Programme (UNDP, 2015). Using country level dataset, data are from 2000 to 2014 for low and lower-middle income SSA countries, based on the World Bank classification list of economies (Appendix 2). This classification table divides all economies among income groups according to the 2014 gross national income (GNI) per capita. Countries with a GNI per capita less than $1,045 are classified as low-income countries. The lower-middle income group represents all economies with income per capita between $1,046 and $4,125 (WDI, 2014). Most countries in the Sub-Saharan region are in the latter category (WDI, 2014), except for Angola, Botswana, Equatorial Guinea, Gabon, Mauritius, Namibia, Seychelles and South Africa. Figure 1.4 shows the level of income for all countries in the SSA region. Countries with a GNI per capita greater than $4,125 are deleted. The countries with a GNI per capita greater than U.S $4,125 have experienced economic progress resulting from sectoral improvements from tourism, diamond mining (Botswana, South Africa) and, most importantly, petroleum producing or exporting activities (Gabon). Because of limited data availability, we exclude Chad, Ghana, Sao Tome and Principle, Somalia and South Sudan. As a result, only data for 35 countries remain from the original 48 SSA countries to estimate the model (Appendix 2). Data are not available for all countries and for all periods; thus, making the panel unbalanced but usable[5] for our estimation, since we corrected for missing observations using the mean. Table 2 presents the summary statistics of all variables.

Gross domestic product (GDP) measures the efficiency of population producing goods and services. GDP is the dependent variable in our growth models.

Value-added agriculture refers generally to increasing the economic value of a primary agricultural commodity through manufacturing processes; it measures the output of the agricultural sector of an economy less the value of intermediate inputs (World Bank, 2014). We expect to find

[5] a. There are two key assumptions underlying the consistency of the FE estimators on unbalanced panel; namely, the strict exogeneity assumption and the rank condition. See Wooldridge (2002) for further details.

b. Also, the STATA command xtabond, used for our dynamic panel regression in this chapter, handles data that have missing observations in the middle of panels.

a positive impact on both growth and human development models. A significant coefficient indicates that value-added agriculture contributes substantially to economic and social growth.

Labor measures the total labor force, involving economically active people engaged in an economic activity, whether farm or non-farm activity, paid or unpaid workers (World Bank, 2014).

Capital stock is a measure of the physical assets used in the production; it includes all the production components such as land development, livestock, machinery and equipment and others. This variable is important to growth in the sense that high investment in physical capital may yield to higher returns, thus improving economic growth.

Human capital is an index measuring the level of human capital per person based on years of schooling and returns to education (Penn World Table 9). Proxying human capital investment using school enrolment rates like (Barro, 1993) is problematic. Reasons are it conflates the level and accumulation effects of human capital and may leads to misinterpretations of the role of the labor force growth (Gemmell, 1996). Thus, we include the human capital index in our regressions, to avoid these problems. Similar to capital stock, a higher investment in human capital leads to higher returns and increase GDP.

Technology measures the technological rate of progress over time. In the absence of reliable data on technological change, time trend (year) is used as a proxy variable to explain technological progress. Agricultural technological change is an important measure for growth (de Janvry et al., 2000; Besharat and Amirahmadi, 2011) since it can contribute to agricultural growth and GDP through adoption of new agricultural technologies by poor farmers. Famers who adopt new technology may increase their welfare, thus promoting their social condition.

Population growth measures the annual rate of growth of the total population in a country. Based on the literature review, the coefficient is expected to be negative as the rapid population growth in SSA countries constitutes a challenge in SSA countries (Ramsey, 2005). Further, population in Africa is growing at a faster rate than that of the output per worker.

Rural population refers to a percentage of the total population living in rural areas. Sustainable rural development can translate into better living conditions for the rural poor; especially, since the majority of the population in SSA lives in rural areas (FAO, 2005) where labor in the agriculture sector is intensive. Therefore, a significant coefficient in rural population indicates that growth of the rural population directly contribute to economic growth since agriculture provides employment opportunities for rural dwellers.

Government expenditure, also classified as government final consumption expenditures, measures all current government expenditures on purchases for goods and services in an economy. Government expenditure is an important factor in the economic development of SSA countries (Thirtle et al., 2003). We expect to find a negative impact on both economic and social growth.

Foreign direct investment measures the net inflows of investment from foreign investors among SSA economies. FDI is a dominant factor in most SSA countries as these countries depend significantly on foreign aid, to overcome the world food crisis and reducing poverty and hunger (Fan and Rosegrant, 2008). Thus, a positive coefficient in FDI shows foreign investment contributes to overall economic growth in SSA.

Trade openness is an indicator measuring a country's openness to international trade, relative to domestic transactions. Hence, greater trade openness leads to a stronger economy.

Value-added, non-agriculture is a measure of the share of value-added in other sectors (manufacturing, industry, and service) than agriculture, which are all important determinants of African economies. A significant positive coefficient of value-added from the non-agricultural sector demonstrates strong linkages between value-added from the other sectors of the economy and GDP (Irz et al, 2001).

Corruption index[6] measures the perceived level of a country's corruption in the public sector. The corruption perception index is based on a scale from 1 (very clean) to 6 (highly corrupt). As corruption indicates bribery or deprivation of people, this measure translates into human suffering and deprivation of basic and essential services, such as access to education or healthcare, and, consequently human development. Hence, the corruption perception index constitutes a fundamental determinant of human development among SSA countries. A negative sign would indicate that high incidence of corruption among SSA countries undermines human development.

Human development index measures the level of human development, considering the average achievements of a country on health, education and income, which are distributed among its population (UNDP, 2010). Ranis et al. (2000) define human development as "enlarging people's choice in a way which enables them to live longer, healthier and fuller lives"; therefore, an increased level of human development lowers poverty significantly. We expect to find a positive impact of value-added agriculture on the outcome, since value-added in the agricultural sector is assumed to generate job opportunities for the SSA population and better living standards. Thus, a rise in the human development index due to the high rate of value-added agriculture would translate into social condition improvement of people deprived of health, education, and people living in poverty.

[6] Source: World Bank database http://data.worldbank.org/indicator/IQ.CPA.TRAN.XQ

1.6 Results and Discussion

1.6.1 Economic Growth

From the growth models (i.e. models 1 and 2), we observe similarities in the significance and signs concerning the main variables of interest in table 1.3. As expected, value-added agriculture constitutes an important determinant of economic growth among SSA countries. For instance, results in model 1 show a positive and highly significant coefficient indicating that a 10% increase in value-added agriculture raises GDP per worker by 0.76%. This result is consistent with findings in countries with similar constraints such as countries in Latin American (Thirtle et al., 2003; Christiansen and Demery, 2007), and in Asia (World Development Report, 2008). The findings confirm our expectations and provide evidence that more attention should be given to value-added agriculture since most countries in the SSA region show remarkably low levels of value-added agriculture (ERA, 2013). For instance, Cote d'Ivoire, which is the biggest producer of cocoa, as well as Ghana, exports their primary products in a semi-processed form. Similarly, the coefficient for value-added from the non-agriculture sector has the expected (positive) sign indicating the significant contribution of this sector to output per worker. Specifically, GDP increases by 0.63% following a 10% rise in value-added from non-agricultural sectors. This result is not surprising given that the non-agricultural sector is generally known to be an important contributor to the growth of national economies.

In agreement with the literature, physical capital and human capital are important factors of economic growth among SSA countries; as expected, results show that the coefficients for physical capital and human capital are positive and statistically significant, suggesting that GDP per worker increases by 0.82% and 1.88% respectively with a 10% increase in each factor. However, total factor productivity (technological progress) is not statistically significant in both growth models. This can be explained by the fact that most countries in the region have limited adoption of new agricultural technologies. In addition, irrigation problems and inadequate use of fertilizer are sources of low crops yields in Africa, particularly in many West African countries (Lipton, 2012). As expected, the first lagged value of the GDP per worker is positive and statistically significant; thus, from the model 1, GDP per worker would go up by 7.40% with an increase of 10% in GDP per worker in the previous year. Government expenditure also contributes positively to output per worker. That is, if government expenditure goes up by 10%, GDP would also raise by 0.33%. Similarly, trade openness has a positive effect on output per worker, showing that GDP per worker increases by 0.32% following a 10% increase in openness. Dollar and Kraay (2000) show that countries with high levels of trade openness tend to grow rapidly and generate higher GDP per capita.

Moreover, population growth rate has a positive impact on economic growth in the model 1 while in the second model there is no significant effect. The insignificance of the result of population growth in model 2 is particularly surprising; first, one would expect high population growth rate in Africa would tend to influence economic growth; second, population in Africa is growing at a faster rate than that of the output per worker, and this rapid growth constitutes a challenge in SSA countries (Ramsey, 2005). Furthermore, FDI is insignficant in both model 1 and model 2 as shown in table 3.

1.6.2 Market linkages

The statistical significance of the interaction term in Model 2 (Table 3) is an indication of the existence of market linkages in national economies. Estimation results show that both agriculture and non-agriculture sectors contribute significantly to economic growth in SSA countries. For example, using the typical output of the non-agricultural sector per year, findings show that the total effect[7] of the agricultural sector on economic growth is 1.52% for every 10% increase in agriculture. Hence, this finding confirms that value added contributes significantly to growth among SSA countries. Similarly, GDP goes up by 0.43% following a 10% increase in the non-agricultural sector given the mean annual agricultural output for SSA countries. Thus, the positive effect implies that the higher the share of value added in the secondary (manufacturing) and tertiary (services), the greater (more positive) is the effect of value-added agriculture. In the same way, the higher the effect of value-added agriculture, the higher the effect of value-added non-agriculture on GDP is. As expected, the total effect of agriculture exceeds that of the non-agricultural sector. The results show the importance of the contribution of value-added agriculture in growth. Furthermore, in order to see whether or not the interaction term is valid in our second model (Market linkages variable), we test the joint hypotheses that the interaction term between value added from agriculture and value added from the non-agricultural sector is statiscally significant. From the joint test, we reject the null hypothesis ($p<0.05$) that our interaction variable is zero. Hence, this indicates that the interaction term is valid in our second model, and we can conclude therefore that this variable has a significant impact on GDP per worker. The negative interaction term may suggest competition between the two sectors. Nevertheless the net effect on value-added agriculture is positive.

[7] Since the market linkage model contains an interaction term between two continuous variables (*value-added agriculture and value-added non-agriculture)*, I use the following method to determine the total effect of each variable on GDP and the other sectors: [*coefficient of estimated parameter + (coefficient of interaction term * mean of estimated parameter)]*. Hence, the total effect of value-added agriculture is 0.1925 + (-0.065*6.14) = 0.1527; likewise, the total effect of variable value-added non-agriculture is 0.1770 + (-0.0065*20.53) =0.0435.

1.6.3 Human development

As expected, the results show that a 10% increase in value-added agriculture promotes human development by 0.63% (Model 3, Table 3). It is evident that SSA governments need to promote value-added from agricultural products to commodities in order to benefit from industrialization. Further, model 3 reports a significant coefficient on the lagged GDP variable, showing that the past level of GDP positively influences human development in SSA countries. That is, the level of human development rises up by 0.40% due to a 10% increase in economic growth in the previous years. This result is in accordance with previous studies in that economic growth plays an important role in the level of human development across countries (Ranis et al., 2000; Adeyemi et al., 2006).

Moreover, rural population growth does not have a statistically significant effect on human development level. The result is surprising since most economies in SSA are agrarian. Agriculture in Africa is labor-intensive, and much of the farming activities are located in rural areas. Hence, one would expect that growth of the rural population would directly contribute to economic growth since agriculture provides employment opportunities for rural dwellers.

Government expenditure, however, significantly contributes to human development in SSA countries; a 10% increase in government spending raises human development by 0.47%.

Lastly, the corruption index has no significant impact on SSA's human development progress.

Overall, the findings highlight the importance of value-added agriculture and other factors on economic and social development in low and lower-middle-income SSA countries. This is clear evidence that agriculture should not be neglected given its contribution to socioeconomic development and poverty alleviation. Thus, higher economic performance through high value-added agriculture, significantly improves human development in areas such as income, health and education.

1.7 Conclusion

The contribution of value-added agriculture to economic and social development in Sub-Sahara African (SSA) countries was the main purpose of this chapter. We have applied the Solow growth model using the GMM approach generally used in empirical growth models. Generally, the results support previous studies in that value-added agriculture positively effects GDP and human development. Results also demonstrate that government spending is an important determinant of the nature of economic growth. Although a number of factors are significant in increasing GDP, value-added agriculture is a weak contributor of economic growth in SSA countries. Hence, improvement in value-added in the agricultural sector would drive economic growth thereby reducing poverty and promoting social conditions among SSA countries. Nevertheless, further research should be directed at policies to increase value-added agriculture in Africa. This implies that effective poverty reduction strategies should focus on fostering higher rates of value-added in the agricultural sector and improving market-linkage with other sectors. Thus, governments must invest in agricultural R&D and infrastructure (e.g. constructing rural roads).

The results of this study are important in the sense that emphasizing value-added agriculture can be an effective strategy to reduce poverty and improve human development in SSA countries. Moreover, the findings of this chapter have significant development policy implications for African governments, NGOs, and important donor agencies such as the World Bank.

Overall, the study has shown the link between value-added agriculture, economic growth, and human development.

Chapter 2: EU Harmonized Product Standards: Implications for Raw and processed food trade

2.1 Introduction

The impact of food safety standards on international trade remains a great concern for both developing and developed countries. Although, the principal aims of imposing food standards barriers are to protect the health of consumers, provide assurance of quality, and overcome market failure in bilateral trade, the trade literature suggests that food safety regulations can act as catalysts or as barriers to international trade (Maeterns and Swinnen, 2006; Marette and Beghin, 2010). In response to the food safety crisis or concerns, most industrialized countries use the precautionary principle to justify the imposition of strict food. Not only, food safety standards protect consumer's health, but these strict measures contribute to upgrading agri-food supply chains and helping exporting countries enter in better competitive advantage in global markets and (Henson and Jaffee, 2008). Nevertheless, subject to specific standards, trade impacts of food safety standards vary across sectors, among products and between countries (Moenius, 2006; Disdier, Fontagné, and Mimouni, 2008).

Empirical evidence shows that high food standards also inhibit trade for exporting countries, due to high compliance costs with food standards for developing countries, and sometimes discriminatory use of standards. As with many primary commodities, processed food products are also often taxed or subsidized at different rates compared to primary products (Tamini et al.

2010). The increase in the share of processed food trade on international trade over the past decades, so that now process food trade accounts for more than half of the total exports (Jongwanich, 2009). This highlights the importance of the trade of processed foods. However, given the significant decline of traditional trade barriers such as tariff and non-tariff barriers in both developed and developing countries as a result of the World Trade Organization (WTO) negotiations (Maskus and Wilson 2001), the proliferation of food safety standards on both primary and processed products becomes a major issue in international agri-food trade. Hence, it is important to look at the differential impact of these standards on both types of products.

Some previous studies have investigated the impact of EU harmonized and idiosyncratic standards on trade as well as on welfare (Moenius, 2004; Shepherd, 2007; Shepherd and Wilson 2013). However, only Shepherd and Wilson (2013) of these studies examined the effects of stricter EU standards of raw or lightly processed food on processed food trade. In this chapter, we examine the impact of EU standards on raw and processed food trade, separating the trade impact of standards that are either consistent with the International Standards Organization (ISO) or uniquely EU-specific (Non-ISO) standards. In other words, the main objective is to study whether strengthening international standards for raw or less processed food affect trade of the more processed products. Similarly, we want to see if standards of processed food products affect the supply and demand of unprocessed or lightly processed food. We draw from previous work by Shepherd and Wilson (2013) who cover a wide range of agricultural products from HS chapters 1-24 (Harmonized System). However, our work mainly focuses on a single sector, namely cereal products.

The structure of the current chapter is as follows: the first section reviews relevant literature on international standards of raw and processed food trade, and then uses it to develop a theoretical basis of our work. The second section presents that framework to assess empirical evidence of the links between international standards of less process food and those of more processed foods; followed by the methodology and the data sources. The final sections present the results and the conclusion.

2.2 Literature review

Maerterns and Swinnen (2006) explore the vast literature associating increased food standards with trade and welfare in developing countries. They provide evidence that emerging food regulations may benefit developing countries that upgrade trade capacity and gain access to high value food markets. Further, the authors highlight the importance for developing countries investing in food quality, as the benefit of compliance with standards outweighs the cost of compliance such that standards can serve as catalyst for trade, growth and poverty reduction. In addition, they outline the factors and advantages of complying with increasing food standards. For instance, increased demand for product quality and food safety, increased trade of fresh products to food safety risks, foreign investment in the agro-food sector, technical and scientific knowledge are linked to increased food standards from developed country. However, due to high compliance costs of food standards to developing countries, high standards may also act as barriers, as presented in Jaffe and Henson (2004). While the implementation of standards provides potential opportunities in the short term, such as better market access in the international trade and higher products prices, it also constitutes a challenge for small and medium scale producers in developing countries. Poor developing countries might not be able to participate in food export markets, and comply with stringent food safety standards. Thus, the situation is problematic for some developing countries as poor farmers and smallholders' exporters are excluded from high standards food supply chains (Maerterns and Swinnen, 2006; Swann, 2010). Country case studies provided evidence that over time the compliance costs of small-scale exporters vary with stricter standards and regulations. Total compliance costs of China's agri-food exporting enterprises in meeting foreign food safety regulations raised from $28.11 million in 2005 to $83.42 million in 2007 (Song and Chen, 2010). Other case studies carried out in African developing countries in the fisheries and other food sectors illustrate the significant impact of EU stricter food safety regulations and standards on the performance of these countries (Frohberg et al., 2006; Henson, 2006; Atici, 2013).

In the context of the dichotomies between "standards as catalysts" and "standards as barriers", Bao and Chen (2013) investigate technical barriers to trade (TBT) effects on trade. They show that TBT can have a mixed effect on trade performance. Using the gravity model, probit and Cox proportional hazard models to examine the effects of TBTs on various components of countries trade performance, such as trade probability, volume and duration of trade, the authors found that TBT can act as barriers and catalysts. On one hand, they report that implementing TBT will increase trade costs, restricting the probability of trade. On the other hand, these standards will increase trade flows through consumers' awareness as well as keeping out potential competitors. Likewise, Disdier et al. (2008) analyze SPS and TBT agreements on agricultural trade and report that SPS and TBT can promote or impede trade, depending on whether consumers have information on the traded products. SPS and TBT regulations negatively affect European imports more than other OECD countries. However, no significant effect exists for trade between OECD members. While Disdier et al. (2008) report that mandatory product standards are trade reducing for export from developing countries, Moenius (2004) focuses on voluntary product standards and show that bilaterally shared voluntary standards promote trade whereas country-specific standards impede agricultural trade.

Food safety standards impact on trade has recently been the center of attention in the trade literature. Otsuki et al. (2001) found that EU standards of aflatoxin reduce exports from developing countries by more than 60%. As well, Wilson and Otsuki (2004) report 1.63% reduction in banana imports due to tightening of pesticide regulation by 1%. A recent study in Mauritius shows that cost of meeting EU norms in developing agro-food exporting country range between 76% and 100% higher than what would have been required on the local markets (Neeliah et al., 2013). Jongwanich (2009) reported that the standards imposed by developing countries could inhibit processed food exports from developing countries. The author found that regulations that are more stringent reduce export volume of processed food.

Tamini et al. (2010) argues that governments often tax or subsidies processed food products. However, the rate of these taxes and policies are at different rates compared to the primary products, such that a policy on one type of product can influence the demand and supply of the other product through vertical linkage between both products (Tamini et al. 2010). As the authors point out, assessment of trade effects of products standards by differentiating primary and processed commodities is important.

In addition, compared to the significant number of studies showing evidence of the impact of international standards as trade-promoting and trade barriers, very few studies distinguish the effects of the EU-specific standards relative to ISO equivalent standards. Clougherty and Grajek (2008) and Kim and Reinert (2009) estimate the effects of ISO 9000 standards on bilateral trade. They find that exports increase for exporting developing countries using ISO standards. However, the use of ISO 9000 standard by an OECD importer can impede entry to imports from non-OECD countries, but can actually serve to promote imports from other OECD countries.

As well, Shepherd and Wilson (2013) use data on agricultural component from the EU standards database, which captures information on whether or not a particular EU standard is equivalent to ISO standard. They highlight the important role of voluntary standards rather than mandatory standards in influencing global trade patterns in food and agricultural markets. Overall, the results suggest that the effects of product standards depend on the sector, the degree of international harmonization, and the income level of the exporting country. Evidence suggests that in most cases non-harmonized EU standards have more negative effects on trade than international harmonized standards, confirming the view that standards act as barriers to exporting countries. However, ISO standards tend to act sometimes as barriers and sometimes as catalysts.

Shepherd and Wilson (2013) also demonstrate that EU product standards hurt developed countries more than developing countries, depending on the sector. Furthermore, for less processed products, voluntary standards tend to have a larger impact on developing country exporters compared the developed country exporters. As a result, the study highlights the important role of voluntary standards in influencing global trade patterns in food and agriculture as well as in a context of increasingly globalized supply chains. This chapter work draws on this existing work and look at the effect of ISO and non-ISO standards on raw and less process products on more process food trade, and inversely.

2.3 Empirical Model

2.3.1 Theoretical framework

2.3.1.1 Gravity model

The gravity model of international trade is based on the gravitational force concept, to explain the volume of trade flows between two trading countries. Originally, gravity models begin with Newton's law for the gravitational force (GF_{ij}) between two objects *i* and *j*, that is directly proportional to the masses of the objects (M_i and M_j) and indirectly proportional to the distance between them (D_{ij}). This is expressed in the following equation form:

$$GF_{ij} = \frac{\mathrm{M_i M_j}}{\mathrm{D_{ij}}} \quad \mathrm{i} \neq \mathrm{j}$$

2.3.1.2 Theoretical considerations

Starting with the pioneer Tinbergen (1962), researchers have estimated bilateral trade flows with the gravity model in numerous research papers. One theoretical justification of this approach is that the model predicts the pattern of international trade using economic factors and distance between two countries. This justification relies on the assumptions that bigger countries tend to trade more as well as more distant countries tend to trade less. As a result, gravity models of international trade implement the previous equation by using trade flows or exports (X_{ij}) from country *i* to country *j* in place of the gravitational force; in equation form, this is expressed as follow:

$$X_{ij} = \mathrm{G}\frac{\mathrm{M_i^{\beta_1} M_J^{\beta_2}}}{\mathrm{D_{ij}^{\beta_3}}} \quad \mathrm{i} \neq \mathrm{j}$$

Where G is a constant; M_i and M_j represents the economic mass of each the country pairs (often GDPs of both countries); and D_{ij} is the distance between the bilateral countries.

The traditional approach to estimating the above equation transforms the model in logarithm form; hence, the basic form of the model is as follows:

$$\ln X_{ijt} = \beta_0 + \beta_1 lnGDP_{it} + \beta_2 \ln GDP_{jt} - \beta_3 \ln Dist_{ij} + \varepsilon_{ijt} \quad i \neq j$$

where X_{ijt} is export from country *i* to country *j* in period *t*; GDP_{it} and GDP_{jt} represent respectively the gross domestic products in the exporting country *i* and importing country *j* in period *t*, representing trade costs between the bilateral trading countries; $Dist_{ij}$ is the geographical distance between country *i* and *j*, *representing trade costs*; and ε_{ijt} is the error term.

In general, the expected signs of GDPs are $\beta_1 > 0$,$\beta_2 > 0$, when mass is associated with the gross domestic product (GDP) of the bilateral trading. However, the economics of the equations above can lead to the interpretation of GDP as income, and when applied to agricultural goods (our case study), Engel's laws allows for GDP in the destination country to have a negative influence on demand for imports. Hence, it is possible that, $\beta_2 < 0$.

2.3.1.3 Econometric estimation of the gravity model

Since the gravity equation is in logarithm form, the logical methodology to use to estimate the model is the ordinary least squares (OLS) method. However, this approach encounters several issues such as endogeneity and heteroskedasticity problems leading to bias and inconsistent OLS estimates (Santos Silva and Tenreyro, 2006). As an alternative, several authors proposed various approaches to control for firm heterogeneity, zero trade value, and h heterosckedasticity (Helpman et al., 2008; Martin and Pham, 2008; Santos Silva and Tenreyro, 2006); Further, Anderson and van Wincoop (2003) propose the inclusion of multilateral resistance terms and fixed effects for consistent estimates of the gravity equation. However, all these results were challenged by Santos Silva and Tenreyro (2006) who propose the Pseudo Poisson Maximum Likelihood (PPML) approach that is not only consistent with heteroschedasticity, but also provides a way to deal with zero values of the dependent variable.

Therefore, following Shepherd and Wilson (2013), this chapter uses the Poisson pseudo-maximum likelihood approach (PPML) with fixed effect by Santos Silva and Terenyo (2006) to estimate the gravity model. The PPML is robust to heteroskedasticity problem and deals with zero trade flows observations Santos Silva and Terenyo (2006). Further, we include important variables that generally capture trade costs as well as EU harmonized standards.

2.3.2 Model

The traditional gravity model includes the GDPs of the bilateral pairs; however, we observe a new trend in recent empirical bilateral trade studies applying the gravity model without the GDPs of the trading countries (Disdier & Marette; 2010 and Feenstra; 2004). Disdier et al. (2008) point out that the size effects of income can be captured by using the fixed effects estimation approach. Hence, the use of the PPML with fixed effect by Santos Silva and Terenyo (2006) in this chapter is relevant. While we are very conscious of the importance of fixed effects by Anderson and van Winncoop (2003) and Disdier et al. (2008), and concerned about the empirical validity of the traditional specification (including GDPs as additional control variables), we consider the implication of different estimators in this paper. We, therefore, consider the earlier and recent trend in the school of thought on the relevance of including GDPs. First, we estimate a gravity model that utilizes the traditional specification with GDPs. Then, following Disdier & Marette (2010) specification, we exclude the GDPs from our gravity equation. Our empirical models are expressed into the following equations:

(a) Models with GDPs

Model 1: Trade model for raw products

$$(1)\ \ln X_{ijt}^{R} = \alpha_0 + \alpha_1 \ln Distance_{ij} + \alpha_2 Colony_{ij} + \alpha_3 Language_{ij} + \alpha_4 Contiguous_{ij}$$

$$+ \alpha_5 \ln ISO_{jt}^{R} + \alpha_6 \ln nonISO_{jt}^{R} + \alpha_7 \ln ISO_{jt}^{P} + \alpha_8 \ln nonISO_{jt}^{P}$$

$$+\alpha_9 Developing_i + \alpha_{10}(Developing_i * lnISO_{jt}^{R})$$

$$+ \alpha_{11}(Developing_i * lnISO_{jt}^{P}) + \alpha_{12} lnGDPe_{ij} + \alpha_{13} \ln GDPi_{ij}$$

$$+ \delta_i + \delta_j + \delta_t + \varepsilon_{ijt}$$

Model 2: Trade model for processed products

$$(2)\ \ln X_{ijt}^{P} = \beta_0 + \beta_1 \ln Distance_{ij} + \beta_2 Colony_{ij} + \beta_3 Language_{ij} + \beta_4 Contiguous_{ij}$$

$$+ \beta_5 \ln ISO_{jt}^{R} + \beta_6 \ln nonISO_{jt}^{R} + \beta_7 \ln ISO_{jt}^{P} + \beta_8 \ln nonISO_{jt}^{P}$$

$$+\beta_9 Developing_i + \beta_{10} (Developing_i * lnISO_{jt}^{R})$$

$$+ \beta_{11}(Developing_i * lnISO_{jt}^{P}) + \beta_{12} lnGDPe_{ij} + \beta_{13} \ln GDPi_{ij}$$

$$+ \delta_i + \delta_j + \delta_t + \varepsilon_{ijt}$$

(b) Models without GDPs

Model 1: Trade model for raw products

$$(1)\ \ln X_{ijt}^{R} = \alpha_0 + \alpha_1 \ln Distance_{ij} + \alpha_2 Colony_{ij} + \alpha_3 Language_{ij} + \alpha_4 Contiguous_{ij}$$

$$+ \alpha_5 \ln ISO_{jt}^{R} + \alpha_6 \ln nonISO_{jt}^{R} + \alpha_7 \ln ISO_{jt}^{P} + \alpha_8 \ln nonISO_{jt}^{P}$$

$$+\alpha_9 Developing_i + \alpha_{10}(Developing_i * lnISO_{jt}^{R})$$

$$+ \alpha_{11}(Developing_i * lnISO_{jt}^{P}) + \delta_i + \delta_j + \delta_t + \varepsilon_{ijt}$$

Model 2: Trade model for processed products

$$(2)\ \ln X_{ijt}^{P} = \beta_0 + \beta_1 \ln Distance_{ij} + \beta_2 Colony_{ij} + \beta_3 Language_{ij} + \ \beta_4 Contiguous_{ij}$$

$$+\ \ \beta_5 \ln ISO_{jt}^{R} + \beta_6 \ln nonISO_{jt}^{R} + \beta_7 \ln ISO_{jt}^{P}\ + \beta_8 \ln nonISO_{jt}^{P}$$

$$+\beta_9 Developing_i\ + \beta_{10}\ (Developing_i * lnISO_{jt}^{R})$$

$$+\ \beta_{11}(Developing_i * lnISO_{jt}^{P}) + \delta_i\ + \delta_j + \delta_t + \varepsilon_{ijt}$$

where the superscripts *R* and *P* represent raw and processed products; δ_i , δ_j, δ_t are time and country fixed effects representing MRTs of trading partner *i* and *j*'s, respectively. The equations above are estimated separately. Model 1 attempts to examine the impact of ISO and non-ISO standards on raw products as well as the impact of standards on processed products on trade effect of raw products ($ln\, X_{ijt}^{R}$). Similarly, in model 2, the trade effect of processed products ($ln\, X_{ijt}^{P}$) is explained by standards of raw products as well as processed products, and other potential variables. $Colony_{ij}$; $Language_{ij}\ and\ Contiguous_{ij}$ are respectively dummy variables that take the value of 1 when two trading countries *i* and *j* have a past colonial relationship, a common official language and share a common land border. Variable $lnDistance_{ij}$ is included in the gravity model to see the distance effect on bilateral trade. Further, we also include a country dummy variable $Developing_i$ in order to determine the volume of trade when the exporting country is developed or not. The main variables of interests are $lnISO_{jt}^{R}$, $lnISO_{jt}^{P}$, $lnNonISO_{jt}^{R}$, and $lnNonISO_{jt}^{P}$, representing counts of the standards that are harmonized with international norms (*ISO*) and those that are not (*NonISO*). The interactions terms $(Developing_i * lnISO_{jt}^{R})$ and $(Developing_i * lnISO_{jt}^{P})$ capture the effect of internationally harmonized standards for each type of product (raw or processed) on developed and developing countries. In line with the literature, we expect to find negative coefficients of these two parameters, as product standards affect developing countries more. Gross domestic products in each exporting country ($lnGDPe_{ij}$) and gross domestic products in each importing country ($ln\,GDPi_{ij}$) represent economics size of the bilateral countries. As mentioned earlier, we also include time, exporter and importer fixed effects to take into account multilateral resistance terms as suggested by Anderson and van Wincoop (2003).

2.4 Data

Trade data are from the Eurostat trade database (Eurostat, 2010). Control variables such as geographical disctance, contiguity, colonial ties, and common languages are from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database; developing, ISO and NonISO standards are from the World Bank's EU standards Database (EUSDB)[8] based on the CE-Norm and the Perinorm database. The definitions of all variables are in table 2.1. The dataset covers the period from 1995 to 2003 and includes both developed and developing countries[9]. In this chapter, we use secondary data provided by and employed in Shepherd (2007). Following Shepherd and Wilson (2013), the current chapter differentiates effects of products standards that are equivalent to ISO against those that are not. However, we consider a single sector by covering only agricultural products from HS chapter 10 (cereals) and 19 (preparation of cereals, flour, starch or milk; bakers wares) at the two digit level. Figure 5 and figure 6 show product standards over time for raw (cereals) and processed products (preparation de cereals, flour, starch or milk; bakers

[8] EUSDB concentrates on European product standards at the community level and does not include data on national standards from individual member states. In addition, see Shepherd (2007) and Shepherd and Wilson (2013) for information concerning the construction of the standard variables.

[9] To see the list of countries used in this chapter, use link provided by Shepherd (2007)

wares), respectively. For both raw and processed products, the number of non-ISO product standards increase over time. ISO standards, however, are constant over time.

2.5 Results and Discussion

Table 2.2 displays the estimation results of the PPML regression with FE. We do not report the fixed effects parameters for simplicity. The first column reports estimation results for trade of raw commodities whereas the second column shows the parameter estimates for trade of processed products. Most of the variables are statistically significant in both trade models. As expected, distance is negative and statistically significant in both models, indicating that geographically close countries pairs tend to trade more than other countries (0.326% in model 1 and 0.302% in model 2). This result is in line with previous study by Disdier and Head (2008) who reported a large negative distance effect on bilateral trade between country pairs. The dummy variables for countries sharing the same official language are positive and statistically significant. For instance, concerning trade for raw products (column 1), result show that countries speaking the same official language tend to trade more than other country pairs (1,011%). Similarly, bilateral cereal exports between country pairs sharing a common border (*contiguity*). In contrast, colonial relationship (*colony*) between country pairs does not have a significant impact on trade between countries. Further, the coefficient for developing country is negative and significant. Coefficients are respectively -8.417% for model 1 and -11.206% for model two, indicating that developing countries trade less cereals than developed countries, especially for the export of processed cereals (model 2). Our result is consistent with our expectation and in line with Shepherd and Wilson (2013) who report that there is a lower volume of trade for some specific products from developing countries than developed countries.

Concerning our main variables in the first column, results show that ISO standards on raw commodities (*ISO_R*) have a negative effect on the trade of raw commodities (-0.037%), indicating the potential role of the international standards as trade barriers. However, the effects of non-ISO standards on raw commodities (*NonISO_R*) are positive and significant (0.031%). In contrast, the coefficient for the standards imposed on processed products (*NonISO_P*) is not statistically significant, showing that these standards do not help strengthen trade for raw products. However, ISO standards imposed on the processed commodities (*ISO_P*) have a positive effect on trade of raw commodities (0.027%). These findings suggest an ambivalent effect of the standards on trade as seen in the gravity literature. In the two cases, evidence confirms that these standards act as barriers or as catalysts depending on the case. Concerning our interaction terms, results are similar to Shepherd and Wilson (2013) findings, suggesting that ISO standards on both raw and processed commodities (*ISO_R and ISO_P*) tend to promote trade in developing countries whereas non-ISO standards for both types of products (*NonISO_R and NonISO_P*) reduce the volume of trade for developing country exporters.

In the second column, most parameters estimates are similar to the results in the first model. However, non-ISO standards on processed food are statistically significant and reduce the volume of trade of processed food (-0.047%). This implies that a reduction in the non-ISO standards imposed on processed cereals would result in a decrease of 0.047% in bilateral export.

Concerning the interaction terms *Devloping***ISO_R* and *Developing*ISO_P*, result show that the total effects[10] are positive and significant, respectively 0.042% and 0.055% in the first

[10] Variables are interactions terms including a continuous (ISO standards) and a 1/0 dummy variable (*Developing*); hence, for developing countries (*Developing* =1), total effects are obtained as follows:
Total effect for ISO standards: coefficient of *ISO* + coefficient of Interaction term * coefficient of *Developing)*
In model 1 Total effect for ISO_*R* =-0.036+0.078*1 =0.042; total effect for *ISO_P* is 0.0027+0.028 =0.55; Total effect for *nonISO_R* =0.031-0.043*1 =-0.012;

model. This implies that a 1% increase in ISO standards imposed on both raw and processed food tend to increase trade volume of raw products for developing exporter countries (column 1). Results are similar in the second model with positive effects[11] on exports. The positive impact implies that trade volume for processed food goes up when more standards are imposed on raw (0.041%) or processed products (0.071%). In contrast, although, the coefficient for the interaction term *Developing*nonISO_P* is statistically significant, increasing non-ISO standards on raw products (*NonISO_P)* plays no role on trade flows of raw products in developing country (column 1). However, there is a positive and significant coefficient of *Developing*nonISO_R* (0.201) in column 2. This indicates that trade of processed products in developing country food goes up by 0.182% (total impact) due to stricter non-ISO standards imposed on raw products (*nonISO_R)*. Further, the coefficient for *Developing*NonISO*_P is statistically significant and negative (-0.072); this result demonstrates that a 1% increase in the non-ISO standards imposed on processed products (*NonISO_P*) have a negative impact on trade volume, reducing export of processed product by 0.12%.

Concerning the impact of GDP on bilateral trade, results shows that gross domestic product variables in each country are statistically significant, as expected. In model 1, the coefficient for GDP of the importer country is negative (-0.04%) as expected, showing that trade for raw products decreases with GDP of the importer countries while it increases with GDP of the exporting country (0.241%). In model 2, the coefficients of GDPs are both positive showing that trade of processed products increases with an increase in GDPs of the importer (0.341%) and the exporter countries (0.103%). This is in line with earlier trend of studies that shows that GDP is an important variable

[11] In model 2, Total effect for *ISO_R* =-0.030+0.071*1 =0.041; total effect for *ISO_P* is 0.033+0.038 =0.071; Total effect for *nonISO_R* =-0.019+0.201*1 =0.182; Total effect for *nonISO_P* =-0.047-0.073*1 =-0.12.

to include in the gravity model (Anderson, 1979; Bergstrand, 1985; Helpman, 1987). This finding is also confirmed in more recent studies (Khosla, 2015; Martin and Pham, 2015) that show that GDPs of exporter and importer countries contributes significantly to trade flows among these countries. Hence, our findings highlight that the traditional model with GDP measurements is consistent with the gravity model as it predicts that trade depends on country size.

When GDPs are excluded from the gravity equation, we observe no statisctical differences in the results, as they are similar for models including GDPs and for models without GDPs in terms of significance and magnitude. We, further, test the fit of the different estimators here using a joint test of our control variables and a likelihood ratio test to compare both models. The joint test reports that all variables are jointly significant (p=0.0147). In addition, the likelihood-ratio test reports also that they are significant at 0.06%. Therefore, concerning the relevance of including or not GDPs in the gravity model, our results shows that both the traditional specification (including GDPs variables) and the new specification without GDPs are empirically valid in our particular analysis.

Overall results indicate that product standards that are not equivalent to ISO standards (*NonISO*) inhibit trade for developing countries, as the total impact for Non-ISO standards imposed on either raw or processed products have a negative effect. However, the total impact for internationally EU harmonized standards (ISO) on raw or processed products is positive, increasing trade in developing countries. Nevertheless, concerning the main effects of product standards on trade, the impact varies depending on the product. Further, this chapter highlights the evidence that the impact of EU standards depends on the category product (raw or processed).

2.6 Conclusion

This chapter shows empirical evidence on the mixed effects of food safety standards on bilateral trade. Results suggest that internationally harmonized EU standards as well as national standards tend to act as catalyst or barriers. However, these internationally harmonized EU standards have a larger impact compared to the non-ISO standards. Further, internationally harmonized EU standards on processed products promote trade of raw agricultural products rather than lowering trade. This result is consistent with the argument that standard can act as catalysts.

The current work makes an important contribution to the existing literature on the impact of products standards on bilateral trade. Although there is various published chapter on the trade impact of food safety standards, this chapter is unique for the following reasons. First, the chapter distinguishes the trade effects of the internationally EU harmonized standards equivalent to ISO to those that are not. In addition, like Shepherd and Wilson (2013), this chapter explores the differential impact of these standards on demand and supply of two categories of commodities: raw and processed. More, this chapter provides evidence on the impact of standard on one category product (raw or processed) on the demand and supply for the other type. Overall, impact of more stringent product standards on commodities (either raw or processed) is an important matter because these strict standards inhibit trade for developing countries.

Chapter 3: Impact Assessment of Microcredit Services (SACCOS) on Households in Tanzania: Evidence from Gender Differences

3.1 Introduction

In Tanzania, the level of poverty remains high with one-third of the population still living in extreme poverty (World Bank, 2013). Tanzania's economic growth is driven by various industries mostly located in urban areas, including construction, transportation, communication, and retail sectors. Despite the significant contribution of these sectors to increasing productivity in agriculture and creating off-farm jobs, the poorest families tend to be left behind with rural households that depend on relatives or social ties to face everyday life challenges. One successful strategy from the Tanzanian Government in addressing poverty eradication consists of increasing access to sustainable rural financial services. The provision of credits to the poor is an effective development and poverty alleviation tool. Worldwide, microfinance institutions (MFI) promote social and economic empowerment of its members, with a positive impact on savings, businesses, health, education and food security. Numerous studies highlight the success of financial services on the poverty reduction challenge around the world. For instance, a cash transfer program implemented by the Tanzania Social Action Fund (TASAF[12]) showed promising results in addressing the needs of the poor population in Tanzania (World Bank, 2013). Such program may be part of the solution in getting poor households out of poverty;

[12] TASAF is a government program implemented to enable poor household to access opportunities to increase their income. The program targets the third of the population of Tanzania living below the poverty line. (http://www.tasaf.org/index.php?option=com_content&view=article&id=93&Itemid=122)

however, one major concern in this chapter mainly focus on whether such program is beneficial for everyone, with considerations on gender (men or women). At the household level, it is important to target the main recipients of the program within poor rural households, especially women who have limited access to credit. In Tanzania, women face cultural barriers that hinder them from resource accessibility, including financial services. Thus, very few of them can join these programs due to limited access to credits. In other words, women in Tanzania as well as in some other African countries do not own assets for collateral purposes and cannot easily access credit from commercial banks and MFIs. In this chapter, we attempt to evaluate the impact of financial services on the people’s livelihoods, focusing on gender.

A growing body of literature assesses the impact of MFIs in developing countries; however, most recent studies focus mainly on evaluating the impact of microfinance institutions at the macro level—assessing assessing their impact on a country’s growth—or on the performance of small businesses. This chapter, on the other hand, focuses on the effects at the household level, and evaluates the impact of one specific microfinance institution, SACCOS, which is one of the pioneer member-based MFIs in Tanzania.

3.1.1 Overview of the role of financial institutions in Tanzania: case of SACCOS

The microfinance sector in Tanzania is composed of a wide range of formal, semi-formal and informal financial institutions, groups and individuals. The majority of member-based MFIs, which include formal and informal institutions in Tanzania, are the savings and credit co-operatives societies (SACCOS). SACCOS are credit societies exclusively dedicated to promote social and economic position of its members and clients.

Beginning in 1995, MFIs in Tanzania started with non-governmental organizations (NGOs) and SACCOS. We note a sharp increase of SACCOS due to governmental and non-governmental initiatives in promoting SACCOS. The number of SACCOS in Tanzania rose from 133,134 organizations in 2000 to 919,411 institutions recently. These institutions are mainly linked to poverty eradication with a focus on gender. Although one of the main goals of many financial institutions as well as SACCOS is to empower women by improving their financial power and position them equally to men in the society, the number of women in SACCOS remain low. Participation in SACCOS has been different for women and men; the distribution in SACCOS members in Tanzania consists of 914,560 men (60.10%) and 607,133 women (39.89%) in 2012. Reasons for lower participation of women compared to men is due to social and economic factors in which they live (Maleko et al., 2013; Girabi and Mwakaje, 2013).

Consistent with the goal of all MFIs, the main aim of SACCOS is to improve the living standards of its members, particularly the poorest in communities by providing sources of credit enabling them to save and undertake social and economic activities. However, access to financial services is very limited, especially to women who face gender-specific barriers that impede them from participating in MFIs (including SACCOS). The microfinance literature reveals that most significant barriers to credit accessibility are linked to low levels of education, particularly amongst women and in rural areas (Bee, 2009). According to Maleko et al. (2013), three barriers hinder women from being member of SACCOS. First, the lack of institutional links and the lack of assets that can be used as collateral, make poor rural women ineligible to participate in SACCOS. Second, the stereotype that those women are only able to utilize small loans, and that they are unable to engage in profitable, nontraditional self-employment, constitute constraints for women. The third barrier involves the resistance of and interferences from male relatives. In many

African developing countries, men are decision makers in social and economic family matters. Thus, many women cannot engage in economic activities without the permission of their husband or male relatives. Women account for about 33% of the total of members in SACCOS (CDD, 2011). Other major reasons for poor membership by women in SACCOS include lack of property rights, inadequate understanding of SACCOS among men and women, inadequate financial education, and lack of entrepreneurship skills from women in poor rural areas (Bee, 2009 and Maleko et al., 2013).

Thus, this chapter identifies the importance of participating in SACCOS on its members. In other words, we evaluate the impact of participation, by gender, in SACCOS on household outcomes. Hence, this chapter is a significant contribution to the literature in evaluating gender difference impact of MFI, particularly SACCOS in Tanzania. Most empirical studies use cross-sectional data, which may not be robust due to selection and endogeneity problems. The current chapter, however, uses a rich panel data that control for these issues. Thus, the main objective of this chapter is to assess the impact of participation to SACCOS by gender on the standards of living, using an interesting national panel survey data from the World Bank Living Standards Measurement Survey.

The current chapter is as follows: the first section reviews relevant literature on importance of microfinance institutions, including SACCOS in Tanzania. The second section provides the theoretical framework of this study based on the literature review, followed by the methodology used to assess empirical evidence of the microfinance impacts on households' standards of living. The final sections present the results and conclusion.

3.2 Literature Review

Pitt and Khandker (1998) investigate group-based credit programs on poor households in Bangladesh and found that participation in these credit programs is significantly important for labor supply, schooling for girls and boys, expenditures and assets. The study shows a larger effect on households when the program participants are women. Likewise, Khandker (2005) reports a 17% decline in poverty in all villages in Bangladesh due significantly to participation in MFIs. Similarly, Maldonado and Gonzalez-Vega (2008) report that access to MFIs in Bolivia has a significant impact on schooling. Further results, from a two-sample survey, suggest that for both samples children in households with a long tenure of participation in MFIs are more likely to stay in school compared to children who are from households that recently entered MFIs. However, the authors found no significant difference between girls and boys in their schooling achievements. Overall, this study shows the importance of MFIs membership in Bolivia as participation in financial institutions improves income and increases demand for education. Microfinance in SSA is growing in most developing countries. Research suggests that microfinance is a key development tool. In evaluating the impact of MFIs on smallholder farm productivity in Tanzania, Girabi and Mwakaje (2014) found evidence of higher agricultural productivity for credit beneficiaries due to better market access for agricultural commodities, use of inputs and adoption of improved farming technologies. The findings suggest that MFIs in African developing countries contribute to poverty alleviation.

Nevertheless, the MFIs in Africa particularly in Tanzania face several challenges. For instance, most MFIs in Tanzania are concentrated in urban areas instead of rural areas with a high concentration of poor communities and people have limited access to credit services.

Given the limitation of credit facilities in rural areas, an important issue is client targeting, particularly for gender equality. Abebaw and Haile (2013) report that cooperatives members in Ethiopia are more likely to be male and have better access to agricultural extension services. Further, the authors also found that male members in cooperatives are more likely to participate in off-farm work and have leadership experience. Women in Tanzania are dominant participants in crop and livestock production. They often save their monies and engage in small enterprises that raise the value received from their production. In many countries, these enterprises prosper but fail to develop into full-blown industries because of limited credit available to women. Due to their limited access to property and limited sources of collateral security, some financial institutions are not willing to lend to women. However, women are responsible and more trustworthy concerning loan repayment. Numerous studies in various countries have shown that women have higher savings rate as well as higher repayment rates than men (Hosain, 1988; Khandker et al., 1995; Kevane and Wydick, 2001; World Bank, 2007; Christabell, 2009). For instance, in a global analysis of 350 MFIs within 70 countries, D'Espallier et al. (2011) report strong evidence of a positive relation between female and repayment, suggesting that MFIs with higher proportions of women participants have lower portfolios at risk, lower write-off rates and lower credit-loss. In Tanzania, Weber and Musshoff (2012) suggest that loans given to female participants have higher repayment rates than men.

Major functions of MFIs, particularly SACCOS in Tanzania, include not only credit to its clients, but also savings, insurance and money transfers. Due to low participation rate of women joining these institutions, membership of women in SACCOS has been a major concern for researcher and policy makers. Few empirical studies exist on women participation in membership in SACCOS (Maleko et al., 2013). Therefore, it is important to evaluate the impact of membership in SACCOS on the poor household in Tanzania.

3.3 Methodology

3.3.1 Theoretical framework

While much of the literature on the effect of MFIs focuses on micro businesses performance, this chapter focuses on the impact at the household level. Following pioneers Rosenbaum and Rubin (1983), Abebaw and Haile (2013), and Lyngdoh and Pati (2013), the current chapter uses a propensity score matching (PSM) framework to analyze the choice of a household to be a member of the microfinance service (SACCOS), and the impact of this choice on household outcome.

PSM is a popular method to estimate causal effect treatment. Rosenbaum and Rubin (1983) defines the propensity score (PS) as the conditional probability of assignment to a particular treatment given a vector of observed covariates. Further, the PS is a balancing score, forming matched sets of treated and untreated subjects who share a similar value of the propensity score (Rosenbaum and Rubin, 1983a, 1985). Researchers use PSM to estimate the impact of a program or policy by comparing people in the program (the treated group) to people not in the program, but the PSM matches people who are as similar as possible from the treated group to the untreated group. PSM is a relevant tool here to evaluate the impact of a treatment (SACCOS membership) on covariates (household outcomes) because it ensures a matched sample by balancing the treated group (those who participate in SACCOS) and the control group (those who are not member of SACCOS) on baseline covariates. In other words, PSM attempts to control for these differences by making both groups comparable. Further, PSM reduces the possible selection bias that may arise from differences in the outcome between the two groups, which depend on household characteristics that affect whether a household is a member in SACCOS. Therefore, we use PSM to examine the impact of membership in SACCOS, by gender on household incomes in Tanzania.

3.3.2 Model

In implementing the PSM method, we first estimate the propensity score, which is the predicted probability that a household is member of SACCOS given observed characteristics. The model is as follows

$$p\ (X_i) = Prob\ (D_i = 1/X_i\ )$$

where $p\ (X_i)$ is the propensity score estimated by a probit model by regressing SACCOS membership (D_i) on household characteristics (X_i). This first step consists in pooling the treated group (SACCOS members) and the untreated group (non-participants) and then estimating a balancing score for each subject to form a matched sample of the participants and non-participants. After estimating the propensity score, the second step is to implement the PSM method; that is match each subject in the treated group to a subject in the non-treatment group based on the propensity score. Four different propensity score matching methods are available to eliminate the effects of confounding when estimating the effects of treatment on outcomes (Rosenbaum & Rubin, 1983a). Three of matching methods that we do not use in the analysis are radius[13] (caliper), stratification[14], and kernel[15] matching estimators; however, in this chapter, we choose the nearest

[13] Radius (caliper) matching, consists on imposing a tolerance level on the maximum propensity score distance (caliper). Thus, for a given treated subject, one would identify all the untreated subjects whose propensity score lay within a specified distance of that of the treated subject.
[14] Stratification matching involves stratifying subjects into mutually exclusive subsets based on their estimated propensity score. The researcher ranks subjects by their estimated propensity score, and then stratifies subjects into subsets based on previously defined thresholds of the estimated propensity score. A common approach is to divide subjects into five equal-size groups using the quintiles of the estimated propensity score.
[15] Kernel matching (KM) is a non-parametric matching estimator that use weighted averages of all individuals in the control group to construct the counterfactual outcome.

neighbor-matching estimator to match SACCOS members to similar non-members using the predicted propensity score. The nearest neighbor matching methods consists of selecting untreated subjects whose propensity score (non-participants) is "close" to that of treated subjects (SACCOS members).

After matching, we estimate the average impact of SACCOS membership on the household as follows:

$$ATT = E(Y_{1i} - Y_{0i}|D_i = 1) = E(Y_{1i}|D_i = 1) - E(Y_{0i}|D_i = 1)$$

where ATT refers to the average treatment effect on the treated, that is SACCOS members; Y_1 and Y_0 are respectively potential outcomes variables of interest for membership (1) and non-membership in SACCOS; i represents households and D refers to the treatment (participation in SACCOS).

Further, the average treatment effect, which in this chapter is the average impact of SACCOS membership on households, is tested using bootstrapped standards errors to address the variation from the matching procedure. It is important to note two key assumptions of the PSM method. First, the conditional independence assumption, also known as selection on observables, refers to the existence of a set of observables covariates such that after controlling for these covariates, the potential outcomes are independent of treatment status. This assumption requires including in the set of covariates all variables relevant to the probability of receiving treatment. Thus, we include in our regression household characteristics such as age, education, sex, marital status and household size. One of the limitations faced in this chapter is limited data availability on other confounding variables. The second assumption is the common support, which states that the probability of being both treated and controlled for each value of the covariates is positive.

This assumption ensures that there are sufficient similarities in the characteristics of both groups (treated and untreated) to find adequate matches.

Although PSM has a practical advantage (over OLS approach) to reduce the number of dimensions, on which to match participants and comparison units, the matching approach may produce consistent estimates under weak conditions. Thus, in addition to the implementation of the PSM, we also employ a weighted least squares regression by Hirano, Imbens and Ridder (2003), which uses the predicted propensity score as weights and lead to more efficient estimates of the average treatment effect (ATE). This approach consists in using the inverse of a nonparametric estimate of the propensity score such that the treatment effect is estimated by the following equation

$$Y_i = \beta_0 + \beta_1 SACCOS_{i1} + \beta_2 X_i + \varepsilon_i$$

with weights of 1 for SACCOS members and weights of $\widehat{P}(X)/(1 - \widehat{P}(X))$ for the non-members. Y_i is the household outcome, which is the average monthly net income of household i in logarithm form; X_i is the vector of household characteristics including age, education, gender, marital status and household size. $SACCOS_{i1}$ is the treatment indicator, representing household membership to SACCOS (1 for SACCOS members and 0 for non-SACCOS members). ε_i refers to the error term. As a robustness check, we compare these estimates with the PSM estimates. Further, following Rosenbaum and Tubin (1985) and Abadie and Imbens (2006), we test for covariate balancing using differences in standardized means between SACCOS members and matched and weighted non-SACCOS members. This shows that the matching and re-weighting procedures produce satisfactory balancing of the observables between the treatment and control groups.

3.4 Data

Household level data are from the Tanzania National Panel Survey (TZNPS), as part of the World Bank Living Standards Measurement Survey (LSMS). The TZNPS contains a rich panel data, which provides households level information. The dataset used in this analysis are from a longitudinal survey conducted from October 2012 to December 2013, in rural and urban areas of Tanzania.

The TZNPS consists of four survey instruments, including household, agriculture, fishery and community questionnaires. In this chapter, we focus only on household questionnaire, which includes information on personal household characteristics, education, health, labor, food consumption, assistance and credit. The original sample consists of 5,010 households in both rural and urban areas, but after merging and transformation of the original dataset the sample is 3,262 observations. This sample is from a third wave survey conducted two years after two waves conducted respectively from October 2008 to September 2009 (3,280 households) and from October 2010 to September 2011 (3,924 households). This third wave survey revisits all households interviewed in previous rounds. Enumerators traced and re-interviewed household members who left or moved to a new location.[16] The attrition rate is 3.9% for the third wave, which is slightly higher than the attrition rate of the second round (3%).[17] Table 3.1 presents the definition and description of the variables used in our analysis. The dependent variable is household monthly

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[16] The NPS 2012/13 tracked all individuals present in the NPS 2008/09 and the NPS 2010/2011 regardless of their household membership status. Most common reasons for households splitting over time are marriage and migration. Around 96 percent of second-round households were successfully tracked. Thus, the NPS sample grew from 3,924 households in the second-round to 5,010 in the third-round, due to those household members who left their original households to start new households of their own or move with other households.

[17] A potential explanation of the change is the inability to find any member of a household rather than the refusal to participate in the second or third-round of the survey. Thus, we conduct an attrition correction in the original TZNPS LSMS data using a logistic regression model; hence, we do not worry about attrition problems in our empirical analysis.

net income. Since the distribution of the household outcome is right skewed, the logarithm transformation of the variable is necessary to have a normal distribution. The explanatory variables include two variables of interest. The first variable is the treatment variable, which is the participation in membership to SACCOS taking the value 1 for the treated group and the value of 0 for the control group. The second variable is gender, which takes the value of 1 for females, and the value 0 for males. All categorical variables are recoded in this analysis for simplicity; details are given in the description of variables. Table 2 provides the summary statistics of all variables used in this analysis.

3.5 Results and discussion

3.5.1 Descriptive statistics

As observed in table 3.2, of 3,262 household respondents, only 5.55% of the household members are members of SACCOS. On average, households in our sample have a net income of 1,282,298 TZS[18] ($801.22). Average income in the female sample is 1,221,289 TZS while among the males, income is higher and approximately 1,490,117 TZS. Among the respondents that are SACCOS members, about 59.7% are female on average, and 70.2% are married or lived together. The average level of education of the respondents is primary (17.86%). When sorted by membership, results indicate that those that are members of SACCOS have a higher average net income of 1,666,652 TZS ($1,041.66) of than the non-participants do (1,259,718 TZS or $787.32). This result is consistent with the empirical literature, suggesting than participation to credit services improve

[18] TZS is the national local currency in Tanzania: Tanzanian Shilling.
Average USD/TZS exchange rate in the period 2013 was 1,600.44. (World Bank database 2014. http://data.worldbank.org/country/tanzania)

household welfare by increasing income. Concerning education level, most of the respondents that are members of SACCOS have higher levels of education than those in the control group. Further, regarding age and gender of those who are SACCOS members, result shows that participants are on average 39 years old with 59.7% of them are female. This implies that women are more likely to seek out credit or join cooperatives compared to men. Figure 7 confirms the latter, as women demand more credit compared to men. The distribution of income for women is much smaller than income for men. In addition, the number of the married or living together couples in the treated group (70.2%) is higher than those in the control group (64.8%).

3.5.2 Propensity score matching

Findings for the propensity score matching are in table 3.3. The estimates for the probit models tell a consistent story. The dependent variable in the probit models is participation in membership in SACCOS. The signs of the coefficients are the same across the models, except for household size in the male sample, which is not significant; the same variables are statistically significant in each model, except for household size. Results indicate a significant positive relationship between participation in SACCOS and household characteristics in the total sample and the female sample. For instance, the likelihood of participation in membership increases with age (0.002), marital status (0.137), and education (0.066) in the first column; this shows that older, married and more educated household respondents are likely to receive treatment. The coefficient for female is statistically significant (0.139) ($p<0.05$), indicating that females are more likely to be member of SACCOS compare to men. Marital status is statistically significant ($p<0.10$) indicating that the SACCOS membership probability increases when the head of household is married or live with a partner. However, household size is not statistically significant. As expected, the sign of the average treatment effect is positive and statistically significant (0.167), suggesting that those in the treated group are likely to generate more income than those in the control group (non-SACCOS members). Thus, SACCOS members generate 16,700 TZS (US$ 10.43) more than the non-SACCOS members, monthly. This finding highlights that participating in SACCOS membership has a positive impact on household income, and may improve household well-being. This is consistent with the literature (Girabi and Mwakaje, 2013; Salia and Mbwambo, 2014) which suggests that participation in credit programs is a useful tool to alleviate poverty and improve living standards.

Among women in the sample, results are similar concerning age, education, marital status. Table 3.3 indicates that the likelihood of being a member of SACCOS increases with age (0.02), marital status (0.213), and education (0.104); Household size also increases the likelihood to be member of SACCOS by 0.118%. Further, evidence also shows that income is higher for those who join SACCOS. For this sample, the average treatment effect is 0.156 more for the treated group, that is women that are SACCOS members have a higher monthly income of 15,600 TZS (US $9.75). Although women have limited access to financial services, this result implies that joining microfinance institutions (including SACCOS) contributes to women's income.

Concerning the male sample, age, marital status and household size do not matter in the likelihood of being SACCOS member. This is in line with the literature as requirement and participation in SACCOS are different for women and men. Only education is statistically significant (0.048), showing that the survey respondents with a higher education are likely to be members of SACCOS. The average treatment effect is 0.265 showing that men who are SACCOS members are likely to have 26,500 TZS (US$ 16.56) more than those who are not members.

3.5.3 Weighted Least Squares (WLS)

Results for WLS regression are in Table 3.4. The coefficient for age is not statistically significant for the total sample and among men only; however, age is positive and statistically significant among the women. As observed in the probit models, marital status is positive and statistically significant in the total sample and the female sample. However, compared to the female sample, marital status does not matter for household income in the male sample. As expected and like the probit results, education contributes significantly to household income in all three sample. The coefficient, which is significant ($p<0.10$), indicates that head of household with a higher level of education tends to generate a higher income than those less educated. Concerning the main variable of interest in our analysis, results show that participation in SACCOS is positive and statistically significant, showing that SACCOS contribute significantly to the member's income. This is again in line with our expectation and the literature as SACCOS increases household income, especially for male members. The result also implies that men who are SACCOS members tend to generate a larger income than women. Consistent with our expectations and consistent with the probit results, SACCOS do help its members to improve their well-being through generating higher income, especially among women.

However, looking at the results for the total sample, our finding shows a negative relationship between female and household income (-0.162). This suggests that income is lower for female-headed household member compared to men. This result is consistent with the literature which reports that women earn less than men.

Moreover, the results of table 3.4 show that the average treatment effects are respectively 0.147 for the total sample, 0.099 for the female sample and 0.185 for the male sample. This indicates that members of SACCOS generate a higher monthly income compared to those that are not members. However, when comparing male and female samples, our findings demonstrates that male members tend to generate more income that female members.

Appendix 3, 4 and 5 report diagnostics statistics for to check if the propensity score and weighted model are correctly specified. The raw and weighted standardized differences and variance ratios of all covariates from PSM and weighted model are reported in the table. For each sample, the matched sample results indicate that matching on the estimated propensity score balanced the covariates. We observe that the standardized differences are all close to zero, and the variance ratios are all close to one.

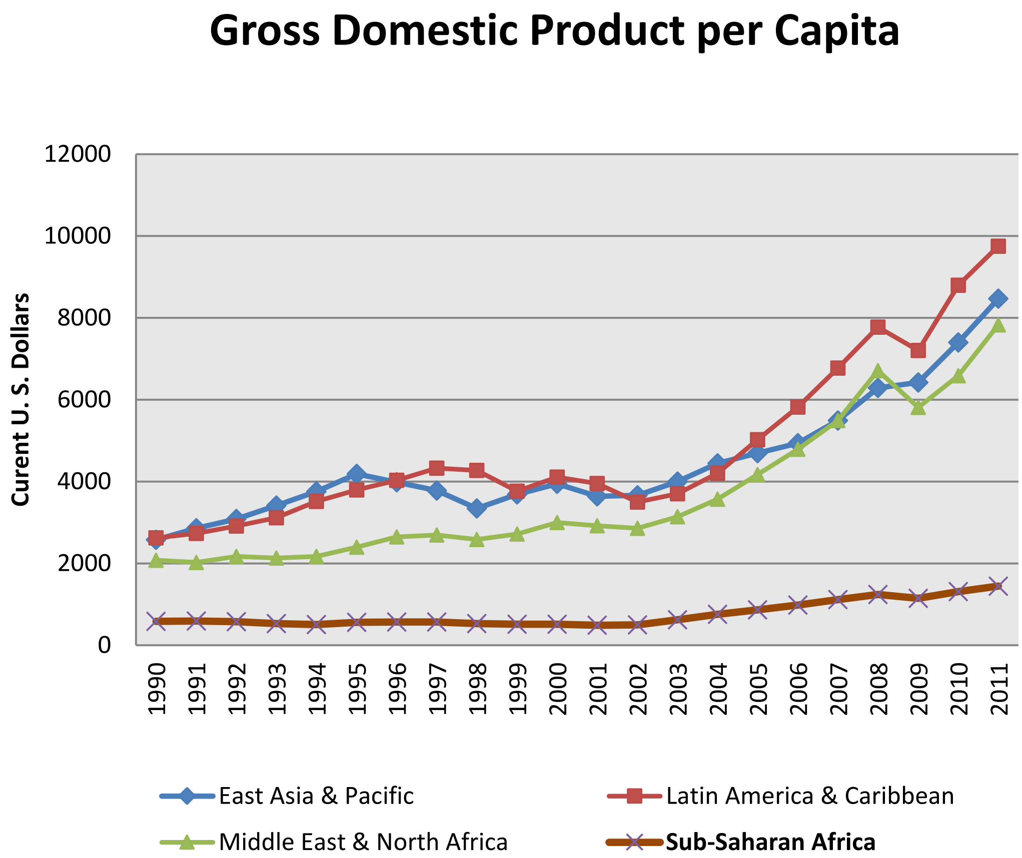
However, the weighted sample results show that the variance ratios for age, education and household size are not close to 1, indicating that the weighted least squares regression did not fully balance the covariates. Hence, this would imply the use of a richer model (including additional covariates) to see whether it balanced the covariates. We attempt to estimate a weighted least squares model that includes power and interaction terms (model and results are not reported here). However, the overidentification test reported in table 3.4 does not reject the null hypothesis of balance in the weighted model using only base covariates but not in the richer model that included power. Hence, we maintain our basic weighted model with only base covariates, as in table 3.4.

3.6 Conclusion

The current chapter examines the impact of participation in SACCOS membership by gender on poor households in Tanzania. We use the propensity score matching technique and the weighted least squares regression with panel data collected in both rural and urban areas on Tanzania. Our findings suggest that age, education and household size significantly influence the demand for credit in Tanzania, especially for women. This study reveals that women members in

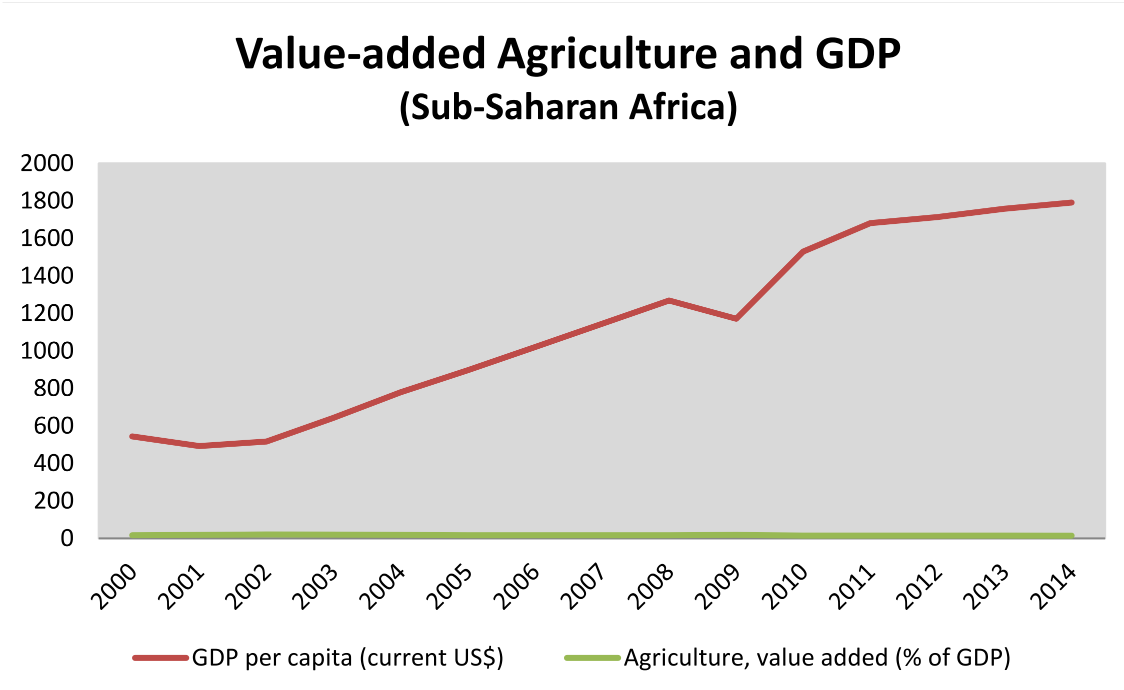
SACCOS outnumber men in looking and accessing credits services. However, results show a higher income for men compare to women, when they are SACCOS members. This finding is important, as women in many developing countries cannot easily access credit from commercial banks due to lack of collateral and property rights. Additionally, participation in SACCOS, especially among the male population increases household income.

Overall, this study confirms that microfinance institutions, particularly SACCOS, are reaching their goal to alleviate poverty among the poor rural households in Tanzania. Governments and non-governmental agencies must continue promoting and give high-priority capacity building to these institutions. Also, there is a need to implement policies and strategies to increase female participation in microfinance intuitions, such as increasing women's awareness and understanding of SACCOS. The current study is relevant and has policy implications as findings show strong evidence of the overall goal of MFIs to serve the financial needs of poor households, especially women.



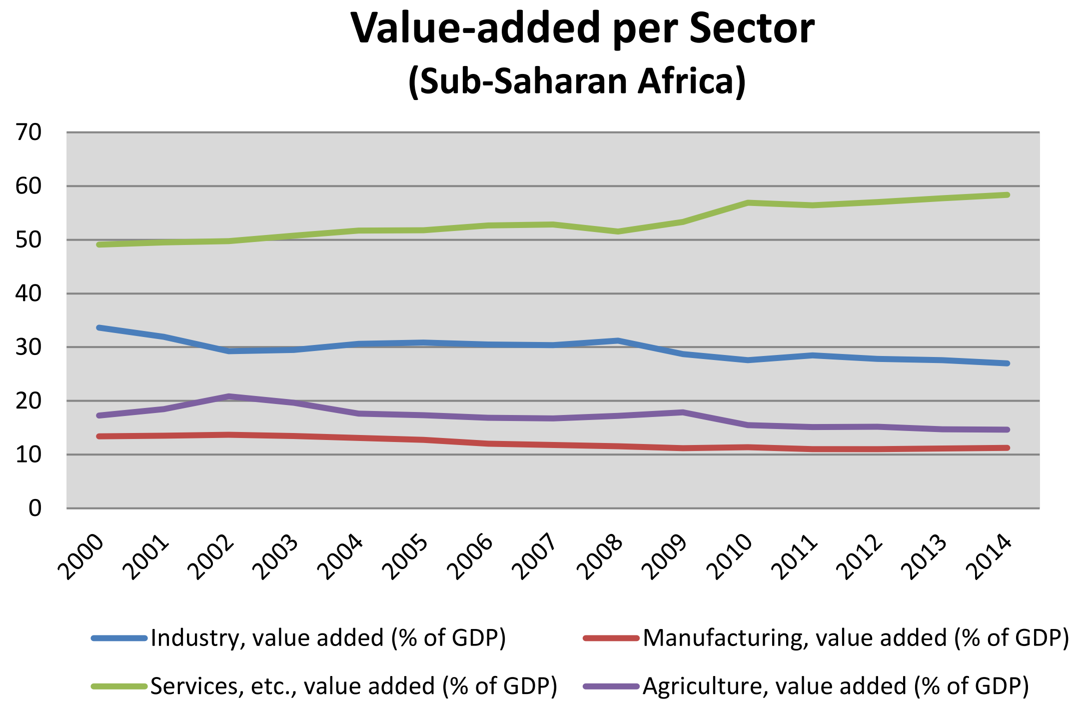
Source: World Bank, World Development Indicators database 2014

Figure 1. Gross domestic product per capita per regions



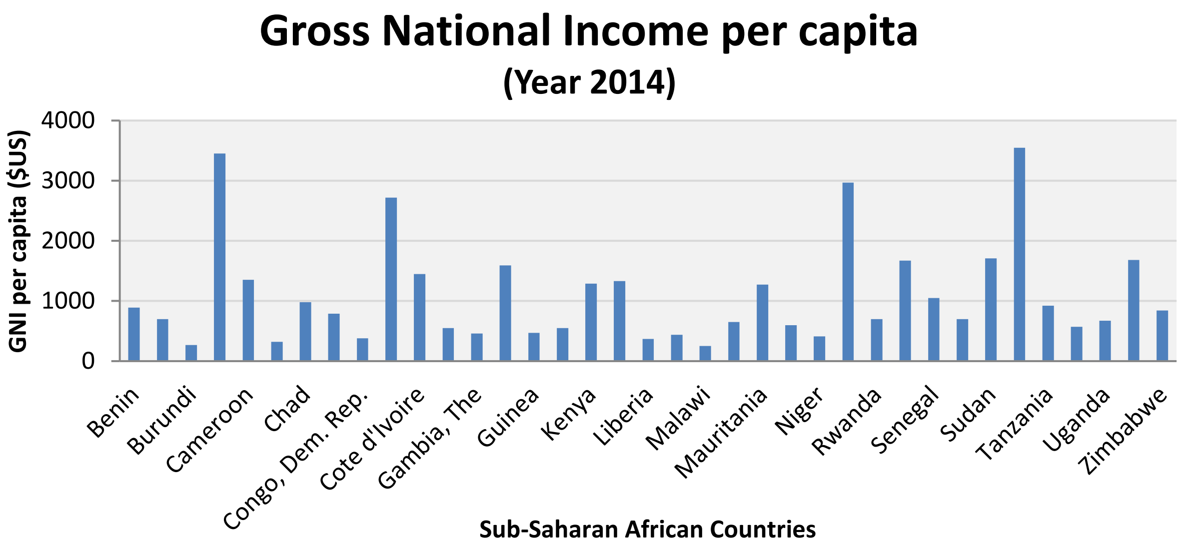
Source: World Bank, World Development Indicators database 2014

Figure 2. Value-added agriculture and gross domestic product per capita in Sub-Saharan Africa



Source: World Bank, World Development Indicators database 2014

Figure 3. Value-added per sectors in Sub-Saharan Africa



Source: World Bank_ World Development Indicators database 2014

Figure 4. Gross national income per capita in low and lower-middle income Sub-Saharan African Countries

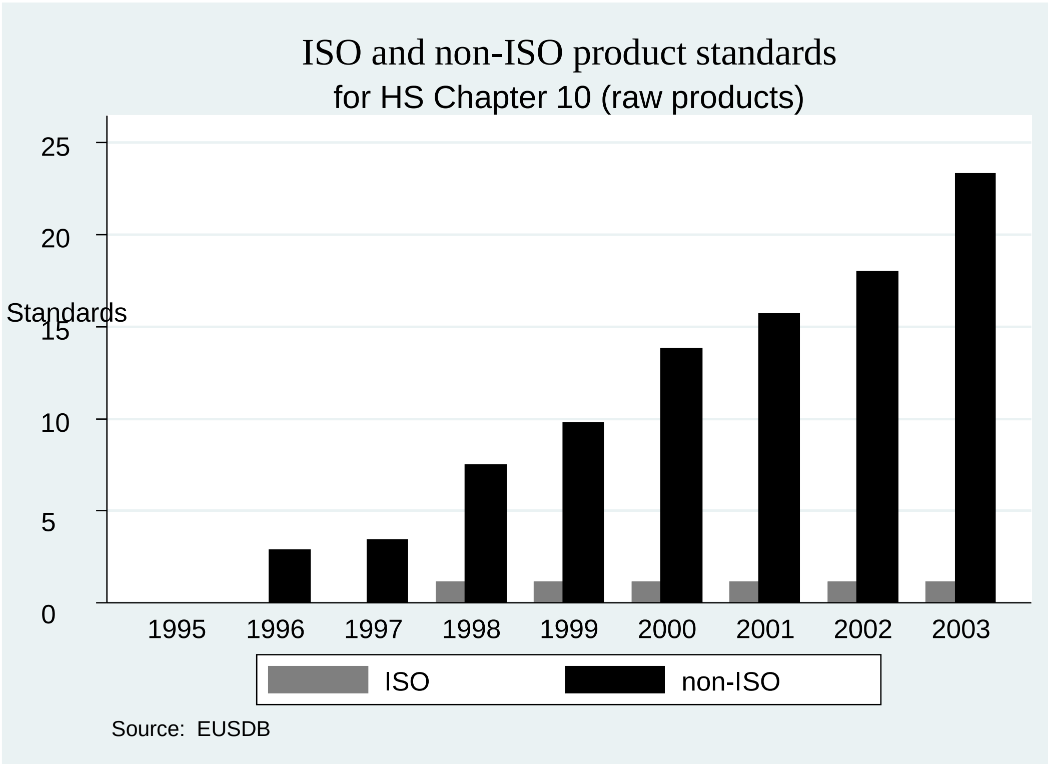


Figure 5. ISO and non-ISO standards of raw products over time, 1995-2003

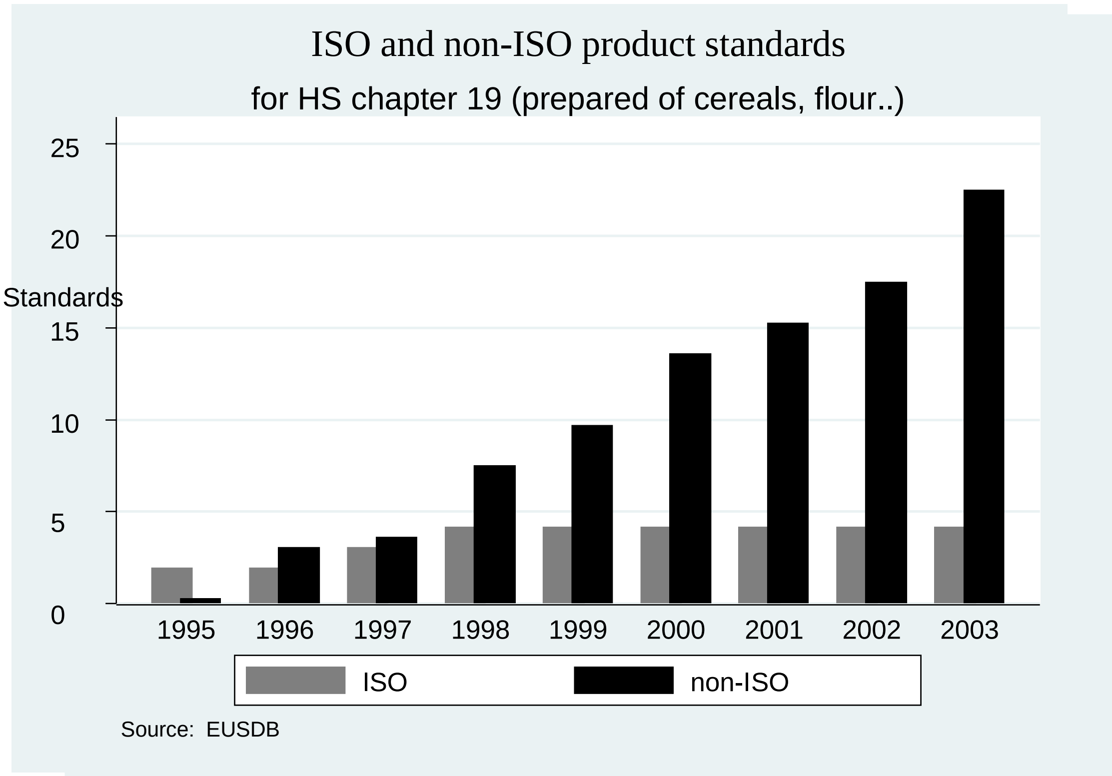


Figure 6. ISO and non-ISO standards of processed products over time, 1995-2003

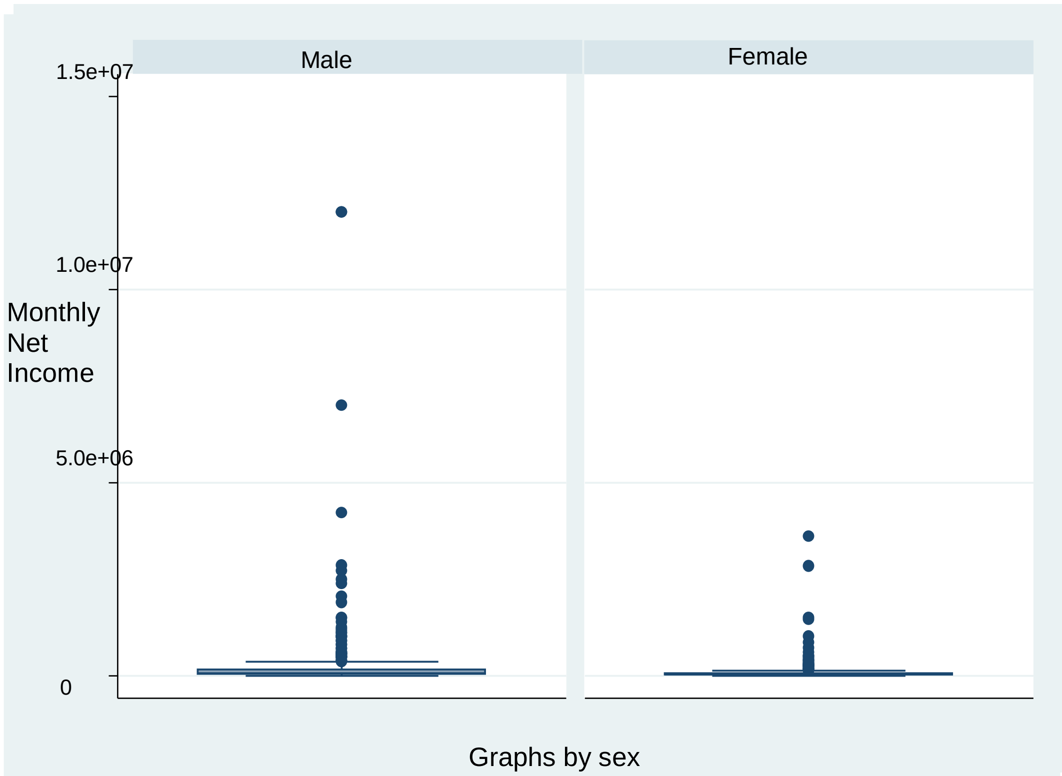


Figure 7. Household income by gender

Table 1.1 Description of variables

Variables	Description
Corruption (*corr*)	Corruption Perception Index (1=Low, 6 =High)
GDP (*y*)	Gross Domestic Product (constant 2005 US$, in millions)
Government expenditure (goe)	Government final consumption Expenditures (constant 2005 US$)
Human capital (*h*)	Human capital index, proxied with investment in human capital per person based on years of schooling and return to education
Human development (*hd*)	Human Development Index
FDI (*inv*)	Foreign direct investment, net inflows (BoP, current US$)
Labor (*l*)	Total economically active population in agriculture
Lagged GDP (*lgdp*)	Lagged value of gross domestic product (constant 2005 US$)
Openness (*open*)	Trade Openness indicator (US $ at current prices, in millions)
Physical capital (*k*)	Gross Capital Stock (constant 2005 prices)
Population (*pop*)	Population growth rates (annual %)
Rural Population (*rupop*)	Percentage of total population living in rural areas
Technology (*a*)	Technological change, proxied with time trend (year)
Value-added, agriculture (*va*)	Share of value-added in agriculture (constant 2005 US$)
Value-added, non-agriculture (*nonag*)	Value added in non-agriculture such as Industry, Services... (constant 2005 US$)

Table 1.2 Summary statistics (N=525 Observations)

Variables	Mean	Std dev.	Min.	Max.
Corruption	2.727	0.622	1	4.5
GDP	5.12e+12	1.05e+13	3.95e+08	6.80e+13
Government expenditure	1.54e+09	3.09e+09	3.60e+07	2.38e+10
Human capital index	1.6066	0.3156	1.0694	2.5503
Human development	0.4321	0.0733	0.2621	0.6359
FDI	4.98e+08	1.11e+09	-4.21e+08	8.84e+09
Labor	7702555	1.02e+07	158091	5.58e+07
Openness	4109.86	11536.22	38.527	99755.75
Physical capital	101359	211022.9	2054.008	1875939
Population Growth	2.6035	0.7199	0.5276	5.5981
Rural Population	65.4894	13.8706	35.043	91.754
Technology	8	4.3243	1	15
Value-added, agriculture	2.88e+09	7.37e+09	2.15e+07	5.87e+10
Value-added, non-agriculture	7.62e+09	1.55e+10	0	1.31e+11

Sources: Penn World table 9.0; UNDP 2015; WDI 2014, unless otherwise stated.

Table 1.3 Estimation Results

		Growth model (GDP)		Human Development (HDI)
		Model 1	Model 2	Model 3
Explanatory variables	Expected Sign			
Technology	+	0.0048	0.0108	
		(0.0107)	(0.0101)	
Physical capital	+	0.0816***	0.0752**	
		(0.0296)	(0.0295)	
Human capital	+	0.1885***	0.2478***	
		(0.0615)	(0.0711)	
Value-added, agriculture	+	0.0761***	0.1926***	0.0627**
		(0.0267)	(0.0443)	(0.0277)
Lag(GDP)	+	0.7404***	0.8372***	0.0403*
		(0.0476)	(0.0444)	(0.0215)
Government expenditures	+	0.0329***	0.0104	0.0469***
		(0.0109)	(0.0124)	(0.0130)
Foreign investment	+	-0.0029	-0.0016	
		(0.0024)	(0.0025)	
Openness	+	0.0321***	0.0273**	
		(0.0112)	(0.0109)	
Population growth	-	0.0275*	0.0213	
		(0.0165)	(0.0161)	
Value-added, non-ag	+	0.0631***	0.1770***	
		(0.0169)	(0.0445)	
Ag*non-ag, value added	+		-0.0065***	
			(0.0023)	
Rural population	+			0.0630
				(0.0399)
Corruption index	-			0.0042
				(0.0449)
Constant		3.5966***	1.1712	-4.4509***
		(0.9727)	(1.0267)	(0.5261)
$F_{(5,361)}$				19.70
Wald Chi2		3,209.05	3,141.12	84.04
R-squared		-	-	0.2174
Number of Observations		276	276	398

Notes: _1_: Asterisks indicate level of significance: ***=1%, **=5%, *=10%.
_2_: Robust standard errors are in parenthesis except for OLS estimation.
_3_: All variables are in logarithm form.
_4_: In model 1 and model 2, both dependent and independent variables are in first differences.
_5_: In model 2, we use a joint test to test whether the interaction term is statistically significant different from zero. The small p-value (p=0.0047) indicates that the interaction term in the model is valid and that the market linkages between agricultural other sectors and significantly affects GDP in SSA.

Table 2.1 Definition of Variables

Variables	Definition
Contig	Dummy variable for common land border (1 if countries share a common border, 0 otherwise)
Colony	Dummy variable for colonial link (1 if countries had a colonial relationship, 0 otherwise)
Developing	Dummy variable equal 1 if exporter country is developing country, 0 otherwise
Distance	Geographical distance between trading countries
GDPi	Gross Domestic Product in the exporting country
GDPj	Gross Domestic Product in the importing country
ISO	Number of ISO-harmonized standards (count)
Non-ISO	Number of nonISO-harmonized standards (count)
Language	Dummy variable for common language (1 if countries share a common official language, 0 otherwise)
Trade	Value of trade between countries

Table 2.2 Summary statistics (N=30085 Observations)

Variables	Mean	Std dev.	Min.	Max.
Common language	0.1048	0.3063	0	1
Contiguity	0.1380	0.3449	0	1
Colony	0.7961	0.2707	0	1
Developing	0.2693	0.4436	0	1
Distance	3376.195	3470.613	59.61772	19147.14
ISO standards on Raw	4.8847	7.6774	0	22
NonISO standards on Raw	14.6648	14.1963	0	41
ISO standards on Processed	4.0133	5.2845	0	13
NonISO standards on Processed	13.3449	14.2289	0	41
Trade*, Raw Products	10.1617	51.6168	1.00e-05	1424.125
Trade, Processed food	46.2671	14.2289	1.00e-05	4476.102

*Original trade values were rescaled, by dividing values by 1,000,000.

Sources: primary data come from the study by Shepherd and Wilson (2013) "Product Standards and Developing Country Agricultural Exports: The Case of the European Union." Food Policy 42:1-10

Table 2.3 Estimation results

	Model 1 ($\ln X_{ij}^{R}$)		Model 2 ($\ln X_{ij}^{p}$)	
	With GDPs	*Without GDPs*	*With GDPs*	*Without GDPs*
Distance	-0.327**	-0.326**	-0.305**	-0.302**
	(0.135)	(0.135)	(0.143)	(0.143)
ISO_R	-0.037***	-0.036***	-0.030***	-0.032***
	(0.005)	(0.005)	(0.005)	(0.005)
NonISO_R	0.031**	0.031**	-0.016***	-0.019***
	(0.010)	(0.010)	(0.004)	(0.004)
ISO_P	0.026***	0.027***	0.033***	0.033***
	(0.004)	(0.004)	(0.004)	(0.004)
NonISO_P	-0.002	-0.002	-0.043**	-0.047**
	(0.010)	(0.010)	(0.016)	(0.016)
Developing	-6.430***	-8.417***	-11.130***	-11.206***
	(0.883)	(0.797)	(0.647)	(0.598)
Developing*ISO	0.079***	0.078***	0.072***	0.071***
	(0.018)	(0.018)	(0.016)	(0.015)
Developing*nonISO	-0.039**	-0.043**	0.019	0.020
	(0.017)	(0.017)	(0.018)	(0.018)
Developing*ISOp	0.028**	0.028**	0.037***	0.038***
	(0.013)	(0.013)	(0.008)	(0.008)
Developing*nonISOp	-0.144***	-0.148***	-0.072**	-0.073**
	(0.023)	(0.023)	(0.032)	(0.032)
Colony	0.297	0.283	0.117	0.116
	(0.260)	(0.260)	(0.344)	(0.344)
Language	1.010***	1.011***	1.206***	1.206***
	(0.239)	(0.239)	(0.259)	(0.259)
Contiguous	0.346*	0.345*	0.348*	0.349*
	(0.186)	(0.186)	(0.193)	(0.193)
GDPj	-0.040***	-	0.341*	-
	(0.009)		(0.184)	
GDPi	0.241***	-	0.103***	-
	(0.054)		(0.026)	
Constant	-11.914***	-11.517***	23.404***	-11.313***
	(1.989)	(1.340)	(5.015)	(1.343)
R-squared	0.1506	0.1510	0.1546	0.1559

Robust standards errors are in parentheses.

$\ln X_{ij}^{R}$: Dependent variable of trade model for raw products.

$\ln X_{ij}^{P}$: Dependent variable of trade model for processed products.

Table 3.1 Description of the variables

Variable	Definition	Description
Age	Age of the respondent	Continuous variable
Female	Gender of the respondent	Dummy variable recoded to 1: Female, 0: Male
Marital status	marital status of the respondent	Dummy variable recoded to 1: married or living together and 0: otherwise
Household income	Household average monthly net income (100,000 TZS (local currency)	Continuous value
SACCOS	Participation to membership in SACCOS	Dummy variable recoded to 1: Yes; 0: No
Education	Highest grade of school completed	Categorical variable recoded to 2: University and above, 1: Secondary, and 0: Primary
Household size	Number of household members	Continuous variable

*TZS: Tanzanian Shilling (Tanzania local currency)

Table 3.2 Summary statistics by membership and gender

Variables	Mean					Std. Dev.	Min	Max
	Members	Non-members	Female	Male	Total			
Age	39.873	39.363	38.967	39.939	39.391	16.119	0	102
Female	0.597	0.562	-	-	0.563	0.496	0	1
Marital status	0.702	0.648	0.602	0.714	0.651	0.477	0	1
Household income*	1,666,652	1,259,718	1,221,289	1,490,117	1,282,298	236,7624	0	7.20e+07
SACCOS	-	-	0.0587	0.0512	0.055	0.229	0	1
Education	20.495	17.714	17.634	18.171	17.869	3.821	1	45
Household size	1.727	1.667	1.769	1.542	1.670	0.761	1	12
Number Observations	181	3,081	1,838	1,424	3,262	-	-	-

*Household income is in Tanzanian shilling currency (TZS). Average USD/TZS exchange rate in the year 2013 was 1,600.44. (World Bank database 2014. http://data.worldbank.org/country/tanzania

Table 3.3 Propensity score matching regression results on female, male, and total samples

Parameter	Total household	Females sample	Males sample
Parameter	Odds ratio	Odds ratio	Odds ratio
Age	0.0025	0.020***	0.0022
	(0.0024)	(0.005)	(0.0039)
Marital status	0.1373*	0.213*	0.0684
	(0.080)	(0.127)	(0.1486)
Education	0.0658***	0.104***	0.0477***
	(0.076)	(0.014)	(0.0097)
Household size	0. 0670	0.118*	-0.0186
	(0.047)	(0.052)	(0.0905)
Female	0.1387*	-	-
	(0.077)	-	-
Constant	-3.210***	-4.482***	-2.653***
	(0.227)	(0.407)	(0.3176)
Log Likelihood	-661.677	-379.37	-276.132
Likelihood Ratio chi Square	75.17***	62.99***	23.66***
Pseudo R-Square	0.0538	0.0767	0.0411
Number of Observations	3,262	1,838	1,424
	Average treatment effect		
Matching estimators			
Nearest neighbors	0.167	0.156	0.265
(Mahalanobis)	(0.09)	(0.116)	(0.160)
Radius (Caliper)	0.246	0.072	0.171
	(0.081)	(0.133)	(0.128)

Notes: Asterisks indicate level of significance: ***=1%, **=5%, *=10%. Standards errors are in parenthesis. Bootstrapped standards errors are reported for the propensity score matching technique and robust standards errors are used in the OLS estimation.

Table 3.4 Weighted Least Squares regression results on female, male, and total samples

	Total household	Among Females	Among Males
Parameter	Estimates	Estimates	Estimates
Age	0.002	0.007***	-0.002
	(0.001)	(0.002)	(0.002)
Marital status	0 .101**	0.225***	0.134
	(0.045)	(0.057)	(0.087)
Education	0 .033***	0.036***	0.029***
	(0 .005)	(0.009)	(0.007)
Household size	0 .066**	0.046	0.115**
	(0 .031)	(0.040)	(0.053)
SACCOS	0.128***	0.093*	0.171***
	(0.042)	(0.055)	(0.065)
Female	-0.162***	-	-
	(0 .043)	-	-
Constant		12.412***	12.973***
		(0.208)	(0.200)
Average treatment effect	0.1468	0.0989	0.1847
	(0.051)	(0.077)	(0.006)
R-squared	0.0214	0.0227	0.0214
Adjusted R-squared	0.0196	0.0200	0.0180
F-value	11.88***	8.51***	6.21***
Overidentification test	10.5878 (*p*=0.102)	5.7367 (*p*=0.333)	5.8748 (*p*=0.319)
Number of observations	3,262	1,838	1,424

Notes: Asterisks indicate level of significance: ***=1%, **=5%, *=10%. Standards errors are in parenthesis.

References

Abadie. and G., Imbens. 2001. “Simple and Bias-Corrected Matching Estimators for Average Treatment Effects”. *Department of Economics UC Berkeley*.

Abebaw, D. and M. G., Haile. 2013. “The Impact of Cooperatives on Agricultural Technology Adoption: Empirical Evidence from Ethiopia”. *Food Policy*. 38:82-91.

Adeyemi, S. L., G. T. Ijaiya, M. A. Ijaiya and S. D. Kolawole. 2006. “Determinants of Human Development in Sub-Saharan Africa” *African Journal of Economics Policy* 13(2): 15-34.

Anderson, J. and E. van Wincoop. 2003. “Gravity with Gravitas: A Solution to the Border Puzzle.” The American Economic Review 93(1): 170-192.

Arellano, M., and O. Bover. 1995. “Another Look at the Instrumental Variable Estimation of Error-components Models”. *Journal of Econometrics* 68:29-52.

Atici C. 2013. “Food Safety Regulations and Export Responses of Developing Countries: The Case of Turkey’s Fig and Hazelnut Exports”. FAO Commodity and Trade Policy Research Working Paper No. 39.

Bao X. and W-C. Chen. 2013. “The Impact of Technical Barriers to Trade on Different Components of International Trade” Review of Development Economics, 17(3): 447-460

Barro, R. J. and J.W. Lee. 1993. "International Comparisons of Educational Attainment". *Journal of Monetary Economics*, 32: 363-394.

Barro, R., and J.W. Lee. 2001. "International Data on Educational Attainment: Updates and Implications." *Oxford Economic Papers* 53(3) :541-563.

Bee, F. K. 2009. “Rural Financial Markets in Tanzania: An Analysis of Access to Financial Services in Babati District, Manyara Region, University of South Africa, Pretoria, <http://hdl.handle.net/10500/1746>

Besharat A. and M. Amirahmadi. 2011. “The Study of Factors Affecting Productivity in the Agriculture Sector of Iran”. *African Journal of Agricultural Research*. 6(18):4340-4348.

Bloom, D. E., Canning, D., and Sevilla, J. 2004. “The Effect of Health on Economic Growth: A Production Eunction Approach”. *World Development* 32(1): 1-13.

Bloom, D. and Canning D. 2005. Health and Economic Growth: Reconciling the Micro and Macro Evidence. CDDRL Working Papers, February, 2005. http://cddrl.stanford.edu.

Blundell, R., and S. Bond. 1998. “Initial Conditions and Moment Restrictions in Dynamic Panel Data Models”. *Journal of Econometrics* 87(1): 115-143.

Bond, S., A. Hoeffler, and J. Temple. 2001. “GMM Estimation of Empirical Growth Models”. CEPR Discussion Paper No. 3048.

Bresciani, F. and A. Valdés. 2007. “Beyond Food Production: The Role of Agriculture in Poverty Reduction”, FAO, Rome.

Chrisabell, P.T. 2009. “Women Empowerment through Capacity Building: the Role of Microfinance. Concept Publishing Company, New Delhi-India.

Christiaensen, L. J. and L. Demery. 2007. “Down to Earth: Agriculture and Poverty in Africa”. Washington D.C. World Bank.

Christiaensen, L., L. Demery. and J. Kuhl. 2011. “The (Evolving) role of Agriculture in Poverty Reduction - An empirical perspective.” *Journal of Development Economics*. 96: 239-254.

Clougherty, J.A. and M. Grajek. 2008., “The Impact of ISO 9000 Diffusion on Trade and FDI: A New Institutional Analysis”, Journal of International Business Studies, 39 (4): 613-633.

Datt, G. and M. Ravallion. 1996. “How Important to India‘s Poor is the Sectorial Composition of Economic Growth?”. The World Bank Economic Review 10 (1): 1- 25.

De Janvry, A., G. Graff, E. Sadoulet, and D. Zilberman. 2000. “Technological Change in Agriculture and Poverty Reduction”. Concept paper for the WDR on Poverty and Development 2000/01.

Dethier,J.-J. and A. Effenberger. 2012. “Agriculture and development: A Brief Review of The Literature.” *Economic Systems*. Vol. 36, No. 2, 2012. Available at SSRN http://ssrn.com/abstract=2101059.

D’Espallier, B., I. Guerin and R. Mersland. 2011. “Women and Repayment in Microfinance: A Global Analysis” World Development Vol. 39, No. 5, pp. 758–772.

Diao, X., P. Hazell, D. Resnick and J. Thurlow. 2006. “The Role of Agriculture in Development: Implications for Sub-Saharan Africa.” DSGD Discussion Paper No. 29, IFPRI, Washington D.C.

Ding S., and J. Knight. 2009. “Can the Augmented Solow Model explain China's remarkable Economic Growth? A Cross-country Panel Data Analysis”. *Journal of Comparative Economics* 37: 432-452.

Disdier, A.-C., Fontagné, L. and M. Mimouni. 2008. “The Impact of Regulations on Agricultural Trade: Evidence from SPS and TBT Agreements,” American Journal of Agricultural Economics 90:336-350.

Disdier, A., C and Head .2008. “The Puzzling Persistence of the Distance Effect on Bilateral Trade.” The Review of Economics and Statistics. 90(1): 37-48.

Doytch N. and M. Uctum. 2011. “Does the Worlwide Shift of FDI from Manufacturing to Services Accelerate Economic Growth? A GMM Estimation Study”. *Journal of International Money and Finance*. 30(3):410-427

Dollar D. and A. Kraay. 2000. “Trade, Growth and Poverty”. The World Bank Development Research Group, Washington.

Economic Report on Africa. 2013. “Making the Most of Africa’s Commodities: Industrializing for Growth, Jobs and Economic Transformation”. United Nations Economic Commission for Africa, 2013. Addis Ababa, Ethiopia. ISBN-13:978-92-1-1-125119-7.

Fan, S., P. Hazell, and S. Thorat. 2000. Government Spending, Growth, and Poverty in Rural India. *American Journal Agricultural Economics* 82(4): 1038-1051.

FAO, 2005. “The MDGs and Sustainable Rural Development in Sub-Saharan Africa: Challenges and Implications for Education for Rural People (ERP)”. Working Document. Ministerial Seminar on Education for Rural People in Africa: Policy Lessons, Options and Priorities 7–9 September 2005, Addis Ababa, Ethiopia. http://www.fao.org/sd/dim_kn2/kn2_051101_en.htm.

Frohberg, K., U. Grote and E. Winter. 2006. “EU Food *Safety* Standards, Traceability and Other Regulations: A growing Trade Barrier to Developing Countries’ Exports? Invited paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006.

Garner P. 2006. “Economic Growth in Sub-Saharan African.” Available at SSRN: http://ssrn.com/abstract=853184 or http://dx.doi.org/10.2139/ssrn.853184.

Girabi F. and A. E. G. Mwakaje. 2013. “Impact of Microfinance on Smallholder Farm Productivity in Tanzania: The case of Iramba District”. *Asian Economic and Financial Review* 3(2):227-242

Hansen L. P. 1982. “Large Sample Properties of Generalized Method of Moments Estimators.” *Econometrica*. 50(4): 1029-1054.

Helpman, Elhanan, Marc Melitz, and Y. Rubinstein. 2008. "Estimating Trade Flow: Trading Partners and Trading Volumes," Quarterly Journal of Economics 123: 441-487.

Hirano, K. and G. W. Imbens. 2002. "Estimation of Casual Effects Using Propensity Score Weighting: An Application to Datat on Rights Heart Catheterization." Health Services & Outcomes Research Methodology 2: 259-278.

Hirano, K., G. W. Imbens, and G. Rider. 2000. "Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score." NBER Technical Working Paper 251.

Hoeffler A. E. 2002. "The Augmented Solow Model and The African Growth Debate". *Oxford Bulletin of Economics and Statistics*. 64 (2): 135-158.

Hossain, M. 1988. Credit for Alleviation of Rural Poverty: The Grameen Bank of Bangladesh. Institute Research Report 65. Washington, DC: International Food Policy Research.

Irz, X., L. Lin, C. Thirtle and S. Wiggins. 2001. "Agricultural Productivity Growth and Poverty Alleviation". *Development Policy Review* 19 (4): 449 – 466.

Jaffee, S. and S. Henson. 2004. "Food Exports from Developing Cpuntries: The Challenge Posed by Standards in Aksoy MA and JC Beghin (eds): Global Agricultural Trade and Developing Countries. Oxford University Press, to Oxford.

Jongwanich J. 2009. "The Impact of Food Standards on Processed Food Exports From Developing Countries." *Food Policy.* 34: 447-457.

Kevane, M., and Wydick, B. 2001. "Microenterprise Lending to Female Entrepreneurs: Sacrificing Economic Growth for Poverty Alleviation?" *World Development*. 29(7), 1225–1236.

Khandker, S. R. 2005. "Microfinance and Poverty: Evidence using Panel data from Bangladesh". *The World Bank Economic Review*, 19.

Khosla, P. 2015. "Intra-Regional Trade in Africa and The Impact of Chinese Intervention: A gravity Model Approach" *Journal of Economic Development*, 40 (4), 41-66

Kim, S.J. and K.A. Reinert. 2009. "Standards and Institutional Capacity: An Examination of Trade in Food and Agricultural Products," *The International Trade Journal*, 23 (1), 54 -77

Lipton, M. 2012. "Learning from Others: Increasing Agricultural Productivity for Human Development in Sub-Saharan Africa". Working Paper, United Nations Development Programme, Regional Bureau for Africa.

Lyngdoh B. F. and A. P. Pati. 2013. "Impact of Microfinance on Women Empowerment in the Matrilineal Tribal Society of India: An Analysis Using Propensity Score Matching and

Difference-in-Difference". *International Journal of Rural Management*. 9(1):45-69

Maeterns M. and J. F. M. Swinnen. 2006. "Standards as Barriers and Catalysts for Trade and Poverty Reduction" Invited paper prepared for the invited Panel Session on Food Safety Standards and Agri-food Exports from Developing Countries" at the 26th conference of the International Association of Agricultural Economiscts, Queensland, Australia, August 12-18, 2006

Maldonado, J. H. and C. Gonzalez-Vega. 2008. "Impact of Microfinance on Schooling: Evidence from Poor Rural Households in Bolivia. *World Development* 36(11): 2440-2455

Maleko, G.N, B. S. A. Liheta, D. Aikaruwa, A. Lukas and G. A. Sumari. 2013. "Women Participation in Microfinance Institutions of Tanzania: The Case of Savings and Credit Co-Operative Societies (SACCOS)". *Journal of Business Administration and Education* 2(4):139-175.

Mangeloja, E. 2005. "Economic Growth and Religious Production Efficiency". *Applied Economics*. 37: 2349–2359.

Marette, S., and J. C. Beghin. 2010. "Are Standards Always Protectionist?" *Review of International Economics* 18(1): 179-192.

Martin, W., and C. S. Pham. 2015. "Estimating the Gravity Model When Zero Trade Flows are Frequent." World Bank Policy Research Working Paper 7038.

Moenius, J. 2004. "Information Versus Product Adaptation: The Role of Standards in Trade", International Business and Markets Research Center Working Paper, Kellogg School of Management Working Paper, Northwestern University, Evanston.

Ndambiri H. K., C. Ritho, S. I. Ng'ang'a, P. C. Kubowon, F. C. Mairura, P. M. Nyangweso, E. M. Muiruri, and F. H. Cherotwo. 2012. "Determinants of Economic Growth in Sub-Saharan Africa: A panel Data Approach. "*International Journal of Economics and Management Sciences*. 2(2):18-24.

Neeliah, S. A., H. Neeliah, and D. Goburdhun. 2013. "Assessing the Relevance of EU SPS Measures to the Food Export Sector: Evidence from a Developing Agro-Food Exporting Country. "*Food Policy*. 41:53-62.

Nkurunziza, J. D. and R. H. Bates. 2004. "Political Institutions and Economic Growth in Africa". Working Paper, CSAE WPS/2003-03. (Center for International Development Working Paper, No 98). Harvard University.

Otsuki, T., J. Wilson, and M. Sewadeh. 2001. "What Price Precaution? European Harmonization of Aflatoxin Regulations and African Groundnut Exports." *European Review of Agricultural Economics* 28(2): 263-283.

Penn World Table Version 9.0, Center for Comparisons at the University of Pennsylvania (CICUP), October 2002. Available at: http://www.rug.nl/research/ggdc/data/pwt/pwt-9.0

Pitt, M. M. and S. R. Khandker. 1998. "The Impact of Group-based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter?" *Journal of Political Economy*, 106(5):958-996.

Ramsey, A. 2005. "A Growth Model of Sub-Saharan Africa". http://econ.duke.edu/uploads/assets/dje/2005_Symp/Ramsey.pdf.

Ranis, G., F. Stewart and A. Ramirez. 2000. "Economic Growth and Human Development". *World Development*. 28(2):197-219.

Ranis, G., and F. Stewart. 2005. "Dynamic Links between the Economy and Human Development". DESA working paper No 8.

Rosenbaum P. R. and D. B. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects". *Biometrika*, 70(1) 41-55.

Salia P. and J. S. Mbwambo. 2014. "Does Microcredit make any difference on Borrowers Businesses? Evidences from a survey of women owned microenterprises in Tanzania". *International Journal of Social Sciences and Entrepreneurship*. 1(9):431-444.

Santos Silva J. and S. Tenreyro. 2006. "The Log of Gravity." The Review of Economics and Statistics. 88:641-658.

Shepherd, B. 2007. Product Standards, Harmonization, Trade: Evidence from the Extensive Margin, Policy Research Working Paper. World Bank, Washington, D.C.

Shepherd, B, and N. L. W. Wilson. 2013. "Product Standards and Developing Country Agricultural Exports: The Case of the European Union." Food Policy 42:1-10.

Song H. and K. Chen. 2010. "Trade Effects and Compliance Costs of Food Saftey Regulations: The Case of China." International Conference on Agricultural Risk and Food Security 2010. Agriculture and Agricultural Science Procedia 1:429–438

Solow, R. M. 1956. "A Contribution to the Theory of Economic Growth". *Quarterly Journal of Economics* (The MIT Press) 70 (1): 65–94. doi:10.2307/1884513. JSTOR 1884513.

Solow, R. M. 1957. "Technical Change and the Aggregate Production Function". *Review of Economics and Statistics* (The MIT Press) 39 (3): 312–320. doi:10.2307/1926047. JSTOR 1926047.

Tamini L., P. Ghazalian, J-P. Gervais, and B. Larue. 2012. "Trade Liberalization in Primary and Processed Agricultural Products." International Economic Journal. 26(1): 85-107

Thirtle C., L. Lin and J. Piesse. 2003. "The Impact of Research- Led Agricultural Productivity Growth on Poverty Reduction in Africa, Asia, and Latin America". *World Development*. 31 (12): 1959-1975.

UNDP. 2015. United Nation for Development programs database. http://hdrstats.undp.org/en/tables/

UNCTADSTAT. 2016. United Nations Conference on Trade and Development Statistics http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx

Weber, R. and O. Musshoff. 2012. "Microfinance for Agricultural Firms - Credit Access and Loan Repayment in Tanzania." Paper prepared for the 123rd EAAE Seminar. Price Volatility and Farm Income Stabilisation Modelling Outcomes and Assessing Market and Policy Based Responses. Dublin, February 23-24.

Wilson, J.S. and T. Otsuki. 2004. "Standards and Technical Regulations and Firms in Developing Countries: New Evidence from a World Bank Technical Barrier to Trade Survey", http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/Services/TBT_Data_Description.pdf

Wooldridge, J. 2002. "Econometric Analysis of Cross Section and Panel Data". MIT Press.

World Bank. 2007. Finance for all? Policies and pitfalls in expanding access. A World Bank Policy Research Report. Washington, DC: World Bank

World Bank. 2008. "Agriculture for Development." World development Report 2008. World Bank Publications, 2007. ISBN: 978-08213-6807-7.

World Bank. 2013. Tanzania Economic Update: "Raising the Game: Can Tanzania Eradicate Extreme Poverty".

World Bank. 2013. World Bank Database: http://data.worldbank.org/.

World Bank. 2013. "State of the Poor: Where Are the Poor and Where are the Poorest?" Available at: http://www.worldbank.org/content/dam/Worldbank/document/State_of_the_poor_paper_April17.pdf.

World Bank. 2016. World Development Indicators 2014. World Bank. http://data.worldbank.org/data-catalog/world-development-indicators/wdi-2014

Appendix 1. Statistical Analysis Results for the Growth Model

	Value
Breusch and Pagan Lagrange multiplier test	
Chi-square	1,122.85***
Hausman (FE-RE)	
Chi-square	52.46***
Heteroskedasticity (Modified Wald test for groupwise heteroskedasticity)	
Chi-square	21,318.85***
Autocorrelation (Arrelano-Bond test)	
F-test (Woodridge test)	1,925.69***
Overidentifying restrictions (Sargan test)	
Chi-square	274.34***
Joint-test (for interaction term in market linkage model)	
Chi-square	7.99**

Note: Asterisks indicate level of significance: ***=1%, **=5%, *=10%.

Appendix 2. World Bank classification of economies and their gross national income per capita (GNIp)

Economy	*Income group*	*GNIp*	*Economy*	*Income group*	*GNIp*
Angola	Upper middle income		Madagascar	Low income	440
Benin	Low income	890	Malawi	Low income	250
Botswana	Upper middle income	7240	Mali	Low income	650
Burkina Faso	Low income	700	Mauritania	Lower middle income	1270
Burundi	Low income	270	Mauritius	Upper middle income	9630
Cabo Verde	Lower middle income	3450	Mozambique	Low income	600
Cameroon	Lower middle income	1350	Namibia	Upper middle income	5630
Central African Rep.	Low income	320	Niger	Low income	410
Chad	Low income	980	Nigeria	Lower middle income	2970
Comoros	Low income	790	Rwanda	Low income	700
Congo, Dem. Rep.	Low income	380	São Tomé and Principe	Lower middle income	1670
Congo, Rep.	Lower middle income	2720	Senegal	Lower middle income	1050
Côte d'Ivoire	Lower middle income	1450	Seychelles	High income:	14120
Equatorial Guinea	High income:	10210	Sierra Leone	Low income	700
Eritrea	Low income		Somalia	Low income	
Ethiopia	Low income	550	South Africa	Upper middle income	6800
Gabon	Upper middle income	9720	South Sudan	Low income	
Gambia, The	Low income	460	Sudan	Lower middle income	1710
Ghana	Lower middle income	1590	Swaziland	Lower middle income	3550
Guinea	Low income	470	Tanzania	Low income	920
Guinea-Bissau	Low income	550	Togo	Low income	570
Kenya	Lower middle income	1290	Uganda	Low income	670
Lesotho	Lower middle income	1330	Zambia	Lower middle income	1680
Liberia	Low income	370	Zimbabwe	Low income	840

Source: World Bank, World Development Indicators database 2014. Available at https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries

Appendix 3. Diagnostic Statistics (Total Sample, including both men and women)

	Raw	Weighted
Number of obs =	3,262	3,262.0
Treated obs =	181	1,605.6
Control obs =	3,081	1,656.4

	Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted
age	.0335602	-.027525	.7533096	.8583407
sex	.0711971	-.0653262	.9825089	1.01205
mar	.1142233	.0211817	.9227445	.9861131
hhsize	.0831062	.0567631	.806051	.746908
education	.5843349	.0833552	2.444767	.7623688

	Means		Variances	
	Control	Treated	Control	Treated
age	39.36287	39.87293	263.4897	198.4893
sex	.561506	.5966851	.246297	.241989
mar	.6481662	.7016575	.2281208	.2104972
hhsize	1.666575	1.726986	.5851424	.4716546
education	17.71427	20.49538	13.15167	32.15277

Appendix 4. Diagnostic Statistics (Female Sample)

Covariate balance summary

	Raw	Weighted
Number of obs =	1,838	1,838.0
Treated obs =	108	906.1
Control obs =	1,730	931.9

	Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted
age	.0003954	-.0595505	.5978917	.5986793
mar	.1211043	.0593068	.9457458	.9713532
hhsize	.1737849	.1289575	.777906	.631827
education	.6309101	.0061661	3.687152	.7691943

	Means		Variances	
	Control	Treated	Control	Treated
age	38.96647	38.97222	264.5263	158.1581
mar	.5988439	.6574074	.2403688	.2273278
hhsize	1.76194	1.887191	.5843296	.4545535
education	17.4775	20.1399	7.598576	28.01711

Appendix 5. Diagnostic Statistics (Male Sample)

Covariate balance summary

	Raw	Weighted
Number of obs =	1,424	1,424.0
Treated obs =	73	701.0
Control obs =	1,351	723.0

	Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted
age	.00827889	-.0116819	.9857483	1.11416
mar	.1269095	-.0448948	.8814196	1.040959
hhsize	-.0783115	.0269172	.7288139	.8040347
education	.5559532	.1058178	1.903336	.7614748

	Means		Variances	
	Control	Treated	Control	Treated
age	39.87047	41.20548	261.898	258.1655
mar	.7113249	.7671233	.2054939	.1811263
hhsize	1.544456	1.489969	.5600383	.4081637
education	18.01747	21.02129	20.10965	38.27542