IMPACT OF HEALTH INSURANCE ON LAND-RELATED INVESTMENTS IN AFRICA: EVIDENCE FROM GHANA

Edward Asiedu¹², and Dorcas Sowah¹ Amin Karimu¹³

¹University of Ghana Business School, Legon
²Chair of Development Economics, University of Passau Germany
³Department of Economics, Umea University Sweden

Abstract
It has been observed that health shocks decreases the productivity and potential investments into agriculture, and as such further perpetuates poverty among smallholder farmers. It is argued that, health insurance coverage for smallholder farmers can go a long way to ameliorate the impact of heath shocks and smoothen agricultural investments. However, very little is known about the impact that health insurance coverage has on smallholder farmers’ land-related investment. Thus, this study using enrolment information on the Ghana National Health Insurance Scheme (NHIS) examines the determinants of health insurance coverage amongst smallholder farmers and goes further to examine the impact of coverage on agricultural investments in the form of the level of agricultural inputs used in production and also the level of hired labour employed.

The study employed a number of estimation approaches to address issues relating to endogeneity – the fact that NHIS coverage is nonrandom or in other words NHIS is not randomly assigned. To address this issue and estimate causal impact of NHIS, propensity score matching (PSM) estimations and two-stage stage residual inclusion model were estimated to augment the Ordinary Least Squares (OLS) estimator. The result shows that, household head characteristics such as gender, age and educational level, as well as farm size and household expenditure influences the enrollment in NHIS amongst smallholder farmers. In term of impact, estimates from propensity score matching and the two-stage residual inclusion reveals a positive and significant effect of NHIS on agricultural input used and improved hired labour use on smallholder farms.

JEL Classification:
1. INTRODUCTION

Studies have shown that the status of a farmer’s health can influence his income by changing the farmer’s harvesting time, his skills for working and his productivity (Pitt & Rosenzweig, 1984). Hawkes & Ruel (2006) also confirmed that poor health reduces wage and efficiency making it difficult for the farm households to address their poor health status. In Africa, the agriculture sector is also more labour intensive and therefore relies mostly on household labour and less skilled labour force that is increasingly becoming expensive to employ. A lot has been invested in increasing labour productivity but then it has been observed that health shocks decreases farm investments directly through lower labour productivity (Asenso-Okyere et al., 2011). Africa is known to have a high prevalence of diseases, like malaria, Buruli ulcer, guinea worm, and HIV/AIDS etc., and this can affect smallholder farmers who live in rural parts of Africa significantly and result in lower agricultural productivity and investment. Farmer’s exposure to chemicals such as pesticides and herbicides do have serious impact on their health (Del Prado-Lu, 2007). Due to the high prevalence of diseases any possible health shock coming from the environment and agronomic activities can adversely affect the farmer’s health, productivity and general household’s welfare (Adharyu & Beegle, 2012; Pitt & Rosenzweig, 1986).

Economists and public health professionals have argued that bad health can enforce extensive costs on individuals and families and intend put pressure on the society as a whole. Thus, any possible health shock can have an undesirable effect on the financial situation of poor households (see Townsend, 1994; Dealon, 1997; Gertler & Gruber, 2002; Wagstaff, 2007). Some developing countries in Africa including Ghana, Rwanda, Tanzania, Kenya & Nigeria have in recent times initiated National Health Insurance Schemes (NHIS) with the aim of reducing out-of-pocket expenditure and making sure that individuals particularly the poor have access to quality
health care when needed at an affordable cost (Carrin et al., 2008; Witter & Garshong, 2009; Mensah et al. 2010; Ekman, 2004 cited in Abuosi, 2014 Nigeria). Due to the motivation from international organization such as WHO and donor governments, many countries are convinced that a national health insurance scheme is one of the major answers to improving quality health care (Wagstaff & Pradhan, 2005; Assuming, 2013). However, the effect of health insurance on households in developing countries are still not well understood (Bernal, Carpio & Klein, 2015). Sekyi & Domanban (2012) found out health insurance has helped to reduce financial barriers on the usage of health care services for insured users whereas the uninsured users continue to radically recount grave health care utilization. In terms of the impact of health insurance on farm households, very little is known.

According to Nguyen & Zawacky (2009), health insurance has helped to improve the performance of employees in the manufacturing firms in United States. Studies have shown positive correlation of health insurance and health care utilizations. Mensah et al., (2010) found out most women insured under the NHIS visited the hospital more often specially to receive antenatal care, and to deliver at the hospital than others. Sekyi & Domanban (2010) also confirms that individuals with health insurance visited the health facilities frequently. Unlike the issues of the impact of health insurance on health status, there has been few empirical studies on health insurance and agriculture. This study aims to examine the impact of Ghana’s NHIS on smallholder farmer’s land-related investments and hired labour employment.

Rural productivity in developing countries is subjected to physical strength and stamina and consequently good health and as such poor health influences labour efficiency to a large extent. Specifically, ill health and the associated high medical expenditure has the ability to reduce the adoption of enhanced agricultural practices and new innovation in agriculture (Asenso-Okyere et
al, 2010), Also, Slater & Wiggins, (2005) ill health can lead to cultivation of less-intensive crops, reduction in farming sizes and decrease in livestock numbers evolving into household poverty. Asfaw (2003) added that bad health leads to direct expenditure on medicine, treatment and transport also reduce labour supply and productivity indirectly.

In the context of agriculture, the sector plays a major role in developing countries. Majority of rural households depend on agriculture for their living (Global Donor Platform for Rural Development, 2007). According to the World Bank, Agriculture employs about 65 percent of the poor working adults in developing countries (World Bank, 2017). In Ghana, Ligon & Elisabeth (2007) recorded that poverty has reduced severely in the rural household as a result of increased agricultural investments and growth. Currently, agriculture sector is known to be the least growing sector with its share of GDP declining from 18.7 percent as at 2016 to 18.3 percent as at 2017 (GSS, 2018). Thus, investment and growth in agriculture have the potential of lessening rural poverty in Ghana. However, agriculture is labour intensive, hence the wellbeing of farmers and their households can affect agriculture investment and as such rural poverty (Lipton De Kadt, 1988). Agriculture has been the main source of revenue for rural households in many developing countries in Africa. Thus, agriculture’s output in Africa continually relies on the readiness and quality of the labour and as such disease or ill-health has the potential to reduce labour productivity (Osei-Akoto, Adamba, & Osei, 2013). Also, the Ghana Health Service (GHS) have observed high prevalence of diseases such as malaria, tuberculosis, HIV in the country (GHS, 2017). Studies have shown how bad it can be, when individuals in a household most especially farm households are faced with health shocks. Bad health reduces their farm profits and wages resulting to a decline in productivity (see O’Donnell, 1995; Schultz & Tinsel, 1997; Strauss, 1986; Deolalikar, 1988; Dercon & Krishnan, 2000; Gertler & Gruber, 2002, World Bank, 2007), selling of farm asseets in
order to pay for their health expenses (Wagstaff et al., 2007), makes the household resort to traditional healers and drug vendors. Baldwin & Weisbrod (1974) found a negative impact of health shocks on agricultural productivity. Audibert & Etard, (1998, 2003) examined the effect of schistosomiasis on rice production using a quasi-experimentation and found that health enhancement had no effect on rice production but then improved the household’s use of its labour resources and their ability to utilize other resources.

In the context of Ghana, Osei-Akoto et al. (2013) conducted a study on the impact of health shocks on farm labour use at all stages of farming activities, use of non-labour inputs and on end value of agricultural inputs”. In examining the impact, they found that poor health affects the family labour for land preparation and farm management. Bovbjerg & Hodley (2007) posited that the health of individuals can be become better via universal coverage of health insurance. In this study we aim to examine the impact of health insurance coverage on land-related investments and hired labour use in agriculture by relying on detailed household data.

Applying propensity score matching (PSM) and the two-stage residual inclusion model estimators among others to control for both observed and unobserved drivers of NHIS enrolment to 5,883 farming households, this study found that NHIS has a positive impact – about 40% increase – on land-related investments in agriculture. This result confirms findings of Lui (2016) who found positive effect of NHIS in rural China on investments in children human capital formation. Regarding hired labour, NHIS lead to about 37% increase in investments in hired labour.

The rest of the paper is structured as follows. Section 2 presents a background of the Ghana’s National Health Insurance Scheme. Section 3 presents related literature. Section 4 presents the data and the empirical strategy adopted for our empirical estimation. Section 5
discusses the empirical results. Finally, section 6 provides a summary of our key findings, conclusion and recommendations.

2. BACKGROUND OF GHANA’S NATIONAL HEALTH INSURANCE SCHEME AND AGRICULTURE SECTOR

Ghana launched the National Health Insurance Scheme (NHIS) in 2003 with the introduction and passage of the National Health Insurance Act 650. The National Health Insurance Act 650 sets out three prominent types of health Insurance schemes to be established and operated in Ghana. These includes: “District Mutual Health Insurance, Private Mutual Health Insurance and Private Commercial Health Insurance”. The mission of Ghana’s health Insurance is “to ensure equitable universal access for all residents of Ghana to an acceptable quality of essential health services without out-of-pocket payment being required at the point of service” (MOH, 2004a). In order for these schemes to function legally in the country the schemes have to register with the government. In order for the health Facilities to be accredited they need to meet a minimum requirement. Amongst these schemes, the NHIS is formulated around the District Mutual Health Insurance Schemes and the government provides direct financial aid to support the District Mutual Health Insurance scheme (Sabi, 2005).

Recently in 2012, the NHIS Act was amended from ACT 650 to ACT 852 with the objective that every Ghanaian is expected to enroll on the scheme including residents in Ghana and non-residents visiting Ghana. This is to provide universal coverage and also offer those covered by the scheme proper access to health care services (NHIA, 2013). NHIS is financed
mainly by a sales tax levy (a 2.5 percent earmarked addition to the value added tax) and a 2.5 percent of formal sector workers contributions to the Social Security and National Insurance Trust Fund (SSNIT) which is controlled by the NHIF (Escober et al., 2011). Hence, 80 percent of the financing is done through a tax revenue and donor funds and 20 percent is internally generated through the out-of-pocket system (MOH, 2004). The NHIS receives subsidies from the NHIF at the focal levels in order to reinsure them against cataclysmic events and also reduce the risk level of diseases in one region to the other. This subsidy is to help programs that build up more access to health care services and also to take care of the social insurance for indigents and other observed groups considered deserving of being financed (Escober et al., 2011; MOH, 2004).

NHIS proffers an exceedingly liberal package that covers over 95 percent of the diseases that affect Ghanaians encompassing outpatient and inpatient care deliveries (including complications), diagnostic tests, generic medicines and emerging care (Escober et al, 2011). The groups excluded from paying premiums include SSNIT contributors, retirees who are also SSNIT contributors, aged from 70 years and above, children under age 18, and pregnant women (Asenso-Boadi, 2009).

Agriculture in Ghana is mainly on the smallholder basis. Most farmlands are less than two (2) hectares when measuring, most farmers still use the traditional systems of farming which involves the hoe and cutlass as tools used for farming. Even though some cultivate their land using the mechanized systems especially the northern farmers practice the bullock farming (Chamberlin, 2007; FAO, 2013). Agriculture has been known as one of the important economic sectors especially in the developing countries. It accounts for 23% of the national Gross Domestic product (GDP) in 2013. The agriculture sector has expanded so well from 2007 due to the high international
prices especially for the cocoa which is the main export. In spite of the expansion, agriculture in Ghana has largely depended on the rainfalls for its irrigation (FAO, 2015).

Ghana has five distinct agro-ecological zones which are (1) The Coastal Savannah, (2) Transition, (3) Northern Savannah (Guinea and Sudan Savanna), (4) Deciduous Forest and (5) Rainforest Zones. These zones have their distinct farming systems. Agriculture production differs with amount and appropriation of rainfall yet soil factors are additionally vital such as the texture, nutrient levels and ph. Most of the food crops are intercropped due to the nourishment of the food crop whereas large scale farmers practice mono cropping. Soils are prevalently light in texture in which sandy soil and loamy soils are normal. Soils in the savannah areas have low levels of organic matter, high levels of iron, and are prone to erosion (FAO, 2013 cited in Shaw, 2014). It is observed that south western areas are hot and sunny whiles the north is dry and hot. It has also been found out that the tropical east coastal belt is warm and relatively dry. The average temperature in a year ranges from 26.1°C in the coastal areas to 28.9°C in the farther north. Cocoa, cassava, maize, yam, with other fruits and other cereals has being the main commodities produced in Ghana. The main cash crops are the oil palm, rubber, cashew, coconut, and cotton, (FAO, 2013).

According to the GLSS wave 6, a little above half of the households operates on a farm or owns a farm of which farming has frequently been rural, with 82 percent of the rural households engaged: 93 percent of the households are involved in the rural savannah, and 81.3 percent in the rural forest and 64.7 percent in the rural coastal.

3. LITERATURE REVIEW

Studies have shown that farmers, labourers, and their family members are exposed to a lot of health, safety and environmental risk and are highly prone to fatal and non-fatal injuries and
ailments (OSHA, 2013). Most especially, a safe and healthy farmer has a greater effect on the family’s quality of life and how productive the farm will be. When an employer or employee is indisposed because of an illness, it causes a lot of negative consequences for management, marketing and productivity. Gillespie & Johnson (2010) noted that the farmer is able to better manage health shocks and recover if he or she has access to health care center (Gillespie & Johnson, 2010). High medical cost has the potential to deplete the household’s assets. Thus, health insurance decreases health related financial risk that households bears.

Studies have shown that the rate at which farmers suffer injury is very high more than the rate of any other worker is. The application of chemicals insecticides, rodenticides, fungicides, herbicides etc., exposes farmers to many illnesses. Inwood (2015) found that 65 percent of commercial farmers in the U.S distinguished the cost of health insurance as the most genuine risk to their farm. In that study, it was also reported that 40 percent of the farmers indicated that, if inflicted by an ailment their farmlands will be negatively affected and 50 percent reported they would have no one to run their farm for them if there is any major disease.

Some economists have looked at the impact of health shocks (Malaria, HIV/AIDS and others) in diverse scales, investigating family units, communities and comparing states and nations. It is widely known that health shocks caused by disease are causing huge problems in agriculture especially in the developing countries. Mwaniki (2006) claims that these diseases reduce available labour-hours to agriculture and decrease farmer’s access to food and as such further perpetuating poverty. The impact of ill-health of the agriculture workforce is one of the main causes of the food insecurities as cited by the U.S Government Accountability Office (GAO, 2008). According to Audibert et al. (2003) in their investigation which evaluated the impact of malaria on the cotton-crop development in the savannah zone using a production frontier model, they estimated that
unhealthy households are not efficient enough on their farms. Practically, in sub-Saharan Africa, it is observed that household’s expenditure on malaria treatment ranges from US$2 to US$25 and expenditure for prevention each month ranges from US$0.20 to US$15 (Mills, 1998; Goodman et al., 2000 Chima et al., 2003 & Russell, 2003). In Kenya and Nigeria, the treatment cost is being estimated to 5 percent and 13 percent of their household expenditure respectively (WHO, 1999), and in Northern Ghana 34 percent of poor household income (Akazili, 2002; Akazili et al., 2007). Osei-Akoto et al. (2013) confirmed with Chima et al. (2003) & Malaney et al. (2004) and concluded that even though Malaria which is a health shock depletes household cash reserves and reduces the productivity of labour, it also lessens the demand for agricultural inputs for production and also for other goods and services. This raises the question regarding to what extent does national health insurance coverage helps to ameliorate the effect of shocks on agricultural investments.

Osei-Akoto et al. (2013) in their study in Ghana also found that a severe health shock can deplete the individual or household’s investible capital which can affect agriculture investment due to the catastrophic expenditure on health care services. In a study conducted by Lui (2016) in rural China found that the introduction of health insurance health insurance helped households to maintain investment in children's human capital during negative health shocks. In this study, we extend existing studies by examining the direct impact of health insurance coverage in Ghana on agricultural land-related investments and hired labourer use.

With regards to health care utilization in Ghana, findings from some studies have shown that members of the households have increased considerably their access to formal care and have decreased their out-of-pocket expenditure upon enrolling in the newly introduced national health insurance schemes (Witter & Garshong, 2009). In terms of the determinants of health insurance
enrollment in Africa, Kirigia et al. (2005) did examine the drivers south African women whereas Ayitey et al (2013) and Duku (2018) have examine for some regions in Ghana. These studies have identified socio-demographic, economic, household size, behavioral factors and place of residence as significant predictors of health insurance enrolment. Some theories have stated that as individuals ages, they intend experiences a lot of health shocks therefore they invest in the health by purchasing health insurance just to avoid the catastrophic health expenses (Grossman, 1972). Nevertheless, the effect of age on Health insurance have shown some inconsistent findings. While Jutting (2001) and Ying et al (2007) found that young individuals are more likely to enroll on health Insurance, Savage & Wright (2001), Bhat & Jain (2006), Mwaura & Pongpanich (2012) and Ayitey et al. (2013) found individuals that have advanced in age increase their probability of enrolling on health insurance. Other empirical studies have also found that being married and having a higher level of education increases the likelihood of having a health insurance (Asenso Okyere et al., 1997; Mwaura & Pongpanich, 2012). However, Muurinen (1982) found highly educated individuals have low probability of purchasing health insurance and explained that these individuals are less likely to encounter any health shocks hence they have low probability of enrolling on Health Insurance.

Empirical evidence on the effect of Gender on health insurance have also reported inconsistent results. While Jutting (2001) and Ayitey et al. (2013) found that female headed households increase their probability of health insurance enrolment, Asenso et al. (1997) and Bourne & Kerr-Campbell (2010) found male headed households increase the likelihood of enrolling on health insurance. Also, household size have been reported to be a significant determinant of health insurance. The direct impact of health insurance coverage on land-related investments in Sub-Saharan Africa have not been examined to the best of our knowledge. We set
out with detailed data on Ghana – one of the first NHIS adoptors in Africa – examine the impact of this important intervention on farm households.

4. DATASET, SPECIFICATION AND ESTIMATION STRATEGY
The Ghana Living Standards Survey is a household level survey conducted with a nationwide sample of households so as to statistically be a representative of all of Ghana. The data used for the empirical analysis is from the sixth wave of the Ghana Living Standard Surveys: GLSS 6 (2012/13). The GLSS 6 centers on the main socio-economic unit and provides meaning to the living conditions in Ghana. This study considers 5,883 farming households out of 16,772 total households interviewed in the GLSS wave 6 conducted between October 2012 and October 2013. The survey collected detailed information on Ghana National Health Insurance Scheme and land-related investment in agriculture. Using a quantitative approach, the Ordinary Least Square (OLS) was first used to examine impacts. Due to possible endogeneity (omitted variable problem and selection bias), Propensity Score Matching and the Two-Stage Residual Inclusion model estimation are carried out to improve causal interpretation of the results.

Table 1 presents the descriptive statistics for the variables used for the analysis. The summary statistics includes 5,883 respondents with 64.1 percent enrolled in the NHIS whereas 35.9 percent not under NHIS coverage. In term of household headship, 72 percent of farm households are headed by males whereas 28.05 are headed by females. In terms of NHIS coverage at the household level, 73 percent of female headed household are enrolled on NHIS whereas 61 percent of the male headed households have enrolled on NHIS. The table also presents that farm households that have NHIS are slightly older than those without NHIS as indicated earlier, there
are male headed households than female household heads however, there are slightly more males without NHIS than males with NHIS. Farm households that have NHIS are slightly more educated than those without NHIS. There is no significant difference in farm size amongst farm households with NHIS and those without.

There are also no significant differences in household income between households that are enrolled and those who are not. Despite similar income, farm households with NHIS tend to spend (household expenditure) than those without NHIS therefore any observed differences in enrollment cannot be attributed to income. On the average, farm households without NHIS are slightly more married than farm households with NHIS. Lastly, on the average farm households with NHIS tend to have higher farm investments than households without NHIS.

Table 1: Descriptive Statistics on the Enrolled and Non-enrolled Farm Household

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Pooled Mean</th>
<th>With NHIS Mean</th>
<th>Without NHIS Mean</th>
<th>Difference in Mean</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NHIS Yes=1, No=0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land-related Investment in Agriculture</td>
<td>494.78</td>
<td>560.692</td>
<td>375.299</td>
<td>1.2</td>
<td>15720</td>
</tr>
<tr>
<td></td>
<td>185.39***</td>
<td>-5.195</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>46.245</td>
<td>48.441</td>
<td>42.325</td>
<td>15</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>6.116***</td>
<td>-14.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to estimate the impact of national health insurance scheme on agricultural investment, we specify the following econometric equation:

\[ In\text{Ln}\text{Invest}_i = \beta_0 + \beta_1 NHIS_i + \beta_2 Mar_i + \beta_3 Edu_i + \beta_4 InHHInc_i + \beta_5 InHHExp_i + \beta_6 HHSize_i + \beta_7 FSize_i + \beta_8 Male_i + \beta_9 Age_i + \epsilon_i \] (1)

Where \( In\text{Ln}\text{Invest}_i \) denotes the amount of money spent on agricultural inputs (such as fertilizer, herbicides, pesticides, insecticides, irrigation, purchase seedlings, hired technological inputs such as hired tractors, ploughs etc.), \( NHIS \) dummy which assumes a value of one (1) if more than half of the household members are enrolled on NHIS and zero (0) if otherwise, \( Mar \) represents Marital Status of the household head, \( Edu \) represents the educational level of the household head, \( Age \) variable represents the age of the household head, \( InHHInc_i \) denotes household Income, \( InHHExp_i \) denotes household expenditure, \( HHSize \) represents household size, \( FSize \) represents farm size of the household and \( Male \) represents the gender of the household head. \( \beta_0 \) is the intercept. Furthermore, the subscript “i” represents a household. The coefficient of the respective parameters varies from \( \beta_1 \) to \( \beta_9 \) and \( \epsilon_i \) is the error term for each household in the model.
Results of the estimation

To examine the latent impact of national health insurance on agricultural investment, we estimate Equation (1). Table 2 presents the result of Eqn (1). As indicated earlier, ordinary least square is carried out to examine the impact of NHIS on Land-related investment. However, the linear model is an initial step in the empirical analysis which helps to evaluate the partial correlation between NHIS and the other variables indicated in the model. Table 2 shows the estimation results of the OLS. The table reports the result which shows that NHIS has an impact on Land-related Investment in agriculture. From the results presented below, it is observed that there is a positive effect of NHIS on Land-related Investment in agriculture. The coefficient on NHIS is positive and significant at 1 percent, which means that households with NHIS tend to invest more on Land-related investment in agriculture than those without NHIS. The coefficient suggests that households with NHIS invest about 32.3 percent more on Land-related agricultural investment. This implies that, the farming households have replaced income that will be used on catastrophic health care expenses on investing in agricultural inputs by 32.3 percent.

The coefficient of Age is negative and has a significant impact on Land-related investment at 1 percent significance level which suggest that younger household heads with NHIS invest more on agricultural inputs than older household. Also, we observe that male headed households invest more than female headed households at a 1 percent significance level. Male headed households invest about 40 percent more on agriculture inputs as well as married farm household heads invest more in agricultural input at a 5 percent significance level. The results further present that as the household size increases, investment in agriculture input also increases, this can be attributed to the fact, the more hands one has on the farm land the more productive the farm will be and the higher income could be channeled to buying more agricultural inputs Nevertheless, the coefficient
is not significant. Finally, it is observed that, as income increases more of such income is invested in agricultural input. Thus, a 1% increase in income translates into a 15.5 increase into agricultural land related investments. Also an increase in household expenditure makes the household invest more (44.6 percent) in agricultural Investment and is significant at 1 percent significance level.

Table 2: Ordinary Least Square Estimates of the Impact of NHIS on Land-related investment in agriculture.

| Variables          | Coefficient | S. E  | P>|t| |
|--------------------|-------------|-------|-----|
| NHIS               | 0.324***    | 0.064 | 0.000 |
| Age                | -0.004**    | 0.0019| 0.050 |
| Male               | 0.402***    | 0.097 | 0.000 |
| Farm Size          | 0.007**     | 0.004 | 0.044 |
| Household Size     | 0.125***    | 0.035 | 0.000 |
| Marital Status     | 0.149*      | 0.090 | 0.098 |
| Educational Level  | -0.039      | 0.026 | 0.137 |
| Household Income   | 0.155***    | 0.027 | 0.000 |
| Household Expenditure | 0.446***  | 0.049 | 0.000 |
| Constant           | -0.925**    | 0.412 | 0.024 |
| R-Squared          |             | 0.2242|     |
| Prob> F            |             | 0.000 |     |

*** p<0.01, ** p<0.05, * p<0.1

Note that, these estimates are simple OLS estimates which do not control for possible endogeneity. NHIS coverage is non-random, therefore the causal interpretation should be done cautiously. Specifically, the problem of selection bias or income could be related to adoption or there may be
unobservable that could affect the adoption thus OLS estimation may be bias. As a robustness check for the OLS estimates we move on to examine impact of NHIS using matching estimators. Therefore, this study uses a various propensity score matching (PSM) estimators to construct the counterfactual effect of investing in agriculture inputs if a household has a NHIS or not given similar observed household characteristics that can dive a household to enroll in NHIS:

\[ p(H_i) = \Pr\{T_i = 1 | H_i\} = E\{(T_i) | H_i\}; \quad P(H_i) = F\{z(H_i)\} \] (2)

where \( H_i \) denotes a vector of pre-Treatment characteristics of the household i, \( T_i \) indicates if the household has NHIS or not it a binary variable \( T_i = (1,0) \), \( E \) is the expectation operator, and \( F\{\} \) represents a logistic or normal cumulative distributive frequency. Thus, the probability of a household enrolling in NHIS is conditional pre-treatment household characteristics.

The propensity score matching methodology is a two-stage process. In the first stage, a logit or probit estimation model is used to generate the p-scores - the propensity of a household to enroll in NHIS based on observables (Rosenbaum & Rubin, 1983). In our case we use a probit model to estimate the factors that influence NHIS adoption predict the scores which serves as the basis for our matching (see Sianesi, 2004). The predicted score is then used to examine the impact NHIS by examining households with similar p-scores but different enrollment outcomes. Majority of scholars have argued that the Average Treatment effect (ATE) is a very good estimator which is used to measure the mean difference in outcomes across the two groups (control and treatment group) (Heckman, 1996; Becker & Ichino, 2002; Khandker et al., 2009). Average Treatment effect on treatment group (ATT) and the Average Treatment for the Untreated (ATU) is mostly used in studies reviewed. The ATE captures the treatment effect for the whole sample; ATT
represents the treatment effects on participants in the intervention. ATT has been highlighted to be the best parameter of interest for the estimation of the propensity score (Becker & Ichino, 2002).

Given the \( p(H_I) \), the effects are examined as:

\[
ATE = E[E(y_t^* | T_I) = 1, p(H_I)] - E\{y_t | (T_I) = 0, p(H_I)\}
\]

\[
ATT = E[E(y_t^* | T_I) = 1, p(H_I)] - E\{y_t | (T_I) = 0, p(H_I)\}|(T_I) = 1
\]

(3)

where \( y_t^* \) is the counterfactual outcome of households with “NHIS “, \( y_t \) is the counterfactual outcome of households without “NHIS”, the counterfactual estimates denote what the investment level in agricultural input would be if they did not have NHIS.

In the second stage, the control and treatment groups are matched together to find similarities using their observed characteristics which are not affected by the intervention. A number of matching methods have been recommended for such estimation such as Nearest-Neighbour Matching, Radius Matching, Kernel Matching and Stratification Matching. Matching is usually employed to eliminate over-biasness and evaluate the treatment effect. These methods are adopted for robustness purposes.

Due to the underlying principles and conditions of PSM as stated by Hechman, Lalonde & Smith (1991); Augurzky & Schmidt (2001); Lechner (2001) and Bryson, Dorsett & Purdon (2002), the probit treatment model is adopted to estimate the probability of a farm households adopting NHIS. Table 3 presents the estimates from the probit model and the marginal effects which captures the predictors that influence farming household’s decision to enroll in NHIS. Table 3 shows the significant variables that influence the decision for a farm household to get insured with NHIS. The significant factors identified to influence farm household’s enrolment on NHIS are age, gender, educational level, marital status of the household head, and household expenditure.
Income is not a significant driver of farm household’s NHIS enrolment decisions. Thus, interventions can easily be targeted based on demographics to address enrollment challenges among farm households. Specifically, we observe that male headed farm households are less likely to adopt NHIS by 16.3 percent which confirms Mensah et al (2010) results. Educational Level is consistent with findings from Besley et al. (1999) and Mensah et al (2010) who also found that highly educated households are more likely to enroll in NHIS. Also, we find that farm household that spend more, have a high probability of adopting NHIS.

Table 3: Results of probit Treatment Model from Propensity Score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Err</th>
<th>P&gt;(t)</th>
<th>Margin</th>
<th>P&gt;(z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.013***</td>
<td>0.002</td>
<td>0.000</td>
<td>0.0048</td>
<td>0.000</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.458***</td>
<td>0.963</td>
<td>0.000</td>
<td>-0.163</td>
<td>0.000</td>
</tr>
<tr>
<td>Educational Level</td>
<td>0.130***</td>
<td>0.029</td>
<td>0.000</td>
<td>0.046</td>
<td>0.000</td>
</tr>
<tr>
<td>Marital Status</td>
<td>0.0012</td>
<td>0.915</td>
<td>0.989</td>
<td>0.0005</td>
<td>0.989</td>
</tr>
<tr>
<td>Farm Size</td>
<td>0.010*</td>
<td>0.006</td>
<td>0.077</td>
<td>0.004</td>
<td>0.075</td>
</tr>
<tr>
<td>Household Income</td>
<td>0.00002</td>
<td>0.026</td>
<td>0.999</td>
<td>0.00008</td>
<td>0.999</td>
</tr>
<tr>
<td>Household Size</td>
<td>-0.035</td>
<td>0.036</td>
<td>0.340</td>
<td>-0.012</td>
<td>0.340</td>
</tr>
<tr>
<td>Household Expenditure</td>
<td>0.201***</td>
<td>0.049</td>
<td>0.000</td>
<td>0.0714</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.915***</td>
<td>0.407</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Log Likelihood: -1220.6524
P>chi2: 0.0000
Pseudo R2: 0.0583

*** p<0.01, ** p<0.05, * p<0. Source: Author’s Compilation using Stata 15.0

With the probit treatment model results shown in Table 4.4 above, the propensity score is evaluated for households that invest in agricultural inputs. The common support option in propensity score
is bounded within 0.293 to 1 for households that have enrolled and households that have not enrolled. The Graph “Distribution of the propensity score” after matching shows that the estimation of the p-score balance between the insure and the non-insured group occupy. This result shows a good match between the insured and not insured across all rages of the p-score distributions.

Figure 1: Distribution of Propensity Score for the Matched Samples

Table 4 below shows the indices of the quality of the matching process. Here, reduction in the mean absolute standardized bias between the unmatched and matched samples is used to determine the balancing powers of estimation. From table 4, the mean bias before and after matching is 18.0 and 2.0 respectively, shown in columns four and five. It is observed that after matching, the mean bias in the covariates is below 20 percent level of bias reduction suggested by Rosenbaum & Rubin (1985). Hence the covariates are significantly balanced by using the propensity score matching algorithms.

The before and after Pseudo R² is shown in the second and third column with their respective p-values in parenthesis. The study observes that, Pseudo R² is fairly low and the
diagnostic statistics is not significantly different from zero, after matching. This suggest that there is no significant difference between farm households enrolled in NHIS and farm households not enrolled (Pseudo R$^2$ before and after matching 0.054 and 0.004 respectively). The p-value reduced from a highly significant level of 0.000 before matching to an insignificant level of 0.174 after matching. Hence, there is no systematic variance in the distribution of covariates between farm household enrolled in NHIS or not enrolled. This implies that the outcome variable from the matching process is suitable in balancing the covariates between the farm households enrolled and farm households not enrolled (Sianesi, 2004).

Table 4: Indices of the Matching Quality

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pseudo R$^2$ (Unmatched)</th>
<th>Pseudo R$^2$ (Matched)</th>
<th>Mean bias (Unmatched)</th>
<th>Mean bias (Matched)</th>
<th>Bias reduced (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-related</td>
<td>0.054</td>
<td>0.004</td>
<td>18.0</td>
<td>2.0</td>
<td>51.6</td>
</tr>
<tr>
<td>Investment</td>
<td>(0.000)</td>
<td>(0.174)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P-values in parenthesis

5. TREATMENT EFFECT

5.1 Impact of NHIS on Land-related Investment

To examine how NHIS impacts land-related investment in agriculture under the propensity score estimation approach, the average treatment effect is estimated which is shown in Table 4.6 and 4.7 below. Using nearest-neighbour matching which eliminates most of the bias between the treated and the control groups, the result from Table 5 shows that farm households with NHIS invests about GHC 242.93 (60 $) in agricultural investment whilst farm households without NHIS invest about GHC 171.45 (42 $).\(^2\) This implies that, farm households with NHIS invest roughly GHC

\[^2\] \ln_{e}x = 5.493 and therefore x equals 242.93. Note than Logx/m equals Logx – Logm and not x-m.
71.48 (18 $) than farm households without NHIS. This is 42 percent increase over the controlled group value. The impact is significant at a 1 percent significance level. Comparing it to the OLS estimation result which reveal that farming households with NHIS enrollment invest 32 percent in agricultural inputs.

Table 5: Effect of NHIS on Land-related Investment in Agriculture Input. (Nearest Neighbour Matching)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Treated</th>
<th>Control</th>
<th>Difference</th>
<th>Std Error</th>
<th>T-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-related</td>
<td>Unmatched</td>
<td>5.540</td>
<td>5.144</td>
<td>0.396</td>
<td>0.069</td>
<td>5.75</td>
</tr>
<tr>
<td>Investment</td>
<td>ATT</td>
<td>5.493</td>
<td>5.144</td>
<td>0.348</td>
<td>0.078</td>
<td>4.46</td>
</tr>
</tbody>
</table>

Using Kernel Matching, the results from Table 6 confirms that there is a positive significant effect of NHIS enrollment on agricultural inputs and significant at a 1 percent significance level. Thus, under the Kernel estimator, the results suggest that farm households with NHIS invest GHC68.08 (17 $) more than farm households without NHIS (roughly 37 percent more).

Table 6: Treatment Effect of NHIS on Land-related Investment in Agriculture Input (Kernel Matching).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Treated</th>
<th>Control</th>
<th>Difference</th>
<th>Std Error</th>
<th>T-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land-related</td>
<td>Unmatched</td>
<td>5.540</td>
<td>5.144</td>
<td>0.396</td>
<td>0.069</td>
<td>5.75</td>
</tr>
<tr>
<td>Investment</td>
<td>ATT</td>
<td>5.526</td>
<td>5.210</td>
<td>0.316</td>
<td>0.076</td>
<td>4.16</td>
</tr>
</tbody>
</table>

5.2 Impact of NHIS on Hired Labour

To examine how NHIS impacts hired labour under the propensity score estimation approach, the average treatment effect is estimated which is shown in Table 7 below. Using nearest-neighbour matching, the result from Table 7 show that farm households with NHIS invests about GHC 200.60
(50 $) on hired labour whilst farm households without NHIS invest about GHC 146.57 (36$). This implies that, farm households with NHIS invest roughly GHC 54.02 (14 $) than farm households without NHIS. This is 37 percent increase over controlled group value. The impact is significant at the 5 level of percent significance.

Table 7: Effect of NHIS on Hired Labour (Nearest Neighbour Matching)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Treated</th>
<th>Control</th>
<th>Difference</th>
<th>Std Error</th>
<th>T-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired</td>
<td>Unmatched</td>
<td>5.320</td>
<td>5.036</td>
<td>0.284</td>
<td>0.084</td>
<td>3.39</td>
</tr>
<tr>
<td>Labour</td>
<td>ATT</td>
<td>5.301</td>
<td>4.986</td>
<td>0.314</td>
<td>0.146</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Source: Author’s Estimation using stata 15

Using the Kernel Matching, the results from Table 8 confirms that there is a positive significant effect of NHIS enrollment on hired labour and significant at a 5 percent significance level. Thus, under the Kernel estimator, the results suggest that farm households with NHIS invest by GHC 46.69 more than farm households without NHIS (roughly 30 percent more).

Table 8: Effect of NHIS on Hired Labour (kernel matching)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample</th>
<th>Treated</th>
<th>Control</th>
<th>Difference</th>
<th>Std Error</th>
<th>T-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hired</td>
<td>Unmatched</td>
<td>5.320</td>
<td>5.036</td>
<td>0.284</td>
<td>0.084</td>
<td>3.39</td>
</tr>
<tr>
<td>Labour</td>
<td>ATT</td>
<td>5.301</td>
<td>5.036</td>
<td>0.265</td>
<td>0.089</td>
<td>2.98</td>
</tr>
</tbody>
</table>

Source: Author’s Estimation

5.3 Robustness Check -Two Stage Residual Inclusion

The propensity score matching estimation method shows the causal effect of NHIS on land-related agricultural investment that enhances the OLS estimates by controlling for observables that impacts NHIS enrollment. As indicated, as a robustness check we estimate and present the two-stage residual inclusion model which controls for all possible omitted variables and therefore
improves causal interpretation and inference. We estimate a first stage regression as indicated earlier, and then include the residuals of the first stage regression in the second stage impact model, with the intention that if there are any unobservable characteristics that could influence NHIS enrolment and bias the estimate of NHIS is controlled for in the second stage model (Terza, Basu & Rathouz, 2008). We specify the following econometric equation:

The First Stage Equation is:

\[ NHIS_i = \beta_0 + \beta_1 Mar_i + \beta_2 Edu_i + \beta_3 Age_i + \beta_4 InHHInc_i + \beta_5 InHHExp_i + \beta_6 HHSize_i \]
\[ + \beta_7 FSize_i + \beta_8 Male_i + \beta_9 SurveyYear_i + \varepsilon_i \]  

(4)

The Second Stage Equation is

\[ \ln (\text{Invest})_i = \alpha_0 + \alpha_1 Mar_i + \alpha_2 Edu_i + \alpha_3 Age_i + \alpha_4 InHHInc_i + \alpha_5 InHHExp_i + \alpha_6 HHSize_i \]
\[ + \alpha_7 FSize_i + \alpha_8 Male_i + u_i + \hat{\varepsilon}_i \]  

(5)

Where \( \hat{\varepsilon}_i \) is the residuals predicted from the first stage and the definition for the other variables are the same as the already defined ones in the land-related investment in agriculture model.

The estimation results on Table 9 presents both the first and second stage results for the residual inclusion model, the results from the two- stage residual inclusion model shows that, consistent with the OLS and propensity score estimates, household’s with NHIS tend to invest more in agricultural inputs than those without NHIS and this effect is significant at the 1 percent significance level.

Table 9: Effect of NHIS on Agricultural Inputs (two-stage residual inclusion)

<table>
<thead>
<tr>
<th>Variable</th>
<th>First Stage (NHIS)</th>
<th>Second Stage (Land investment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHIS</td>
<td>6.796***</td>
<td>6.796***</td>
</tr>
<tr>
<td>Age</td>
<td>0.005***</td>
<td>-0.034***</td>
</tr>
<tr>
<td></td>
<td>(0.0006)</td>
<td>(0.0103)</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.143***</td>
<td>1.343***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.326)</td>
</tr>
<tr>
<td>Farm Size</td>
<td>0.00018</td>
<td>0.0061***</td>
</tr>
<tr>
<td></td>
<td>(0.0003)</td>
<td>(0.0015)</td>
</tr>
</tbody>
</table>
Employing the two-stage residual inclusion model to examine the impact of NHIS on hired labour, the results from Table 10 below shows that NHIS has a positive and significant impact on hired labour, which indicates that’s household are able to hire more when they are insured with NHIS and can use their expenses spent on health to invest more on labourers. Also, majority of male headed household invest more on hired labour than female household heads. In addition, the bigger or larger the farm, the more labour is hired, and as household increase their income and their expenditure, more of labour is also hired. The unobservable variables that was accumulated in the residuals is significant in the land-investment model but not significant in the hired labour model.

Table 10: Two- stage residual Inclusion Estimation of Impact of NHIS on Hired Labour

<table>
<thead>
<tr>
<th>Variables</th>
<th>First Stage (NHIS)</th>
<th>Hired Labour (Hired Labour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHIS</td>
<td>0.343***</td>
<td>0.343***</td>
</tr>
<tr>
<td>Age</td>
<td>0.0047***</td>
<td>-0.0042**</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.143***</td>
<td>0.431***</td>
</tr>
<tr>
<td>Farm Size</td>
<td>0.00018</td>
<td>0.029***</td>
</tr>
</tbody>
</table>
CONCLUSION

National health Insurance Scheme has been in existence for more than a decade. The scheme has had significant impacts on insured individuals by reducing the financial burdens on health care services. Therefore, this study examines the impact on NHIS on land-related investment in agriculture. Applying the propensity score matching and the two-stage residual inclusion model estimators among others to 5,883 farming households, this study found that NHIS has a positive impact on land-related investment in agriculture which confirms with the findings of Lui (2016) who found positive effect of NHIS on investments in children. Regarding hired labour, NHIS has a positive impact at a 5 percent significance level based on propensity score matching and 1 percent from the two-stage residual inclusion model.

Overall, the findings suggest that NHIS enrolment contributes greatly to smallholder farmers’ investments in agriculture. Thus, farmers with NHIS are able to channel their saved income from health expenses into agricultural inputs. Some recommendations are made towards policy, practice and future research based on these findings. The government and the National
Health Insurance Authority should make education on the importance of NHIS accessible to farm households. This will ensure that farmers understand the need to enroll on NHIS. Also, through sensitization programs, farm households can be motivated to register and if more education is done the impact of health insurance would be greater on agricultural inputs and would increase the share of GDP from agriculture.

Interventions are also needed for enrolled farmers to stay on the scheme. The government must also increase health infrastructure across the country especially the rural areas to promote improved health care service delivery to farm households enrolled on NHIS. The agricultural sector launched the Ghana Agricultural Insurance Pool in 2011. The government can make policies that will improve agricultural insurance adoption overall in this country. This can also improve farmers’ investment level in agricultural input and will hence increase agricultural productivity and GDP.

REFERENCES
Audibert, M., Mathonnat, J., & Henry, M. C. (2003). Malaria and property accumulation in rice
production systems in the savannah zone of Cote d'Ivoire. *Tropical Medicine & International Health, 8*(5), 471-483.


Chamberlin, J. (2007). Defining Smallholders Agriculture in Ghana: Who are smallholders, what do they do and how are they linked with markets?


Ghana Health Service (2017). The Health Sector in Ghana: Facts and Figures


Sekyi, S., & Domanban, P. B. (2012). The effects of health insurance on outpatient utilization and
healthcare expenditure in Ghana. *International Journal of Humanities and Social Science*, 2(10), 40-49.


