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Faculty of the Professions
School of Economics

Health Insurance, Healthcare Utilisation and Labour Market Outcomes: A Micro Study of Ghana

a thesis

by

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Table of Contents

List of Tables

List of Figures

Abstract

The majority of the people in sub-Saharan Africa work in the informal sector. This sector plays a significant role in the growth and development of many developing countries as it contributes nearly two-thirds (63.6%) of the GDP in sub-Saharan Africa. People in this sector characteristically have lower incomes than those in the formal sector and are more susceptible to illness, while being less likely to receive medical care. They struggle to generate adequate resources to pay their healthcare expenses. This sometimes affects their healthcare access, health and the labour market outcomes. In 2003, Ghana introduced health insurance to improve healthcare access and the general health of Ghanaians. This thesis, therefore, uses Ghana as a case study to scrutinise the nexus between health insurance, labour market outcomes and healthcare utilisation in sub-Saharan Africa.

First, the thesis investigates how the expansion of health insurance coverage affects the healthcare utilisation and labour market outcomes of the elderly in Ghana. Using household-level data from the Ghana Living Standard Survey (GLSS) and adopting a difference-in-difference framework, the thesis examines the effect of health insurance on the elderly's healthcare utilisation, hours worked, earnings and food consumption. The thesis finds that having health insurance increases the number of visits the elderly make to a health facility and the probability of being treated by health professionals. For labour market outcomes, the results indicate that having health insurance increases both the number of hours worked and the earnings of the elderly. In terms of consumption, it is found that having free health care increases expenditure on food, with the size of the increase slightly larger for the elderly in the high-wealth group than for those in the low-wealth group.

Second, the thesis studies whether or not health insurance affects the labour productivity of workers in Ghana through illness-related absenteeism at the workplace. Employing household-level data from the GLSS, the study applies

count data estimation techniques to investigate how health insurance affects labour productivity through the expected time workers spend out of work due to illness. The results show that health insurance has a positive effect on labour productivity by reducing the extent of illness-related absenteeism in the workplace, after accounting for potential endogeneity in health insurance. A decline in the extent of illness-related absenteeism at the workplace is observed for insured workers in both the formal and informal sectors, but the reduction is lower in the informal sector than in the formal sector.

Finally, the thesis examines the effect of health insurance on maternal healthcare utilisation and abortion in Ghana. Unsafe abortion is the second largest cause of maternal mortality in Africa, and in Ghana, unsafe abortion alone accounts for about one-third of maternal deaths. This study uses cross-sectional data from the Demographic and Health Survey of Ghana and employs non-parametric and parametric estimation strategies for the analysis. The study finds that on average, health insurance causes a sizeable and significant increase in maternal healthcare utilisation. No evidence is found that the abortion rate responds to health insurance in general. However, in subgroup analysis, the study finds a significant reduction in abortion among young insured women aged 15-19 years compared with those in the same age group without health insurance. The reduction in abortions is also observed for unmarried women.

Keywords: health insurance, healthcare utilisation, abortion, labour market outcomes, consumption expenditure, labour productivity.

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Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Dedication

To My MOTHER

Chapter 1

Introduction

Healthcare access is a major issue confronting people in developing countries, who nevertheless are faced with 92% of global deaths from communicable diseases, 68% of deaths from non-communicable diseases and 80% of deaths from injuries. These statistics differ among the developing countries and are more prevalent in Africa than on other continents. This makes Africa the continent with the highest mortality and morbidity rate. The differences in mortality rates across developing countries also indicate that the issue is critical in some countries relative to others (Murray and Lopez, 1997; Boutayeb and Boutayeb, 2005; Chirwa, 2016; Boutayeb, 2006).

Despite the high mortality and morbidity rate in Africa, healthcare access is a major challenge for a large section of people, particularly those in sub-Saharan Africa. This has resulted in low utilisation of health care in the sub-region. One major factor affecting healthcare access among people in Africa is the cost of medical treatment, which constitutes a major financial burden on households, especially those in the low-income group (Xu et al., 2003; Russell, 2004; Xu et al., 2006). According to World Health Organization (2015), about 150 million people in developing countries suffer financial catastrophe every year when faced with unexpected out-of-pocket medical expenditure. This indicates that affordability of health care is a challenge in developing countries.

Individuals who cannot afford medical costs sometimes defer their medical treatment, others also resort to self-medication. Postponing treatment can have serious consequence for individuals' health, with wider implications for individuals

and households, in terms of household earnings, consumption, hours of work and labour productivity (Leive and Xu, 2008; Sparrow et al., 2014; Mohanty et al., 2014; Cheng et al., 2018). It also contributes to poverty because people, especially those in the low-income group, have less access to health services and the lack of access worsens their health, which in turn leads to lost income and higher medical expenses which impair people's welfare (Smith, 1999; Peters et al., 2008). For these reasons, improving healthcare access and health has been a primary concern for policymakers and researchers in many countries. Several interventions have been initiated and better access to health insurance has been shown to improve healthcare utilisation and general health (Wang et al., 2009; Card et al., 2008; Finkelstein et al., 2012; Cheng et al., 2015; Duku et al., 2015). Despite the importance of health insurance, very little research has focused on labour market outcomes and productivity of workers, especially in sub-Saharan Africa.

Ghana, one of the countries in sub-Saharan Africa, introduced a health insurance scheme in 2003 to improve healthcare access and the general health of Ghanaians. This thesis, therefore, attempts to investigate the effect of health insurance on healthcare utilisation, labour market outcomes and productivity in Ghana. The thesis focuses on Ghana because factors that affect healthcare access, morbidity and mortality are closely related to most countries in sub-Saharan Africa. Before the introduction of health insurance, Ghana ranked highly among the countries in the region with healthcare access challenges. Healthcare services were financed by user fees, where individuals paid for healthcare services before receiving treatment. This policy resulted in a huge decline in the utilisation of healthcare services (Asenso-Okyere et al., 1998; World Bank, 2007; Ghana Health Service, 2009). The decline in healthcare utilisation, especially in the 1990s and the early 2000s, prompted the Government of Ghana to establish health insurance in 2003 to improve healthcare access and the health of its citizenry (Arhin-Tenkorang, 2001; Ghana Health Service, 2009). Therefore, investigating how health insurance affects healthcare utilisation, labour market outcomes and productivity in a society where the majority of people are prone to illness is important.

There is evidence that people with health conditions are more likely to participate in the health insurance program and therefore consume more health care. This makes health insurance endogenous to outcome variables of interest which, in turn, affect the results (Cameron et al., 1988; Cheng, 2014). This is because in the presence of endogeneity, the error term and health insurance are correlated, and this render the estimated parameters biased and inconsistent (Wooldridge, 2010). The study accounts for this possible endogeneity issue in the health insurance program by employing appropriate estimation strategies in our analysis.

This thesis comprises three main chapters and they examine three research questions. Chapter 2 asks the question of whether exempting the elderly from health insurance premium payments affects healthcare utilisation, hours of work, earnings, and food consumption in Ghana. Chapter 3 seeks answers to the question of whether health insurance affects labour productivity through illness-related absenteeism at the workplace, with the investigation focusing largely on informal sector workers in Ghana. Chapter 4 investigates whether health insurance affects maternal healthcare utilisation and abortion in Ghana. This chapter attempts to determine if there are heterogeneous effects of health insurance on abortion with respect to women's characteristics in terms of age, marital status, place of residence and educational status, to understand whether the effects differ for different groups in the sample. The following paragraphs explain the order of the thesis in more detail.

Chapter 2 investigates how health insurance affects healthcare utilisation, labour market outcomes and consumption of the elderly in Ghana. The study concentrates on the elderly, who for the purpose of this study are above 55 years of age and are active in the informal sector of the economy, which accounts for the majority of the labour force in the agricultural sector in Africa. Africa is a continent with a youthful population; approximately 60% of the African population is below 24 years of age. However, the average age of the labour force in the agriculture sector (farmers) in Africa is 60 years (Food and Agriculture Organization, 2014). This indicates that the majority of people in the agriculture sector in Africa are the elderly and they contribute immensely to Africa's economy which depends largely on agricultural

outputs.

Despite their contribution to Africa's economy (Ghana's in particular), the cost of healthcare access was a challenge for the elderly until the introduction of health insurance in 2003, when those aged 70 years and over were exempted from health insurance premium payments[1] and thus given free healthcare. As the informal sector, particularly the agricultural sector, plays a significant role in the growth and development of many developing countries. It is therefore important to investigate the effect of health insurance on healthcare utilisation, hours worked, earnings and food consumption of the elderly. The study uses household-level data from the Ghana Living Standard Survey from 1998/99 to 2012/13 and adopts a difference-in-differences framework for this analysis. In the model specification, the study assigns the elderly exempted from health insurance premium payments as the treatment group, and those not exempted as the control group. A falsification and pre-treatment balancing test was performed and the results suggest that the differences in outcome between the elderly with free health care and those without free health care could be attributed largely to the intervention of the National Health Insurance Scheme (NHIS). The overall findings suggest that subsidising the elderly's healthcare expenses or exempting them from premium payments increases healthcare utilisation, the number of hours of work and earnings, which in turn increases food consumption.

In Chapter 3, the study extends the analysis by examining whether or not health insurance affects labour productivity through illness-related absenteeism at the workplace in Ghana. Individuals' state of health influences their labour force participation and labour productivity; where in this study labour productivity refers to the amount of goods and services that a worker produces in a given time. This indicates that the number of workdays missed affects worker productivity through output loss. Most of the absenteeism at the workplace has been associated with ill-health (Davis et al., 2005; Holden et al., 2011). There is evidence that suggests

[1]Most of the elderly in sub-Saharan Africa work in the informal sector of the economy, which is characterised by low income, therefore, they struggle to generate adequate resources to finance their healthcare expenses when ill.

that people in sub-Saharan Africa are more disposed to illness compared with people in other regions (Deaton and Tortora, 2015). This suggest that the effects of illness-related absenteeism at the workplace are likely to be greater in developing countries than in developed countries. The relationship between individuals' health and their work has been shown to be more observable in societies where the majority of the people are vulnerable to illness (Currie and Madrian, 1999). Therefore, investigating the relationship between health insurance and labour productivity through illness-related absenteeism at the workplaces in Ghana is vital for policy making in a developing country context, where people are more susceptible to illness.

The study uses two waves (2005/06 and 2012/13) of household-level data from the GLSS and applies count data estimation techniques for this analysis. However, the demand for health care and the probability of missed workdays may depend on the health status of a worker, and those with poor health conditions or health risk are more likely to miss workdays and also to participate in an insurance program. This unobserved health status of workers may bias the estimates. On the other hand, an individual with good health may be expected, ceteris paribus, to miss fewer workdays. Therefore, ignoring the endogeneity issue in health insurance would greatly affect the estimates. Thus, it would lead to the conclusion that would suggest a reduction in the number of missed workdays even if there is no effect. The study accounts for this potential endogeneity problem in the health insurance program by employing regional-level average health insurance coverage as an instrumental variable. This instrument is likely to reflect the exogenous variation in the individuals' participation in the health insurance scheme in Ghana. The findings reveal that having health insurance increases labour productivity through a reduction in illness-related absenteeism at the workplace. This increases the country's output through a reduction in output loss, which in turn increases economic growth and development.

Chapter 4 studies the impact of health insurance on maternal healthcare utilisation and abortion in Ghana. The study investigates this relationship because maternal healthcare access and abortion contribute immensely to maternal

mortality in sub-Saharan Africa. According to the World Health Organization (2012), about 21.6 million unsafe abortion cases are reported annually. In terms of abortion-related deaths, more than 99% cases occur in developing countries particularly, in sub-Saharan Africa, Central and Southeast Asia, Latin America and the Caribbean (Okonofua, 2006; Sedgh et al., 2016). This suggests that abortion-related deaths in developing countries are of critical concern. In Ghana, unsafe abortion is the second largest cause of maternal mortality, accounting for 15%-30% of maternal deaths (Asamoah et al., 2011). Ghana failed to meet most of the 2015 Millennium Development Goals (MDGs) set in the 1990s, in particular the maternal mortality ratio,[2] indicating that maternal mortality in Ghana remains high. Despite the enormous contribution of abortion to maternal mortality in sub-Saharan Africa, the study on the relationship between health insurance and abortion in developing country settings is limited, particularly in the sub-Saharan Africa context.

This study, therefore, investigates how health insurance affects maternal healthcare utilisation and abortion in Ghana. It further examines the heterogeneity in abortion in terms of women's age, marital status, place of residence and educational status. The study uses two waves of cross-sectional data (2008 and 2014) from the Demographic and Health Survey of Ghana and employs non-parametric and parametric estimation strategies for the analysis. The findings show that the provision of health insurance improves maternal healthcare utilisation and also reduces abortion among young women aged 15-19 years and unmarried women.

Chapter 5 concludes the study by summarising the major findings, together with the contribution of the study to the literature. It also discusses policy issues from the study and suggests a direction for further research.

Background

Health insurance has been seen as a means for improving healthcare utilisation and protecting households against impoverishment from out-of-pocket expenditures in

[2]In 2015, 319 deaths per 100,000 live births were recorded, and this exceeds the MDG 5 target of 190 deaths per 100,000 live births between 1990 and 2015 (World Health Organization, 2015).

low-and middle-income countries (Hsiao and Shaw, 2007; Devadasan et al., 2007; McIntyre et al., 2006). According to Nyman (1999), insurance reduces the financial stress associated with user fees and this improves access to healthcare. In Ghana, there are a number of studies that show how health insurance provides financial protection to households (Nguyen et al., 2011; Strupat and Klohn, 2018; Aryeetey et al., 2016; Okoroh et al., 2018). There are various types of health insurance. National or social health insurance (SHI) is based on mandatory enrolment of all individuals. Countries implementing this type of insurance include Thailand, the Philippines and Vietnam. Voluntary insurance includes the private health insurance (PHI) which is widely implemented in countries such as Brazil, Chile, Namibia, and South Africa (Smith, 2007), and community-based health insurance (CBHI) which is used in countries such as Congo, Ghana, Rwanda and Senegal (Ranson, 2002; Ekman, 2004; Lagarde and Palmer, 2006; McIntyre, 2007). These insurance schemes have different impacts on the population for instance, while the PHI is said to mainly serve the affluent segments of a population, the CBHI also benefits the poor in terms of health financing (Carrin et al., 2005; Smith and Sulzbach, 2008). The type of health insurance operate in most of the sub-Saharan Africa countries is the CBHI. Several studies have shown how the subsidisation of health expenditure through the CBHI system has improved healthcare use and health in most developing countries (Wang et al., 2016; Mensah et al., 2010; Aggarwal, 2010; Dzakpasu et al., 2012; Brugiavini and Pace, 2016).

In Ghana, a number of studies have also shown how the introduction of health insurance health insurance has improved healthcare utilisation in general. Most of the findings are little different from findings in studies in other developing countries. Thus, health insurance increases health care use (Mensah et al., 2010; Dzakpasu et al., 2012; Brugiavini and Pace, 2016). In terms of maternal healthcare utilisation, studies have revealed how health insurance increases maternal health care use, particularly, the frequency of antenatal care visits, and delivery in a health facility (Mensah et al., 2010; Dixon et al., 2014; Abrokwah et al., 2014). With regard to the relationship between health insurance and health care use by the elderly, the studies are limited,

and of the few that are available, the results are also mixed (Duku et al., 2015; Van Der Wielen et al., 2018). Whereas Duku et al. (2015) finds significant effects of health insurance on healthcare utilisation by the elderly, Van Der Wielen et al. (2018) finds no significant impact on healthcare utilisation among older people in rural areas.

Most studies of the effects of health insurance on healthcare outcomes in Ghana concentrate on specific geographical areas. In the Brong-Ahafo and the Upper East regions, health insurance utilisation reduces birth complications, infant and maternal deaths (Mensah et al., 2010). In the Northern region, the NHIS leads to a decline in the number of days of illness and better self-reported health outcomes (Asuming, 2013). In the Greater Accra region, Ansah et al. (2009) finds that the NHIS increases healthcare utilisation, but insignificant effect on healthcare outcome of children. Overall, most studies find that the introduction of health insurance has improved health care utilisation and health among the populace (Mensah et al., 2010; Dixon et al., 2014; Abrokwah et al., 2014; Dixon et al., 2014; Abrokwah et al., 2014). The condition of ones's health has been shown to influence one's ability to work, but studies of how health insurance affects labour market outcomes and labour productivity the sub-Saharan Africa context are limited. Therefore, understanding the relationship between insurance and labour market outcomes is important for policy evaluation within the sub-Saharan Africa context. The study also examines how improvement in healthcare access through health insurance affects abortion in Ghana.

Institutional context of the Ghana NHIS

Ghana introduced the NHIS in 2003 on a pilot basis in four regions and it became fully operationalised in all the regions in 2005. To improve healthcare access, the scheme provides free health insurance to indigents and vulnerable people by exempting them from the NHIS premium payment. The elderly aged 70 and over were among the people captured as vulnerable in the NHIS and are therefore provided with free healthcare. People with a mental disorder, children under 18 years and pregnant women are also exempted from the NHIS premium payment. Exempting these

groups of people from premium payment eliminates financial barriers affecting their healthcare access (Ghana Health Service, 2009; Mensah et al., 2010).

The scheme covers both outpatient and inpatient services for 95% of disease conditions that affect Ghanaians.[3] The scheme excludes heart and brain surgery, HIV, cancer treatments other than cervical and breast cancer.[4] In Ghana NHIS, there are no co-insurance or co-payment, and no deductibles when register or participate in the NHIS.

Before the introduction of the NHIS, healthcare services in Ghana were financed by user fees, where individuals pay for healthcare services before receiving treatment. This policy, known as the cash and carry scheme, was part of the Structural Adjustment Programme introduced in the 1980s to address Ghana's budget deficits. It discouraged unnecessary utilisation of healthcare services and encouraged private sector participation to expand the healthcare system. This policy created disparities in access to healthcare services and resulted in a huge decline in the utilisation of healthcare services (Asenso-Okyere et al., 1998; World Bank, 2007; Ghana Health Service, 2009). It also made vulnerable people more susceptible to financial impoverishment in the event of catastrophic illness (World Bank, 2007).

The decline in healthcare utilisation, especially in the 1990s and the early 2000s, prompted the government of Ghana to establish the NHIS in 2003 (Arhin-Tenkorang, 2001; Ghana Health Service, 2009). It was established under the National Insurance Act 2003 (Act 650) to eliminate out-of-pocket payments and to ensure equity in access to healthcare services. The scheme protects the indigents and vulnerable people from catastrophic healthcare expenditures. A new Act (Act 852) replaced Act 650 in 2012 to consolidate the NHIS activities, eliminate administrative challenges, corruption and improve transparency of the scheme.

Contribution to the NHIS is mandatory for formal sector employees, and their contributions are made through payroll deduction of 2.5% of their Social Security and

[3]It covers most of the outpatient services such as, malaria treatment, acute respiratory diseases and eye infections, hypertension, diabetes, skin diseases and ulcers. Inpatient services also covered by the scheme are cervical and breast cancers treatment. Other general and specialist inpatient care includes oral health, eye care services, maternal care and emergencies such as road accidents.

[4]Other disease conditions excluded are organ transplantation, dialysis, antiretroviral medicines, cosmetic surgeries and angiography, and other medicines not on the NHIS list.

National Trust Fund into the National Health Insurance Fund. However, employees need to be registered before becoming a member in the NHIS. The membership of informal sector workers is voluntary, and they contribute to the scheme through annual premium payments. Premiums are based on a person's ability to pay and are not determined based on health needs. The amount is usually determined by the authorities of the scheme at the district level, therefore, there are variations in premiums across different districts in Ghana. Premiums for individuals working in the informal sector ranges from GH7.2 - GH48¢($US\$2 - \$12$)[5] for individuals in the lowest and highest-income groups respectively (Mensah et al., 2010). In addition to contributions by formal and informal sector workers, there are other sources of finance contributing to the NHIS. These include a National Health Insurance levy on goods and service, which is 2.5% of value added tax (VAT), 5% Road Fund, 20% Communication Service Tax and a levy on tobacco and alcoholic drinks. Ghana NHIS is regulated by the National Health Insurance Authority, which also manages the National Health Insurance Fund.

There are three types of health insurance operating in Ghana: the Private Commercial Health Insurance Scheme, the Private Mutual Health Insurance Scheme and the District Mutual Health Insurance Scheme (DMHIS). The DMHIS is the dominant one and is operated in all districts in Ghana. More than 99% of individuals participating in the insurance schemes are within the DMHIS; therefore, our analysis of the NHIS is based on the DMHIS. The DMHIS is responsible for the day-to-day administration of the scheme, eligibility, enrolment, collecting contributions and paying claims.

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[5]The study used average Ghana Cedis to US Dollar rate within the study period (2016-2019) at the rate of GH¢4.3 = US$1.

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Chapter 2

The Effect of Health Insurance on Healthcare Utilisation, Labour Market Outcomes and Consumption of the Elderly in Ghana

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Abstract

This study examines the effects of health insurance coverage on healthcare utilisation and labour market outcomes and consumption expenditure of the elderly in Ghana. Using household-level data from the Ghana Living Standard Survey and adopting a difference-in-difference framework, the study investigates whether exempting the elderly from health insurance premium payments affects healthcare utilisation, earnings, hours worked and consumption. The study finds that having health insurance increases the number of visits the elderly make to a health facility and the probability of being treated by health professionals. For labour market outcomes specifically, hours worked and earnings in the agriculture sector, the results indicate that health insurance increases both the number of hours worked and earnings of the elderly, with the increase being larger for males than females. With regard to consumption, the study finds that free insurance increases food consumption expenditure of the elderly, and the size of the increase is slightly larger for the elderly in the high-wealth group than those in the low-wealth group.

Keywords: health insurance, healthcare utilisation, labour market outcomes.

JEL Classification: I10, I18, J14,

2.1 Introduction

Poor health and its implications for the economic well-being of individuals and households have been an issue of concern in many developing countries (Reddy, 2002; Boutayeb, 2009). Poor health limits the ability of individuals to engage in income-generating activities, and this affects household income, hours of work and labour force participation (Currie and Madrian, 1999; Cai and Kalb, 2007; Cai, 2010). This issue is of particular importance among the elderly, especially those in sub-Saharan Africa, because the elderly are the key source of labour in the agricultural sector (Food and Agriculture Organization, 2014).[1] Overall, ill-health affects the size of the effective workforce, which could affect the nation's production. It could also potentially reduce government revenue and increase government spending on other health-related transfers (Hadley, 2003).

One major factor that contributes to poor health in developing countries is the high cost of health treatment, specifically out-of-pocket health expenditure. High medical costs reduce access to health care and this in turns affects health outcomes (Xu et al., 2003; Russell, 2004; Xu et al., 2006). Most of the elderly in developing countries work in the informal sector, which is characterised by low income, and therefore, they struggle to generate adequate resources to pay for their healthcare expenses. Individuals who cannot afford medical costs sometimes defer their medical treatment (Leive and Xu, 2008; Kruk et al., 2009). The postponement of treatment can have serious consequences for the individual's health, and this has wider implications for individuals and households in terms of household earnings, consumption and hours of work (Gertler and Gruber, 2002; Asfaw and Braun, 2004; Sparrow et al., 2014; Mohanty et al., 2014; Cheng et al., 2019).

Health expenditure increases with age and according to Alemayehu and Warner (2004), major expenditure on illness is often experienced after 65 years. This suggests that medical expenses are a challenge for most of the elderly in low-income groups in developing countries. To reduce high medical costs and improve health care,

[1] According to Food and Agriculture Organization (2014), the average age of the labour force in the agriculture sector (farmers) in Africa is 60 years. This indicates that the majority of people in the agriculture sector in Africa are the elderly.

the World Health Organization (WHO) advocated for universal health insurance coverage in 2005 (World Health Organization, 2010). Studies have shown how the subsidisation of health expenditure through health insurance has improved healthcare access and health outcomes of the elderly in both developed and developing countries (Lichtenberg, 2002; Wang et al., 2009; Card et al., 2008, 2009; Finkelstein et al., 2012; Cheng et al., 2015; Duku et al., 2015). The elderly are more disposed to illness and need regular health care, but owing to financial challenges, they are less likely to receive proper health care.

The provision of free medical care for the elderly through a health insurance system in most advanced countries is quite similar to that in developing countries. However, one major difference between them is age eligibility for free health care through the insurance program. In most developed countries, the majority of people are in the formal sector and the eligible age for free health care corresponds to their retirement age. Therefore, the elderly from these countries enrol in the health insurance program immediately after their retirement. This system improves elderly health and productivity even after retirement, thereby contributing immensely to the economic development of their respective countries.[2] However, in most developing countries, the majority of people work in the informal sector, and are relatively few work in the formal sector, therefore, retirement and age eligibility for free health care is completely different. In most cases, the elderly have to wait a number of years before meeting the age criterion. In Ghana, for instance, although the eligible age for free health care through health insurance program is 70 years, the majority of the elderly work in the informal sector, and the few that work in the formal sector retire at 60 years. This indicates that the majority of the elderly, especially those in the informal sector, have to wait a number of years before being eligible for free health care.[3] Whether or not the number of years the elderly in a developing country such as Ghana have to wait before being eligible for free healthcare affects

[2]In advanced countries such as the US and Australia, for instance, the retirement and age eligibility for free medical care are not very different.

[3]This arrangement is similar to other developing countries such as Vietnam and Chile, where the eligible age for free health care is 85 and 80 years respectively, while the retirement age in these countries is 60 and 65 years.

their health and labour market outcomes is unknown. If having health insurance is positively associated with health, and health influences an individual's ability to work, an important question, then, is whether or not providing the elderly with free health insurance affects the health care and labour market outcomes of the elderly in Ghana.

This study, therefore, investigates whether or not health insurance affects healthcare use, labour market outcomes and consumption expenditure of the elderly in Ghana. The study concentrates on the elderly who are above 55 years of age and are active in the informal sector of the economy, which constitutes the majority of the labour force in the agricultural sector in Africa. These people contribute immensely to Africa's economy, which depends largely on agricultural outputs, but they are less likely to receive proper healthcare. Besides, most of the elderly also engage in subsistence agriculture, which covers most food production in sub-Saharan Africa. Most of this food production serves as food/nutrition security in the respective countries. Their activities also provide job opportunities for younger ones, which helps to reduce rural-urban migration and also encourages youth interest in the agriculture sector (Aboderin and Beard, 2015; World Health Organization, 2014). Ill-health in the elderly can affect the size of the effective workforce and the nation's production. Therefore, understanding the relationships between health insurance and healthcare use, together with labour market outcomes from a developing country such as Ghana, will help to improve policy decisions. The study also adds to a shred of small evidence in the literature about the impacts of health insurance on labour market outcome and consumption of the elderly in the informal sector in the sub-Saharan Africa context.

This analysis focuses on Ghana, because issues on health and healthcare access of the elderly are similar across Africa (World Health Organization, 2014; Aboderin and Beard, 2015). Affordable access to health care was a challenge for the elderly in Ghana until the introduction of the National Health Insurance Scheme (NHIS) in 2003, where the elderly aged 70 and over were exempted from paying premiums. The study, therefore, employs a difference-in-difference (DID) strategy to examine the

effects of the NHIS on the elderly (i.e. those exempt from the NHIS premium payment and those aged 55-69 whor are not exempt from the premium payments) in terms of healthcare utilisation, labour market outcomes and consumption expenditure. The study uses nationally representative household-level data from Ghana Living Standard Survey (GLSS) for this analysis. The findings show that health insurance has significant effects on measures of healthcare utilisation and labour market outcomes of the elderly. Specifically, having health insurance increases the number of visits to a health facility and the probability of being treated by health professionals. With regard to labour market outcomes, the results show that having health insurance increases the number of hours worked and earnings, with the increase being larger for males than for females. The study also finds that exempting the elderly from the health insurance premium payment increases food consumption expenditure of the elderly, and the size of the increase is larger for those in high-wealth groups compared with those in low-wealth groups.

This study contributes to the literature in a number of ways. First, the study focuses on the elderly in the informal sector, who constitutes the majority of the labour force in the agriculture sector in developing countries. While many of the previous studies in the relevant literature focus on formal sector workers, understanding the effect health insurance has on elderly people who work in the informal sector is important as this sector plays a significant role in the growth and development of many developing countries. Finally, most of the existing studies, specifically those on health insurance and labour market outcomes, are in developed countries context. There are limited number of studies conducted in the sub-Saharan Africa context. Therefore, examining the effects of the NHIS on labour market outcomes in Ghana is vital for policy evaluation within the sub-Saharan Africa context. The findings provide background information that will help to improve health insurance policies in Ghana and other developing countries.

The rest of the paper is organised as follows. Section 2 describes the background of the study. Section 3 discusses the data used in the analyses. Section 4 presents the econometrics framework underlying the study. The results are presented in Section

5. Section 6 discusses the results and Section 7 concludes.

2.2 Background

2.2.1 Health insurance and healthcare use

As already mention, the impact of health insurance on elderly health care has been examined in the developed and in some developing countries and most of the findings are similar. The arguments are that health insurance reduces financial risk: specifically, out-of-pocket expenditure associated with health treatment. The reduction in out-of-pocket medical expenses allows individuals to afford the needed care and therefore increases their healthcare access. Card et al. (2008) investigate the impact of nearly universal insurance coverage on the utilisation of health care by the elderly. They find that the onset of Medicare eligibility increases the utilisation of healthcare services in the US. The results obtained by Card et al. (2008) are similar to those of other studies in the advanced countries context such as (Lichtenberg, 2002; Card et al., 2009; Finkelstein et al., 2012). From the developing countries perspective, Cheng et al. (2015) study how having health insurance affects health outcomes and healthcare expenditure by the elderly in China and find that the elderly enrolled in health insurance receive adequate medical service when ill. Similarly, Wang et al. (2009), who study the effects of rural community-based health insurance on healthcare outcomes in China, find that having such insurance improves the health status of the elderly.

In Ghana, there are a number of studies on the effects of the NHIS on healthcare utilisation in general, and most of the results suggest that health insurance increases health care use (Mensah et al., 2010; Dzakpasu et al., 2012; Brugiavini and Pace, 2016). In terms of maternal healthcare utilisation, studies have revealed that health insurance increases maternal health care use (Mensah et al., 2010; Dixon et al., 2014; Abrokwah et al., 2014). However, there are few studies on the relationship between health insurance and health care use of the elderly, and the few that are available provide the mixed results (Duku et al., 2015; Van Der Wielen et al., 2018). Duku

et al. (2015) investigate whether Ghana's health insurance system improves healthcare access for older people, and they find that health insurance improves the utilisation of elderly healthcare services. Van Der Wielen et al. (2018) conduct a similar study in Ghana but obtain a different result. They find that enrolling in health insurance has no significant impact on the utilisation of healthcare services among older people in rural areas. The mixed results make the Ghana studies inconclusive. Most of the existing studies in Ghana are also limited to district-level analysis, therefore, from the policy-making perspective it is important to examine this relationship with nationally representative data.

2.2.2 Health insurance and labour market outcomes.

There are studies on the effects of health insurance on labour market outcomes, but already mentioned, the focus has been on formal sector employment and the results are mixed. The rationale for the positive effect of health insurance on labour market outcomes is that insurance reduces healthcare expenses, which improves healthcare access. Regular healthcare access, together with the use of preventive care services, improves labour participation, hours of work and earnings (Currie and Madrian, 1999; Hadley, 2003; Dizioli and Pinheiro, 2016). Gruber and Hanratty (1995), who investigate the effects of health insurance on labour market outcomes in Canada, find that access to health insurance has increased employment and wages. Currie and Madrian (1999) conduct a similar study in the US and find that health insurance improves labour market outcomes such as labour force participation. Strumpf (2011), who studies the impacts of Medicaid on women's labour force participation, finds that having health insurance increases female labour supply in the US.

Conversely, some studies find health insurance to be a disincentive to labour market outcomes. One argument is that providing free health insurance for the elderly increases the likelihood of retirement, and early retirement could also affect labour force participation and hours of work (Gruber and Madrian, 2002). Others argue that the provision of free health insurance makes informal sector jobs (self-employment) more attractive because fringe benefit contributions (premium payments) are not

required. This reduces labour supply in the formal sector, because workers move from the formal sector to the informal sector. Subsidising the cost of medical treatment also reduces the financial burden of the elderly. Therefore, most of the elderly with free health care increase their leisure by reducing some of the labour market outcomes, particularly labour force participation and hours of work, in order to preserve energy for the rest of their life span (Aterido et al., 2011). Boyle and Lahey (2010) study the impact of public health insurance on the labour market outcome of the veterans in the US, and find that access to health insurance reduces labour supply of the elderly workers. A study by Dague et al. (2017) finds similarly that enrolment in public insurance (Medicaid) reduces adult employment and earnings in the US. Baicker et al. (2014), who study the effects of Medicaid on the employment of individual recipients in the Oregon health insurance experiment, also find that enrolling in Medicaid reduces labour force participation and earnings. In Taiwan, Kan and Lin (2009) investigate the effect of insurance on labour market outcomes and find that the introduction of health insurance reduces both the hours of work and the wage rate. The mixed results on the relationship between health insurance expansion and labour market outcomes make the studies' findings inconclusive.

On a slightly different note, there is evidence that suggests how an increase in government health expenditure affects the total consumption expenditure of the elderly (Mohanty et al., 2014). In China, Bai and Wu (2014) investigate the impact of health insurance on consumption expenditure and find that health insurance increases non-medical related consumption.

As there is a limited number of studies conducted in sub-Saharan Africa on the impact of health insurance on the elderly labour market outcomes, this study investigates the effects of health insurance on healthcare utilisation and labour market outcomes, particularly hours of work, earnings and consumption expenditure from the sub-Saharan Africa perspective, specifically Ghana, which is vital for policy analysis.

2.3 Data

The data used in this study are drawn from three cross-sections of the GLSS conducted by the Ghana Statistical Service. The GLSS is a nationally representative multipurpose household survey of living standard in Ghana. These three cross-sections are the fourth (1998/99), fifth (2005/06) and sixth (2012/13) rounds. The fourth round has a sample of more than 5,998 households with over 25,000 individuals; the fifth round has 8,687 households with 37,128 individuals; and the sixth round has a significantly larger number of interviewees compared with previous years, with 16,772 households and 72,168 individuals.[4]

The analysis is limited to individuals aged 55-85 years given that the focus of the study is on the elderly engaging in informal sector work. In Ghana, formal sector workers can opt to voluntarily retire from age 55-59 years, with compulsory retirement at age 60. There is no a stipulated retirement age for informal sector workers, however individuals may choose to continue to work in the informal sector after retiring from their formal sector jobs. Figure 2.1, which presents employment status by age group in the 2005/06 survey, shows that the share of formal sector workers decreases from 25% for individuals aged 55-59 years to 10% for those aged 60-64 years. By contrast, the share of informal sector workers remains steady from age 50 onwards, and falls slightly for the age groups 70-79 years. The upper limit of 85 years serves to capture individuals who are physically able to engage in agricultural work.

The number of individuals aged 55-85 years in each survey round was 2,231 (1998/99), 3,072 (2005/06) and 6,715 (2012/13), with a combined sample of 12,018. This sample includes elderly who reported illness and those who were not ill two weeks before the survey. The study focuses on the elderly who reported illness and sought for medical treatment before the survey. After excluding observations of the elderly with no health conditions prior to the survey (9,906) and missing responses (58), the resultant sample size for the elderly reduced to 2,054 for health care utilisation

[4]The significant increase in observations in the succeeding years is due, firstly, to an increase in the number of households included in the survey so as to capture more individuals. Secondly, additional sections were introduced in successive surveys, which increases the number of observations in that particular survey round.

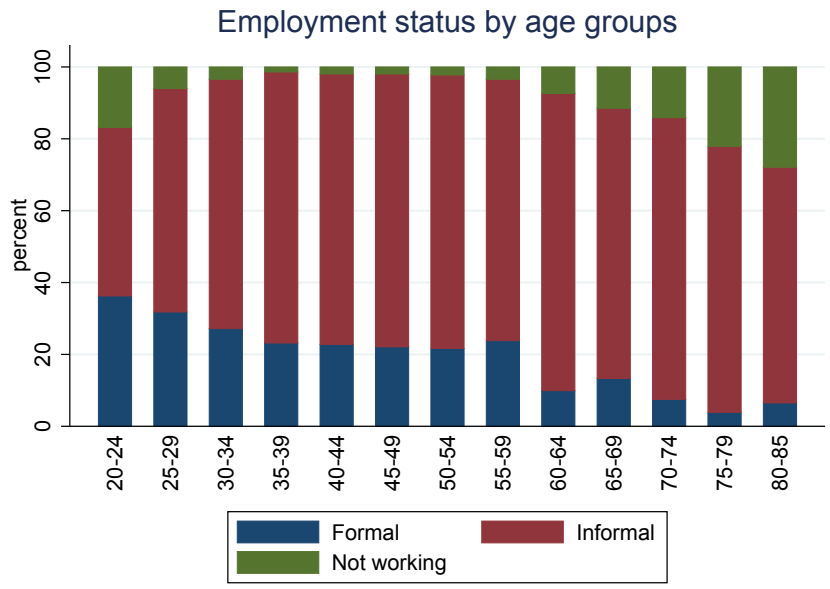

Figure 2.1: Employment status of the elderly by age group

analysis. In terms of labour market outcomes, the study focused on the elderly who had been utilising healthcare services two weeks before the survey. In this sample, some elderly reported hours of work, earnings and consumption expenditure, whereas others did not. This analysis focused on the individuals who reported their hours of work, earnings and consumption expenditure. After excluding missing responses for hours of work, earnings and consumption expenditure, the sample reduced to 768 observations.

This study is concerned with the impacts having health insurance has on healthcare utilisation and labour market outcomes. In each year, the survey collects a number of health care utilisation measures. The first, measure is a facility respondents visit when they are ill. With this outcome, we assigned 1 to facilities such as hospital, clinics and pharmacies that are covered by health insurance, and 0 for facilities such patient homes, chemical stores, consultants homes and other homes not covered by the NHIS. The second measure is whether or not respondents are treated by health professionals when they are ill. For this outcome, the study assigned 1 to treatment by trained health professional such as doctors, dentist, nurse, medical assistant midwife and pharmacist, and 0 to non-health professionals such as traditional healers, spiritualist and other healers. The third measure is whether or not they had been

admitted to hospital two weeks prior to the survey.

Measures of labour market outcomes that are collected in the survey include hours worked per week, employment status, annual total earnings, and annual earnings for agricultural work. In the survey, the observed hours of work per week range from 0 to 120 hours. The study restricts the number of hours of work of individuals working in the informal sector to 60, which corresponds to the 90th percentile of the distribution of observed work hours in the informal sector as shown in Table A1 in Appendix A.[5] The study converts annualised variables such as annual earnings and consumption expenditure into weeks by dividing by 52 to commensurate with other variables captured in weeks. A logarithm transformation is applied to all hours worked and income variables. The study converted the income variables from Ghana Cedis to US Dollars.[6]

The control variables that are used in this study can be classified into the following categories: individual and household demographic characteristics (age, marital status, gender, household size, ethnicity), socioeconomic characteristics (highest education level, employment status, household wealth, and time and cost of transport to travel to health facility), health status measure (illness) and geographical information (region/state, rural and urban)

Panel A in Table 2.1 reports the summary statistics of healthcare utilisation by the elderly aged 55-69 years and those 70 years and over by survey year. The estimates show that, on average, health insurance increased health care use much more for the elderly age 70 years and over compared to those aged 55-69 years. Healthcare utilisation is also higher in 2005/06 compared to 1998/99, but the significant point is that the utilisation increased for those aged 70 years and over compared with those below 70 years. The differences in health care use between the elderly aged 70 years and over and those below 70 years in 2012/13 are similar to the 2005/06

[5]The study limits the number of hours worked in the informal sector to 60 hours per week because the hours of work in the 75th percentile in the distribution of observed hours is 45 hours, which is equivalent to the maximum hour worked by formal sector workers. Workers in the informal sector work more than those in the formal sector, and the next highest category hours is 60 hours, which corresponds to the 90th percentile in the distribution of observed hours. The study therefore considered 60 hours per week the number of hours worked by the workers in the informal sector.

[6]The study used average Ghana Cedis to US Dollar rate within the study period (2016-2019) at the rate of GH¢4.3 = US$1

sample. These differences in healthcare utilisation in the survey years contributed to the application of the DID estimation technique. On average, the elderly respondents aged 55-69 years and those aged 70 years and over visited a health facility in the two weeks prior to the survey in 2012/13 (93.1% vs 93.6%), with the proportion being larger than those in the 2005/06 (88.8% vs 90.3%) and 1998/99 (77% vs 69.2%) samples. The proportion of the elderly below 70 years and those 70 years and over treated by a health professional when ill were 81.7% vs 76.1% in the 1998/99 sample, 93% vs 94.4% in the 2005/06 sample and 96.1% vs 96.3% in the 2012/13 sample. In terms of receiving hospital care, the means percentages for the elderly below 70 years and those 70 years and over are 4.3% vs 5.1% in 1998/99, 4.2% vs 7.4% in 2005/06 and 5.1% vs 6.2% in 2012/13.

Panel B in Table 2.1 reports the summary statistics of the labour market outcomes and consumption sample by survey year. The average hours worked per week by the elderly below 70 years and those aged 70 years and over were 22.8 vs 21.5 hours in the 1998/99 sample, 31.6 vs 24.1 hours in the 2005/06 sample and 32.1 vs 29.4 hours 2012/13 sample. The mean weekly earnings of the elderly below 70 years and those aged 70 years plus were \$0.50 vs \$0.30 in the 1998/99 sample, \$2.70 vs \$1.90 in the 2005/06 and 0\$10.20 vs \$12.90 in the 2012/13 sample. The mean weekly consumption expenditures were \$0.90 vs \$0.70 in the 1998/99, \$3.30 vs \$3.00 in the 2005/06 and \$11.60 vs \$ 14.00 in the 2012/13 sample.

The estimates show that on average there has been a successive increase in healthcare utilisation and some labour market outcomes since the introduction of the NHIS in 2003. The extent to which these increases are due to the introduction of the NHIS is the question this study seeks to address.

Table 2.1: Summary statistics: Healthcare outcomes, weekly hours of work, earnings and consumption expenditure

	1999		2006		2012	
	55-69 (1)	70 + (2)	55-69 (3)	70 + (4)	55-69 (5)	70 + (6)
Panel A: Healthcare outcomes						
Health facility	0.770	0.692	0.888	0.903	0.931	0.936
Standard deviation	[0.422]	[0.464]	[0.316]	[0.297]	[0.253]	[0.244]
Health professional	0.817	0.761	0.930	0.944	0.961	0.963
Standard deviation	[0.387]	[0.429]	[0.256]	[0.230]	[0.194]	[0.188]
Hospital care	0.043	0.051	0.042	0.074	0.051	0.062
Standard deviation	[0.204]	[0.222]	[0.201]	[0.262]	[0.220]	[0.421]
Observations	230	117	356	216	707	436
Panel B: Labour market outcomes						
Hours of work	22.79	21.50	31.55	24.05	32.12	29.37
Standard deviation	[12.53]	[14.27]	[13.81]	[14.79]	[15.67]	[15.80]
Earnings	0.538	0.324	2.69	1.88	10.24	12.94
Standard deviation	[0.746]	[0.565]	[3.91]	[2.54]	[27.57]	[23.28]
Consumption expenditure	0.88	0.66	3.34	3.04	11.55	13.99
Standard deviation	[0.70]	[0.32]	[3.11]	[3.21]	[9.83]	[11.54]
Observations	100	34	187	86	210	143

Note: Hour of work, earnings and consumption expenditure are in a week. Earnings and consumption expenditure are in the US dollars. "Health facility" measures a facility respondents visit when they are ill. "Health professional" measures whether or not respondents are treated by health professionals when they are ill. "Hospital care" measures whether or not respondents had been admitted to the hospital two weeks prior to the survey.

2.4 Econometrics framework

The study employs a DID approach to quantify the effects of health insurance on healthcare use and labour market outcomes. To improve healthcare access for the elderly in Ghana, health insurance is provided free to elderly individuals aged 70 and over. The study therefore assigns individuals aged 70 years and over to the treatment group, and those below 70 years to the control group.[7] Given that our sample comprises individuals 55-85 years of age, individuals in the control group are

[7]The study chose the elderly below 70 years not entitled to the NHIS as a control group because free elderly healthcare is a national policy implemented across the country at the same period (time). Both groups (elderly above and below 70 years) are within the retirement age and are likely to have a similar characteristic in terms of medical needs, healthcare expenditure and labour force participation. Therefore, choosing individuals aged 55-69 years as a control group is appropriate for this analysis.

aged 55-69 years.

In the model specification, suppose the study defines W = 1 to denote the elderly who received free health insurance (treatment group) and W = 0 for those who did not receive free health insurance (control group). Furthermore, the study observes two time periods, where *pre* and *post* are defined as time periods prior to, and after, the introduction of the NHIS respectively. Following Ravallion (2001), the average treatment effect of the treated (ATET) under the potential outcome framework is expressed as:

$$ATET = E[Y_{i,post} - Y_{i,pre}|X_i, Z_i, W_i = 1] - E[Y_{i,post} - Y_{i,pre}|X_i, Z_i, W_i = 0] \quad (2.1)$$

where Y_i represents healthcare use and labour outcomes of individuals. X_i represents the observed covariates that consist of individuals and household characteristics; and Z_i denotes individual-specific unobserved characteristics.

Individuals in the sample may have different characteristics (observed and unobserved), which might explain the differences in the outcome (rather than the program being the cause). If unobserved characteristic Z_i is time-invariant or time-variant but has the same time trend between the treated and control groups, we can eliminate these individual-specific characteristics with a DID approach. Based on the above argument, the ATET in equation (2.1) can be expressed as:

$$ATET = E[Y_{i,post} - Y_{i,pre}|X_i, W_i = 1] - E[Y_{i,post} - Y_{i,pre}|X_i, W_i = 0] \quad (2.2)$$

Equation (2.2) can be expressed in a regression approach in the form of:

$$Y_i = \alpha + \delta INSURANCE_i + \theta POST + \beta(INSURANCE_i \times POST) + \gamma X_i + \varepsilon_i \quad (2.3)$$

where $INSURANCE_i$ is the dummy variable that takes the value of 1 if the elderly receive free health insurance and 0 for those who did not receive free health insurance.

The indicator $POST$ is equal to 1 for the time periods after the NHIS has been introduced and 0 otherwise. X_i is a vector of control variables. β is the key parameter of interest and is equivalent to the ATET in equation (2.2). ε_i is the idiosyncratic error term.

2.4.1 Pre-treatment test

Prior to the introduction of the NHIS, there may have been unobserved factors that could have evolved differently between treated and control groups, which may also affect the outcomes the study are interested in studying. The existence of these unobserved factors may lead to a violation of the parallel trend assumption, which could potentially lead to a bias in the estimation of our treatment effect β. To assess the presence of these factors, the paper conducts a balancing test on the covariates of our sample before the introduction of the NHIS to determine if there are significant differences in the observable characteristics between the treated and control groups.

Table 2.2 describes the differences in the outcomes and the remaining covariates in the treatment and control group before the NHIS was introduced. As observed in the Table 2.2, there are no significant differences between the treated and control group in most of the covariates prior to the NHIS intervention. A test of parallel trend assumptions requires at least two years of data prior to the introduction of the policy in question. In our application, the study has data from one year of the GLSS. For most of the outcome variables, there are no significant differences in the mean of the variables by treatment and control status.

Figure A1 to Figure A5 illustrate the impact of health insurance on labour market outcomes, consumption expenditure and healthcare utilisation before and after the introduction of the NHIS policy. The figures reveal a noticeable increase in earnings, consumption expenditure, hours worked and healthcare utilisation after the implementation of the NHIS. Thus, on average, there has been a successive increase in labour market outcomes, consumption expenditure and healthcare utilisation since the introduction of the NHIS in 2003. Figure A1 and Figure A2 illustrate earnings and consumption expenditure (in US dollars) before and after the NHIS implementation,

Table 2.2: Pre-treatment balancing test

Variables	Treatment	Control	Difference	P-value
Outcomes				
Health facility	0.692	0.770	0.077	0.120
Health professional	0.761	0.817	0.057	0.215
Hospitalised care	0.051	0.043	-0.008	0.744
Hours worked	21.50	22.97	1.467	0.830
Earnings	0.327	0.538	0.211	0.592
Consumption expenditure	0.657	0.884	0.227	0.532
Covariates				
Poorest	0.174	0.110	-0.064	0.211
Poor	0.101	0.150	0.048	0.345
Medium	0.130	0.189	0.059	0.298
Rich	0.232	0.189	-0.043	0.479
Richest	0.362	0.362	-0.001	0.997
Employment	0.043	0.078	0.035	0.217
Male	0.470	0.378	-0.092	0.101
Health status	0.863	0.852	-0.011	0.782
Household size	3.493	3.843	0.350	0.420
Western region	0.061	0.080	0.019	0.537
Central region	0.105	0.138	0.033	0.397
Greater Accra region	0.105	0.080	-0.025	0.441
Volta region	0.192	0.147	-0.046	0.276
Eastern region	0.175	0.169	-0.007	0.880
Ashanti region	0.175	0.191	0.016	0.727
Brong-Ahafo region	0.070	0.053	-0.017	0.536
Northern region	0.035	0.062	0.027	0.294
Upper East region	0.044	0.036	-0.008	0.708
Upper west region	0.035	0.044	0.009	0.689
Time taken to Health facility	3.398	3.480	0.082	0.855
Akans	0.487	0.513	0.025	0.650
Ga Dangbe	0.104	0.087	-0.050	0.151
Ewe	0.162	0.157	-0.006	0.888
Guans	0.051	0.061	0.010	0.718
Northern	0.094	0.143	0.049	0.192
No Tribe	0.068	0.039	-0.029	0.234

Note: The table reflects averages in the pre-treatment period, a year before the introduction of the NHIS in 2003; earnings and consumption expenditure are given in the US dollars.

and we observe a significant increase in average earnings and household consumption after the NHIS introduction. Figure A3 shows hours of work and that relatively younger people have the ability to work more hours than older people. The estimate reveals a significant increase in hours worked by the elderly after the provision of free health care. In terms of healthcare utilisation, as illustrated in Figure A4 and Figure A5, the figures show an increase in healthcare utilisation by the elderly after the introduction of the NHIS. Overall, the average earnings, hours worked, consumption expenditure and healthcare utilisation of the elderly was higher after the NHIS implementation than before, as illustrated in Figure A1 to Figure A5

In addition to the balancing test, the study further assesses the robustness of our results by performing a number of falsification tests. The results of these tests are discussed after presenting the key findings of the study. The next section presents the key results of the paper.

2.5 Results

2.5.1 Health insurance and healthcare utilisation

Table 2.3 reports the parameter estimates of β, the DID estimates showing the effects of the NHIS policy on healthcare utilisation by the elderly. In all specifications, the study estimates clustered standard errors by region to allow for within-group correlation and report them in the parentheses below the coefficient estimates. Here, the study uses three waves, 1998/99, 2005/06 and 2012/13, where 1998/99 is the pre-NHIS period, and 2005/06 and 2012/13 are the post-NHIS periods. The results show that having health insurance increases the probability of visiting a health facility and being treated by a health professional. Specifically, having health insurance increases the probability that elderly individuals visit a health facility by 9.3 percentage points (10.4% of the mean), and increases the probability of being treated by a health professional by 6.9 percentage points (7.4% of the mean). In terms of hospital care as shown in column (3), the elderly with free NHIS are less likely to be hospitalised, although the estimated coefficient is not statistically significant.

Table 2.3: DID estimates of the effect of health insurance on healthcare utilisation

Outcome variables	Health facility (1)	Health professional (2)	Hospital care (3)
Insurance×Post	0.093**	0.069**	-0.005
	(0.039)	(0.035)	(0.028)
R-squared	0.076	0.083	0.053
Mean of outcome variable	0.891	0.927	0.053
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	2,054	2,054	2,054

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. Weekly hours worked is the dependent variable and is given in logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status and educational status); health status measure (illness); region; and year fixed effect.

2.5.2 Heterogeneous effect of health insurance on healthcare utilisation

To assess the presence of a heterogeneous effect, the study estimates the impact of the NHIS policy by gender and whether the elderly respondent lives in an urban or rural area.[8] The results presented in Table 2.4 show that there is a significant difference in health facility visits between elderly men and women. Elderly men with free health care are 12.6 percentage points (14.3% of the mean) more likely to visit a health facility compared with those without free health care. Thus, the probability of elderly men visiting a health facility for a proper treatment when ill is higher for those with free NHIS compared with those without it. For women, the study finds that insurance does not have a significant effect on health facility visits. With regard to treatment by health professionals and hospital care, the study did not find significant differences between elderly men and women.

In terms of rurality, the study did not find a significant difference in healthcare utilisation between the elderly residing in rural areas and those in urban areas. Most of the estimates for those in rural areas show a positive effect and those in urban areas

[8]The provision of health facilities in Ghana is not uniform across the country. People may have free health insurance but may not have access, to health facilities. The study therefore investigates how the elderly's place of residence affects healthcare utilisation. In terms of gender, the study seeks to investigate whether there is a significant difference in healthcare utilisation between elderly men and women in Ghana.

Table 2.4: DID estimates of heterogenous effect of health insurance on healthcare utilisation

Variables	Health facility (1)	Health professional (2)	Hospital care (3)
Males			
Insurance×Post	0.126*	0.068	-0.019
	(0.060)	(0.075)	(0.033)
R-squared	0.125	0.142	0.047
Mean of outcome variable	0.879	0.911	0.061
Observations	848	848	848
Females			
Insurance×Post	0.039	0.041	-0.018
	(0.044)	(0.043)	(0.046)
R-squared	0.059	0.051	0.058
Mean of outcome variable	0.899	0.939	0.048
Observations	1,206	1,206	1,206
Living in rural area			
Insurance×Post	0.125	0.103	-0.064
	(0.087)	(0.076)	(0.044)
R-squared	0.133	0.130	0.034
Mean of outcome variable	0.862	0.909	0.184
Observations	875	875	875
Living in urban area			
Insurance×Post	-0.0002	-0.0674	0.0269
	(0.107)	(0.0823)	(0.0265)
R-squared	0.121	0.077	0.057
Mean of outcome variable	0.938	0.955	0.185
Observations	536	536	536

Note: Standard errors, clustered by regions, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. All the estimates in Table 2.4 are subgroup analysis. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status, educational status and time taken to travel to the hospital); health status measure (illness), region and year fixed effect.

show a negative effect, but neither is statistically significant. That is, there is no significant difference between the elderly with free health care and those without free health care residing in both rural and urban centres in terms of healthcare utilisation. Overall, the results suggest that the elderly's place of residence does not influence their healthcare use.

2.5.3 Health insurance and labour market outcomes

The study also examined the effect of health insurance on the elderly's hours of work and earnings. In this analysis, the study focuses on the working hours and earnings of elderly individuals in the informal sector, specifically those who work in the agricultural sector, given that a large proportion of the elderly are engaged in work as farmers.

Table 2.5: DID estimates of the effect of health insurance on weekly hours of work

Variables	Combined	Males	Females
	(1)	(2)	(3)
Panel A: Informal sector			
Insurance×Post	0.404**	0.620**	0.285*
	(0.115)	(0.186)	(0.131)
R-squared	0.061	0.062	0.098
Mean hour of work	31.12	31.52	28.37
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	768	426	342
Panel B: Agricultural sector			
Insurance×Post	0.407**	0.390**	0.544**
	(0.126)	(0.147)	(0.222)
R-squared	0.067	0.046	0.104
Mean hour of work	28.88	30.64	26.12
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	511	312	199

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. Weekly hours worked is the dependent variable and are given in the logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status and educational status); health status measure (illness); region; and year fixed effect.

Compared with other sectors, the majority of the elderly in the informal sector work in agriculture. As shown in Table A2 in Appendix A, about 70% of the elderly in the sample work in the agricultural sector. The study, therefore, focuses on hours of work and earnings in the informal sector as a whole and those in the agricultural sector. We also consider the elderly's hours of work and earnings in terms of gender.[9]

Table 2.5 describes the effects of the NHIS on hours of work of the elderly in the informal sector in general (Panel A) and the agricultural sector (Panel B). The estimates in both panels show positive and statistically significant effects of insurance on hours of work. In Panel A, the result in column (1) shows that having insurance increases the weekly number of hours of work in the informal sector by 40.4%. In terms of gender, the effect is slightly larger for males (62%) than females (29%).[10]

In the agricultural sector as shown in Panel B, we observe that, providing the elderly free insurance have increases their weekly number of hours of work in the agricultural sector by 41%. However, a slightly larger effect of insurance is observed for females (54.4%) compared with males (39%).[11] The result suggests that elderly women in Ghana work more hours than men in the agricultural sector, but in informal sector as a whole, men work more hours than women.

In terms of earnings, the estimates in Table 2.6 show a positive and statistically significant effect of NHIS on weekly earnings across the panels. The estimates in Panel A are earnings in the informal sector as a whole. The findings show that having free health insurance increases earnings by 66%, with the estimated effect larger for females (73.4%) compared with males (59.4%).[12] In the agricultural sector, the estimates are similar to those in the informal sector as a whole in terms of signs

[9]In this subsection, the study did not consider the heterogeneous effect in terms of the elderly place of residence (rural or urban) because most of the agricultural in activities (farming) in Ghana occur in rural areas rather than urban centres.

[10]Since the labour market outcomes have been log-transformed, we estimate increases in hours of work in the informal sector by computing (exp(coefficient)-1)*100=[exp(0.404)-1]*100= 49.78%. In terms of gender, hours of work increase by 85.89%=[exp(0.620)-1]*100 for males and 32.98%=[exp(0.285)-1]*100 for females when insurance status changes from 0 to 1.

[11]With regard to the agriculture sector, hours of work increase by 50.23%=[exp(0.407)-1]*100 and is higher for females 72.23%=[exp(0.544)-1]*100 than males 47.70%=[exp(0.388)-1]*100 for females when insurance status changes from 0 to 1

[12]Thus, earnings in the informal sector increases by 92.71%=[exp(0.656)-1]*100 and are higher for females 108.34%=[exp(0.734)-1]*100 than males 81.12%=[exp(0.594)-1]*100 when insurance status changes from 0 to 1.

Table 2.6: DID estimates of the effect of health insurance on weekly earnings

Variables	Combined	Males	Females
	(1)	(2)	(3)
Panel A. Informal sector			
Insurance×Post	0.656***	0.594**	0.734**
	(0.134)	(0.190)	(0.194)
R-squared	0.396	0.395	0.306
Mean earnings ($)	7.58	10.08	4.46
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	768	426	342
Panel B. Agricultural sector			
Insurance×Post	0.682***	0.905**	0.388**
	(0.237)	(0.283)	(0.204)
R-squared	0.370	0.383	0.336
Mean earnings ($)	9.85	12.01	6.45
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	511	312	199

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. Weekly earnings is the dependent variable and are given in the logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status and educational status); health status measure (illness); region; and year fixed effect.

and statistical significance. The findings show that providing free NHIS through the exemption of health insurance premium payments increases earnings in the agricultural sector by 68.2%, with the earnings being increased by 91% for males and 39% for females.[13]

The estimates in Table 2.5 and Table 2.6 indicate that irrespective of gender, having health insurance increases the number of hours worked and earnings of the elderly. In the informal sector, the results reveal that men work more hours than women, but women earn more than men in this sector. These differences in earnings may be due to the activities both men and women engage in. Most women in this sector engage in petty trading and these contributes to regular or daily earnings, compared with the artisan activities men engage in, in this sector. However, in the agricultural sector the situation is completely different. Whereas women work more hours, they earn less compared with men. These differences in earnings may also be due to agricultural activities both engage in: most women engage in subsistence farming, while men engage in cash crops and plantation farming (Fortmann, 2009). This may account for the differences in earnings between the elderly men and women in the agricultural sector.

2.5.4 Health insurance and consumption

There is evidence internationally that ill-health affects the consumption of individuals and households in developing countries, and the effects are larger among the poor relative to the rich. The mechanism through which this occurs is that illness reduces the ability of individuals to participate in the labour force, and this negatively affects earnings. This reduction in earnings in turn affects consumption (Asfaw and Braun, 2004; Sparrow et al., 2014). Since having health insurance reduces health expenditure, as already stressed, the study examines the impact of the NHIS on households' food consumption expenditure. In this analysis, household consumption

[13]With regard to earnings in the agricultural sector increases by 97.78%=[exp(0.682)-1]*100 when insurance changes from 0 to 1. In terms of gender, earnings increase by 147.19%=[exp(0.905)-1]*100 for males and 47.40%=[exp(0.388)-1]*100 for females when insurance status changes from 0 to 1.

is also considered in terms of wealth-quintiles.[14]

Table 2.7: DID estimates of the effect of health insurance on weekly food consumption expenditure

Outcome variables	Combined	Low-wealth group	High-wealth group
	(1)	(2)	(3)
Insurance×Post	0.319**	0.153**	0.390*
	(0.126)	(0.072)	(0.101)
R-squared	0.617	0.642	0.739
Mean consumption expenditure ($)	9.12	6.83	11.37
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	768	381	387

Note: Standard errors, clustered by region, are in parentheses. *** p<0.01, **p<0.05, * p<0.1. Weekly consumption expenditure is the dependent variable and are given in the logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status and educational status); health status measure (illness); region; and year fixed effect.

The results shown in Table 2.7 indicate that exempting the elderly from health insurance premium payments increases household weekly food consumption expenditure by 32%, with the increase being slightly larger for the elderly in the high-wealth group (39%) compared with those in the low-wealth group (15.3%).[15] As the majority of the elderly in Ghana are in the low-wealth group, the results suggest that subsidising healthcare expenditure of the elderly improves food consumption of the elderly in both low and high-income groups in Ghana.

2.5.5 Falsification (placebo) test

The validity of the DID estimates hinges on the parallel trend assumption being satisfied. Thus, the trends in the outcome variables between the elderly with free health care and those without free health care would have remained similar in the

[14]The GLSS wealth index categorises households into 5 wealth quintiles: poorest (1st quintile), poor (2nd quintile), middle (3rd quintile), richer (4th quintile), richest (5th quintile). This helps in distinguishing between poor and wealthy households. In the estimation, the study categorised the 1st and 2nd wealth quintiles as a low-wealth group and 4th and 5th quintiles as a high-wealth group.

[15]In other words, food consumption expenditure increases by 37.58%=[exp(0.319)-1]*100. In terms of wealth quintile, consumption increases by 47.70%=[exp(0.390)-1]*100 for the elderly in high-wealth group and 16.53%=[exp(0.153)-1]*100 for those in high-wealth group.

absence of the NHIS, but this identifying assumption is not directly tested.[16] The study therefore conducted a pre-treatment balancing test analysis on variables of interest before the policy intervention. As shown in Table 2.2, the pre-treatment balancing test suggests that there are no significant differences between the elderly with free NHIS and those without it on most of the covariates before the policy implementation. This section examines other falsification (placebo) tests to check the validity of our results.

In the baseline model, the elderly aged 70 years and over were the treated group, but to conduct falsification analysis, the study assigned elderly individuals aged 55-69 years who are not affected by the policy as the treated group and those aged 40-55 years as a control group. The results from the falsification tests are reported in Table 2.8 to Table 2.10. In all specifications, the estimates are either insignificant or have the wrong signs for most of the outcome variables. Column (1) to column (3) in Table 2.8 reports the estimates of the effect of NHIS on healthcare use, and the results as shown in column (1) to column (3) in Panel A are imprecisely estimated. Thus, the estimates are different in terms of signs and statistically significant compared with the baseline DID results presented in Table 2.3 and Table 2.4, specifically the health facility visits and treatment by the health professional.

[16] A test of parallel trend assumptions requires at least two years of data prior to the introduction of the policy in question. In this analysis, the study has access to only one year of data from the GLSS, therefore, it was not possible to perform a regression analysis before the policy intervention.

Table 2.8: Placebo checks on healthcare utilisation

	Health facility	Health professional	Hospital care
Panel A: Full sample			
Insurance×Post	-0.001	0.006	0.009
	(0.039)	(0.031)	(0.022)
Mean of outcome variable	0.898	0.932	0.056
Observations	3,496	3,496	3,496
Panel B: Subgroup			
Males			
Insurance×Post	0.057	0.097	0.006
	(0.065)	(0.061)	(0.026)
Mean of outcome variable	0.895	0.925	0.061
Observations	1,362	1,362	1,362
Females			
Insurance×Post	-0.031	0.045	0.006
	(0.059)	(0.049)	(0.027)
Mean of outcome variable	0.901	0.937	0.053
Observations	2,134	2,134	2,134
Living in rural areas			
Insurance×Post	0.050	0.029	0.025
	(0.060)	(0.060)	(0.023)
Mean of outcome variable	0.870	0.916	0.046
Observations	1,290	1,290	1,290
Living in urban areas			
Insurance×Post	0.091	0.095	0.026
	(0.061)	(0.081)	(0.043)
Mean of outcome variable	0.953	0.967	0.049
Observations	896	896	896

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status, educational status and time taken to travel to the hospital); health status measure (illness); region; and year fixed effect.

Table 2.9: Placebo checks on weekly hours of work and earnings

	Hours			Earnings		
	Combined	Males	Females	Combined	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Informal sector						
Insurance×Post	0.009	0.071	0.210	0.301	0.240	0.404
	(0.099)	(0.089)	(0.151)	(0.225)	(0.232)	(0.362)
R-squared	0.037	0.045	0.040	0.379	0.412	0.241
Mean of outcome variable	32.55	33.91	30.48	$7.44	$9.99	$3.59
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,408	849	559	1,408	849	559
Panel B: Agricultural sector						
Insurance×Post	0.060	0.254	-0.185	-0.015	-0.201	0.006
	(0.126)	(0.129)	(0.053)	(0.219)	(0.291)	(0.268)
R-squared	0.030	0.015	0.056	0.389	0.407	0.325
Mean of outcome variable	31.60	33.47	27.94	$10.23	$12.73	$5.22
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	785	520	265	785	520	265

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. Weekly hours worked is the dependent variable and are given in the logarithm form. Weekly hours worked and earnings are the dependent variable and are given in the logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status, educational status and time taken to travel to the hospital); health status measure (illness); region; and year fixed effect.

The results indicate that health insurance has no statistically significant effect on most of the healthcare outcomes. The study applied the falsification test to the weekly hours worked and earnings of the elderly. The results presented in columns (1) to (6) of Table 2.9 also show insignificant effects of the NHIS on weekly hours worked and earnings of the elderly. As shown in columns (1) to (3) of Table 2.10, the findings for food consumption are different from the baseline results, which also suggest insignificant effects of the NHIS on consumption expenditure. The overall results are either insignificant or have the wrong signs for most of the outcome variables examined. These are in direct opposition to our baseline model. The pre-treatment balancing test and falsification tests described above suggest that the differences in most of the outcome variables between the elderly with free health care and those without free health care could be attributed largely to the introduction of the NHIS policy.

Table 2.10: Placebo checks on weekly food consumption expenditure

Outcome variables	Combined	Low-wealth group	High-wealth group
	(1)	(2)	(3)
Insurance×Post	-0.105	0.075	-0.263*
	(0.084)	(0.046)	(0.062)
R-squared	0.663	0.697	0.759
Mean consumption expenditure ($)	10.01	6.26	9.55
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	1,408	744	664

Note: Standard errors, clustered by region, are shown in parentheses. *** p<0.01, **p<0.05, * p<0.1. Weekly Consumption expenditure is the dependent variable and are given in the logarithm form. Demographic characteristics (age, gender, marital status, ethnicity); Socioeconomic characteristics (employment status, educational status, wealth quintiles and hours worked); Health status measure (illness); region; and year fixed effect.

2.5.6 Robustness check: propensity score matching with DID

The study assesses the robustness of the results using a combined propensity score matching and difference-in-difference (PSMDID) estimation technique as an

alternative empirical model to check the robustness of the baseline results. The PSMDID can accommodate unobserved factors of the control group that are constant over time and more likely to affect program participation. It also helps to eliminate the observed and unobserved characteristics that are constant over time and are more likely to affect the treatment effect of the outcome variables (Heckman et al., 1998, 1999; Imbens, 2004; Blundell et al., 2004; Wagstaff et al., 2009; Wang et al., 2009; Gertler et al., 2016; Cheng et al., 2015). The specification of PSMDID is little different from the treatment effect specification in equation (2.2). According to Rosenbaum and Rubin (1983), if potential outcomes are independent of participation conditional on the observable factors, then they are also independent of participation status conditional on the propensity score, $p(X_i) \equiv P(W_i = 1|X_i) = E(W_i|X_i) = P(W_i = 1|X_i)$. Thus, the probability of receiving treatment given the observed covariate is based on the propensity score of treated and control groups. The study, therefore, substitutes the propensity score into equation (2.2), and the model is expressed as:

$$ATET = E[Y_{i,post} - Y_{i,pre}|p(X_i), W_i = 1] - E[Y_{i,post} - Y_{i,pre}|p(X_i), W_i = 0] \quad (2.4)$$

Estimating equation (2.4) should fall strictly within the unit interval (range), $0 < P(W_i = 1|p(X_i)) < 1$, known as common support. According to Blundell and Dias (2009), the common support in PSMDID ensures that all the observations in a treated group have a counterpart in the control group before and after the intervention. To implement the PSMDID, the study estimates the propensity score of individuals given their observed covariates with the logit model at the first stage. The study then matches the elderly who receive treatment with those in the control group by their propensity score. The study uses the average weight obtained from the propensity score from the first stage to run the treatment effect regression. Several propensity score matching (PSM) techniques have been proposed for the identification of a control group in the first stage estimation of the propensity score. A kernel

matching approach is applied,[17] and all the estimates are based on bandwidth 0.06. In all specifications, the study imposed common supports in the estimation.

A. Balancing tests of PSMDID covariates

The validity of the PSMDID estimation requires satisfaction of most of the post-estimation conditions, such as minimum mean and median biases, and most of the post-estimation conditions required for consistent estimates were satisfied. The covariates of treated and control groups should balance, therefore, the study performed a series of iterations, and the balancing properties were also satisfied in all specifications. The estimation of ATET is defined in the region, therefore, the study checks the region of common supports of treated and control groups using their propensity density function. The results as shown in Figure A12 to Figure A17 in Appendix A indicate that the common supports assumption is not violated, because most of the estimated density masses are within the range of the region of common supports. The tests showing the matching qualities are also presented in Table A5 in Appendix A. Table A5 describes the overall covariates balancing test of each specification. The first column of data shows a significant reduction of pseudo-R^2 after matching. The next two columns (3) and (4) show the likelihood test ratio of joint significance and the p-value, and it is expected to be statistically significant before matching, indicating the differences between treated and control groups, and insignificant after matching, suggesting otherwise. The results shown in Table A5 indicate that the treated and control groups are not different (similar) after matching. The mean and median biases between treated and control groups after matching are reduced substantially and are less than 3% as required. The absolute standard difference of mean (B) is also less than 25% as required after matching, and the ratio (R) of treated to control is within the range (0.5 - 2) as recommended by Rubin (2001).

The graphical presentations as shown in Figure A6 to Figure A11 in Appendix A are similar to the estimates in Table A5, which confirms the reduction of standard

[17]The kernel matching estimator used a weighted average of all individuals in the control group to construct the counterfactual outcomes.

biases after matching. All the balancing (diagnostic) results suggest a successful covariate balance between treated and control groups. The diagnostics test results reported in Appendix A indicate that the differences between the treated and control group are minimal, therefore our analyses between them are reliable.

B. PSMDID results

Table A6 in Appendix A describes the results of healthcare utilisation in the PSMDID. The estimates as shown in column (1) to column (3) of Panel A in Table A6 are similar to the DID results in Table 2.3 in terms of signs and statistical significance. Table A7 also describes the estimates of the elderly's hours of work and earnings, and most of the results similar to the DID results in Table 2.5 and Table 2.6 in terms of signs and statistical significance. The results of food consumption expenditure by the elderly (reported in columns (1) to (3) in Table A8) are also not different from the DID results in Table 2.7 in terms of signs and statistical significance. The major differences between the DID and PSMDID in most of the model specifications is the magnitude of the estimated coefficients. This variation may be a result of observations used in the estimation. In the PSMDID as already elaborated, the estimations are made within the region of common support, and observations outside common supports are usually dropped from the estimation. This drop in observations could account for the differences in magnitude between the DID and PSMDID coefficients. The results suggest that the effects of health insurance on healthcare utilisation and labour market outcomes are robust to alternative estimation techniques.

2.6 Discussions

This study employs a DID approach to examine the effects of health insurance on healthcare utilisation and labour market outcomes of the elderly in Ghana. The study also applies the PSMDID and falsification (placebo) tests to check the robustness of the baseline results. In all specifications, the study clustered the standard errors by age to allow within-group correlation at the individual level. The study performed trend analysis for the period before the policy intervention, but we did not see a trend

for the elderly with free health care and those without free health care in terms of the covariates before the NHIS. After the implementation of the policy in 2003, the utilisation of healthcare services remained the same for the control group. Thus, the elderly in the control group continue to pay for health care through premium payment while the treated group were exempt from premium payments, and this affected the extent to which they utilised health care.

The study categorised this analysis into three parts: The first part examines the effects of the NHIS on healthcare utilisation of the elderly, and the second part focuses on labour market outcomes in the informal sector (weekly hours worked and earnings in the agricultural sector). The third part concentrates on food consumption expenditure.

In the first part, the findings indicate that exempting the elderly from health insurance premium payments increases the frequency of their visits to a health facility and the probability of being treated by health professionals. A falsification test is performed by assigning the elderly who receive no treatment as the treatment group, and the study found no significant effects across each specification. The falsification and pre-treatment balancing test suggests that the differences in outcome between the elderly with free health care and those without free health care could be attributed largely to NHIS intervention.

As the availability and distribution of health facilities in Ghana is not uniform across the country, people may have free health insurance but may not have access to a health facility. To investigate this, the study examines how the elderly's place of residence affects healthcare utilisation, and the findings reveal that there is no significant difference in healthcare use between those residing in rural areas and those in urban areas. The results suggest that the elderly's place of residence does not influence their healthcare use. Thus, irrespective of their place of residence, having the NHIS does not affects healthcare utilisation by the elderly.

In the second part of the analysis, the study focuses on hours of work and earnings in the informal sector of the economy, specifically the agricultural sector. The study concentrates in the agriculture sector relative to other sectors because Ghana's

economy depends largely on agriculture production, and the labour force in this sector is predominantly the elderly. The findings show a significant effect of health insurance on weekly hours worked. Thus, giving the elderly free health care increases the elderly's weekly hours of work. This affects the country's production, because an increase in hours worked also increases output, which in turn, improves the total output of the nation. On average, elderly males work more hours than elderly females in the informal sector as a whole, whereas females work more hours than males in the agricultural sector. Most females engaged in subsistence agriculture, but their activities contribute immensely to Ghana's economic growth and development.

Because hours of work are closely related to earnings, the study investigates the effect of the NHIS on earnings in the agricultural sector and finds a positive and statistically significant effect. The increase in earnings among the elderly is more likely to improve their purchasing power and welfare, and this will help to reduce income inequality among the elderly population in Ghana. The existing literature on the impact of health insurance on labour market outcomes presents mixed results as already discussed. The results are similar to the studies by Boyle and Lahey (2010) on old veteran in the US, in which the authors find that having public insurance has a positive effect on the income of those who are less educated. The results are also accord with the findings of Gruber and Hanratty (1995), that the introduction of health insurance increases wages in Canada. Their analyses were based on earnings in the formal sector of the economy relative to the informal sector, but the results are similar to this study.

Finally, the study examines the effects of the NHIS on the consumption expenditures of the elderly. In this analysis, the study focuses on the elderly in low and high-wealth groups. The findings suggest a significant effect of health insurance on food consumption expenditure among the elderly, but the increase is larger for those in the high-wealth group than in the low-wealth group. Healthcare is a major area of expense for the elderly, especially those in the low-income groups in most developing countries, therefore, subsidising health expenditure relieves the elderly in this group from catastrophic healthcare spending. The money that would have been

spent on health care can be channelled to other household expenditure, such as food consumption. The estimates suggest that improving the health of the elderly through the NHIS, especially those in the low-wealth group, also improves their consumption, which in turn improves their welfare. The result is similar to those found in the study by Bai and Wu (2014) in China, that find that having health insurance increases non-medical related consumption. The overall results indicate that giving elderly free health care improves their utilisation of health care, hours of work, earnings and food consumption expenditure.

Despite the benefits associated with the provision of free health care for the elderly, there are other issues that need to be addressed in order for the scheme to achieve its intended purpose, especially the elderly health care access. There is a section of the elderly population, specifically those aged 60-69 years, that are equally in need of healthcare assistance in the form of free health care in order to remain healthy and contribute to Ghana's economic development. As elaborated, these people are no different from the elderly aged 70 and over in terms of their medical needs, health expenditure and labour force participation. The majority of people in this age group are usually engaged in cocoa and other cash crop production, which make a major contribution to Ghana's economy, and they constitute a large labour force in the agriculture sector. Excluding them from the free health care policy could affect Ghana's economy in the long run because people in these age groups are also prone to illness.

Figure A18 in Appendix A uses United Nations Department of Economic and Social Affairs (DESA 2015) data from its study of adult mortality from 1995 to 2015. The DESA, UN (2015) data reveal the high mortality rate in Ghana among the elderly aged 60-70 years. This indicates that, periodically, Ghana loses most people within its labour force in the agriculture sector, and this can affect Ghana's agriculture output if appropriate policies are not put in place. The study, therefore, recommends three approaches. First, it is necessary for government to lower the age eligibility for free health care to at least 60 years in order to assist more people, who may postpone treatment for financial reasons. This will aid diagnosis and enable the resolution of

illness-related complications that have been accumulated in individuals over time due to financial constraints. Secondly, to help in early diagnosis and proper treatment, it is necessary to ensure the elderly given free health care adhere to a strict periodic health check-up, and this will also help in early diagnosis and proper treatment. Lastly, to improve health care access, it is necessary to expand the Community-based Health Planning and Services (CHPS) and clinics in communities where they are not available, specifically in emerging communities, urban slums and rural (particularly hinterland communities). The end results will be improved output and the economic well-being of individuals, households and the nation.

There are some limitations to our estimated results. First, a test for the parallel trends assumption requires at least two periods, as we have only one year of data that predates the NHIS, we cannot formally test for the parallel trends assumption. Instead, we conducted a balancing test on the covariates of the treated and control subjects to determine if subjects differ in their observable characteristics. While the results from a balancing test cannot, in principle, be used to rule out the presence of unobserved factors, a sample that is balanced on observed covariates can be indicative that the sample may also be balanced on unobserved characteristics. Second, in the PSMDID, the study acknowledged that the combination between the PSM and DID would control for observed and unobserved factors, but there may be confounding factors that may influence the unobserved time-varying factors. Though the study tested for the validity of our DID and PSMDID results, there might be a bias that could affect the estimates. Finally, the investigation of the effect of health insurance on labour market outcomes of the elderly in developing countries, particularly in sub-Saharan Africa, is very limited, even though the elderly in these countries are the source of the labour force in the agriculture sector. A major reason for this limitation is data availability. This study may have some data challenges in terms of the sample size and time intervals of the survey, but understanding the impact of the Ghana NHIS and its implications is very important in developing countries' growth and development. Despite these limitations, the study makes some important contributions to the literature on health insurance and labour market outcomes in

the informal sector in a developing country.

2.7 Conclusion

The elderly are more susceptible to illness and need regular medical care access, but healthcare access for the elderly in Ghana was a challenge until the introduction of the NHIS, under which the elderly were given free health care by exempting them from the health insurance premium payment. The study, therefore, examines the effects on healthcare utilisation and labour market outcomes of extending exemption from health insurance premiums to the group of elderly aged 70 years and above. Using the DID strategy, the study finds that subsidising health insurance premium payments eliminates financial barriers that often confront the majority of the elderly in Ghana, and this increases healthcare utilisation, hours worked, earnings and consumption. The improvement in the earnings and consumption of the elderly also improves the welfare of the entire household, because in most families in developing countries (in sub-Saharan Africa), the elderly are the breadwinners and household heads. Therefore, an issue that affects their labour market outcomes has implications for the entire household. Overall, the improvement in earnings and food consumption expenditure is expected to reduce poverty and the inequality gap that characterises the elderly population in Ghana. To better understand how health insurance affects mortality and savings of the elderly, further research is needed on the effects of health insurance on elderly mortality and household savings, comparing those with free healthcare and those without it.

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Appendix A:

Table A1: Observed hours of work per week

Hours of work per week				
	Percentage (%)	Smallest observed hours		
1%	0	0		
5%	5	0		
10%	8	0		
25%	20	0		
50%	30			
		Largest observed hours	Mean	33.36
75%	45	105	Std.Dev	20.03
90%	60	105	Variance	401.3
95%	70	114	Skewness	0.720
99%	90	119	Kurtosis	3.695

Note: Source: Estimation is based on GLSS data.

Table A2: Proportion of agricultural workers in the informal sector

Outcome variables	Non agricultural workers (1)	Agricultural workers (2)	*Total* (3)
Formal sector workers	75	0	75
Informal sector workers	182	511	693
Total	257	511	768

Table A3: Healthcare utilisation sample by survey years

	All		1999		2006		2013	
	Mean (1)	Std Dev (2)	Mean (3)	Std Dev (4)	Mean (5)	Std Dev (6)	Mean (7)	Std Dev (8)
OUTCOME VARIABLES								
Health facility	0.891	0.312	0.744	0.437	0.893	0.309	0.934	0.248
Health professional	0.927	0.260	0.798	0.402	0.935	0.246	0.962	0.190
Hospital care	0.053	0.225	0.046	0.210	0.054	0.227	0.055	0.228
CONTROL VARIABLES								
Age	66.36	8.136	65.71	7.633	66.06	8.090	66.70	8.295
Education	0.437	0.496	0.334	0.439	0.392	0.489	0.492	0.500
Male	0.413	0.492	0.409	0.492	0.432	0.496	0.404	0.491
Female	0.587	0.492	0.591	0.492	0.568	0.496	0.596	0.491
Health status	0.848	0.359	0.856	0.352	0.855	0.353	0.842	0.364
Time taken to health facility	1.283	2.522	3.452	3.967	0.815	2.184	0.859	1.614
Employed	0.532	0.499	0.066	0.249	0.656	0.476	0.611	0.488
Ethnicity								
Akans	0.469	0.499	0.504	0.502	0.540	0.499	0.423	0.494
Ga Dangbe	0.066	0.248	0.104	0.305	0.061	0.255	0.056	0.231
Ewe	0.136	0.343	0.159	0.366	0.112	0.316	0.142	0.349
Guans	0.037	0.188	0.058	0.233	0.035	0.184	0.031	0.173
Northern	0.276	0.447	0.127	0.333	0.231	0.422	0.344	0.475
No tribe	0.016	0.126	0.049	0.216	0.021	0.143	0.004	0.059
Marital status								
Married	0.554	0.497	0.530	0.500	0.533	0.499	0.572	0.495
Separated	0.022	0.148	0.029	0.168	0.031	0.175	0.016	0.125
Divorce	0.130	0.336	0.144	0.352	0.154	0.361	0.114	0.318
Widowed	0.290	0.454	0.297	0.458	0.278	0.448	0.294	0.456
Never married	0.003	0.058	0.002	0.048	0.003	0.059	0.004	0.066
Regions								
Western	0.092	0.290	0.074	0.262	0.108	0.311	0.090	0.286
Central	0.076	0.266	0.127	0.333	0.068	0.252	0.066	0.248
Greater Accra	0.075	0.263	0.088	0.284	0.077	0.267	0.070	0.255
Volta	0.128	0.334	0.162	0.369	0.110	0.313	0.127	0.333
Eastern	0.135	0.342	0.171	0.377	0.121	0.326	0.131	0.337
Ashanti	0.159	0.365	0.186	0.390	0.198	0.339	0.131	0.338
Brong Ahafo	0.090	0.286	0.059	0.236	0.121	0.326	0.084	0.277
Northern	0.077	0.267	0.053	0.225	0.100	0.300	0.073	0.260
Upper East	0.111	0.314	0.038	0.192	0.045	0.208	0.165	0.372
Upper West	0.056	0.231	0.041	0.199	0.052	0.223	0.063	0.243
Religion								
Christians	0.060	0.238	0.066	0.249	0.068	0.252	0.054	0.227
Muslims	0.697	0.460	0.720	0.449	0.696	0.460	0.691	0.462
Traditionalist	0.136	0.344	0.104	0.305	0.135	0.342	0.147	0.354
No religion	0.106	0.308	0.110	0.313	0.101	0.302	0.108	0.310

Note: Calculation is based on GLSS 1998/99, 2005/06, 2012/13.

Table A4: Labour market outcomes sample by survey years

	All		1999		2006		2013	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OUTCOME VARIABLES								
Weekly hours of work	30.12	15.29	22.79	12.52	29.19	14.53	31.21	15.75
Weekly Earnings	7.581	20.94	0.513	0.723	2.438	3.551	11.13	26.28
Weekly Consumption expenditure	9.115	10.11	0.857	0.668	3.247	3.139	13.18	11.06
CONTROL VARIABLES								
Informal sector employment	0.907	0.290	0.938	0.243	0.919	0.273	0.890	0.313
Agriculture sector employment	0.634	0.482	0.636	0.482	0.651	0.477	0.623	0.485
Age	66.33	8.151	65.69	7.694	66.06	8.104	66.66	8.296
Education	0.437	0.496	0.336	0.473	0.386	0.487	0.491	0.500
Male	0.411	0.492	0.404	0.492	0.431	0.496	0.405	0.491
Female	0.588	0.492	0.595	0.492	0.569	0.496	0.595	0.491
Health status	0.895	0.307	0.858	0.493	0.900	0.300	0.880	0.325
Employed	0.532	0.499	0.066	0.248	0.656	0.475	0.609	0.488
Household Size	4.021	3.108	3.719	2.890	3.879	3.067	4.168	3.174
Ethnicity								
Akans	0.467	0.499	0.501	0.501	0.540	0.499	0.421	0.495
Ga Dangbe	0.065	0.247	0.103	0.304	0.061	0.240	0.056	0.230
Ewe	0.137	0.344	0.165	0.372	0.112	0.316	0.140	0.347
Guans	0.038	0.190	0.057	0.232	0.035	0.184	0.033	0.179
Northern	0.277	0.448	0.125	0.332	0.231	0.422	0.346	0.476
No Tribe	0.016	0.125	0.048	0.215	0.021	0.143	0.003	0.059
Marital status								
Married	0.556	0.497	0.530	0.500	0.533	0.500	0.575	0.495
Separated	0.022	0.146	0.028	0.167	0.031	0.173	0.015	0.123
Divorce	0.129	0.336	0.145	0.353	0.154	0.361	0.112	0.316
Widowed	0.289	0.454	0.300	0.457	0.279	0.449	0.293	0.455
Never married	0.003	0.058	0.002	0.048	0.003	0.058	0.004	0.065
Regions								
Western	0.074	0.261	0.073	0.260	0.079	0.270	0.071	0.257
Central	0.091	0.288	0.125	0.332	0.084	0.278	0.085	0.279
Greater Accra	0.043	0.203	0.087	0.283	0.034	0.183	0.034	0.182
Volta	0.139	0.346	0.160	0.367	0.138	0.345	0.134	0.340
Eastern	0.148	0.356	0.178	0.383	0.133	0.340	0.147	0.355
Ashanti	0.161	0.368	0.184	0.388	0.212	0.409	0.129	0.336
Brong Ahafo	0.079	0.270	0.061	0.240	0.100	0.300	0.074	0.261
Northern	0.087	0.282	0.052	0.223	0.100	0.300	0.091	0.287
Upper East	0.115	0.319	0.038	0.191	0.059	0.235	0.166	0.372
Upper West	0.061	0.241	0.041	0.198	0.060	0.238	0.069	0.253
Wealth quintiles								
Lowest	0.146	0.353	0.133	0.340	0.128	0.334	0.159	0.366
Low	0.160	0.367	0.133	0.340	0.125	0.331	0.184	0.388
Middle	0.167	0.373	0.168	0.375	0.186	0.389	0.156	0.363
High	0.223	0.416	0.204	0.404	0.208	0.407	0.234	0.424
Highest	0.305	0.461	0.362	0.482	0.353	0.478	0.266	0.442
Residence								
Urban	0.385	0.487	0.321	0.468	0.392	0.489	0.396	0.489
Rural	0.615	0.487	0.678	0.468	0.608	0.489	0.604	0.489

Note: Calculation is based on GLSS 1998/99, 2005/06, 2012/13.

Treated and control groups before and after the NHIS policy.

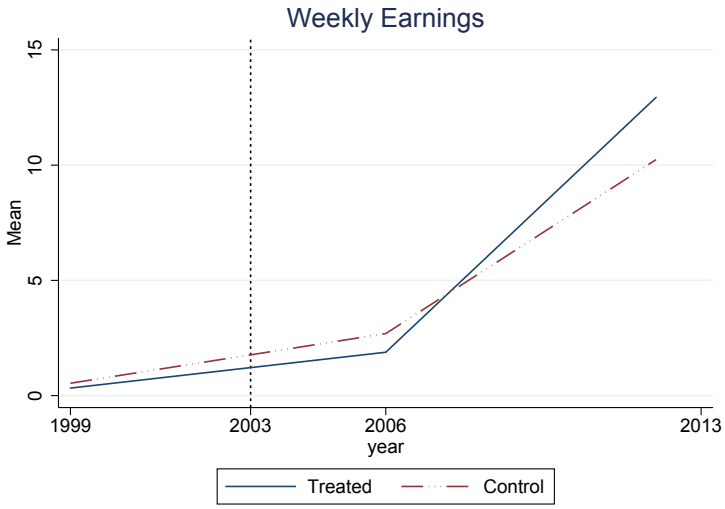

Figure A1: Weekly earnings before and after the NHIS

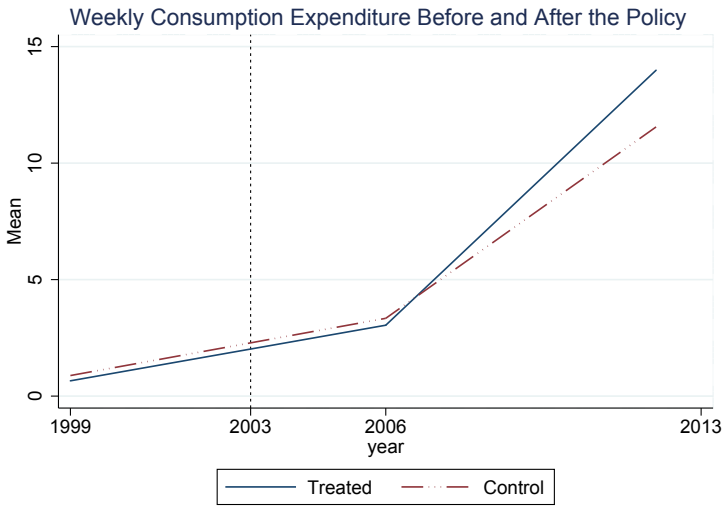

Figure A2: Weekly consumption expenditure before and after the NHIS

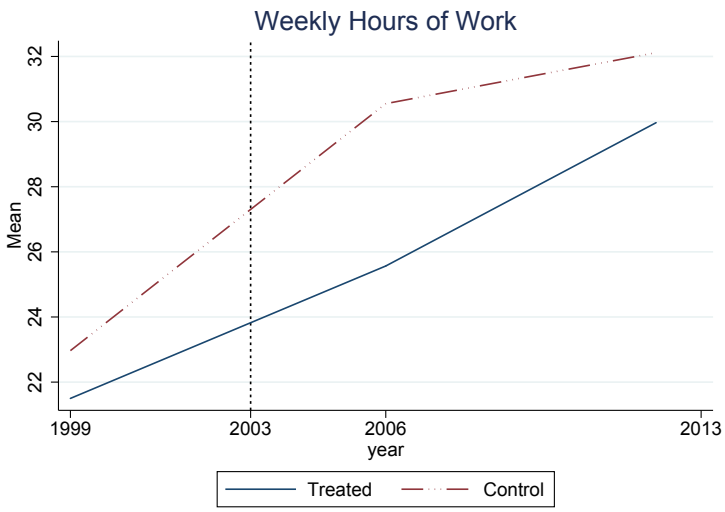

Figure A3: Weekly hours of work before and after the NHIS

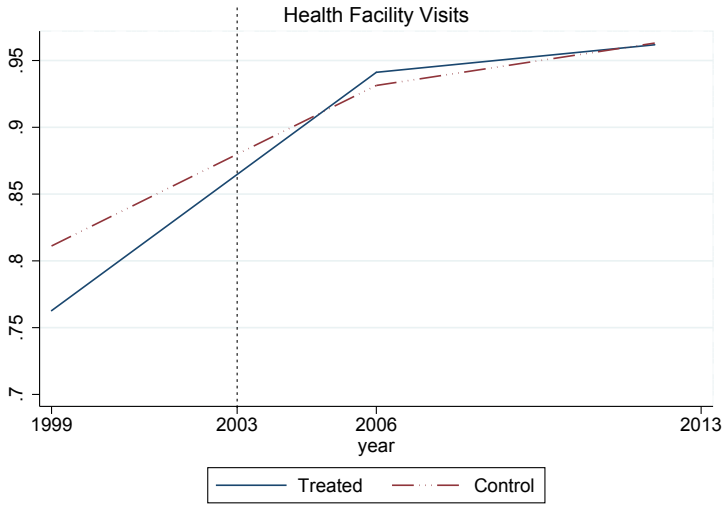

Figure A4: Treatment by health professionals before and after the NHIS

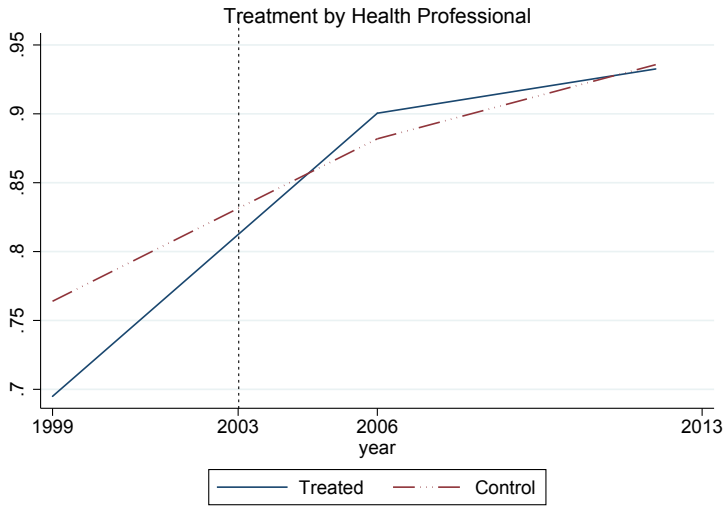

Figure A5: Health facility visits before and after the NHIS

Table A5: Overall covariates balancing tests

	Samples	Pseudo-R^2	LRχ^2	P>χ^2	Mean Bias	Median Bias	B	R
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health facility visit	Unmatched	0.155	123.6	0.000	14.2	11.2	99.1	0.82
	Matched	0.005	2.84	1.000	2.4	1.8	17.0	1.52
Health professionals	Unmatched	0.155	123.6	0.000	14.2	11.2	99.1	0.82
	matched	0.005	2.84	1.000	2.4	1.8	17.0	1.52
Hospitalised care	Unmatched	0.158	123.4	0.000	13.9	10.7	100	0.75
	Matched	0.006	3.25	1.000	2.7	2.5	18.5	1.45
Hours worked	Unmatched	0.115	98.4	0.000	12.9	9.6	85.8	0.82
	Matched	0.002	1.09	1.000	1.9	1.7	10.2	1.29
Earnings	Un matched	0.012	64.5	0.000	15.3	14.5	86.3	1.13
	Matched	0.005	1.52	1.000	3.5	3.9	15.8	1.41
Consumption	Unmatched	0.114	143.3	0.000	14.5	10.9	85.2	0.63
	Matched	0.003	2.97	1.000	1.9	1.0	13.4	1.42

Note: The Pseudo-R^2 shows the extend covariate explain the probability of participation. Likelihood ratio test shows a joint significant before and after matching and is expected to be statistically significant before matching indicating differences between treated and control groups, and insignificant after matching. Mean and the median biases in the model are expected to be reduced considerably after matching and sufficient bias reduction should not exceed 5%. B is the absolute standard difference of mean propensity score index in treated and control group and is expected to be less than 25%. R is the ratio of treated to control group of the propensity score index and also expect to fall within the range between 0.5 and 2 for the sample to be considered balanced.

Table A6: PSMDID estimates of the effects of health insurance on healthcare utilisation

	Health		
	Health facility	Health professional	Hospital care
	(1)	(2)	(3)
Panel A: Full sample			
Insurance×Post	0.062**	0.057*	-0.017
	(0.031)	(0.029)	(0.029)
Mean of outcome variable	0.888	0.927	0.189
Observations	2,034	2,034	2,034
Panel B: Subgroup			
Males			
Insurance×Post	0.068	0.031	-0.006
	(0.066)	(0.070)	(0.033)
Mean of outcome variable	0.867	0.913	0.176
Observations	842	842	842
Females			
Insurance×Post	0.029	0.041	-0.023
	(0.038)	(0.029)	(0.048)
Mean of outcome variable	0.902	0.936	0.187
Observations	1,192	1,192	1,192
Living in rural areas			
Insurance×Post	0.100	0.090	-0.066
	(0.083)	(0.079)	(0.042)
Mean of outcome variable	0.872	0.917	0.185
Observations	872	872	8 872
Living in urban areas			
Insurance×Post	0.004	-0.065	-0.009
	(0.095)	(0.086)	(0.031)
Mean of outcome variable	0.910	0.940	0.185
Observations	531	531	531

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status, educational status and time taken to travel to the hospital); health status measure (illness); region; and year fixed effect.

Table A7: PSMDID estimates of the effects of health insurance on weekly hours of work and earnings

	Hours			Earnings		
	Combined	Males	Females	Combined	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Informal sector						
Insurance×Post	0.314***	0.350***	0.260***	0.537***	1.012***	0.696***
	(0.167)	(0.124)	(0.161)	(0.163)	(0.160)	(0.256)
Mean of outcome variable	31.12	31.52	28.37	7.58	10.08	4.46
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	766	426	339	766	426	339
Panel B: Agricultural sector						
Insurance×Post	0.404***	0.330***	0.460***	0.935***	1.012***	0.696***
	(0.166)	(0.124)	(0.161)	(0.163)	(0.160)	(0.256)
Mean of outcome variable	28.88	30.64	26.12	9.85	12.01	6.45
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	509	311	194	509	311	194

Note: Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. Weekly hours worked and earnings are the dependent variable and are given in the logarithm form. The covariates include demographic characteristics (age, gender, marital status, ethnicity); socioeconomic characteristics (employment status and educational status); health status measure (illness); region; and year fixed effect.

Table A8: PSMDID estimates of the effect of health insurance on weekly food consumption expenditure

Outcome variables	Combined	Low-wealth group	High-wealth group
	(1)	(2)	(3)
Insurance×Post	0.414*	0.069	0.580**
	(0.213)	(0.070)	(0.134)
Mean consumption expenditure ($)	9.12	6.83	11.37
Controls	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	756	376	380

Note: Standard errors, clustered by region, are shown in parentheses. *** p<0.01, **p<0.05, * p<0.1. Weekly Consumption expenditure is the dependent variable and are given in the logarithm form. Demographic characteristics (includes age, gender, marital status, ethnicity); Socioeconomic characteristics (employment status, educational status, wealth quintiles and hours worked); Health status measure (illness); region; and year fixed effect.

Covariate balancing tests

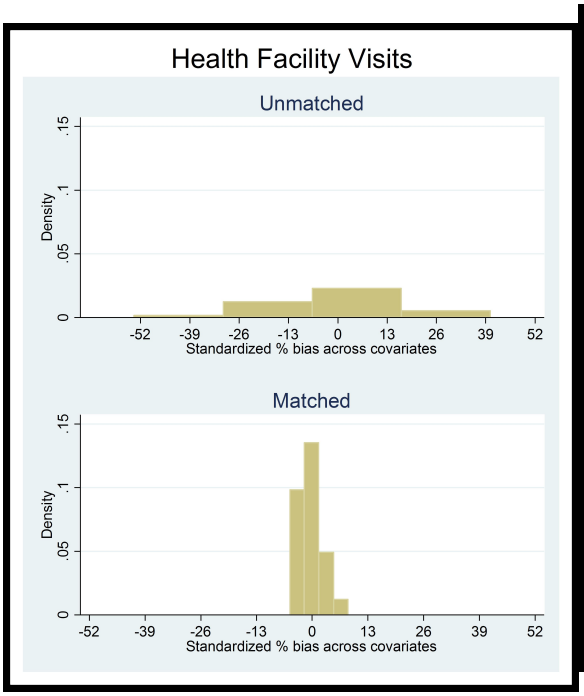

Figure A6: Standard bias before and after matching for health facility visits

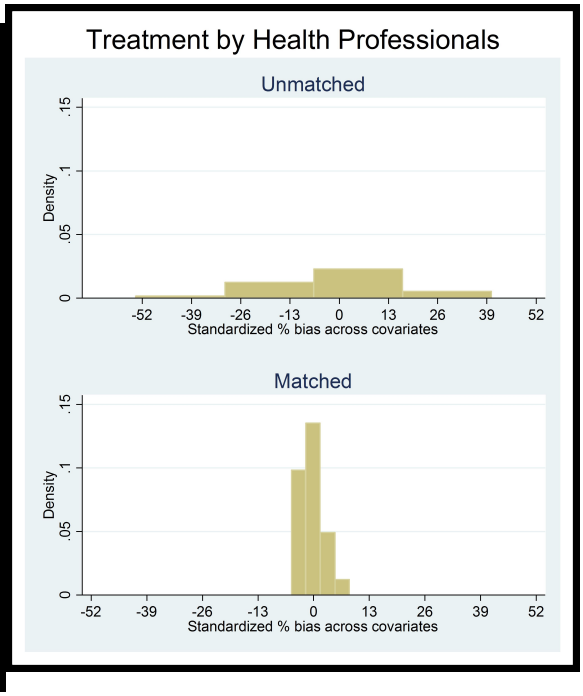

Figure A7: Standard bias before and after matching for treatment by health professionals

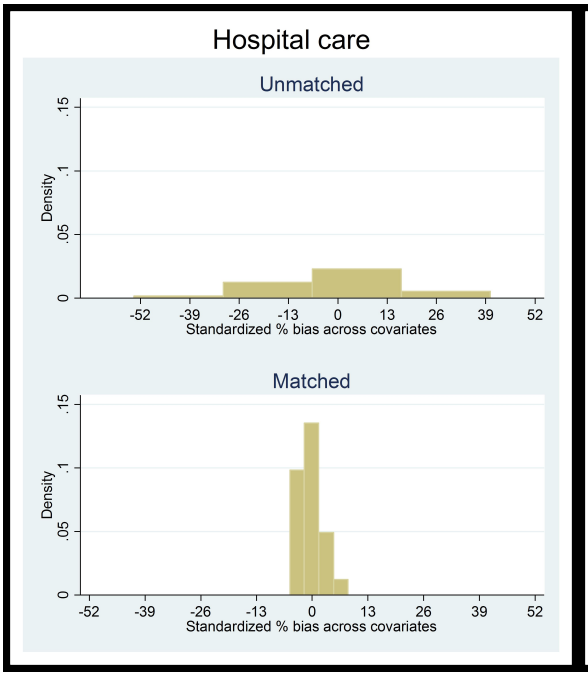

Figure A8: Standard bias before and after matching for hospital care

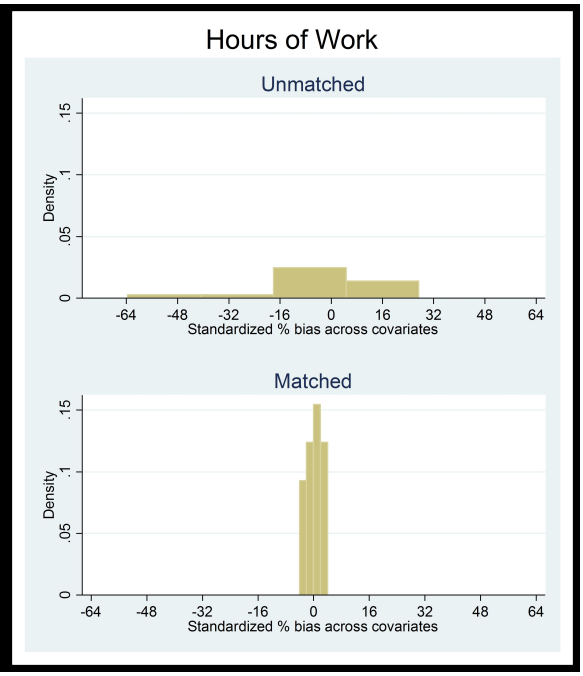

Figure A9: Standard bias before and after matching for hours of work

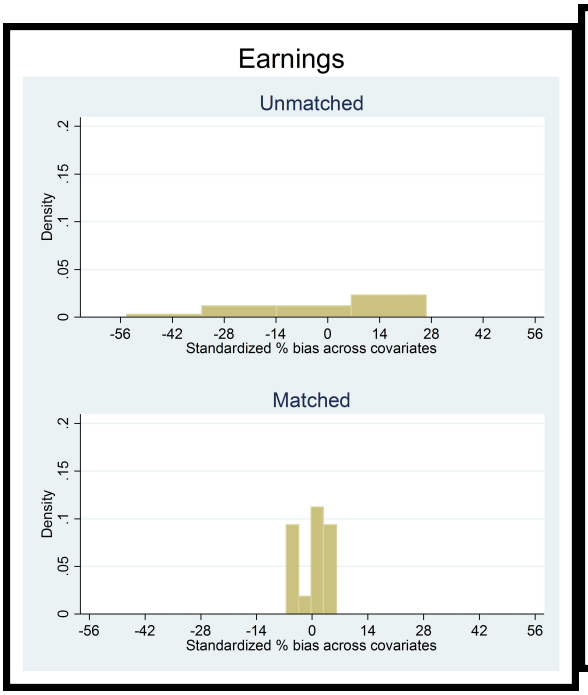

Figure A10: Standard bias before and after matching for earnings in agriculture

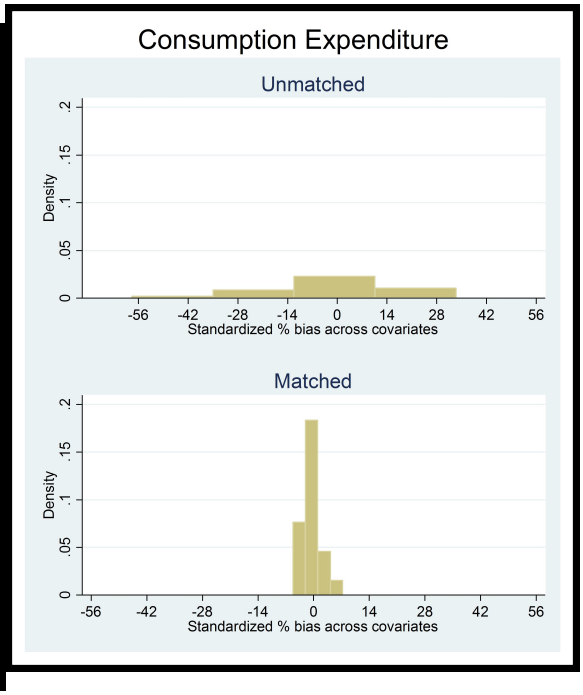

Figure A11: Standard bias before and after matching for consumption expenditure

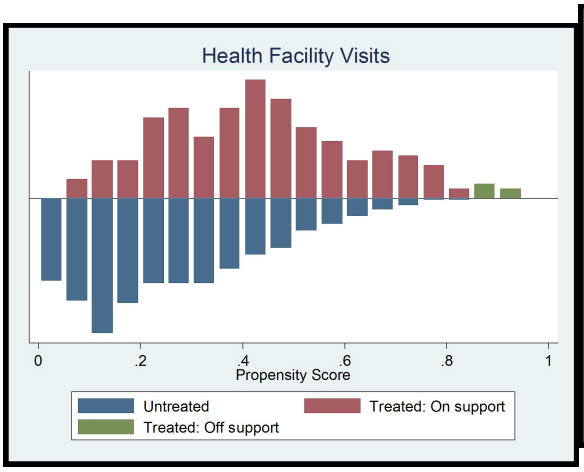

Figure A12: Health facility visits in the region of common supports

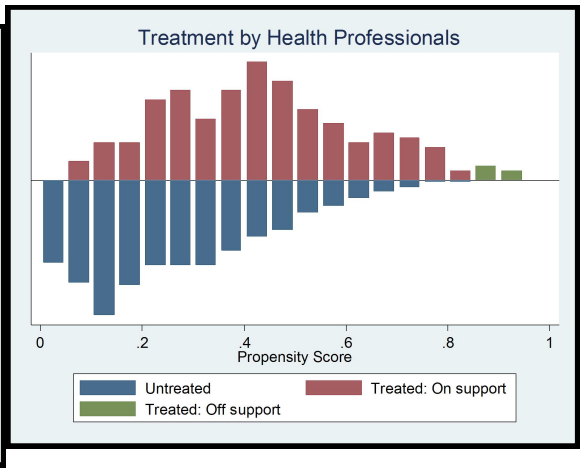

Figure A13: Treatment by health professional in the region of common supports

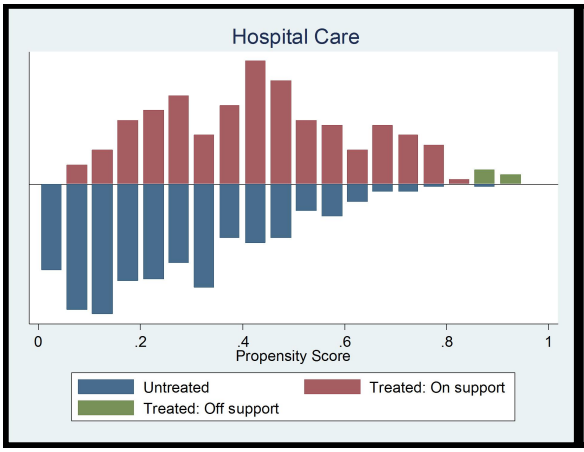

Figure A14: Hospital care in the region of common supports

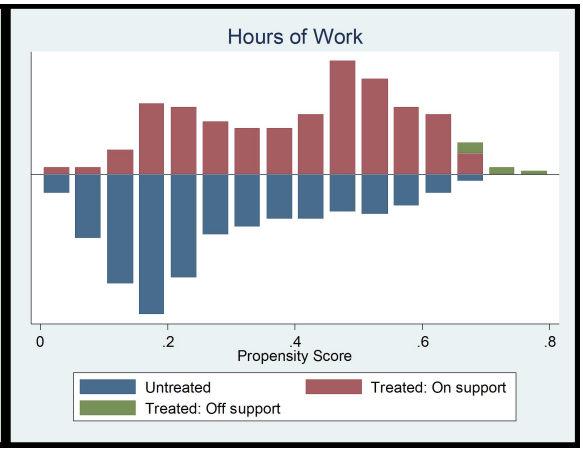

Figure A15: Hours of work in the region of common supports

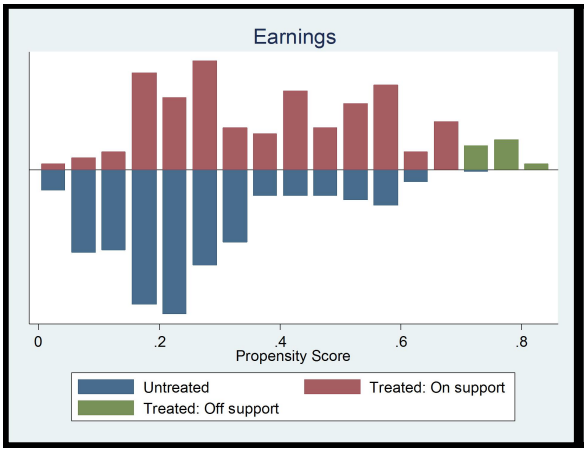

Figure A16: Earnings in the region of common supports

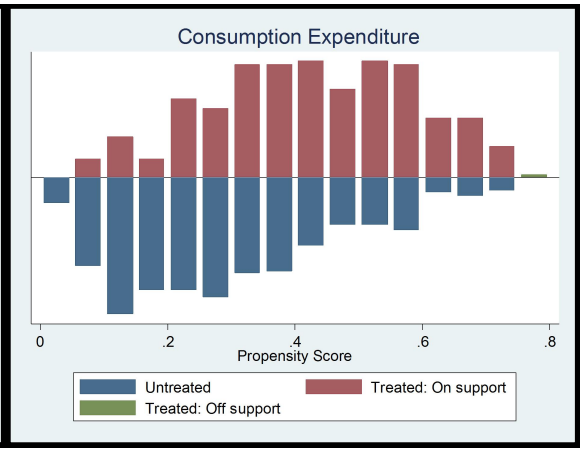

Figure A17: Consumption expenditure in the region of common supports

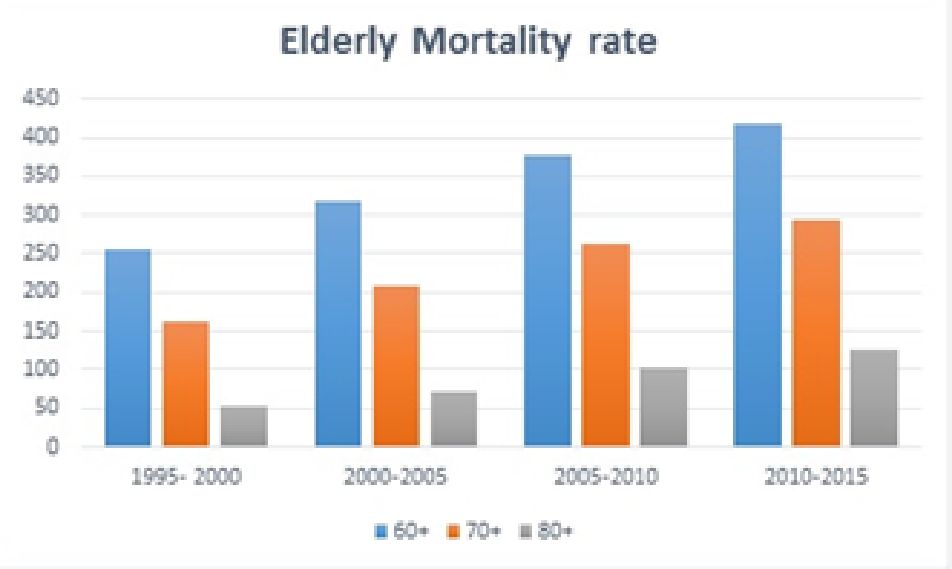

Figure A18: Elderly mortality rate in Ghana

Chapter 3

Does Health Insurance Affects Labour Productivity through Illness-Related Absenteeism at the Workplace in Ghana?

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Statement of Authorship

Title of Paper	Does Health Insurance Affects Labour Productivity through Illness-Related Absenteeism at the Workplace in Ghana?
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Principal Author

Name of Principal Author (Candidate)	Frank Darkwah		
Contribution to the Paper	This paper is written by a sole author (the Candidate)		
Overall percentage (%)	100%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the sole author of this paper.		
Signature		Date	17/07/2019

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

i. the candidate's stated contribution to the publication is accurate (as detailed above);

ii. permission is granted for the candidate in include the publication in the thesis; and

iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author			
Contribution to the Paper			
Signature		Date	

Name of Co-Author			
Contribution to the Paper			
Signature		Date	

Please cut and paste additional co-author panels here as required.

Abstract

The paper investigates whether health insurance expansion affects labour productivity through illness-related absenteeism at the workplace among workers in Ghana. The paper employs household-level data from the Ghana Living Standard Survey and applies count data estimation techniques to investigate how health insurance affects labour productivity through the expected time workers spend out of work due to illness. The results show that health insurance has a positive effect on labour productivity by reducing the extent of illness-related absenteeism in the workplace, after accounting for a potential endogeneity in health insurance. The reduction is statistically significant for male workers but insignificant for female workers. The decline in the extent of illness-related absenteeism at the workplace is observed for insured workers in both the formal and informal sectors, but the reduction is lower in the informal sector than in the formal sector.

Keywords: health insurance, health, labour productivity.

JEL Classification: I10,I13 I18, J46

3.1 Introduction

Understanding the effects of health insurance on workdays missed by workers is important for economic growth and development. This is because absenteeism at the workplace has implications for a country's production through output loss. A study by Davis et al. (2005) revealed that in 2003 about 69 million employees in the United State (US) missed about 407 million days of work due to illness. The monetary value of the missed workdays is estimated to be $48 billion, when missed work time is valued at workers' actual wages. This suggests that worker absenteeism could greatly affect a country's output.

Ill-health is the main cause of workplace absenteeism (Davis et al., 2005; Holden et al., 2011; Xu and Jensen, 2012). Health influences an individual's ability to work, and there is a body of literature that has shown how health conditions affect labour productivity at the workplace (Smith, 1999; Hadley, 2003; Bloom et al., 2004; Cai and Kalb, 2006; Mitchell and Bates, 2011; Holden et al., 2011; Cheng et al., 2019). Davis et al. (2005) examine the economic impact of health problems on workers productivity and find that ill-health (poor physical condition) negatively affects workers' productivity in the US. Mitchell and Bates (2011) study the effects on health-related productivity loss among workers in the US. They also find that workers with a health condition or health risk contribute immensely to firms' productivity loss. Holden et al. (2011) also examine health conditions associated with productivity loss among Australian workers, and they find that mental health conditions contribute considerably to productivity loss among Australian workers. These studies suggest that ill-health affects labour productivity and firms' output. Labour productivity in this analysis refers to the amount of goods and services that a worker produces in a given time. This means that the number of workdays missed due to illness affects worker productivity through output loss.

If illness contributes significantly to output loss at the workplace, then the impact is likely to be higher in developing countries than developed countries. This is because people in developing countries are more disposed to illness than those in the developed countries (Deaton and Tortora, 2015; Boutayeb, 2006). Besides, the impact

in developing countries will also have a spillover effect on the entire household. This is because most workers in developing countries, specifically Africa, are breadwinners of their families or households, therefore any issue (illness) that affects their day-to-day activities directly or indirectly affects other dependants within the household or community (Aboderin and Beard, 2015)

One factor affecting poor health conditions among people in developing countries is healthcare access and the cost of medical treatment. The cost of medical care is a major financial burden on households, having a greater effect on those in the low-income group than on those in the high-income group (Xu et al., 2003). It largely affects households in the low-income group because most of these people work in the informal sector, which is characterised by low income, and therefore they find it difficult to finance their healthcare expenses when they are ill. This issue is also more prevalent in developing countries than advanced countries. Several interventions have been initiated in many countries. Health insurance has been shown to mitigate the financial impact of large medical expenses and improves healthcare access and health (Lichtenberg, 2002; Wang et al., 2009; Card et al., 2008; Finkelstein et al., 2012; Cheng, 2014; Cheng et al., 2015; Duku et al., 2015). As a result, several developing countries have introduced health insurance policies to reduce the healthcare expenses that usually confront their citizenry, thereby improving healthcare access and health.

However, studies on the relationship between health insurance and labour productivity through illness-related absenteeism at the workplace in developing countries, especially in sub-Saharan Africa context, are limited. Most of the studies are in the developed country context, and the evidence is that having health insurance reduces the number of workdays missed due to illness because the likelihood of falling ill is reduced. The reduction in workdays missed due to illness improves workers' productivity because it reduces output loss. Reducing output loss through a reduction in absenteeism at the workplaces increases the amount of goods and services that a worker produces in a given time, which in turns increases workers' productivity (Vistnes, 1997; Lofland and Frick, 2006; Xu and Jensen, 2012; Dizioli and Pinheiro, 2016). The available studies are in the developed country context. Understanding

this relationship is important because if it is found that health insurance reduces illness-related absenteeism at the workplace, it may strengthen the incentive for employers to sponsor workers with health insurance, and this will increase the country's production. Since the healthcare system and labour market structure in Ghana is similar to other countries in sub-Saharan Africa, the findings will provide background information that will help to improve health insurance policies in these countries, where most people are vulnerable to illness.

This study therefore seeks to investigate whether health insurance affects labour productivity through illness-related absenteeism at the workplace in Ghana. The issues that affect health and healthcare access in Ghana are not much different from those in other sub-Saharan Africa countries (World Health Organization, 2014; Aboderin and Beard, 2015). Africa is the continent with the highest morbidity and mortality rate, and Ghana, one of the African countries, is no exception. Infectious disease alone accounts for at least 69% of deaths in the continent (Boutayeb, 2006; World Health Organization, 2011b; Young et al., 2009). The prevalence of chronic non-communicable diseases and their risk factors has increased and this contributes significantly to Ghana's disease burden (de Graft Aikins et al., 2012). The non-communicable diseases in 2010 accounted for 39% of all deaths in Ghana (World Health Organization, 2011a). This suggests that Ghana and other sub-Saharan African countries are more likely to experience illness-related absenteeism in the workplace which, in turn, negatively affects output. Despite the importance of health insurance, no research has focused on the productivity of workers, especially those in sub-Saharan Africa, where the majority of people are more susceptible to illness.

This study uses nationally representative household survey data of Ghana to investigate whether having health insurance affects the probability that workers will miss a workday and the number of workdays missed due to illness. There is evidence that people with health condition (risk) are more likely to participate in the health insurance program and therefore consume more health care. This makes health insurance endogenous to outcome variables of interest, which in turn, affect the results (Cameron et al., 1988; Cheng, 2014). In terms of absenteeism at the workplace,

people with poor health conditions or health risk are more likely to miss workdays, while individuals with good health or healthy people naturally miss fewer workdays. This issue also suggests a potential endogeneity problem in the analysis and ignoring it would rendered the estimated parameters biased and inconsistent. It would be unclear in the final analyses whether having health insurance affects illness-related absenteeism at the workplace or not. The study addresses this potential endogeneity problem in the health insurance program by employing regional-level average health insurance coverage as an instrumental variable (IV).

The findings indicate that health insurance has a positive effect on labour productivity by reducing the extent of illness-related absenteeism at the workplace. Thus, having health insurance reduces the probability of missing a workday and the number of workdays missed due to illness compared to not having health insurance. In terms of the employment sector, the study observed a reduction in the days of illness-related absenteeism for insured workers relative to uninsured workers in both the informal and formal sectors. The study also observed that there is no significant difference between insured workers aged 18-49 years (younger workers) and those aged 50-60 years (older workers) in the probability of missing workdays due to illness. Overall, the estimates indicate that workers with health insurance are absent from work less often and therefore are more productive in terms of output losses compared with workers without health insurance.

There is a body of literature on how health insurance affects labour market outcomes. Most studies have focused on labour force participation, hours worked and earnings (Gruber and Hanratty, 1995; Gruber and Madrian, 2002; Kan and Lin, 2009; Strumpf, 2011; Baicker et al., 2014; Dague et al., 2017). There are few studies on the effects of health insurance on labour productivity through illness-related absenteeism in the workplace (Vistnes, 1997; Lofland and Frick, 2006; Xu and Jensen, 2012; Dizioli and Pinheiro, 2016). The empirical results are also mixed; some studies find a significant effect of health insurance on illness-related absenteeism at the workplace, whereas others find no effect. Xu and Jensen (2012) investigate how health insurance affects illness-related absenteeism among older workers in the US. They find no

difference between the number of workdays missed due to illness in older workers without health insurance and older workers with health insurance. Thus, health insurance does not have a significant effect on illness-related absenteeism among older workers in the US. Lofland and Frick (2006) examine the effects of health insurance on workplace absenteeism in the US workforce but find different results. They find that health insurance is significantly related to a reduced likelihood of the number of missed workdays. A study by Dizioli and Pinheiro (2016) also investigates how health insurance affects labour productivity through a reduction in the expected time workers spend out of work on sick days. They find that workers with health insurance miss fewer workdays than those without health insurance. However, Vistnes (1997), who examines how insurance affects gender differences in days lost from work due to illness in the US, finds that insurance actually increases illness-related absenteeism in the workplace. Such results make the findings inconclusive, therefore, from developing country perspective, investigating the effect of health insurance on illness-related absenteeism at the workplace is important for health insurance policy analyses.

This study contributes to the literature in a number of ways: Firstly, few studies have been conducted and those that do exist were conducted in a developed country context. No study has been undertaken in a developing country, specifically in sub-Saharan Africa. According to Currie and Madrian (1999), the relationship between individual's health and their work is more observable in societies where the majority of the people are vulnerable to illness. The evidence indicates that individuals from sub-Saharan Africa are more susceptible to illness compared with individuals in other regions (Deaton and Tortora, 2015). Therefore, investigating the relationship between health insurance and illness-related absenteeism in the workplaces in Ghana is vital for policy-making in a developing country context. Secondly, whereas most of the previous studies focus on formal sector workers, this study quantifies the effect of health insurance on productivity for workers in the informal sector. This evidence is particularly important for a developing country like Ghana, where the majority of the labour force population is in the informal sector. This study adds to the literature about the impacts of health insurance

on illness-related absenteeism at the workplace for workers in the informal sector. Besides the informal sector analysis, the study also examines the effects in the formal sector to understand if there is a significant difference between the workers in both sectors, and also to check whether or not the effect in a developing country context differs from those in developed countries. Thirdly, the study considers the heterogeneous impact of health insurance on illness-related absenteeism in terms of age group (younger and older worker) and gender to understand how these factors could influence workers absenteeism. As older workers are more prone to illnesses than younger workers, understanding the effect of health insurance on workers age category and gender would assist policy making in Ghana.

Health insurance for individuals in some countries, particularly the US, is offered predominantly through the employers,[1] who therefore finance the greater portion of employees' health expenditure. However, in developing countries many healthcare programs, including health insurance, are financed by the government. In Ghana, for instance, about 75% of health insurance expenditure is financed by the government. The informal sector constitutes about 70% of the labour force, but their personal contribution to health insurance revenue in Ghana is 3.8% compared to that of the formal sector, which is 15.6% (Schieber et al., 2012). The expenditure on healthcare through the health insurance system in Ghana is similar to most developing countries. Thus, most of the health insurance expenditure in developing countries is funded by the government. Health spending has also been found to improve health outcomes (Gupta et al., 2003; Gottret and Schieber, 2006; Anyanwu and Erhijakpor, 2009; Baldacci et al., 2003). Whether or not government expenditure in the healthcare system through the National Health Insurance Scheme is commensurate with gains in worker productivity (by reducing the days of illness-related absenteeism at workplaces) is unknown in most developing countries, specifically sub-Saharan Africa. It is therefore important to understand how health insurance affects illness-related absenteeism in the workplace from a developing country perspective.

The remainder of the paper is organised as follows. Section 2 describes the

[1]In the US, for example, about 88% of private individuals who acquired health insurance in 2005 did so through their workplace Gruber (2010).

institutional background of Ghana's health insurance scheme. Section 3 describes the data obtained for the analysis. Section 4 presents the econometrics framework underlying the study. The results are presented in section 5. Section 6 discusses the results and Section 7 concludes the paper.

3.2 Data

The study uses two waves of data from the Ghana Living Standard Survey (GLSS), conducted by the Ghana Statistical Service (GSS). The GLSS is a nationally representative household survey in Ghana. These two cross-sections of data collected by the GSS are the fifth and sixth rounds of surveys. The fifth round was conducted in 2005/06 and comprises 8,687 households with 37,128 individuals. The sixth round, conducted in 2012/13, has a significantly greater number of respondents compared with previous years, with 16,772 households and 72,168 individuals. The study considers these two waves because they are the cross-sections that capture the health insurance status of workers and some other variables of interest, particularly the number of workdays missed due to illness.

The study focuses on respondents who are in the active labour force, therefore, it restricts the analysis to the sample of individuals aged 15-60 years. This is because the minimum age for employment in Ghana is 15 years and the retirement age for formal sector workers is 60 years.[2] Limiting the sample to this age range will help to capture working individuals in the survey. Individuals outside the 15-60 years age range in the sample were dropped.[3] In this sample, some workers reported the number of workdays missed due to illness, while others did not. This analysis focused on the individuals who reported the number of workdays missed due to illness.

[2]There are two forms of retirement in Ghana: voluntary retirement, which usually occurs from age 55, and compulsory retirement at 60 years. The study limits the upper age of the sample to compulsory retirement age in order to capture the majority of people in the labour force. In terms of the minimum employment aged, people age 13 years can be employed to do light work, but the definition of light work is difficult to determine.

[3]After excluding individuals outside 15-60 years, the number of observations declined to 9,524 in 2005/06 sample and 18,625 in the 2012/13 sample. Taking into consideration variables of interest such as the total number of workdays missed due to illness, the sample dropped to 3,091 observations. This significant drop in the majority of the observations is due to the differences in observations of the two surveys.

After considering some variables of interest, particularly the outcome variables and excluding missing responses, the sample size of employed workers across two surveys is reduced to 3,091 observations, consisting of 2,607 insured and 484 uninsured workers.

The survey collected a wide range of healthcare outcomes, such as: whether respondents suffered from illness and the number of days respondents had suffered from this illness; and whether respondents had stopped usual activities (work) as a result of the illness and the number of days respondents had to stop these activities. The data also contain information on socioeconomic characteristics such as the highest education level, age, marital status, gender, type of residence, household size, region and ethnicity. In this study, we are interested primarily in two outcome variables. The first variable is a binary outcome showing whether the respondent missed a day from work due to illness. The second variable captures the total number of days the respondent missed work.

The definition of both outcome and explanatory variables have been presented in Table 3.1. In the analyses, the study uses the full sample along with the subgroup, stratified by respondents' age (young and old), the sector of employment (formal and informal) and gender (male and female). Overall, more than half of the workers (57.8%) in our sample missed some days from work due to illness prior to the survey periods. The workers who missed work due to illness missed 5.9 days on average (See Table B1). The statistics reported in Table 3.1 suggest that without adjusting for any covariates, on average, workers without health insurance are less likely to miss days from work than workers with health insurance (55.3% vs 58.3%). The mean of workers reporting having experienced an illness or injury are lower for individuals without health insurance compared to those with health insurance, although, the differences are statistically insignificant. In the informal sector, the number of workers without health insurance exceeds those with health insurance (82.5% vs 76.6%). Thus, on average, the number of workers without health insurance in the informal sector is relatively higher than those workers with insurance. As contributions to the NHIS are mandatory for formal sector workers and optional for informal sector workers, it follows that the majority of formal sector workers participate in the NHIS program.

The study observed that differences in workers' age, gender and employment sector contribute to illness-related absenteeism at the workplace. Differences in marital and health status of a worker also contribute to illness-related absenteeism at the workplace. The estimates further reveal the significant differences in mean in most of workers' region of residence and this could also influence illness-related absenteeism.

Workers with NHIS tend to have a higher education level compared with those without NHIS (75.4% vs 69.9%). Fewer workers without health insurance are single (53.8%) compared to compared to those with NHIS (60%). More workers with health insurance reside in the rural areas (55.1%) than in urban centres (44.9%). The average household size of workers with NHIS (4.1) is greater than that of workers without health insurance (3.9). In terms of the ethnic groups, more workers in the Northern tribe have NHIS than workers in other tribes. The Northern tribe are composed of Mole-Dagbani, Grusi, Gurma and Mande. As for religious affiliation, the majority of workers with health insurance are Muslims, even though the majority of Ghanaians are Christians. This is not surprising because the majority of workers in the Northern tribe, which dominates participation in the NHIS, are Muslims. The differences in individuals' place of residence (rural/urban), household size, ethnicity and religious affiliations are statistically insignificant to contribute to illness-related absenteeism at the workplace. The statistics show that the average age of workers with NHIS and those without NHIS is 38 and 36 years respectively.

Table 3.1: Variable definitions and descriptive statistics

		Insured			Uninsured			Mean test	
	Description	Mean	Std dev	N	Mean	Std dev	N	Diff	p-value
OUTCOMES									
Missing workday due to illness	1 if worker miss workday due to illness, or 0 otherwise	0.583	0.493	2,607	0.553	0.498	484	-0.030	0.214
Number of workdays missed	Number of workdays missed due to illness	5.774	3.976	2,607	5.768	3.938	484	-0.006	0.977
CONTROL									
Age	Workers age	37.93	12.36	2,607	36.26	11.69	484	-1.668	0.006
Education status	1 if worker had education, or 0 otherwise	0.754	0.431	2,607	0.699	0.459	484	-0.055	0.011
Male	1 if worker is male, or 0 otherwise	0.351	0.478	2,607	0.394	0.489	484	0.040	0.087
Female	1 if worker is female, or 0 otherwise	0.646	0.478	2,607	0.606	0.489	484	-0.040	0.087
Informal sector employees	1 if employed in the informal sector, or 0 otherwise	0.766	0.423	2,607	0.825	0.380	484	0.059	0.004
ETHNICITY									
Akans	1 if Akan, or 0 otherwise	0.412	0.492	2,607	0.432	0.496	484	0.011	0.423
Ga Dangbe	1 if Ga Dangbe, or 0 otherwise	0.044	0.204	2,607	0.050	0.217	484	0.006	0.563
Ewe	1 if Ewe, or 0 otherwise	0.130	0.337	2,607	0.116	0.320	484	-0.015	0.379
Guans	1 if Guan, or 0 otherwise	0.048	0.214	2,607	0.037	0.189	484	-0.011	0.288
Northern	1 if Northern, or 0 otherwise	0.356	0.479	2,607	0.357	0.480	484	0.001	0.963
No tribe	1 if other tribe, or 0 otherwise	0.009	0.095	2,607	0.009	0.091	484	-0.001	0.843
MARITAL STATUS									
Married	1 if currently married, or 0 otherwise	0.599	0.490	2,607	0.538	0.499	484	-0.060	0.012
Separated	1 if separated, or 0 otherwise	0.084	0.278	2,607	0.109	0.313	484	0.026	0.065
Divorce	1 if divorce, or 0 otherwise	0.079	0.270	2,607	0.077	0.267	484	-0.002	0.902
Widowed	1 if widowed, or 0 otherwise	0.059	0.234	2,607	0.047	0.211	484	-0.012	0.300
Never married	1 if never married, or 0 otherwise	0.179	0.384	2,607	0.228	0.420	484	0.048	0.012
RELIGION									
Christians	1 if Christians, or 0 otherwise	0.035	0.185	2,607	0.053	0.224	484	0.018	0.062
Muslims	1 if Muslims, or 0 otherwise	0.723	0.448	2,607	0.720	0.450	484	-0.003	0.879
Traditionalist	1 if Traditionalist, or 0 otherwise	0.197	0.400	2,607	0.173	0.378	484	-0.024	0.209
No religion	1 if not in any religion, or 0 otherwise	0.044	0.205	2,607	0.055	0.228	484	0.011	0.286
REGION									
Western	1 if from Western region, or 0 otherwise	0.070	0.254	2,607	0.110	0.313	484	0.040	0.002
Central	1 if from Central region, or 0 otherwise	0.055	0.228	2,607	0.091	0.288	484	0.036	0.002
Greater Accra	1 if from Greater Accra region, or 0 otherwise	0.046	0.210	2,607	0.035	0.184	484	0.011	0.275
Volta	1 if from Volta region, or 0 otherwise	0.119	0.324	2,607	0.147	0.354	484	0.028	0.090
Eastern	1 if from Eastern region, or 0 otherwise	0.129	0.335	2,607	0.110	0.313	484	-0.019	0.245
Ashanti	1 if from Ashanti region, or 0 otherwise	0.162	0.368	2,607	0.172	0.378	484	0.010	0.573
Brong Ahafo	1 if from Brong Ahafo, or 0 otherwise	0.103	0.304	2,607	0.052	0.222	484	-0.051	0.000
Northern	1 if from Northern region, or 0 otherwise	0.108	0.310	2,607	0.184	0.388	484	0.077	0.000
Upper East	1 if from Upper East region, or 0 otherwise	0.115	0.319	2,607	0.033	0.179	484	-0.082	0.000
Upper West	1 if from Upper West region, or 0 otherwise	0.094	0.292	2,607	0.066	0.249	484	-0.028	0.048
RESIDENCE									
Rural	1 if reside in urban area, or 0 otherwise	0.551	0.489	2,607	0.541	0.499	484	-0.010	0.786
Urban	1 if reside in rural area, or 0 otherwise	0.449	0.498	2,607	0.459	0.499	484	0.010	0.786
Household size	Size of the household,	4.053	2.767	2,607	3.934	3.202	484	-0.118	0.562
Health status	1 if worker had any illness, or 0 otherwise	0.597	0.491	2,607	0.850	0.358	484	-0.003	0.044

3.3 Econometric framework

3.3.1 Econometric model

This section describes the econometric model employed to investigate the effects of health insurance on illness-related absenteeism at the workplace. The outcome variables of interest in this analysis are the probability of missing a workday and the total number of workdays missed due to illness. The latter reflect a non-negative integer or a count. The non-negative integer of the outcome variable, which is a focus of this analysis, motivates the application of a model of count regression, and the model is specified as follows. Let y_i be the observed number of workdays missed due to illness for a worker i. Suppose that, conditional on the exogenous covariates X_i, the endogenous variable X_{ei}, and random unobserved heterogeneity terms ε_i, y_i follow a Poisson distribution, with probability density function:

$$y_i \sim Poisson(\mu_i) \tag{3.1}$$

which can be expressed as:

$$f(y_i|X_{ei}, X_i, \varepsilon_i) = Pr(Y = y_i) = \frac{e^{-\mu_i}\mu_i^{y_i}}{y_i!}, y_i = 0, 1, 2, 3, ...$$

with the conditional mean parameters μ_i

$$\mu = E(y_i|X_{ei}, X_i, \varepsilon_i; \beta) = exp(\beta_1 X_{ei} + \beta_2 X'_{i1} + \varepsilon_{i1}) \tag{3.2}$$

where ε_1 is assumed to follow a standard normal distribution, thus $\varepsilon_1 \sim N(0, 1)$. The decision to participate in the health insurance program is represented by the latent variable X^*_{ei} and the observed insurance X_{ei}, which is related to X^*_{ei} by a dichotomous rule specified as:

$$X^*_{ei} = X'_{i2}\beta_3 + \varepsilon_{i2} \tag{3.3}$$

$$X_{ei} = 1[X_{ei}^{*} > 0] \tag{3.4}$$

where X_{i2} is a vector of exogenous covariate variables that affect X_{ei} but does not affect directly y_i, and hence is an independent source of variation in y_i. Assume that the error terms ε_1 and ε_2 are related through:

$$\varepsilon_{i1} = \rho\varepsilon_{i2} + \eta_i \tag{3.5}$$

where $\eta_i \sim [0, \sigma_\eta^2]$ is independent of $\varepsilon_{i2} \sim [0, \sigma_\varepsilon^2]$. If $\rho = 0$, then X_{ei} can be treated as exogenous. Otherwise, it is endogenous, since it is correlated with ε_{i1} in equation (3.2) because both X_{ei} and ε_{i1} depends on ε_i. Because of the count nature of our outcome variable, the study adopted the Poisson estimation technique. The Poisson estimation is based on the equidispersion property of the Poisson distribution, where mean and variance are equal, thus $E(Y) = Var(Y) = \mu$.

If the equidispersion property is violated because of overdispersion $[Var(Y) > E(Y)]$, then the negative binomial approach becomes an appropriate estimation strategy, and it can be expressed as:

$$f(y_i|X_{ei}, X_i, \varepsilon_i) = Pr(Y = y_i|\mu_i, \alpha) = \frac{\Gamma(\alpha^{-1} + y_i)}{\Gamma(\alpha^{-1})\Gamma(y_i + 1)} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \mu_i}\right)^{\alpha^{-1}} \left(\frac{\mu_i}{\mu_i + \alpha^{-1}}\right)^{y_i}$$

where μ_i=$t_i\mu$ and $\alpha = \frac{1}{\nu}$. The parameter μ_i is the mean incidence rate of y per unit of exposure. t_i represents the exposure for a particular observation and ν is a scale parameter. The negative binomial regression model for an observation i can also be written as:

$$f(y_i|X_{ei}, X_i, \varepsilon_i) = Pr(Y = y_i|\mu_i, \alpha) = \frac{\Gamma(\alpha^{-1} + y_i)}{\Gamma(\alpha^{-1})\Gamma(y_i + 1)} \left(\frac{1}{1 + \alpha\mu_i}\right)^{\alpha^{-1}} \left(\frac{\alpha\mu_i}{1 + \alpha\mu_i}\right)^{y_i} \tag{3.6}$$

The study applies probit estimation technique to examine the probability of missing a workday due to illness.

3.3.2 Estimation procedure

Participation in the health insurance program has been associated with the issue of self-selection and the argument that individuals with health conditions are more likely to participate in a health insurance program and therefore consume more healthcare. This would make health insurance potentially endogenous to outcome variables and may affect the estimates. The study employs a control function approach specifically the two-stage residual inclusion (2SRI) method proposed by Terza et al. (2008), to address this problem. The outcome variables are nonlinear,[4] and ignoring the nonlinearity in the outcomes can affect the estimation results. The study, therefore, applies the 2SRI method relative to the two-stage least squares (2SLS) to handle the nonlinear nature of our outcome variables. Following Terza et al. (2008), the study specifies the outcome model in the nonlinear least squares (NLS) method form as:

$$E(Y|X_e, X_o, X_u; \beta) = M(X_e\beta_1 + X_o\beta_2 + X_u\beta_3) \tag{3.7}$$

where $M(X_e, X_o, X_u; \beta)$ represents the conditional mean of Y, given X_e, X_o and X_u. β is a vector of parameters to be estimated. Y denotes the outcome variable. X_e represents a health insurance dummy variable that takes the value of 1 when the participant holds health insurance and 0 otherwise. X_o denotes the observable demographic and socioeconomic characteristics of a worker and X_u denotes unobservable characteristics. The regression model corresponding to equation (3.7) can be expressed as:

$$Y = M(X_e\beta_1 + X_o\beta_2 + X_u\beta_3) + \varepsilon \tag{3.8}$$

[4]Most of the outcome variables are dichotomous (binary), count and ordinal in nature. According to Basu et al. (2018), nonlinear estimators produced the least bias estimates of average treatment effects.

where ε is the regression error term. The demand for health care and the probability of missed workday(s) may depend on the health status of a worker, and those with poor health conditions are more likely to miss workdays and also to participate in an insurance program. This unobserved health status of workers may bias the estimates. Conversely, individuals with good health naturally miss fewer workdays. Therefore, ignoring the endogeneity issue in health insurance would greatly affect the estimates. This is because it would lead to the conclusion that would suggest a reduction/increase in the number of missed workday(s), even if there is no effect. Thus, it will lead to an underestimation/overestimation of any effect the health insurance may have on the reduction/increase in illness-related absenteeism in the workplace. The analysis accounts for this possible endogeneity issue in the health insurance program.

To address this potential endogeneity issue, the study instruments the health insurance variable X_e, and expresses the model in nonlinear auxiliary regression (reduced form equation) as:

$$X_e = r(T\delta) + X_u \tag{3.9}$$

where $r(T\delta)$ represents the conditional mean of X_e given T, and $T = [X_o, Z]$. The variable Z is a vector of IVs and δ is the parameter to be estimated. Z also contains variables that affect the NHIS while affecting only the days of illness-related absenteeism at the workplace through X_e. The study assumes that there is an unobserved factor, X_u, which affects both X_e and Y, and which is the only source of dependence between them, after controlling for the influence of the observed variables X_o and Z. If the residual term X_u were observable, the study could add it as an additional regressor in the model. Estimating this would address the potential self-selection issue associated with health insurance participation.

To implement the model outlined in equations (3.8) and (3.9), the study employs regional-level average health insurance coverage as an IV in our estimation. The area-based IV measure creates variations in the endogenous variable X_e. According to Wooldridge (2010), the regional variable used as the instrument is appropriate

provided other regional variables that affect the dependent variable are controlled for. Area-based IV measures have been used in other studies (Sloan et al., 2001; Grabowski and Hirth, 2003; Sasso and Buchmueller, 2004; Morris, 2007; Jay et al., 2013; Denny and Oppedisano, 2013). The study focuses on regional-level average health insurance coverage as an instrument because the implementation of the NHIS in Ghana differs across regions, and these differences in the NHIS implementation should affect people's enrolment in the NHIS program. The communities with earlier implementation of the NHIS are likely to have higher average health insurance coverage compared with communities with late implementation. This IV should be correlated with the endogenous health insurance variable X_e and therefore is likely to reflect the exogenous variation in the individuals' participation in the NHIS. The IV reflects collective behaviour and is unlikely to be affected by individual unobserved characteristics. The instrument is likely to be correlated with health insurance but uncorrelated with the probability of missing workdays and the number of workdays missed due to illness and the error term. Thus, the instrument is expected to affect the outcome variables only through its effects on the health insurance uptake.[5] There may be regional-level factors that may correlate with the instrument employed, which in turn affect outcomes. The study therefore takes this into account by controlling for other regional factors in the regression model.

Implementation of the 2SRI method involves replacing the unobserved covariate X_u with a consistent estimate. The first step is to estimate equation (3.9) using NLS and thereafter calculate the residual $\hat{X}_u$.[6] The estimated residual can be expressed

[5]There may be a positive externality or spillover effect of NHIS participation and this is an indirect effect. The study, therefore, does not consider this spillover effects in this analysis. Health facilities in Ghana are not uniformly distributed at the district level and this may affect participation in the NHIS. Areas where health facilities are not available would discourage participation in the NHIS. The issue is different at the regional level and this motivated the use of regional-level NHIS averages as the instrument relative to the district level averages.

[6]Residuals in the control function analysis can be constructed in four ways: response, Anscombe, Pearson, and deviance. The estimates in this analysis are based on the response residual, a residual used mostly in control function analysis. However, the other residuals are also used as robustness checks. Generally, the response residual is the differences between the observed treatment and the predicted probability of treatment.

as:

$$\hat{X}_u = X_e - r(T\hat{\alpha}) \tag{3.10}$$

The estimated residual $\hat{X}_u$ as shown in equation (3.10) is then substituted into equation (3.8) as an additional regressor. The estimation equation can be expressed as:

$$Y = M(\beta_1 X_e + \beta_2 X_o, +\beta_3 \hat{X}_u) + \varepsilon^{2sri} \tag{3.11}$$

To estimate equation (3.11), the study uses probit, negative binomial and Poisson, depending on the outcome variables analysed. As with the 2SLS estimation, the 2SRI requires that the IV satisfy the exclusion condition, which has been explained above, and also the relevance condition. To test the strength of the IV, the study applies the standard IV diagnostic tests. The results of the IV diagnostic tests are reported in Appendix B, Table B2 and Table B3.

3.4 Results

This section presents the estimates of the effect of health insurance on the probability of missing a workday due to illness and the total number of missed workdays. The study applies an IV approach to address a potential endogeneity issue associated with voluntary participation in the health insurance program. Although the study uses a 2SRI approach, it also uses 2SLS to obtain the conventional diagnostic tests for instrument strength. The first stage regression results of the IV reported in Table B2 and Table B3. The coefficients of the IV in most of the regressions are positive and statistically significant, indicating that regional-level average health insurance coverage correlated with individuals' NHIS enrolment. The study used an F-test to assess the strength (weakness) of the instruments employed. The instruments are considered valid if F-statistics are larger than the rule of thumb value of 10 (Stock et al., 2002). The IV results as reported in Table B2 and Table B3

indicates that the instrument is not weak and therefore, it is relevant for the model specifications. Thus, the IV is strong enough to identify the NHIS effect. This is because, in all specifications, the F-statistics in the first stage regression, which ranges from 24 to 110, exceeds the rule of thumb value of 10. The F-statistics also greatly exceed Stock and Yogo (2005) critical values, therefore rejecting the null hypothesis of a weak instrument is justified. There is no evidence to suggest that the instrument is weak. Table B2 and Table B3 also report the 2SLS estimates which do not differ from the 2SRI results reported in the main text in terms of signs and the statistical significance. The sensitivity analysis of the instruments employed is discussed in sub-section 3.5.2.

Table 3.2: Estimates of the effects of health insurance on illness-related absenteeism at the workplaces

	Probit	Negative binomial	Poisson
Outcome variables	Probability of missing a workday	Number of days missed	Number of days missed
	(1)	(2)	(3)
Health insurance	-0.223*	-3.056**	-3.151**
	(0.123)	(1.015)	(1.016)
Mean of outcome variable	0.578	5.774	5.774
Observations	3,091	3,091	3,091

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in column (1) are for probit regression, and columns (2) and (3) are for negative binomial and Poisson regressions respectively. Coefficients are marginal effects measured at the mean.

Table 3.2 reports the second-stage estimation results of the effect of NHIS on the extents of illness-related absenteeism at the workplace. All the standard errors in the parentheses below the estimates are robust. Column (1) reports the probability of missing a workday due to illness. The estimates show that there is a significant difference between workers with health insurance and those without insurance in terms of the probability of missing a workday due to illness. Specifically, holding other factors constant, having health insurance reduces the probability of missing a workday due to illness by 22.3 percentage points. Column (2) presents the

estimates of the total number of workdays missed due to illness. There is an issue of overdispersion in the data because the estimated variance exceeds the mean in the outcome variables; the study therefore applies the negative binomial technique to account for the overdispersion. The result shows that having health insurance reduces the number of workdays missed due to illness. Thus, workers with health insurance missed fewer workdays than workers without health insurance. More specifically, having health insurance reduces the number of workdays missed due to illness by 3.1 days on average, holding other factors constant. In terms of signs and statistical significance, the column (2) estimate is similar to the column (3) estimate obtained from an alternative estimation approach (Poisson).[7] Overall, the estimates indicate that health insurance reduces illness-related absenteeism at the workplace through the reduction in the number of sick days a worker takes. This increases labour productivity through a reduction in output loss.

The study also applies the OLS model in this analysis and the results are reported in Table 3.3. The results in column (1) in both panels (A and B) are similar to those in Table 3.2 in terms of signs and statistical significance. The difference between them is the magnitude of the estimates, and it is relatively higher in the 2SRI than the OLS estimates. Our outcome variables are nonlinear, and given the advantage on the efficiency, the estimates obtained by the 2SRI approach is preferred. The rest of the analyses covered in the next sub-sections use the 2SRI estimation approach.

[7]When assuming no difference between the mean and variance mean, and applying the Poisson estimation technique, the results are again similar to the negative binomial estimates in terms of signs and statistical significance.

Table 3.3: OLS estimates of the effects of health insurance on number of workdays missed and the probability of missing a workday due to illness

		Age		Sector		Gender	
	Full sample	15-49	50-60	Formal	Informal	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Number of workdays missed							
Health insurance	-2.308**	-1.823*	4.791*	-2.707	-2.119**	-3.310**	-1.521
	(0.949)	(1.018)	(2.669)	(2.371)	(1.034)	(1.499)	(1.241)
Mean of outcome variable	0.578	0.570	0.611	0.476	0.608	0.569	0.584
Observations	3,091	2,439	652	687	2,403	1,112	1,979
Panel B: Probability of missing a workday							
Health insurance	-0.219*	0.106	-0.219	0.166	-0.311	-0.169	-0.252
	(0.123)	(0.1366)	(0.292)	(0.308)	(0.133)	(0.197)	(0.158)
Mean of outcome variable	5.774	5.559	6.582	5.686	5.800	5.702	5.815
Observations	3,091	2,439	652	687	2,403	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the OLS model. The estimates in Panel A are based on the total number of workdays missed due to illness and Panel B are based on the probability of missing a workday due to illness.

3.4.1 Heterogeneous effects

The study examines the heterogeneity of illness-related absenteeism at the workplace by age groups in terms of both the employment sector in which a worker works and gender. First, the study applies graphical analysis to the outcome variables. The graph as shown in Figure 3.1 shows a significant difference in the number of illness-related absenteeism at the workplace across workers in both the formal and informal sectors. The decline in the number of illness-related absenteeism

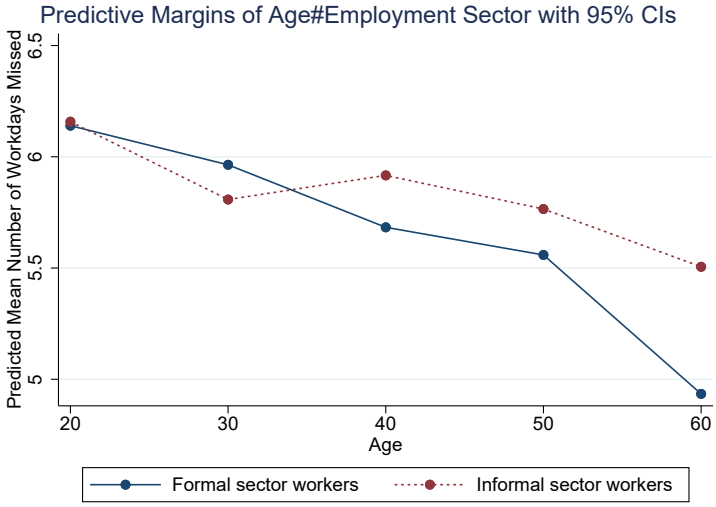

Figure 3.1: Employment sector, age and the number of workdays missed due to illness

at the workplace on average are higher for workers in the formal sector than the informal sector workers. In both employment sectors, illness-related absenteeism at the workplace decline when workers are ageing. The reduction in the number of illness-related absenteeism at the workplace is also observed for both male and female workers and it is relatively higher for males than females, as illustrated in Figure 3.2. The estimates further reveal a reduction of illness-related absenteeism at the workplace before age 50, and after 50 years it increases for male workers but decreases for female workers.

The estimates in Figure 3.1 are based on age groups, but a similar estimation examined individual ages (age not grouped) and the results are illustrated in Figure B1 in Appendix B. Both estimates are similar. The variations in illness-related absenteeism at the workplace illustrated in Figure 3.1 and Figure 3.2 prompted

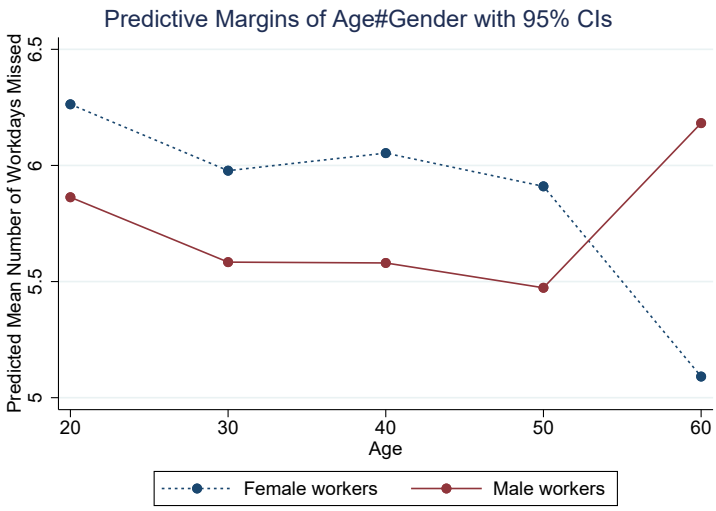

Figure 3.2: Gender, age and the number of workdays missed due to illness

further analysis. The study, therefore, estimates the heterogeneous effects of health insurance on illness-related absenteeism at the workplace in terms of age group, employment sector and gender.

A. Age group

This section investigates whether there is a significant difference between younger and older workers in terms of the probability of missing a workday and the number of workdays missed due to illness. The results are reported in Table 3.4.[8]

The first two columns show a negative effect but the results are not statistically significant, indicating that there is no significant difference between younger and older workers with health insurance and those without health insurance in the probability of missing workday due to illness. With regard to the total number of workdays missed due to illness, the study observes a significant reduction in the number of workdays missed due to illness for both younger and older workers with health insurance compared to those without insurance, as shown in columns (3) and (4) respectively. Holding other factors constant, the effects are larger in magnitude for older workers compared with young individuals, as the study finds the number of

[8]Workers aged 15-49 years were classified as younger workers and 50-60 years as older workers. The study considered workers aged 50-60 years to be older workers because the retirement age for formal sector workers starts at 55 years (voluntary retirement age) and compulsory retirement is 60 years.

Table 3.4: Estimates of the effects of health insurance on illness-related absenteeism at the workplace by age

	Probability of missing a workday		Number of days missed	
Outcome variables	15-49	50-60	15-49	50-60
	(1)	(2)	(3)	(4)
Health insurance	-0.223	-0.271	-2.619**	-4.599*
	(0.136)	(0.293)	(1.104)	(2.494)
Mean of outcome variable	0.570	0.611	5.559	6.582
Observations	2,439	652	2,439	652

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) and (2) are for probit regression, and columns (3) and (4) are for negative binomial regressions. Coefficients are marginal effects measured at the mean.

days workers with health insurance missed work due to illness is reduced by 2.6 days for younger workers and 4.6 for older workers compared with individuals in similar age groups without health insurance.

B. The sector of employment (formal and informal sector)

This section assesses the effects of health insurance on illness-related absenteeism at workplaces by the sector in which a worker works (formal or informal). In Ghana, the majority of the population in the labour force (70%) are in the informal sector and their activities contribute immensely to Ghana's economic development. The focus of this analysis is on those who work in the informal sector, but the study also examines those in the formal sector to find out if there is a significant difference between workers in the two sectors. Understanding the relationship between health insurance and absenteeism at the workplace for workers in both formal and informal sectors is important for policy-making in Ghana.[9]

The results shown in Table 3.5 indicate a significant reduction of the number of workdays missed due to illness for workers in both sectors who have health insurance. Thus, holding other factors constant, having health insurance reduces the number of

[9]Even though the contribution to the NHIS is mandatory for formal sector employees through payroll deduction of 2.5% of their Social Security and National Trust Fund, but the contributor need to be registered before becoming a member of the NHIS. Those who failed to register with the NHIS bear the full cost of their medical treatment.

Table 3.5: Estimates of the effects of health insurance on illness-related absenteeism at the workplace by sector

	Negative binomial		Poisson	
Outcome variables	Formal sector workers (1)	Informal sector workers (2)	Formal sector workers (3)	Informal sector workers (4)
Health insurance	-4.109*	-2.719**	-4.415*	-2.807**
	(2.282)	(1.128)	(2.333)	(1.126)
Mean of outcome variable	5.686	5.800	5.686	5.800
Observations	687	2,403	687	2,403

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) and (2) are for negative binomial regression, and columns (3) and (4) are for Poisson regressions. Coefficients are marginal effects measured at the mean, and the estimates are based on the number of workdays missed due to illness.

workdays missed by workers in the formal sector by 4.1 days on average and workers in the informal sector by 2.7 days, compared with those without insurance. The estimates suggest that, irrespective of the work sector, those with health insurance missed fewer workdays than those without health insurance. The results of the negative binomial are similar to the Poisson estimates shown in columns (3) and (4) in terms of signs and statistical significance, but slightly different from the OLS estimates reported in Table 3.3.

As for the probability of missing a workday due to illness, the results show significant differences between workers in the formal and informal sector (see columns (1) and (2) of Table 3.7). The study observes a significant reduction in workdays missed due to illness for insured workers in the informal sector compared to those without insurance. For workers in the formal sector, however, the study finds that, holding other factors constant, having insurance has no significant effect on missing a workday due to illness.

C. Gender

Table 3.6 and the last two columns of Table 3.7 describe the effect of health insurance on the number of workdays missed and the likelihood of missing a workday due

Table 3.6: Estimates of the effects of health insurance on illness-related absenteeism at the workplace by gender

Outcome variables	Negative binomial		Poisson	
	Male workers (1)	Female workers (2)	Male workers (3)	Female workers (4)
Health insurance	-3.237**	-0.627	-3.300**	-0.636
	(1.386)	(0.962)	(1.377)	(0.979)
Mean of outcome variable	5.702	5.815	5.702	5.815
Observations	1,112	1,979	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. Results in columns (1) and (2) are for negative binomial regression, and columns (3) and (4) are for Poisson regressions. Coefficients are marginal effects measured at the mean, and the estimates are based on the number of workdays missed due to illness.

to illness by gender to determine whether workers' gender influences illness-related absenteeism at the workplace. The first two columns of Table 3.6 show significant differences in the number of workdays missed due to illness for males and females workers. Holding other factors constant, health insurance significantly reduces the number of days male workers are absent from work due to illness by 3.2 days, although no significant effect is found for female workers. The significant difference could be accounted for by several factors, but one major factor is health condition. In Ghana , men are more susceptible to ill-health than women. Life expectancy rate is higher for females (64.4) than males (62.5), indicating that women are ill less often and are therefore less likely to miss workdays due to illness. The results suggest that there is no significant difference between insured and uninsured women in terms of the probability of missing workdays and the total number of workdays missed due to illness.

Table 3.7: Estimates of the effects of health insurance on the probability of missing a workday due to illness by sector and gender

	Probability of missing a workday		Probability of missing a workday	
Outcome variables	Formal sector workers	Informal sector workers	Male workers	Female workers
	(1)	(2)	(3)	(4)
Health insurance	0.177	-0.315**	-0.171*	-0.261
	(0.306)	(0.134)	(0.184)	(0.159)
Mean of outcome variable	0.476	0.608	0.569	0.584
Observations	687	2,401	1,112	1,977

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: The other covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) and (4) are for probit regression. Coefficients are marginal effects measured at the mean, and the estimates are based on the probability of missing a workday due to illness.

D. Employment sector and gender by age

Table 3.8 reports the estimates in terms of employment sector and gender, by age (younger and older workers). The estimates show a significant reduction in illness-related absenteeism at the workplace for insured younger workers in the informal sector compared with those without insurance (see column (3) and column (7) of Panel A). The study did not find a significant effect of health insurance on illness-related absenteeism at the workplace for workers in the formal sector. The results show that the reduction in illness-related absenteeism at the workplace in the informal sector is driven by young workers rather than older workers. In terms of gender, the study finds a significant reduction in the number of workdays missed due to illness for insured male workers (younger and older) relative to those without health insurance. For female workers, a statistically significant difference is observed only on the probability of missing a workday as shown in column (3) in Panel B of Table 3.8. In terms of older female workers, the study finds an insignificant effect of the NHIS on illness-related absenteeism at the workplace. The results shown in Figure 3.3 and Figure 3.4 are not much different from the estimates reported in Table 3.8. A decline in the workdays missed due to illness is observed for both formal and informal sector workers and both genders.

The OLS results reported in columns (2) to (7) of Table 3.3 show the heterogeneous effects. Most of the estimates in both anels (A and B) are similar in terms of signs and statistical significance, while others are completely different when compared with the baseline estimates. The results shown in Table 3.3 suggest that applying an IV approach is appropriate for this analysis.

Table 3.8: Estimates of the effect of health insurance on illness-related absenteeism at the workplace by age group in terms of sector and gender

Outcome variables	Formal sector workers		Informal sector workers		Formal sector workers		Informal sector workers	
Panel A	15-49	50-60	15-49	50-60	15-49	50-60	15-49	50-60
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health insurance	0.407	-0.510	-0.369**	-0.148	-3.606	-1.521	-2.282**	-4.085
	(0.323)	(1.001)	(0.150)	(0.306)	(2.408)	(5.855)	(1.230)	(2.753)
Mean of outcome variable	0.466	0.540	0.602	0.632	5.532	6.394	5.563	6.627
Observations	566	111	1,871	530	566	121	1,872	531
	Male workers		Female workers		Male workers		Female workers	
Panel B	15-49	50-60	15-49	50-60	15-49	50-60	15-49	50-60
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health Insurance	-0.088	-0.213	-0.389**	-0.221	-3.826**	-1.581*	-0.934	-1.209
	(0.216)	(0.346)	(0.159)	(0.302)	(1.512)	(3.397)	(1.051)	(2.341)
Mean of outcome variable	0.555	0.620	0.578	0.605	5.970	5.933	5.970	5.933
Observations	873	237	1,565	412	873	239	1,566	413

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. Results in columns (1) to (4) are for probit regression, and columns (5) to (8) are for negative binomial regressions. Coefficients are marginal effects measured at the mean, and the estimates in columns (1) to (4) are based on the probability of missing a workday due to illness and columns (5) to (8) are based on the total number of workdays missed due to illness.

E. Interaction effect analysis

Interaction effects between the NHIS, gender and employment sector on the number of workdays missed due to illness are also examined. In most specifications, the study observed interaction effects because the lines of observed variables are not parallel as illustrated in Figure 3.3 and Figure 3.4. The study also assesses the significant difference in the sets of effects estimated using contrast estimation techniques in margins. In these analyses, the study observed a significant effect in most categories examined (see Figure 3.3 and Figure 3.4). Figure 3.3 illustrate the interaction effect between the NHIS and employment sector and the results suggest a significant reduction in the number of workdays missed due to illness for insured workers in both informal and formal sectors of the economy compared with those without health insurance.

The study also observed a significant interaction effect between health insurance and gender (see Figure 3.4). These estimates are not much different from the baseline results. Overall, the results show heterogeneous effects of health insurance on labour productivity through a reduction in the number of workdays missed due to illness.

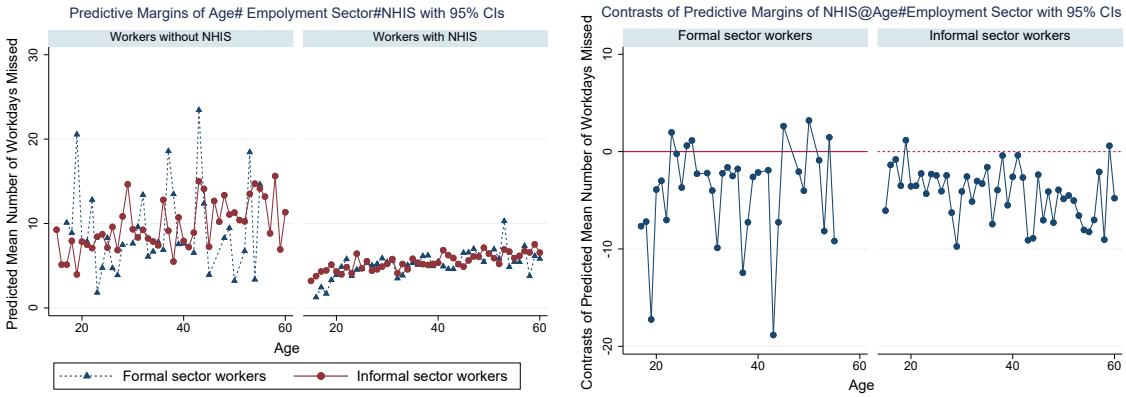

Figure 3.3: Interaction effects on the number of workdays missed due to illness by formal and informal sector workers

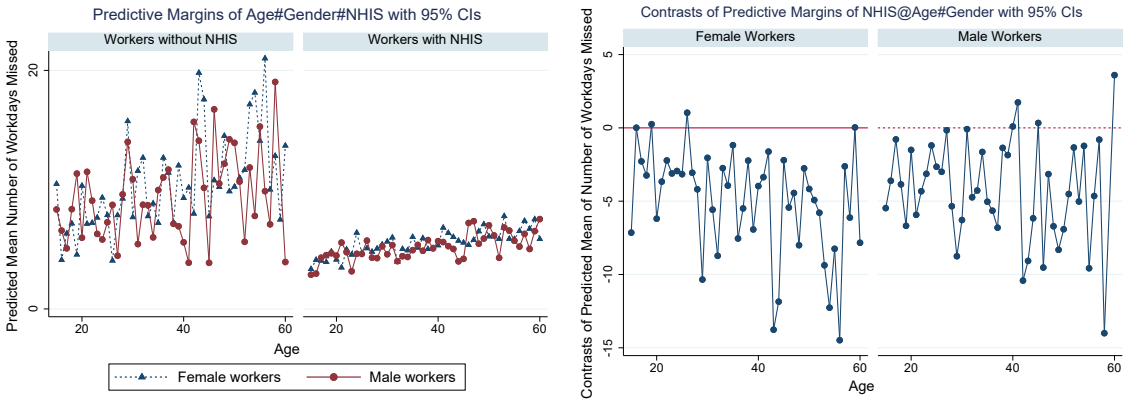

Figure 3.4: Interaction effects of health insurance on the number of workdays missed due to illness by male and female workers

3.4.2 Robustness checks

A. Sensitivity analysis of instrumental variables

There are a number of criticisms of the instruments usually applied to model identification and a major one is that few of these instruments would satisfy the exclusion restriction assumption. Apart from this criticism, there are sometimes issues such as spillover effects and reverse causality problems associated with the studies that apply the IV approach. To address this issue, Conley et al. (2012) proposed a plausibly exogenous estimator to check the potential violation of the exclusion restriction. The study, therefore, applies the plausibly exogenous estimator to check the sensitivity of the instrument employed on the baseline results. To do so, the estimation model is rewritten as:

$$Y_i = \sigma X_e + \gamma Z_i + \epsilon_i \tag{3.12}$$

$$X_e = \delta Z_i + \varepsilon_i \tag{3.13}$$

where Y_i represents outcome variables, X_e is the endogenous variable (health insurance), σ, δ, and γ are the parameters of interest, Z_i is an IV, ϵ_i and ε_i are the error terms. If the exclusion restriction assumption is satisfied, we expect $\gamma = 0$ and if the assumption is violated, then $\gamma \neq 0$. According to Conley et al. (2012), the instruments might not necessarily satisfy the exclusion restriction $\gamma = 0$, but rather,

are close to the exclusion restriction assumption. Therefore, the sensitivity analysis can be performed using prior knowledge of the magnitude of γ to check the extent to which the coefficient of treatment variable σ is positive or negative within a certain confidence interval (Conley et al., 2012). In other words, σ must fall within certain confidence intervals known as union of confidence intervals (UCI), where γ provides support for UCI. For instruments to be valid in the plausibly exogenous model, $\gamma \equiv 0$. The UCI assumes that $\gamma \in \Gamma$ where Γ is the bounded support of γ. Given a specific value of γ from the support known as $\hat{\gamma}$, we can subtract $\hat{\gamma}\ Z_i$ from both sides of equation (3.12), expressed as:

$$\hat{Y}_i = Y_i - \hat{\gamma} Z_i = \sigma X_e + \epsilon_i \tag{3.14}$$

The study then applies the 2SLS to obtain an estimate of σ with an IV Z_i. Applying the UCI approach, we assume a positive support interval $\gamma \in [0, \theta]$,[10] and estimate the union of confidence intervals for the instrument, given that γ is in the UCI support. The magnitude of γ is based on prior information on first stage regression. The result is shown in Figure 3.5. The dashed lines are the UCI and they are composed of the upper and lower limit of confidence intervals respectively. The blue line (long dash) represents the 2SLS estimates of the treatment variable known as a point estimate. Figure 3.5 and Figure 3.6 represent the 95% UCI. The confidence interval containing zero indicates that the IVs are less robust. For the number of workdays missed due to illness results, the confidence intervals exclude zero, as illustrated in Figure 3.5. This suggests that to invalidate the statistical significance of the baseline results under the UCI, the specification requires $\gamma \leq 1.8$. Figure 3.5 indicates that the instrument employed to estimate the health insurance effects on the number of days missed due to illness is robust, even if it violates or departs from a perfect IV. This is because a large exclusion restriction violation is required to invalidate our baseline results. Thus, the exclusion restriction violation is small and as long as that is the case, our baseline result is still robust. The estimates indicate that the effect of

[10]The studies also employs a symmetric support centred at zero $\gamma \in [-\theta, \theta]$ for different values of θ, but the results remain the same.

health insurance instrumented by regional-level average health insurance coverage is plausibly exogenous. Figure 3.6 presents the results from the sensitivity analysis of the IV for missing workdays due to illness. In contrast to Figure 3.5, 95% confidence intervals of the UCI contain zero (0) at any given delta (δ), making the estimate less robust.

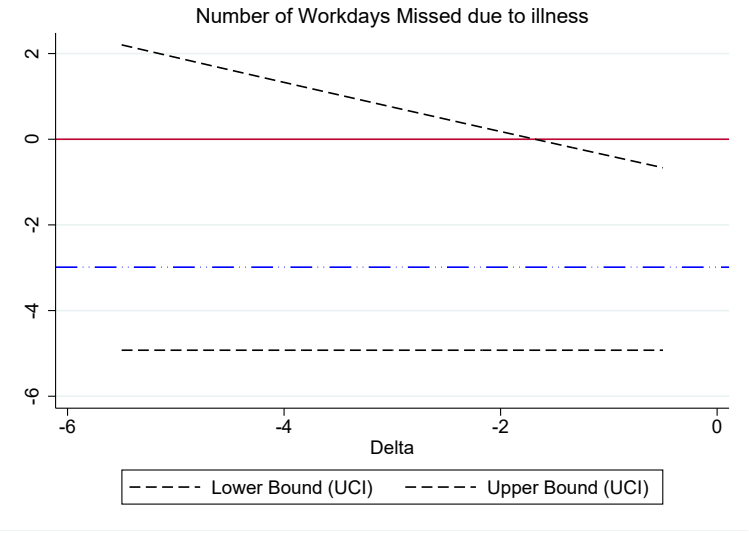

Figure 3.5: The UCI test for instrument validity on the number of workdays missed due to illness and NHIS

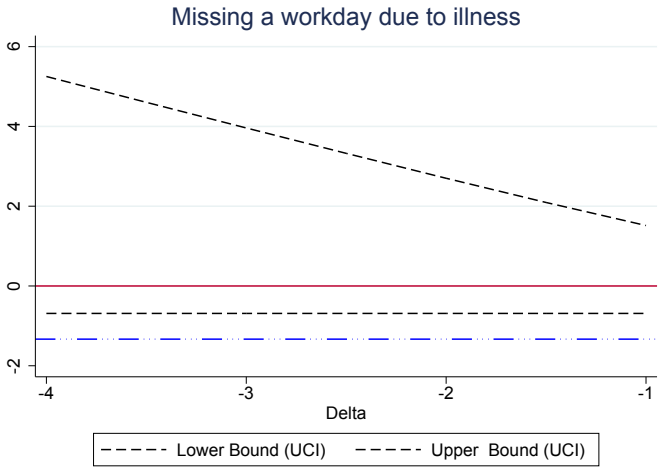

Figure 3.6: The UCI test for instrument validity on the probability of missing a workday due to illness

B. Estimation with other residuals in the control function approach

The control function approach is a general method for addressing the endogeneity issue associated with a regressor(s). A function of the residuals exists in the control function approach, which helps to produce a correct adjustment for endogeneity in the outcome equation (Newey et al., 1999; Garrido et al., 2012). According to O'Malley et al. (2011), control functions are robust to the treatment equation distribution of response residuals if the outcome equation distribution of response residuals is symmetric. For a binary treatment, residuals can be constructed in four ways: response, Anscombe, Pearson and deviance. These residuals are equivalent in linear but not in nonlinear regression models (Gill and Torres, 2019; Garrido et al., 2012). The functional form of the residuals in the control function approach should correspond appropriately with nonlinear specifications, therefore, for this analysis we employed two-stage residual inclusion, one of the estimation techniques commonly used in control function approach (Garrido et al., 2012; Terza, 2018; Basu et al., 2018). The computation of the residuals varies among themselves and the estimates from these residuals are also slightly different from one another.[11]

The estimates in the baseline analysis are based on response residual, therefore, the study checks the sensitivity of our baseline results by applying different estimated residuals. The results from these residuals (Anscombe, Pearson and deviance) are reported in Table B4 to Table B7 in Appendix B. Most of the estimates are similar to the baseline results (response residual results) in terms of signs and statistically significance. The results in most specifications indicate a negative and statistically significant effect of health insurance on illness-related absenteeism at the workplaces. The only difference across the estimates is the magnitudes of the estimates which is slightly different across the estimated residuals. These differences in magnitude could be attributed to the computational differences in the residuals as already stressed.

[11]The computation of the response residual is the difference between the observed treatment and the predicted probability of treatment. Pearson residuals are constructed by dividing the response residuals by the standard error of the predicted probability of treatment. Anscombe residuals are computed using the observed treatment, the predicted treatment probability and the variance of that prediction. Deviance residuals are estimated by taking the square root of the observations that minimised the deviance to obtain the parameter estimates (Pierce and Schafer, 1986; Gill and Torres, 2019; Garrido et al., 2012).

In most specifications, the study observed a significant reduction in illness-related absenteeism at the workplace for workers with health insurance relative to those without health insurance. Most of the results in heterogeneous analyses are also similar to the baseline results in terms of signs and statistical significance.

3.5 Discussion

The study applies a 2SRI approach to investigate the effect of health insurance on labour productivity through illness-related absenteeism at the workplace in Ghana. In the estimation, the study introduces IVs to address the potential endogeneity issue in health insurance analysis. The findings indicate that workers with health insurance miss fewer workdays than those without health insurance. In general, the results correspond to the evidence in the literature that having health insurance improves individual health, and improved health increases labour force participation. Better health also improves labour productivity by reducing illness-related absenteeism at the workplace. This reduces output loss and increases the country's production. These are some possible mechanisms through which health insurance influence absenteeism and productivity.

Contributions to the NHIS in Ghana are mandatory for formal sector workers and voluntary for informal sector workers, therefore, the majority of workers in the formal sector are in the NHIS, but this is not the case in the informal sector. The expectation was that the NHIS would have a more significant effect on formal sector workers compared to informal sector workers, but the results reveal otherwise. The paper finds a negative and statistically significant effect of health insurance on workers in both sectors, indicating that the reduction in the number of days of illness-related absenteeism at the workplace is driven by workers in both formal and informal sectors.

Several factors could account for this finding, including earnings and nature of work in these sectors, particularly the informal sector. Most workers in the informal sector are self-employed and their earnings depend on the activities they engage in. They may be paid on a daily, weekly, monthly, quarterly or yearly basis. Since these earnings are sometimes unstable and unreliable compared with earnings in the formal

sector, absence from work has a large effect on their earnings. The majority of workers in this sector, especially older workers, are also household heads and breadwinners for their families, therefore, illness could affect the entire household earnings and consumption. As a result, they are very conscious of their health and take proper care to avoid catastrophic illness, which could incapacitate them in their daily activities.

Despite a significant reduction of illness-related absenteeism at the workplace in both sectors, there are variations in the size of the effects between workers in the formal and informal sectors, and this may be due to the distribution of health facilities across the country. Most of the available hospitals are in urban centres rather than in rural areas. The majority of people in the informal sector are in rural areas. They may be insured, but they may have challenges in accessing health care compared with those in urban centres, and this may have accounted for these differences. The findings suggest that there is a need to expand the Community-based Health Planning and Service (CHPS) and clinics to emerging communities such as slum areas, rural areas and the hinterlands where they are not available, so as to improve healthcare access and health, which in turn affect health and labour productivity.

The study also investigates the effects of the NHIS separately for young and old workers in terms of the probability of missing a workday and the number of workdays missed due to illness. The findings show no significant effect of the NHIS on the probability of missing workdays due to illness, although a significant effect on the number of days a worker misses work due to illness is observed for both younger and older workers. The study undertakes a series of robustness checks with different estimation techniques. In all specifications, the results suggest that health insurance increases labour productivity by reducing the extent of illness-related absenteeism at workplaces, indicating that the results are robust to the alternative estimation techniques.

To reduce absenteeism and improve workers' productivity in the workplace, the study makes some recommendations. Firstly, CHPS and clinics should be extended to communities where they are unavailable; and this would help to improve healthcare access and health. Secondly, health insurance premiums should be subsidised

for workers in the informal sector who cannot afford the premium payments. These measures would increase participation in the NHIS and reduce illness-related absenteeism at workplaces, and thereby improve labour productivity. With improved labour productivity, the economy would grow and workers' welfare would also be enhanced.

There are some limitations to the study. First, the study controls for some regional characteristics that may affect the estimates, but there are other factors that cannot be controlled for, and this may affect the exogeneity of the instruments employed. Secondly, in this sample, some workers reported the number of workdays missed due to illness but others did not. Because the study focused on the individuals who reported the number of workdays missed due to illness, the sample size dropped significantly, and this can also affect the estimates. Finally, there may be other health conditions individuals have which have not been accounted for in this study and this can also affect the estimates. Despite these limitations, the study makes an important contribution to the literature on health insurance and labour productivity through illness-related absenteeism at the workplace in a developing country context.

3.6 Conclusion

This study examined the effects of health insurance on the labour productivity of workers in Ghana. Holding other factors that affect labour productivity constant, the number of workdays workers missed due to illness affects workers' productivity through output loss. Since health insurance is positively related to health, and health influences an individual's ability to work, the study examined whether health insurance affects workers' productivity through illness-related absenteeism at the workplace in Ghana. The findings indicate that providing workers with health insurance increases their labour productivity through a reduction in the extent of illness-related absenteeism at the workplaces. Thus, workers with health insurance miss fewer workdays than those without health insurance. This indicates that workers with health insurance are absent from work less often and are more likely to reduce output loss compared with workers without health insurance. Future research could

focus on illness-related absenteeism in individual firms to investigate the actual cost of this absenteeism at the workplaces.

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Appendix B:

Table B1: Descriptive statistics by year

	All		2012		2006	
Description	Mean (1)	Std dev (2)	Mean (3)	Std dev (4)	Mean (5)	Std dev (6)
Missing workday due to illness	0.578	0.493	0.586	0.493	0.535	0.499
Number of workdays missed	5.946	4.105	5.738	3.969	5.969	3.974
Informal sector employees	0.735	0.441	0.745	0.436	0.693	0.462
Hours of work	32.45	15.67	32.45	15.56	32.46	16.25
Age	35.71	14.14	35.50	13.16	36.91	13.01
Educational Status	0.763	0.425	0.748	0.434	0.847	0.360
Male	0.352	0.478	0.338	2,665	0.433	0.496
Female	0.648	0.478	0.662	0.473	0.567	0.496
Health status	0.941	0.235	0.939	0.239	0.952	0.214
Household size	3.965	1.822	3.954	2.827	4.018	2.703
ETHNICITY						
Akans	0.419	0.494	0.379	0.485	0.644	0.479
Ga Dangbe	0.045	0.206	0.043	0.202	0.054	0.226
Ewe	0.126	0.332	0.134	0.341	0.080	0.271
Guans	0.045	0.208	0.047	0.219	0.035	0.185
Northern	0.356	0.479	0.389	0.487	0.175	0.380
No tribe	0.008	0.090	0.007	0.086	0.012	0.110
MARITALSTATUS						
Married	0.532	0.499	0.527	0.499	0.556	0.497
Separated	0.081	0.273	0.078	0.268	0.100	0.301
Divorce	0.072	0.259	0.073	0.260	0.069	0.254
Widowed	0.053	0.223	0.055	0.227	0.039	0.194
Never married	0.262	0.440	0.267	0.442	0.235	0.425
REGION						
Western	0.082	0.274	0.081	0.273	0.084	0.277
Central	0.064	0.244	0.011	0.240	0.076	0.266
Greater Accra	0.050	0.218	0.089	0.216	0.058	0.227
Volta	0.117	0.321	0.125	0.331	0.070	0.256
Eastern	0.119	0.324	0.113	0.316	0.154	0.361
Ashanti	0.155	0.362	0.139	0.346	0.244	0.230
Brong Ahafo	0.096	0.295	0.085	0.280	0.157	0.364
Northern	0.123	0.328	0.131	0.337	0.079	0.270
Upper East	0.106	0.308	0.118	0.323	0.038	0.192
Upper West	0.089	0.284	0.097	0.296	0.043	0.202
RELIGION						
Christians	0.123	0.329	0.136	0.343	0.046	0.246
Moslems	0 .153	0.360	0.161	0.368	0.113	0.317
Traditionalist	0.156	0.363	0.165	0.372	0.116	0.321
No religion	0.217	0.412	0.209	0.407	0.251	0.434
Others	0.351	0.477	0.328	0.470	0.456	0.499
RESIDENCE						
Urban	0.469	0.499	0.464	0.499	0.486	0.501
Rural	0.531	0.499	0.535	0.499	0.514	0.501

Table B2: The IV estimates of the probability of missing a workday due to illness

Outcome variables	Probability of missing a workday due to illness				
	Full sample	Formal sector workers	Informal sector workers	Male workers	Female workers
	(1)	(2)	(3)	(4)	(5)
Panel A: Second Stage IV estimates					
Health insurance	-0.133	0.284	-0.241*	-0.177	-0.108
	(0.130)	(0.319)	(0.144)	(0.235)	(0.155)
Mean of outcome variable	0.585	0.476	0.606	0.569	0.584
Panel B: First Stage IV estimates					
Regional-level average NHIS	1.725***	1.705***	1.714***	1.661***	1.771***
	(0.165)	(0.350)	(0.186)	(0.299)	(0.197)
F-statistics	110.0	23.95	84.88	30.96	80.99
Stock&Yogo critical value(15%)	11.59	11.59	11.59	11.59	11.59
Under-identification test (χ^2)	102.7	22.25	79.61	29.75	74.37
Observations	3,091	687	2,403	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. The Kleibergen-Paap Wald rank F-statistic is a weak IV test. The under-identification test is the Kleibergen-Paap rank LM-statistic. The Stock and Yogo critical values correspond to the maximal rejection rate one is willing to tolerate if the true rejection rate is 5%.

Table B3: The IV estimates of the number of workdays missed due to illness

Outcome variables	Number of workdays missed due to illness				
	Full sample	Formal sector workers	Informal sector workers	Male workers	Female workers
	(1)	(2)	(3)	(4)	(5)
Panel A: Second Stage IV estimates					
Health insurance	-2.987**	-4.361*	-2.600**	-5.830**	-1.096
	(1.450)	(2.613)	(1.115)	(2.024)	(1.194)
Mean of outcome variable	5.946	5.686	5.800	5.702	5.815
Panel B: First Stage IV estimates					
Regional-level average NHIS	1.725***	1.705***	1.714***	1.661***	1.771***
	(0.165)	(0.350)	(0.186)	(0.299)	(0.197)
F-statistics	110.04	23.95	84.88	30.96	80.99
Stock&Yogo critical value(15%)	11.59	11.59	11.59	11.59	11.59
Under-identification test(χ^2)	102.74	22.25	79.68	29.75	74.35
Observations	3,091	687	2,403	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: The other covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. The Kleibergen-Paap Wald rank F-statistic is a weak IV test. The under-identification test is the Kleibergen-Paap rank LM-statistic. The Stock and Yogo critical values correspond to the maximal rejection rate one is willing to tolerate if the true rejection rate is 5%.

Table B4: Probit estimates of the effects of health insurance on probability of missing a workday using different residuals

		Age		Sector		Gender	
	Full sample	15-49	50-60	Formal	Informal	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Anscombe residuals							
Health insurance	-0.133	-0.149	-0.099	0.532	-0.296**	-0.139	-0.308
	(0.125)	(0.140)	(0.289)	(0.320)	(0.134)	(0.154)	(0.126)
Mean of outcome variable	0.578	0.570	0.611	0.476	0.608	0.569	0.584
Observations	3,089	2,438	651	687	2,403	1,112	1,979
Panel B: Pearson residuals							
Health insurance	-0.006	-0.002	-0.061	0.549**	-0.112	0.002	-0.106
	(0.070)	(0.078)	(0.172)	(0.174)	(0.076)	(0.105)	(0.083)
Mean of outcome variable	0.578	0.570	0.611	0.476	0.608	0.569	0.584
Observations	3,089	2,438	651	687	2,401	1,112	1,979
Panel C: Deviance residuals							
Health insurance	-0.176	-0.185	-0.165	0.432	-0.327**	-0.173	-0.341**
	(0.136)	(0.152)	(0.314)	(0.345)	(0.147)	(0.160)	(0.131)
Mean of outcome variable	0.578	0.570	0.611	0.476	0.608	0.569	0.584
Observations	3,089	2,438	651	687	2,401	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) to (8) are for probit regression. Coefficients are marginal effects measured at the mean. .

Table B5: Negative binomial estimates of the effects of health insurance on number of workdays missed using different residuals

		Age		Sector		Gender	
	Full sample	15-49	50-60	Formal	Informal	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Anscombe residuals							
Health insurance	-3.809**	-3.276**	-5.348*	-5.609**	-3.258**	-3.902**	-0.785
	(1.481)	(1.602)	(3.730)	(3.292)	(1.649)	(2.022)	(1.415)
Mean of outcome variable	5.774	5.559	6.582	5.686	5.800	5.702	5.815
Observations	3,091	2,439	652	687	2,403	1,112	1,979
Panel B: Pearson residuals							
Health insurance	-2.064**	-1.720	-2.944	-3.054	-1.744	-2.008	-0.432
	(0.986)	(1.065)	(3.730)	(2.208)	(1.096)	(1.361)	(0.956)
Mean of outcome variable	5.774	5.559	6.582	5.686	5.800	5.702	5.815
Observations	3,091	2,439	652	687	2,403	1,112	1,979
Panel C: Deviance residuals							
Health insurance	-4.006**	-3.442**	-5.624	-5.954*	-3.412**	-4.087**	-0.832
	(1.583)	(1.711)	(4.004)	(3.523)	(1.763)	(2.162)	(1.521)
Mean of outcome variable	5.774	5.559	6.582	5.686	5.800	5.702	5.815
Observations	3,091	2,439	652	687	2,403	1,112	1,979

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) to (8) are for negative binomial regression. Coefficients are marginal effects measured at the mean.

Table B6: Negative binomial estimates of the effects of health insurance on the number of workdays missed by age using different residuals

	Informal		Formal		Males		Females	
	15-49	50-60	15-49	50-60	15-49	50-60	15-49	50-60
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Anscombe residuals								
Health insurance	-4.569	-3.563	-2.831*	-4.205	-4.907**	-0.921	-1.230	-2.338
	(3.462)	(8.511)	(1.789)	(4.137)	(2.204)	(4.929)	(1.539)	(3.534)
Mean of outcome variable	5.532	6.394	5.563	6.627	5.970	5.933	5.970	5.933
Observations	566	121	1,872	531	873	239	1,566	413
Panel B: Pearson residuals								
Health insurance	-2.171	-2.248	-1.543	-2.042	-2.759**	0.332	-0.662	-1.515
	(3.702)	(9.144)	(1.910)	(4.439)	(1.483)	(3.308)	(1.039)	(2.408)
Mean of outcome variable	5.532	6.394	5.563	6.627	5.970	5.933	5.970	5.933
Observations	566	121	1,872	531	873	239	1,566	413
Panel C: Deviance residuals								
Health insurance	-4.797	-4.032	-2.973	-4.361	-5.163**	0.881	-1.312	-2.528
	(3.702)	(9.144)	(1.910)	(4.439)	(2.355)	(5.292)	(1.653)	(3.813)
Mean of outcome variable	5.532	6.394	5.563	6.627	5.970	5.933	5.970	5.933
Observations	566	121	1,872	531	873	239	1,566	413

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) to (8) are for negative binomial regression. Coefficients are marginal effects measured at the mean.

Table B7: Probit estimates of the effects of health insurance on the probability of missing a workday by age using different residuals

	Informal		Formal		Informal		Formal	
	15-49	50-60	15-49	50-60	15-49	50-60	15-49	50-60
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Anscombe residuals								
Health insurance	0.784	-0.321	-0.375**	-0.023	-0.163	-0.176	-0.335**	-0.101
	(0.336)	(1.118)	(0.152)	(0.299)	(0.174)	(0.357)	(0.141)	(0.288)
Mean of outcome variable	0.466	0.540	0.602	0.632	0.555	0.620	0.578	0.605
Observations	566	111	1,871	530	873	237	1,565	412
Panel B: Pearson residuals								
Health insurance	0.656***	-0.287	-0.157**	0.066	0.016	-0.183	-0.135	-0.098
	(0.366)	(1.108)	(0.166)	(0.326)	(0.117)	(0.277)	(0.093)	(0.191)
Mean of outcome variable	0.466	0.520	0.602	0.632	0.555	0.620	0.578	0.605
Observations	566	111	1,871	530	873	237	1,565	412
Panel C: Deviance residuals								
Health insurance	0.707***	-0.304	-0.406**	0.064**	-0.207	-0.156	-0.362**	-0.161
	(0.366)	(1.108)	(0.166)	(0.326)	(0.181)	(0.361)	(0.146)	(0.300)
Mean of outcome variable	0.466	0.520	0.602	0.632	0.555	0.620	0.578	0.605
Observations	566	111	1,871	530	873	237	1,565	412

Note: Standard errors, clustered at the level of the region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. The covariates include age, gender, educational status, marital status, ethnicity, health status, employment status, region, year fixed effect, household size and religion. These estimates are obtained from the 2SRI model. Results in columns (1) to (8) are for probit regression. Coefficients are marginal effects measured at the mean.

Figure B1: Interaction effects of NHIS on the number of workdays missed due to illness by employment sector and gender

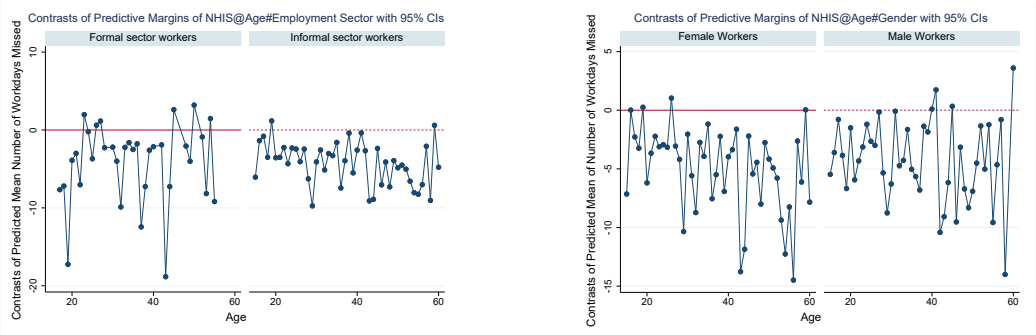

Figure B2: Contrasts on the number of workdays missed due to illness by employment sector and gender

Chapter 4

Health Insurance, Abortion and Maternal Healthcare Utilisation: Evidence from Ghana

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Statement of Authorship

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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

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ii. permission is granted for the candidate in include the publication in the thesis; and

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Abstract

The study investigates the effect of health insurance on maternal healthcare utilisation and abortion in Ghana. This study uses two waves of cross-sectional data from the Demographic and Health Survey of Ghana and employs nonparametric and parametric estimation strategies for the analysis. The study finds that on average, health insurance causes a sizeable and significant increase in maternal healthcare utilisation. In terms of abortion, no evidence is found that the abortion rate responds to health insurance in general. However, in subgroup analysis, a significant reduction in abortions is observed among young women aged 15-19 years compared to those of the same age group without health insurance. The reduction in abortions is also observed for unmarried women. This suggests there are heterogeneous effects of health insurance on abortion for a category of women in Ghana.

Keywords: health insurance, healthcare, abortion, matching method

JEL Classification: C14, I10, I18

4.1 Introduction

Women's and children's health are the bedrocks of economic development. Since a country's development depends on the health status of its citizens, the World Health Organization (WHO) and its member nations committed themselves in the early part of the 1990s to improve maternal and child health under the Millennium Development Goals (MDG 4 and 5), with an emphasis on reducing the under-five mortality rate and maternal mortality ratio (MMR) by two-thirds between 1990 and 2015 (World Health Organization, 2015; Kassebaum et al., 2016). The high mortality ratio the world experienced in the early 1990s shifted health issues, particularly maternal and child health, from a national focus to a global challenge (Currie and Hyson, 1999; Kremer et al., 2009). Since the 1990s, several policies have been initiated in the concerned countries to improve the situation through healthcare access.

Despite global awareness and efforts countries and their development partners have made to improve access to maternal and child health care, most developing countries continue to experience a high number of maternal deaths.[1] Most developing countries in particular sub-Sahara African countries, failed to meet the MDGs target of reducing the MMR by 75% (190 death per 100,000 live births) between 1990 and 2015. Although the maternal mortality ratio in sub-Saharan Africa declined about 50% between 1990 to 2015,[2] it still remained the highest across all the regions in the world (World Health Organization, 2015). This indicates that the maternal death rate remains a challenge in most developing countries.

One of the most important factors influencing maternal deaths in sub-Saharan Africa is poor access to health care, and this is as a result of the financial constraints that confront most women in this region (Nanda, 2002; Sharma et al., 2005; World Health Organization, 2015). In addition, there is evidence suggesting that unsafe abortions contribute immensely to maternal deaths in developing countries. Unsafe abortion is defined by the WHO as a procedure for terminating an unintended

[1] According to the World Health Organization (2015), about 303,000 maternal deaths were recorded. This suggests that about 830 women died each day, and 550 and 180 of these maternal deaths occurred in Africa and South Asia respectively.

[2] Thus, the MMR in sub-Sahara Africa reduced from 990 maternal deaths per 100,000 live births in 1990 to 510 at the end of 2015 (World Health Organization, 2015).

pregnancy carried out either by persons lacking the necessary skills or in an environment that does not conform to minimum medical standards, or both (World Health Organization, 2012b). According to the World Health Organization (2012a), about 21.6 million unsafe abortion cases are reported annually. In terms of abortion-related deaths, more than 99% of unsafe abortions occur in developing countries particularly, sub-Saharan Africa, Central and Southeast Asia, Latin America and the Caribbean (Okonofua, 2006; Sedgh et al., 2016). In 2008, 6.19 million unsafe abortions were reported, causing the deaths of 29,000 women in Africa (World Health Organization, 2012b). This suggests that abortion-related deaths in developing countries are a major issue of concern. Studies have also shown that government interventions such as health insurance affect abortion and maternal healthcare services (Nguyen et al., 2012; Giedion et al., 2007; Cheng, 2014; Whelan, 2010), but studies of the effect of health insurance on abortion in sub-Saharan Africa are limited, despite its enormous contribution to maternal deaths. The important question for this study then is, does health insurance affect abortion in sub-Saharan Africa, particularly Ghana?

Ghana is among the countries in sub-Saharan Africa that failed to meet most of the 2015 MDG targets, particularly the MMR. Ghana recorded about 319 maternal deaths per 100,000 live births in 2015 which exceeded the MDG 5 target of 190 deaths per 100,000 live births between 1990 and 2015, and Ghana's MMR was ranked among the highest in the region (World Health Organization, 2015). This indicates that maternal mortality in Ghana is still a major concern and if the situation continues, Ghana will find it difficult to achieve the new target set under the Sustainable Development Goal (SDG 3.1) of reducing the global MMR to less than 70 deaths per 100,000 live births by 2030 (Immurana and Arabi, 2016; Kassebaum et al., 2016). Failure to achieve the SDG 3.1 target may affect Ghana's quest of minimising its MMR. In Ghana, abortion accounts for 15%-30% of maternal deaths and it is the second largest cause of maternal mortality in the country (Asamoah et al., 2011; Rominski and Lori, 2014). Abortion, particularly unsafe abortion, is common among teenage girls, young women in their 20s and unmarried women in Ghana (Turpin

et al., 2002; Sundaram et al., 2012). Therefore, investigating the effects of health insurance on maternal healthcare utilisation and abortion in Ghana is vital, not only for policymakers but also for researchers.

In Ghana, abortion is a criminal offence regulated by Act 29, Section 58 of the Criminal Code of 1960, amended by PNDCL 102 of 1985. However, Section 2 of the law states that abortion may be performed by a registered medical practitioner when the pregnancy is the result of rape or incest, to protect the mental or physical health of the woman, or when there is malformation of the fetus. This makes the laws governing abortion in Ghana relatively liberal compared with those in other countries (Morhee and Morhee, 2006; Taylor et al., 2011). Steps have been taken by the policy makers (the Government of Ghana) to reduce the negative effects of unsafe abortion by developing a comprehensive reproductive health strategy that specifically addresses maternal morbidity and mortality associated with unsafe abortion (Mote et al., 2010; Taylor et al., 2011). One of these policies is the subsidisation of maternal healthcare services through health insurance. This reduces the financial burden that often confronts pregnant women and increases maternal healthcare services. Despite these policies, the incidence of unsafe abortion is still high in Ghana.

This study uses data from the Demographic and Health Surveys conducted by the Ghana Statistical Service to investigate the effects of health insurance on maternal healthcare utilisation and abortion in Ghana. This survey collects unique reproductive health and maternal healthcare service data that are appropriate for this study. The data employed are nonrandomised and lack of randomisation in observational data may result in large differences between the observed and unobserved characteristics of the treated (women with health insurance) and control (women without health insurance) groups. These differences in covariates between the treated and the control groups makes the observations in the data unbalanced and can lead to bias estimates of the treatment effects (D'Agostino, 2007).

To tackle issue of the potential differences between the covariates (i.e. imbalance covariates), the study employs an identification strategy that has a capacity to control for confounding influences of pre-treatment covariates in the data. Controlling

for these pre-treatment covariate differences between insured and uninsured women reduces covariate differences in the data (Ho et al., 2007; Iacus et al., 2011; Jones et al., 2016). This study, therefore, employs non-parametric coarsened exact matching (CEM) for this analysis. In addition to the CEM approach, the study also applies other matching estimation techniques such as nearest neighbour Mahalanobis distance matching (NNMDM) and nearest neighbour propensity score matching with replacement (NNPSM), and parametric techniques such as probit and instrumental variable (IV) approaches to check the robustness of the baseline result. The study employs CEM because it has the ability to trim observations in the data in such a way that the covariates difference between insured and uninsured women reduces significantly and the two groups become more similar. Achieving a balance of insured and uninsured women on pre-treatment covariates rules out confounding variables in the data. This makes exposure to treatment appear as random as possible, and it also makes a treatment variable exogenous, conditional on the observable characteristics (Ho et al., 2007).

Results obtained using CEM show that on average, having health insurance significantly increases maternal healthcare utilisation in Ghana. Specifically, health insurance increases the probability of receiving antenatal care by at least four times before delivery. It also increases the probability of having the first antenatal check-up within the first three months of pregnancy. The study further finds that having health insurance increases the probability of delivering the baby at a health facility. As well, it also increases the likelihood of the mother to receive postnatal check-ups from health professionals after delivery compared with mothers without health insurance. As for abortion, the results of the full sample analysis show that having health insurance does not have a significant effect. However, the subgroup analysis shows a significant reduction in the number of abortions among young women aged 15-19 years and unmarried women. The study applied different estimation techniques, to check the robustness of the baseline estimates and the results across different estimators indicate that our results are robust.

The study contributes to the literature in a number of ways. Abortion issues

are critical in developing countries because of its immense contribution to maternal deaths and its associated health complications, but there has been little research on the effects of having health insurance on abortion in sub-Saharan Africa. Most of the related studies are in the developed countries context, particularly the US. Therefore, for policy analysis in the sub-Saharan Africa context, where abortion-related deaths are high, it is vital to examine this relationship from different environmental settings. In addition, to understand whether health insurance effects differ across different groups of women , the study investigates heterogeneous effects of health insurance on abortion with respect to women's characteristics: age groups, marital status, place of residence and educational status. This analysis provides background information for the formulation of policies that will strengthen the maternal healthcare policy in Ghana and other developing countries.

The remainder of the paper is organised as follows. Section 2 describes the background of the study. Section 3 presents the econometrics framework underlying the study. Section 4 discusses the data used in the analysis. The results are reported in Section 5. Section 6 discusses the results and Section 7 concludes.

4.2 Background

4.2.1 Health insurance and abortion

In the literature, the impact of health insurance on abortion has been found to be mixed in literature. In terms of positive effects of health insurance on abortion, most studies (Sonfield et al., 2011; Jones and Finer, 2012; Jones et al., 2013) link cost to the abortion procedure. Having health insurance reduces the monetary cost of obtaining an abortion and increases the tendency for women to undertake such procedures. Jones and Finer (2012) study on abortion care in the US reveals that most women use health insurance to pay for their abortion procedures. The authors find that insurance increases the abortion rate. A similar study by Jones et al. (2013) finds that having health insurance reduces the financial constraints associated with abortion care among women in the low-income group. Sonfield et al. (2011) find that

inadequate health insurance for women in the US increases out-of-pocket expenses, and this leads to an increase in unintended pregnancies and abortions.

Some studies also find negative effects of health insurance on abortion. The argument is that subsidising maternal healthcare services reduces expenditure associated with antenatal and postnatal care. The reduction in these costs reduces the financial burden that often confronts pregnant women, and this encourages pregnant women to keep their babies instead of choosing to terminate their pregnancy. Whelan (2010) finds a significant decline in the abortion rate in Massachusetts after expanded health insurance coverage to all residents. Mulligan (2015) examines the effect of insurance mandates on contraception use, abortion and birth, and finds that having insurance decreases the abortion rate in the US. A recent study by Canestaro et al. (2017) in the US also finds that providing women with health insurance reduces the number of unintended pregnancies and abortions.

There is little research on the effects of health insurance on abortion in a developing country context. Most related studies on abortion in developing countries have concentrated on factors that affect abortion (Ahiadeke, 2001; Geelhoed et al., 2002; Jewkes et al., 2005; Gebreselassie et al., 2010). Yogi et al. (2018) examine the prevalence and factors associated with abortion and unsafe abortion in Nepal and find that young, the poorest and uneducated women are more likely to abort their pregnancy through unsafe methods. Meffen et al. (2018) conduct a similar study in Haiti and find that married women and women within the lowest wealth quintile are more likely to abort their pregnancy. In sub-Saharan-Africa context, Dickson et al. (2018) investigates the socioeconomic determinant of abortion among women in Mozambique and Ghana. They find abortion to be high among women with primary education, employed women and married women.

In Ghana, Mote et al. (2010) investigate factors that influence induced abortion among women in Ghana, and they find a high incidence of abortion among women working in the formal sector and a low incidence among uneducated women. Geelhoed et al. (2002) study the prevalence of contraceptive methods and induced abortion in Ghana and find that urban residence and women with higher education were

associated with more induced abortions and and higher use of contraceptive methods. Atakro et al. (2019) also examine the contributing factors that affect abortion among women in selected districts in Ghana. The findings reveal that poor socioeconomic conditions, cultural and religious beliefs, and the desire to bear children only after marriage contribute to unsafe abortion. This study, therefore, examines whether the expansion of health insurance in Ghana affects abortion or not.

4.2.2 Health insurance and maternal healthcare utilisation

There is evidence that having health insurance increases healthcare access. The mechanism is that health insurance reduces out-of-pocket medical expenses that individuals often pay at the point of receiving treatment. The reduction in out-of-pocket medical expenses enables individuals to afford the needed care and therefore improves healthcare access and health (Chandra et al., 2007; Card et al., 2009; Sommers et al., 2017; Escobar et al., 2011; Wagstaff, 2007; Finkelstein et al., 2012; Cheng, 2014). Most of these studies have concentrated on general healthcare access and health outcomes. In terms of maternal healthcare services, studies have shown that the introduction of health insurance improves maternal health care (Giedion et al., 2007; Mensah et al., 2010; Nguyen et al., 2012; Wang et al., 2016; Abrokwah et al., 2014; Dixon et al., 2014). Wang et al. (2016) investigate the effect of health insurance on maternal health services in three developing countries (Ghana, Rwanda, and Indonesia). They find a positive effect of health insurance on at least two of the four maternal healthcare outcomes employed in each of the three countries. Giedion et al. (2007) examine a related study in Columbia and find that participation in a health insurance program increases access to both maternal and child healthcare services. Nguyen et al. (2012) investigate how the provision of financial intervention for women in some districts in Bangladesh improves maternal healthcare use and find that increased utilisation of healthcare services by women in intervention districts. Mensah et al. (2010) study the impact of health insurance on maternal healthcare use in Ghana and find a significant effect on maternal health services, but their study is limited to only four districts in two regions. Similar studies in Ghana produce

results similar to those of Mensah et al. (2010).[3] Other studies find a significant effect of the NHIS on the frequency of maternal health use but insignificant effect on timing of the first three months of antenatal care visits (Dixon et al., 2014). Singh et al. (2015) study also finds a positive effect of health insurance on facility delivery but insignificant effect on antenatal care use. These results make the study inconclusive, as most studies in Ghana concentrate on specific geographical areas. The current study focuses maternal healthcare analysis on outcomes that correspond to the WHO recommendation for maternal healthcare services for pregnant women before delivery. It also considers the heterogeneous effects of health insurance on utilisation, with respect to women's characteristics.

Maternal healthcare access and abortion have been found to be large contributors to maternal deaths in sub-Saharan Africa, but the focus of these studies has been only on access with a little study on the abortion. Therefore, investigating the relationship between health insurance and abortion in Ghana is vital as far as maternal mortality in sub-Sahara Africa is concerned.

4.3 Data

The study employs two cross-sections of data from the Ghana Demographic and Health Surveys (DHS). The DHS is a nationally representative reproductive survey conducted in Ghana. These two cross-sections of data are the fifth and sixth in a series of demographic and health surveys conducted since the 1980s. The study considers these two waves because they are the cross-sections that capture the health insurance status of women and healthcare outcomes of interest, particularly abortion. The surveys were conducted by the Ghana Statistical Service and the Ghana Health Service, supported by the United States Agency for International Development (USAID). The fifth wave was conducted in 2008 and out of 5,096 women aged 15-49 years identified for interviewing, 4,916 were interviewed, yielding a 97% response rate. In the sixth wave, conducted in 2014, 9,656 women in the same age range were identified for interviewing and 9,396 were interviewed, yielding a 97% response rate.

[3]See Blanchet et al. (2012); Aboagye and Agyemang (2013); Abrokwah et al. (2014).

After excluding observations with missing responses, the sample size was reduced to 10,424 observations, comprising 6,392 (61.3%) women with health insurance and 4,032 (38.7%) women without health insurance.

The survey collected a wide range of maternal healthcare outcomes, such as whether respondents visit an antenatal care (ANC), the timing of the first ANC visit and the number of ANC visits before delivery; whether the respondent delivered at a health facility or otherwise; and whether respondents received a postnatal check-up from a health professional after delivery. The study analyses these outcomes to capture the WHO recommendation on maternal healthcare services. In terms of abortion, the respondents were asked whether they had ever terminated a pregnancy before or not. The respondents who had terminated a pregnancy were assigned as 1 and for those who had never terminated a pregnancy were assigned 0. Other information, such as reproductive history, respondent knowledge and use of family planning methods, age at which the respondent first had sexual intercourse, the ideal number of children, and other health issues were also investigated. The data also contained information on women's socioeconomic background and demographic characteristics, such as educational history, age, marital status, place of residence, household wealth, employment history (their own and their husband's); women exposure to mass media, birth history, religious affiliation, ethnicity and region of residence.

Table 4.1 reports the descriptive statistics of women with health insurance and those without health insurance. In terms of maternal healthcare outcomes, the estimates indicate that women with health insurance (94.2%) are more likely than those without it (87.0%) to visit an ANC at least four times. On average, insured women are more likely to receive postnatal care from a health professional after delivery (32.6%), compared with uninsured women (25.2%). On average, women with health insurance have a higher chance of delivering safely at a health facility (73.8%) compared with women without health insurance (53.4%). The probability of women visiting an ANC for a check-up within the first three months of the pregnancy, on average, is higher for women with insurance (32.9.4%) than for those without it

(30.0%). As for abortion, the estimates reveal that women with NHIS are more likely to terminate their pregnancy (20.7%) than those without NHIS (19.4%).

In terms of the covariates, the results reveal that more women with NHIS have a high school education (6.2%), compared to those without insurance (2.6%). The estimates show that the average age of sampled women in the 15-49 year age group with health insurance is 29.8 and of those without health insurance is 29.3 years. Women without insurance are more likely to have more children and are also more likely to lose their virginity at an early age compared with those with health insurance. Most women without health insurance reside in rural areas (58.7%). Unlike those without the NHIS, the majority of women with NHIS have access to electricity, radios and television. Women with health insurance tend to be married (62.8%) rather than unmarried (29.3%). More women in the richest and richer wealth quintiles participate in the NHIS than women in other wealth quintiles. In terms of ethnicity, women with NHIS in Northern tribe (Mole-Dagbani, Grusi, Gurma and Mande) on average dominate other ethnic groups in NHIS enrolment (40.5%). The majority of women with insurance are Christians (74.8%), compared with women affiliated to other religions.

Table 4.1: Variable definitions and descriptive statistics

		Insured			Uninsured		
	Description	Mean	Std dev	N	Mean	Std dev	N
OUTCOMES							
At least 4 ANC visits	1 if visits ANC at least 4 times, or 0 otherwise	0.942	0.234	6,392	0.870	0.336	4,032
First 3 ANC visits	1 if visits ANC within the first 3 months of pregnancy, or 0 otherwise	0.329	0.470	6,392	0.300	0.458	4,032
Postnatal check-ups	1 if receive postnatal check-ups by health professional, or 0 otherwise	0.326	0.469	6,392	0.252	0.434	4,032
Abortion	1 if had terminated pregnancy before, or 0 otherwise	0.207	0.405	6,392	0.194	0.396	4,032
Delivery at health facility	1 if delivered at health facility, or 0 otherwise	0.738	0.440	3,300	0.534	0.499	2,239
COVARIATE							
Age	Women's age	29.76	9.428	6,392	29.28	9.408	4,032
Age at first sex	Age first had sexual intercourse	15.60	6.615	6,392	15.29	6.116	4,032
Expected children	Ideal children women expected to have	4.203	1.277	6,392	4.292	1.288	4,032
Employed	1 if employed, or 0 otherwise	0.729	0.445	6,392	0.757	0.429	4,032
Electricity	1 if household has electricity, or 0 otherwise	0.695	0.460	6,272	0.565	0.496	3,954
EDUCATION							
No education	1 if worker has education, or 0 otherwise	0.244	0.430	6,392	0.298	0.457	4,032
Primary education	1 if worker has education, or 0 otherwise	0.178	0.383	6,392	0.228	0.419	4,032
Secondary education	1 if worker has education, or 0 otherwise	0.516	0.500	6,392	0.449	0.497	4,032
Higher education	1 if worker has education, or 0 otherwise	0.062	0.241	6,392	0.026	0.158	4,032
ETHNICITY							
Akans	1 if Akan, or 0 otherwise	0.375	0.484	6,392	0.441	0.497	4,032
Ga Dangbe	1 if Ga Dangbe, or 0 otherwise	0.051	0.221	6,392	0.057	0.232	4,032
Ewe	1 if Ewe, or 0 otherwise	0.121	0.326	6,392	0.122	0.327	4,032
Guans	1 if Guan, or 0 otherwise	0.029	0.167	6,392	0.027	0.163	4,032
Northern	1 if Northern, or 0 otherwise	0.405	0.491	6,392	0.331	0.471	4,032
No tribe	1 if other tribe, or 0 otherwise	0.019	0.135	6,392	0.022	0.145	4,032
RELIGION							
Christians	1 if Christian , or 0 otherwise	0.748	0.434	6,392	0.790	0.408	4,032
Muslims	1 if Muslim , or 0 otherwise	0.203	0.402	6,392	0.153	0.360	4,032
Traditionalist	1 if Traditionalist , or 0 otherwise	0.023	0.150	6,392	0.059	0.236	4,032
No religion	1 if No Religion, or 0 otherwise	0.026	0.160	6,392	0.045	0.207	4,032
MARITAL STATUS							
Never married	1 if never married, or 0 otherwise	0.293	0.455	6,392	0.299	0.458	4,032
Married	1 if currently married, or 0 otherwise	0.628	0.483	6,392	0.596	0.491	4,032
Divorce	1 if divorced, or 0 otherwise	0.080	0.270	6,392	0.105	0.307	4,032
REGION							
Western	1 if from Western region, or 0 otherwise	0.104	0.305	6,392	0.113	0.314	4,032
Central	1 if from Central region, or 0 otherwise	0.072	0.259	6,392	0.133	0.339	4,032
Greater Accra	1 if from Greater Accra region, or 0 otherwise	0.090	0.286	6,392	0.114	0.318	4,032
Volta	1 if from Volta region, or 0 otherwise	0.088	0.283	6,392	0.086	0.280	4,032
Eastern	1 if from Eastern region, or 0 otherwise	0.101	0.301	6,392	0.084	0.278	4,032
Ashanti	1 if from Ashanti region, or 0 otherwise	0.092	0.289	6,392	0.147	0.354	4,032
Brong Ahafo	1 if from Brong Ahafo, or 0 otherwise	0.121	0.326	6,392	0.070	0.256	4,032
Northern	1 if from Northern region, or 0 otherwise	0.121	0.326	6,392	0.128	0.334	4,032
Upper East	1 if from Upper East region, or 0 otherwise	0.114	0.317	6,392	0.083	0.276	4,032
Upper West	1 if from Upper West region, or 0 otherwise	0.098	0.297	6,392	0.043	0.204	4,032
WEALTH							
Poorest	1 if in poorest wealth quintile, or 0 otherwise	0.259	0.438	6,392	0.282	0.450	4,032
Poor	1 if in poor wealth quintile, or 0 otherwise	0.176	0.381	6,392	0.221	0.415	4,032
Middle	1 if in middle wealth quintile, or 0 otherwise	0.194	0.395	6,392	0.209	0.407	4,032
Richer	1 if in richer wealth quintile, or 0 otherwise	0.191	0.393	6,392	0.168	0.374	4,032
Richest	1 if in richest wealth quintile, or 0 otherwise	0.180	0.385	6,392	0.120	0.324	4,032
RESIDENTIAL TYPE							
Urban	1 if live in urban area, or 0 otherwise	0.494	0.500	6,392	0.413	0.493	4,032
Rural	1 if live in rural area, or 0 otherwise	0.505	0.500	6,392	0.587	0.493	4,032
EMPLOYMENT							
Employed	1 if employed, or 0 otherwise	0.722	0.448	6,130	0.739	0.439	3,535
Electricity	1 if household has electricity, or 0 otherwise	0.707	0.455	6,015	0.610	0.488	3,458
Radio	1 if household has radio, or 0 otherwise	0.689	0.463	6,015	0.621	0.485	3,458
Television	1 if household has electricity, or 0 otherwise	0.582	0.493	6,015	0.452	0.498	3,458

Note: Incomes and consumption expenditure are in logarithms form, Separation compose of consensual and separated union

4.4 Econometrics framework

4.4.1 Econometric model

This section describes the econometric model employed to examine the effect of health insurance on maternal healthcare utilisation and abortion in Ghana. The study uses a treatment effect model for this analysis. In the model specification, the study defines T_i as the treatment variable with value $T_i = 1$ to denote women with health insurance and $T_i = 0$ for women without health insurance. The outcome variable is denoted as Y_i, where $Y_i(0)$ is the potential outcome for the observation i if the unit does not receive treatment and $Y_i(1)$ is the potential outcome if the unit receives treatment. The study considers n unit drawn from a population of N units where $n \leq N$. For this analysis, the study denotes X_i as covariates for observation i. The treatment effect for unit i expressed as $TE_i = Y_i(1) - Y_i(0)$ is unobserved. Therefore, to estimate the treatment effect, the study assumes that treatment assignment is ignorable conditional on X_i (conditional independence assumption). Thus, after controlling for the observable covariates the potential outcome and treatment status is independence and the CIA is expressed as $Y_{0i}, Y_{1i} \perp T_i|X_i$, where T_i is the treatment variable. This study focuses on the mean causal effect $E[Y_i(1)-Y_i(0)]$ of the treatment and following Ho et al. (2007), the paper expresses the average treatment effect (ATE) as:

$$ATE \equiv \frac{1}{n}\sum_{i=1}^{n} E[Y_i(1) - Y_i(0)|X_i] \tag{4.1}$$

$$= \frac{1}{n}\sum_{i=1}^{n} \mu_1(X_i) - \mu_0(X_i)$$

where Y_i is the utilisation of maternal healthcare services and the probability of having an abortion. X_i represents the observed covariates that consist of individuals and household characteristics. $\mu_1(X_i) \equiv E[Y_i(1)|X_i]$ and $\mu_0(X_i) \equiv E[Y_i(0)|X_i]$, and each quantity represents a mean causal effect for a unit whose characteristics are

represented by X_i, averaged over all units.

To evaluate the impact health insurance has on maternal healthcare utilisation and the probability of having abortion, the study estimates the average treatment effect of the treated (ATET), which is expressed as:

$$ATET \equiv \frac{1}{\sum_{i=1}^{n} T_i} \sum_{i=1}^{n} T_i E[Y_i(1) - Y_i(0)|X_i] \tag{4.2}$$

$$= \frac{1}{\sum_{i=1}^{n} T_i} \sum_{i=1}^{n} T_i[\mu_1(X_i) - \mu_0(X_i)]$$

where $T_i = 1$ denotes health insurance and is the dummy variable that takes the value of 1 if women have health insurance and $T_i = 0$ denotes those who do not have health insurance. $\mu_1(X_i) \equiv E[Y_i(1)|T_i = 1, X_i]$ describes the outcome of the probability of women who receive treatment, given the covariate and $\mu_0(X_i) \equiv E[Y_i(0)|T_i = 0, X_i]$ describes the outcome of the probability of women who did not receive treatment given the covariate. ATET is the quantity of interest, but if causal effects are constant over i, then the ATET and the ATE are identical.

This study uses observational data for this analysis. One criticism of the use of observational data to investigate the treatment effect is that the data are nonrandomised, and lack of randomisation in observational data may result in large differences in the observed and unobserved characteristics between the treated and control groups. These differences create imbalances that can bias the treatment effects estimation (D'Agostino, 2007). These imbalances can be controlled through estimation techniques, which have the capacity to control pre-treatment covariates in the data. In observational data analysis where the treated and control groups are not identical before treatment, matching estimators are often used to control for the pre-treatment covariate (Iacus et al., 2012).

The study uses the CEM approach for this analysis. Coarsened exact matching has the ability to trim observations in the data in such a way that the covariate difference between treated and control is reduced significantly and the two groups

become more similar. It also has a capacity to control for confounding influences of pre-treatment covariates in the data (Ho et al., 2007; Iacus et al., 2011; Jones et al., 2016). Controlling for these pre-treatment covariate differences (imbalances) between women who have health insurance (treated) and those without health insurance (control) reduces the imbalances in the data. The CEM approach also reduces the imbalance in a chosen confounder without any detrimental effects on the balancing of other variables. Thus, the imbalance bounding property is achieved by selecting variables into meaningful groups and perform exact matching on the coarsened data (Ho et al., 2007; Iacus et al., 2011; Jones et al., 2016).

Weights are applied to the covariates to estimate the ATET. The weights are generated using the CEM approach shown in equation (4.3),

$$weight_i = \begin{cases} 1, & i \in T^s \\ \frac{mC}{mT}\frac{m_T^S}{m_C^S}, & i \in C^s \end{cases} \tag{4.3}$$

where unmatched units receive $weight_i = 0$. Women with health insurance receive a weight of 1 and those without it receive a weight of $\frac{mC}{mT}\frac{m_T^S}{m_C^S}$, where m_T^S and m_C^S are the number of treated and control units in the stratum. mC and mT respectively are the matched units for treated and control groups.

The weight generated for both treated and control groups makes exposure to treatment appear as random as possible and this makes a treatment variable exogenous, conditional on the observed characteristics.[4] Thus, the generated weight makes treated and control groups appear similar and the only difference between them is the treatment exposure. The CEM technique eliminates all imbalances beyond some chosen level defined by coarsening. The remaining differences or imbalances

[4]Where $weight_i$ is generated by denoting $\tau = (i : T_i = 1)$ be the set of indexes for the treated unit and $n_T = \tau$ be count of the elements of this set. Similarly, $C = (i : T_i = 0)$, $n_C = C$ for control units, with $n_T + n_C = n$, which define sample observation possibly drawn from the population of size N. We denote $m_T \subseteq \tau$ and $m_C \subseteq C$ as the set of indexes of the matched units in the two groups. After coarsening, the CEM algorithm creates a set of strata, say $s \in S$, each with the same coarsened values of X. Units in strata that contain at least one treated and one control unit are retained, while units in the remaining strata are removed from the sample. The study denotes τ^s to represent treated units in stratum s and expresses $m_T^s = \tau^s$ to reflect the number of treated units in the stratum. Similarly, the control units, that is, C^s, are also expressed as $m_C^s = C^s$. It follows that the number of matched units is $m_T = \cup_{s \in S} m_T^s$ for the treated group and $m_C = \cup_{s \in S} m_C^s$ for the control group. To each matched unit i in stratum s, CEM assigns the above *weights*.

within coarsened strata can be controlled through a statistical model.

In the econometric analysis, the probit model is used together with the weights obtained from the CEM. The study also applies other matching techniques such as NNMDM and PSM to check robustness of the baseline estimates.

The estimation of equation (4.2) is based on the conditional probability of observed covariate, therefore, the study uses the other matching techniques such as the PSM approach, where the estimation is based on the propensity score, to check sensitivity of the baseline estimates. According to Rosenbaum and Rubin (1983), if potential outcomes are independent of participation conditional on the observable factors, then they are also independent of participation status conditional on the propensity score, $p(X_i) \equiv P(T_i = 1|X_i) = E(W_i|X_i) = P(T_i = 1|X_i)$. Thus, the probability of receiving treatment given observed covariate is based on the propensity score of the treated and control groups. The study estimates the ATET in the PSM by substituting the propensity score into equation (4.2), and the model is expressed as:

$$ATT \equiv \frac{1}{\sum_{i=1}^{n} T_i} \sum_{i=1}^{n} T_i E[Y_i(1) - Y_i(0)|p(X_i)] \tag{4.4}$$

$$= \frac{1}{\sum_{i=1}^{n} T_i} \sum_{i=1}^{n} T_i[\mu_1 p(X_i) - \mu_0 p(X_i)]$$

where $\mu_1 p(X_i) \equiv E[Y_i(1)|T_i = 1, p(X_i)]$ describes the outcome of the probability of women receiving treatment given the propensity score and $\mu_0 p(X_i) \equiv E[Y_i(0)|T_i = 0, p(X_i)]$ describes the outcome of the probability of women not receiving treatment given the propensity score. The CIA in the propensity score is expressed as $Y_{0i}, Y_{1i} \perp T_i|p(X_i)$. The paper applies the common support condition, which rules the occurrence of perfect predictability of treatment given the covariate and can be written as $0 < P(T_i = 1|X_i) < 1$ and $0 < P(T_i = 1|p(X_i)) < 1$ in the propensity score estimation. The common support equation implies that the probability of receiving treatment or not should fall strictly within the unit interval (range).

4.4.2 Implementation strategy

The identification strategy involves a combination of CEM and a parametric regression analysis on the balanced data. Matching on the continuous variable creates an imbalance, which leads to a biased estimate. The study, therefore, applies CEM, which coarsened continuous, ordinal and nominal variables into a set of strata to reduce the dimensionality of the matching process and increase more matches. To begin the estimations, the study performs CEM on covariates such as age, highest educational level, religious affiliation, the age of first sexual intercourse, ethnicity, wealth quintiles, ideal number of children and employment status.[5] The first step coarsened the results using an automatic binning algorithm, which leads to a stratification of the sample into strata. The study captures matched women with health insurance and those without health insurance in 698 strata. The weights generated by CEM are used to estimate the treatment effect. The imbalance in the covariates are checked and the estimates reveal a substantial reduction in imbalance, suggesting a good match. The study controls the remaining imbalance by including covariates such as place of residence, marital status and region in the estimation. The estimation results are reported in Table 4.2 to Table 4.4, which are discussed in the next section.

4.5 Results

4.5.1 Maternal healthcare utilisation

Table 4.2 reports the effect of health insurance on maternal healthcare utilisation. The results show a positive and statistically significant effect of health insurance on most of the maternal healthcare outcomes. Specifically, having health insurance increases the probability of antenatal check-ups at least four times by 3.4 percentage points. Health insurance increases the probability of having the first antenatal

[5] Andersen (1995) identified predisposing factors that influence healthcare utilisation in his conceptual healthcare model as age, sex, education, religion, ethnicity, wealth quintiles, employment, income, use of a health facility and insurance. The covariates included in the analysis are based on Andersen's identification.

check-up within the first three months of pregnancy by 2.8 percentage points compared with those without health insurance. The estimates further show that participation in a health insurance program increases the probability of delivery at a health facility by 11.6 percentage points. It also increases the likelihood of receiving postnatal check-ups by health professionals by 4.7 percentage points compared with women without health insurance. Overall, the results indicate that having health insurance contributes to the use of maternal health care in Ghana.

Table 4.2: Marginal effect estimates of the effects of health insurance on maternal healthcare utilisation

Dependent variables	At least 4 ANC visits	First 3 ANC visits	Facility delivery	Postnatal check-ups
Full sample	(1)	(2)	(3)	(4)
Health insurance	0.034***	0.028**	0.116***	0.047**
	(0.006)	(0.010)	(0.012)	(0.010)
Observations	8,570	8,570	4,497	8,570

Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1.
Note: Results are for probit using CEM weights. Coefficients are marginal effects measured at the mean.

4.5.2 Heterogeneous effects of health insurance on maternal healthcare utilisation

A. Maternal healthcare use and women's place of residence

This section assesses the rural-urban heterogeneity in maternal healthcare utilisation. This analysis was considered because the provision of health facilities in Ghana is not uniform across the country; women may have health insurance but may not have access to a health facility. The study, therefore, investigates how women's place of residence affects maternal healthcare utilisation and the results are reported in Panel A of Table 4.3. The estimates show a positive and statistically significant effect of health insurance on most of the maternal healthcare outcomes for women residing in rural and urban areas. With the exception of the number of antenatal check-ups, the study did not find a significant difference between insured women in rural and urban areas in their the utilisation of maternal healthcare services.

Table 4.3: Marginal effect estimates of heterogeneous effects of health insurance on maternal healthcare utilisation

Dependent variables	At least 4 ANC visits	First 3 ANC visits	Facility delivery	Postnatal check-ups
Subgroup	(1)	(2)	(3)	(4)
Panel A				
Living in urban areas				
Health insurance	0.007	0.026*	0.041**	0.036**
	(0.006)	(0.015)	(0.015)	(0.015)
Observations	3,991	3,991	1,727	3,991
Living in rural areas				
Health insurance	0.058**	0.038***	0.161***	0.066***
	(0.009)	(0.014)	(0.017)	(0.014)
Observations	4,579	4,579	2,759	4,579
Panel B				
Married				
Health insurance	0.045***	0.046**	0.117***	0.061***
	(0.008)	(0.014)	(0.013)	(0.014)
Observations	5,353	5,353	3,943	5,353
Unmarried				
Health insurance	0.008	-0.009	0.098**	0.012
	(0.006)	(0.010)	(0.037)	(0.010)
Observations	3,217	3,217	554	3,217
Panel C				
Formal education				
Health insurance	0.015**	0.015	0.053***	0.028**
	(0.005)	(0.013)	(0.015)	(0.013)
Observations	5,251	5,251	2,244	5,251
No formal education				
Health insurance	0.049***	0.057***	0.146***	0.080***
	(0.011)	(0.017)	(0.019)	(0.016)
Observations	3,319	3,319	2,253	3,319

Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1.
Note: Results are for probit using CEM weights. Coefficients are marginal effects measured at the mean.

Thus, irrespective of women's place of residence, having health insurance increases the probability of women's having their first antenatal check-up within the first trimester of the pregnancy, increases the likelihood of delivery at a health facility and also increases the chance of receiving a postnatal check-up by a health professional after delivery. On the number of antenatal check-ups, it is observed that women with NHIS residing in rural areas are more likely to visit the ANC before delivery at least four times for check-ups, as recommended by the WHO. In particular, the probability of an increase in the frequency with which insured women in rural areas visit an ANC before delivery increases by 5.8 percentage points. For women in the urban area, however, no significant effect was found. This suggests that there are heterogeneous effects of health insurance on maternal healthcare services in terms of women's place of residence.

B. Maternal healthcare use and marital status

Panel B of Table 4.3 reports the heterogeneity in maternal healthcare utilisation in terms of marital status, and the results show a significant difference between married and unmarried women. The results indicate that married women with health insurance are more likely to meet the WHO recommendation on maternal healthcare services for a pregnant women prior to delivery compared to those without health insurance. The estimates suggest that the use of maternal healthcare is higher among married women than unmarried women in Ghana.

C. Maternal healthcare use and educational status

Panel C in Table 4.3 reports the heterogeneity in maternal healthcare utilisation in terms of women educational status. The results show a significant effect of health insurance on maternal healthcare utilisation for women with formal education and those with no formal education, with the exception of the timing of the first ANC visits, within the first 3 months of the pregnancy, where a significant difference, is observed. Taken as a whole, these results indicate that irrespective of women's educational status, having health insurance increases maternal healthcare utilisation in Ghana.

Overall, the estimates indicate that insured women's place of residence and educational status does not greatly influence their maternal healthcare utilisation.

4.5.3 Abortion

Abortion, particularly unsafe abortion, contributes substantially to maternal mortality in sub-Saharan Africa. As stressed in the introduction, the rise in unsafe abortion in this region has been associated with financial constraints that often confront women.[6] The study, therefore, assesses the impact of health insurance on abortion and the results are reported in Table 4.4. The estimate in column (1) uses a combined sample and the result shows that insurance has no significant effect on abortion. Thus, there is no significant difference between women with health insurance and those without health insurance in terms of abortion in the full sample analysis. This suggests that participation in the NHIS in general, does not influence pregnant women's decision to abort their pregnancies or not.

Table 4.4: Marginal effect estimates of the effects of health insurance on abortion

Outcome variables	Abortion	15-19	20-29	30-39	40-49
	(1)	(2)	(3)	(4)	(5)
Panel A					
Health insurance	0.011	-0.027**	0.004	0.040**	0.037
	(0.009)	(0.009)	(0.015)	(0.018)	(0.023)
Observations	8,683	1,394	3,018	2,515	1,567

Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1.
Note: Results in columns (1) to (5) are for probit using CEM weights. Coefficients are marginal effects measured at the mean.

4.5.4 Heterogeneous effects of health insurance on abortion

The study further investigates heterogeneity in abortion with respect to respondents' characteristics to understand if health insurance effects differ across different groups

[6]In sub-Saharan Africa, most women resort to abortion for several reasons. In Ghana, for instance, the inability of women to afford the needed maternal care during pregnancy is one major constraint that often confronts women (Turpin et al., 2002). This often leads to an unsafe abortion among young and unmarried women. Since the NHIS reduces the financial constraints associated with maternal healthcare services, the study expects access to the NHIS to have a significant impact on the abortion rate in Ghana.

of women. First, the paper estimates the ATET separately in terms of age groups. The study focuses on the age category because the decision to abort a pregnancy differs across women, and it is more common among young and unmarried women than married women in sub-Saharan Africa, specifically Ghana (Turpin et al., 2002). Therefore, for policy-making purposes it is important to understand the NHIS effects in terms of women's characteristics. The results are reported in columns (2) to (5) of Table 4.4.

A. Abortion and age group

Contrary to the full sample analysis as shown in column (1) of Table 4.4, the study observes a significant effect of health insurance on abortion in the subgroup analysis. In particular, the study finds that the probability of insured women aged 15-19 years aborting a pregnancy is reduced by 2.7 percentage points compared with those of the same age group without health insurance. In contrast, there is a positive effect of abortion for women in other age groups, but the estimate is statistically significant for women aged 30-39 years. The study does not find a significant effect of insurance for women aged 20-29 years and 40-49 years. Most women aged 30-39 years are married and a significant reduction in abortion among that age group was anticipated, but the results suggest otherwise.

Graphical analyses are also performed on abortion for age groups in terms of marital status, place of residence and educational status. Figure 4.1 to Figure 4.7 represent results in 95% confidence intervals. Figure 4.1 illustrates the abortion rate

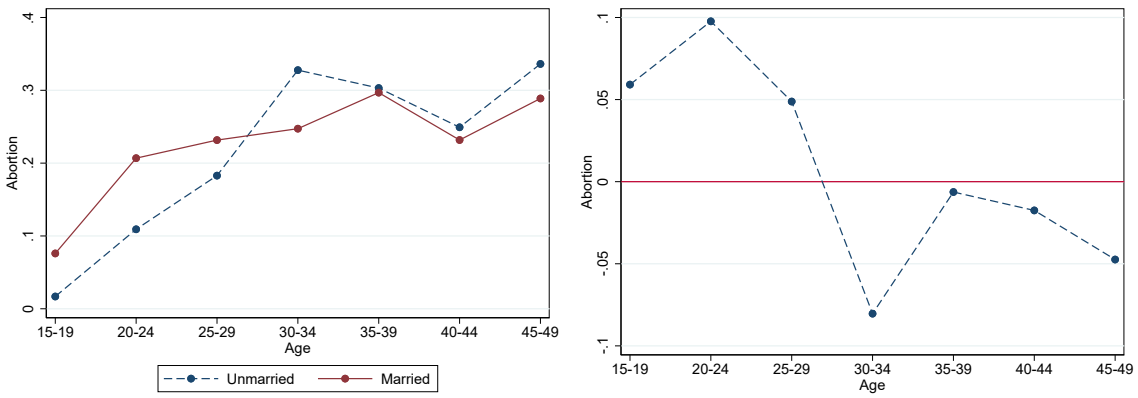

Figure 4.1: Abortion and marital status

for age groups in terms of marital status. Figure 4.1 shows a significant difference in abortion among the married and unmarried women. The results show that those who married at an early or tender age tend to have a higher incidence of abortion relative to unmarried women in the same age group. The unmarried women catch up to married women in the older age ranges and may even surpass married women after age 30. The increases in abortion among women in this age group may be as the result of the unmarried women's desire to bear children only after marriage. The results agree with those found by Atakro et al. (2019), that some women in Ghana wish to bear children only after marriage and this contributes to unsafe abortion.

The study further examines abortion in terms of women's place of residence. As illustrated in Figure 4.2, there is a slight difference in abortion numbers between women residing in rural and urban centres. The estimates suggest higher rates of abortion among young women aged 15-24 residing in urban centres than in rural areas. However, the situation changes after 25 years, where those in rural areas experience a higher abortion rate than those in urban areas. Finally, as illustrated

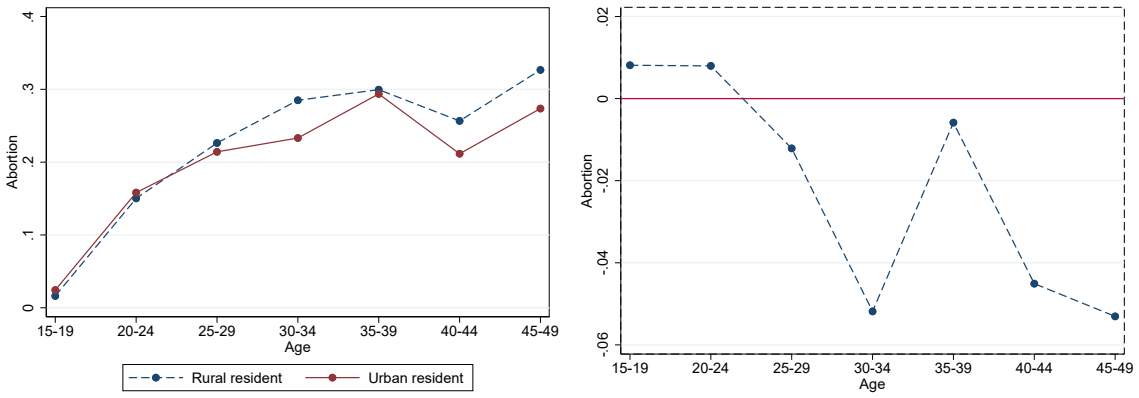

Figure 4.2: Abortion and place of residence

in Figure 4.3, analysis is performed in terms of educational status and abortion numbers. A difference in abortion estimates is observed between women with formal education and those with no formal education. Figure 4.3 shows that young women with a formal education have higher numbers of abortions than those with no formal education. The situation changes after age 24, where those with no formal education tend to have more abortion than with those with formal education. Overall, the

illustration shows significant differences in abortion numbers across age groups.

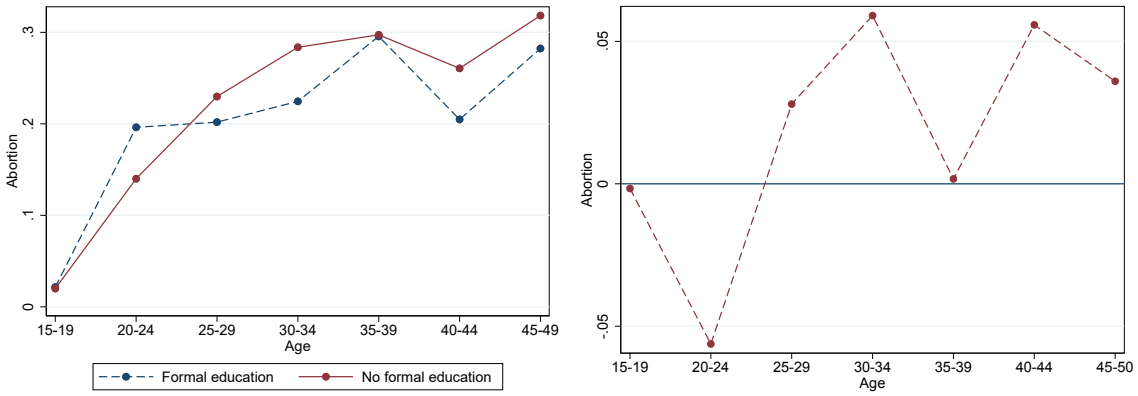

Figure 4.3: Abortion and educational status

After observing variations in abortion in terms of age, marital status, place of residence and educational status, the study then investigates whether having health insurance has effect on abortion numbers in terms of these same characteristics.

B. Abortion and marital status

Next, the study assesses the effect of health insurance on abortion in terms of women's marital status. The estimates in columns (1) and (2) in Table 4.5 show a statistically significant effect of health insurance on abortions for both married and unmarried women. Surprisingly, the effect is positive for married women and negative for unmarried women. This suggests that married women are more likely to terminate their pregnancy than unmarried women. Specifically, the probability of married women terminating their pregnancy is higher by 3.5 percentage points. This suggests that the abortion rate is still high among married women despite a reduction in the antenatal and postnatal care expenses which are covered by the NHIS. For unmarried women, there is a reduction in the number of abortions by 2.4 percentage points.

C. Abortion and women's place of residence

The study additionally investigates whether or not place of residence influences abortion in Ghana. Columns (3) and (4) in Table 4.5 show that having health insurance has no significant effect on abortion among women residing in either rural

Table 4.5: Marginal effect estimates of heterogeneous effects of health insurance on abortions

Outcome variables	Married	Unmarried	Urban	Rural	Formal education	No formal education
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B						
Health insurance	0.035**	-0.024**	0.003	0.016	-0.010	0.043***
	(0.012)	(0.011)	(0.014)	(0.011)	(0.012)	(0.013)
Observations	5,468	3,215	4,027	4,656	5,247	3,436

Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1.
Note: Results in columns (1) to (6) are for probit using CEM weights. Coefficients are marginal effects measured at the mean.

or urban areas. Thus, irrespective of women place of residence, having insurance does not influence women's decision on whether to abort a pregnancy or not.

D. Abortion and educational status

Columns (5) and (6) in Table 4.5 show the effects of health insurance on abortion in terms of educational status. The study considers women's educational status in this analysis because there is evidence that there is a significant difference in abortion numbers between women with and without formal education in Ghana (Mote et al., 2010). Therefore, it is important to understand how insurance affects abortion in terms of women's educational status. The study observes that having health insurance or not leads to a significant difference in the number of abortions between women with formal education and those with no formal education. The estimates indicate that, despite maternal healthcare subsidisation through health insurance, abortions among women with no formal education are higher by 5.4 percentage points. Conversely, a reduction in abortions is observed for women with formal education, but the estimate is not statistically significant.

E. Interaction effect analysis

In addition to subgroup analyses reported in Table 4.4 and Table 4.5, the study also uses graphs to examines the interaction effect between health insurance and a number of characteristics (i.e. age, marital status, place of residence and educational status). According to Norton et al. (2004), the effects of one regressor on the outcome

variable sometimes depends on the magnitude of the other regressors. Therefore, the study examines the interaction effects on some of the outcome variables analysed, particularly abortion. The results (see Figure 4.4 and Figure 4.5) suggest there are increases in the number of abortions among married women and those residing in rural areas, but a reduction in the number of abortions among women with a formal education (see Figure 4.6). Increases in abortions across age groups are also seen, but as shown in the z-statistic of Figure 4.7, most of the estimates are not statistically significant. In terms of sign and statistical significance, these estimates are not much different from the subgroup results shown in Table 4.4 and Table 4.5. Overall, the results show heterogeneous effects of health insurance on abortion for different groups of women in Ghana.

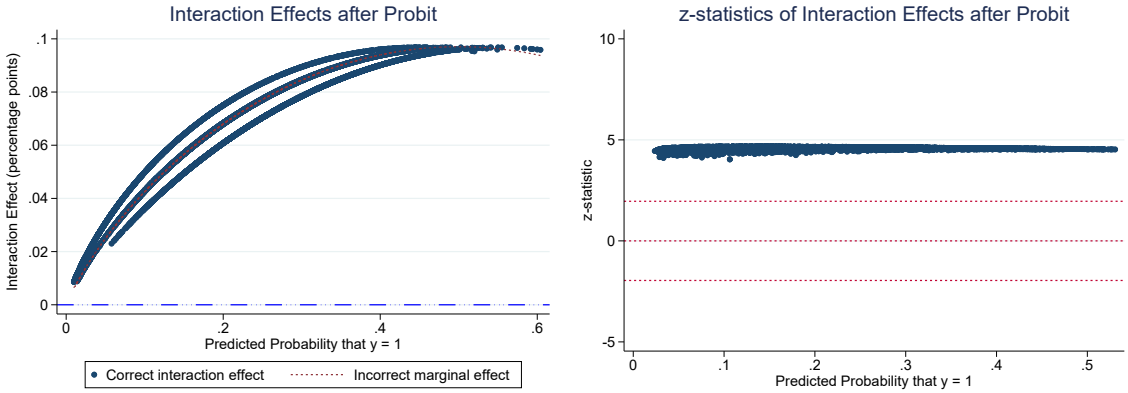

Figure 4.4: Interaction effects of health insurance and marital status on abortion

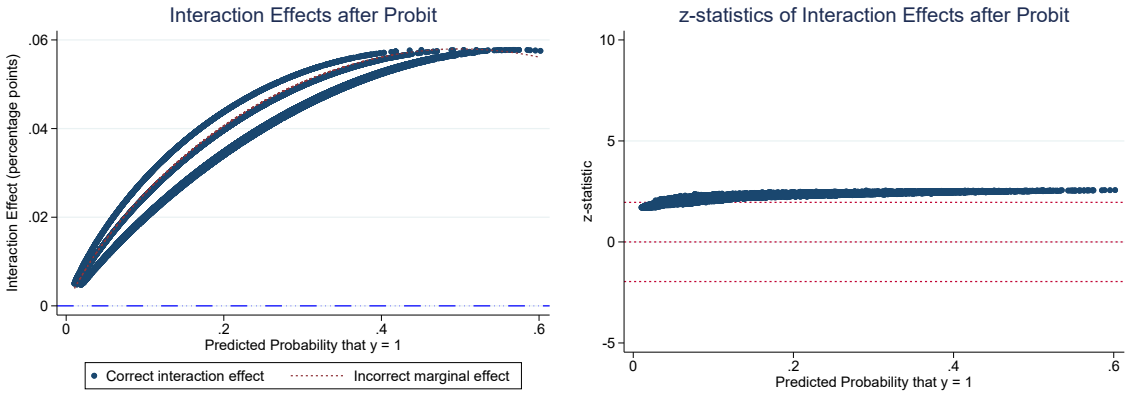

Figure 4.5: Interaction effects of health insurance and women place of residence on abortion

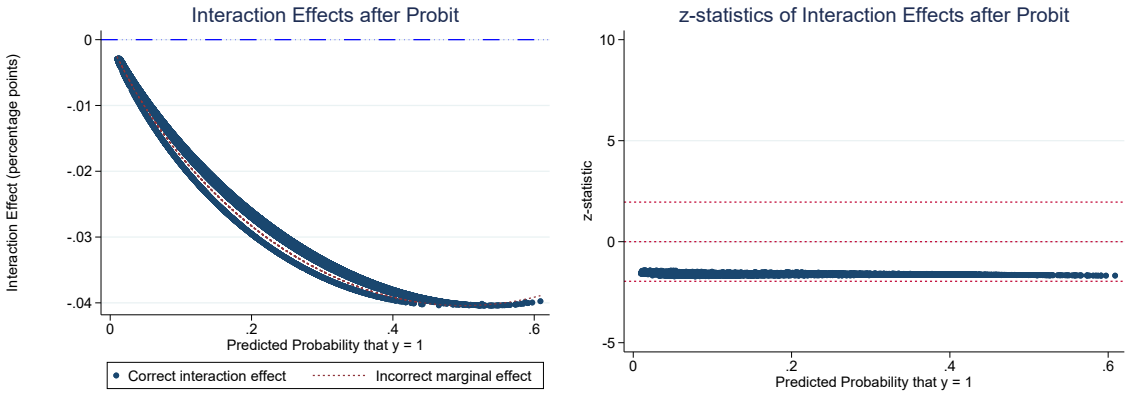

Figure 4.6: Interaction effects of health insurance and education on abortion

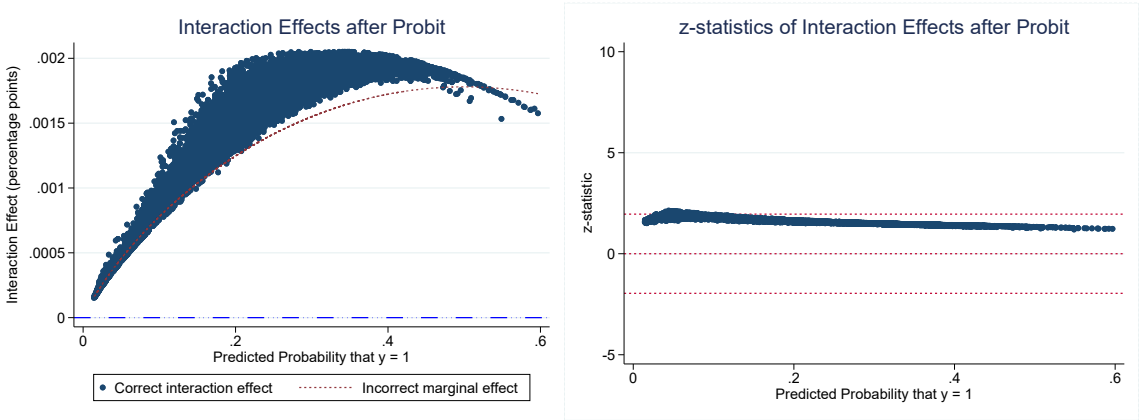

Figure 4.7: Interaction effects of health insurance and age on abortion

4.5.5 Robustness checks

The study applies alternative approaches such as NNMDM, NNPSM, parametric estimation without balanced data (simple probit) and the IV approach as a robustness check.

A. NNMDM and PSM

The study uses other matching estimation techniques, such as NNMDM and NNPSM, to check the robustness of the results and to ensure the adequate balance of the covariates. Using NNMDM, the study matches each treated unit to the nearest control unit and only matched or balanced covariates are used in the estimation. The NNMDM technique helps to achieve a tight balance, and also allow us to control and maintain the balance in a specific variable of interest. It prunes the data and drops the treatment observations that had a very bad match. The study first combines NNMDM and CEM; the estimates are reported in column (1) of Table 4.6 and Table 4.7. Column (2) of both tables reports only NNMDM estimates. In most of the specifications, the results are similar to the baseline estimates in terms of signs and statistical significance.

In addition to NNMDM, the study employs NNPSM specifically with replacement for this analysis. Using NNPSM, the paper estimates the propensity score of women given their observed covariates, with probit model at the first stage. Women with health insurance are then matched by their propensity score. The average weight obtained from the propensity score from the first stage was used to run the treatment effect regression. Estimation results are reported in Table C1 to Table C4 and summary statistics on the distribution of the estimated propensity score are presented in Table C11 to Table C15 in Appendix C.

The post-estimation tests showing the matching qualities are reported in

Table C13 and Table C14.[7] For consistent estimates, the covariates of the treated and control group should balance. A series of iterations is then performed and the balancing property is satisfied in all specifications. Table C13 describes the overall covariate balancing test of each specification and Table C14 describes the individual covariate balancing test. In Table C13, column (2) shows a significant reduction of Pseudo-R^2 after matching. The next two columns (3) and (4), show the likelihood test ratio of joint significance and p-value, which is expected to be statistically significant before matching, indicating differences between treated and control groups, and insignificant after matching, suggesting otherwise. The results shown in Table C13 and Table C14 indicate that the treated and control groups are similar after matching. The mean and median biases between treated and control groups after matching are reduced substantially and are less than 3% as required. The absolute standard difference of mean (B) is also less than 25% as required after matching and the ratio (R) of treated and control groups are within the range 0.5-2 as recommended by Rubin (2001). All specifications show a successful matching.

Figure C1 through to Figure C5 assess the covariates balance before and after matching and the results illustrate a successful matching. They show a reduction of biases after matching, and this suggests a consistent estimate in Table C13. All balancing (diagnostic) results indicate a successful covariate balance between treated and control groups. Based on the results of the diagnostics tests performed, the author is confident that the difference between the treated and control groups is minimal, therefore, the analyses are reliable.

In combined CEM and NNPSM techniques, most of the results in column (3) of

[7]In the t-test we expect significant differences before matching and insignificant differences after matching, indicating covariates balanced in both treated and non-treated groups (Rosenbaum and Rubin, 1985). The Pseudo-R^2 shows the extent to which covariates explain the probability of participation. Therefore, there should be no significant difference if covariates are well distributed between the treated and control groups. Pseudo-R^2 is expected to be low after matching. The mean and the median biases in the model are expected to be reduced considerably after matching and sufficient bias reduction should not exceed 3% in the overall balancing test and below 5% in the individual test (Rosenbaum and Rubin, 1985). Rubin (2001) also recommends that (B), which is the absolute standard difference of mean propensity score index in treated and control groups, should be less than 25% and (R), which is the ratio of treated to control group of the propensity score index should fall within the range between 0.5 and 2 for the sample to be considered appropriately balanced. Likelihood ratio test of joint significance is supposed to be significant before the matching and insignificant after matching (Aggarwal, 2010; Caliendo and Kopeinig, 2008)

Table 4.6 and Table 4.7 remain the same as the NNPSM results in column (4) of Table 4.6 and Table 4.7. All specifications reported in Table 4.2 to Table 4.4 appear robust to the different methods employed, because the estimates in those tables are similar in terms of signs and statistical significance to most estimates obtained from the NNMDM and NNPSM approaches.

Table 4.6: Alternative estimates of the effects of health insurance on healthcare utilisation and abortion

Health insurance effects	CEM & NNMDM	NNMDM only	CEM & NNPSM	NNPSM only	Simple probit	IV
	(1)	(2)	(3)	(4)	(5)	(6)
At least 4 ANC visits	0.038***	0.039***	0.041***	0.046***	0.048***	0.047*
	(0.008)	(0.007)	(0.007)	(0.007)	(0.005)	(0.027)
Observations	8,570	10,220	8,570	10,220	10,220	10,220
First 3 ANC visits	0.017	0.008	0.030	0.017***	0.015***	0.106**
	(0.013)	(0.013)	(0.012)	(0.010)	(0.009)	(0.049)
Observations	8,570	10,220	8,570	10,220	10,220	10,220
Facility delivery	0.112***	0.113***	0.126***	0.133	0.131***	0.282**
	(0.017)	(0.016)	(0.015)	(0.155)	(0.011)	(0.072)
Observations	4,497	5,453	4,497	5,453	5,453	5,453
Postnatal check-ups	0.027***	0.028***	0.079**	0.056**	0.05**	-0.207**
	(0.013)	(0.013)	(0.011)	(0.010)	(0.009)	(0.049)
Observations	8,570	10,220	8,570	10,220	10,220	10,220

Note: Robust standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. Demographic characteristics (includes age, gender, marital status, ethnicity); Socioeconomic characteristics (includes employment status, educational status, household size, religion, household wealth); Geographical information (region of residence and rural/urban residence), Health status measure (illness), and year fixed effect. Coefficients of simple probit are marginal effects measured at the mean.

Table 4.7: Alternative estimates of the effects of health insurance on abortion

Health insurance effects	CEM & NNMDM (1)	NNMDM only (2)	CEM & NNPSM (3)	NNPSM only (4)	Simple probit (5)	IV (6)
Abortion	0.008	0.016	0.024*	-0.001	0.011	-0.039
	(0.013)	(0.012)	(0.011)	(0.012)	(0.008)	(0.045)
Observations	8,683	10,220	8,683	10,220	10,220	10,220
15-19 years	-0.016	-0.022***	-0.032**	-0.033**	-0.017**	-0.132
	(0.026)	(0.013)	(0013.)	(0.014)	(0.009)	(0.057)
Observations	1,583	1,793	1,583	1,793	1,492	1,492
20-29 years	-0.006	-0.012	0.0003	0.015	0.008	-0.211**
	(0.026)	(0.021)	(0.0214)	(0.030)	(0.014)	(0.092)
Observations	3,018	3,533	3,018	3,533	3,533	3,533
30-39 years	0.049**	0.057**	0.050**	0.013	0.033	0.057
	(0.024)	(0.024)	(0.021)	(0.023)	(0.018)	(0.088)
Observations	2,515	2,965	2,515	2,965	2,965	2,965
40-49 years	0.017	0.015	-0.015	0.049*	0.029	-0.065
	(0.029)	(0.028)	(0.037)	(0.029)	(0.021)	(0.097)
Observations	1,567	1,929	1,567	1,929	1,929	1,929
Urban	-0.010	0.015	0.041	0.005	0.001	-0.141**
	(0.010)	(0.019)	(0.014)	(0.017)	(0.013)	(0.062)
Observations	4,027	4,735	4,027	4,735	4,735	4,735
Rural	0.023	0.013	0.032	0.007	0.016	0.079
	(0.014)	(0.014)	(0.014)	(0.016)	(0.010)	(0.066)
Observations	4,656	5,485	4,656	5,485	5,485	5,485
Married	0.030**	0.034*	0.041**	0.015	0.038**	-0.134**
	(0.016)	(0.016)	(0.016)	(0.019)	(0.011)	(0.067)
Observations	5,486	6,318	5,486	6,318	6,321	6,321
Unmarried	-0.032	-0.025	-0.032*	-0.004	-0.026*	0.066
	(0.022)	(0.016)	(0.014)	(0.015)	(0.011)	(0.056)
Observations	3,215	3,899	3,215	3,899	3,899	3,899
Formal Education	-0.013	-0.010	-0.003	-0.001	-0.003	0.015
	(0.016)	(0.016)	(0.014)	(0.015)	(0.011)	(0.057)
Observations	5,257	5,996	5,257	5,996	5,999	5,999
No formal education	0.038**	0.044***	0.022	0.032*	0.025**	0.111
	(0.018)	(0.017)	(0.018)	(0.018)	(0.012)	(0.073)
Observations	3,436	4,223	3,436	4,223	4,223	4,223

Note: Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. Coefficients of simple probit are marginal effects measured at the mean.

B. Simple probit

This section employs parametric estimation techniques that are not based on CEM weight to check the robustness of the estimates. The results are reported in column (5) of Table 4.6 and Table 4.7. Most of the results shown in Table 4.6 are little different from the baseline results in Table 4.2 in terms of signs and statistical significance in most of the healthcare utilisation specifications, with the exception of place of residence, particularly urban centres which are statistically significant in simple probit estimates but insignificant in the baseline results. Table C5 also describes heterogeneous effect of NHIS on maternal healthcare utilisation. Overall, the results show that health insurance increases the probability of maternal health care use in Ghana.

As for abortion, most of the estimates in Table 4.7 are similar to the baseline results in Table 4.4 and Table 4.5. The study finds a reduction in abortion for insured women aged 15-19 years but an increase in abortion for women aged 30-39 years. With the exception of women's educational status, where the signs are different from the baseline estimates, both results are statistically insignificant. Most of the estimates are different in terms of signs and statistical significance, as reported in column (5) of Table 4.6 and Table 4.7. The results suggest the difference between coarsened (baseline estimates) and not coarsened data analysis.

C. The IV approach

Although the CEM technique has the ability to prune imbalances in the observation in such a way that the covariates difference between treated and control groups reduces significantly and the two groups become more similar. There may be confounding factors that influence the unobserved time-varying factors and these may affect the estimates. To address a potential endogeneity issue in this analysis, the study employs an IV approach. There are studies that applied matching estimation methods with the IV approach as robustness checks on health insurance analysis (Trujillo et al., 2005; Brugiavini and Pace, 2016).

In dealing with a potential endogeneity issue, the study instruments health

insurance by regional-level average health insurance coverage. The area-based IV measures create variations in the endogenous variable. Area-based IV measures have been used in other studies (Sloan et al., 2001; Grabowski and Hirth, 2003; Sasso and Buchmueller, 2004; Morris, 2007; Jay et al., 2013; Denny and Oppedisano, 2013). The implementation of the NHIS in Ghana differs across regions, and these differences in the NHIS implementation may affect people's enrolment in the NHIS program. Regional-level average health insurance coverage is likely to explain a variation in women's enrolment in the NHIS, therefore, the study uses regional-level average health insurance coverage as an instrument. It is expected that the communities with earlier NHIS implementation have higher average health insurance coverage than communities with late implementation. It is expected that the instrument affects the maternal healthcare outcomes and abortion only through its effects on health insurance.

Diagnostic tests are used to test the strength (weakness) of the instrument. The IV coefficients in the first stage regression results reported in Table C7 to Table C10 are positive and statistically significant indicating that regional-level average health insurance coverage contributes to NHIS participation. The study used F-test to assess the strength (weakness) of the instruments employed and the instruments are considered valid if F-statistic is larger than the rule of thumb value of 10. The results from the first stage regression indicate that the instruments are not weak in all specifications because the F-statistics exceed the rule of thumb value of 10, indicating that the instrument is strong enough to identify the NHIS effect. The F-statistics also greatly exceed Stock and Yogo (2005) critical values, therefore, rejecting the null hypothesis of a weak instrument is justified.

The estimates of most maternal healthcare outcomes and as reported in (6) of Table 4.6 are similar to baseline results in terms of signs and statistical significance, with the exception of the timing of the first ANC visit, where the estimate is not statistically significant. Table C8 also describes heterogeneous effect of NHIS on maternal healthcare utilisation. Column (6) of Table 4.7 report abortion estimates. After taking endogeneity into account, some of the subgroup results for abortion are

little different from our baseline results in terms of signs and statistical significance. Overall, the results show that women with NHIS are more likely to meet the WHO recommendation on maternal healthcare utilisation before delivery than women without the NHIS.

4.6 Discussion

The paper employs both nonparametric and parametric estimation techniques to examine the effect of health insurance on maternal healthcare utilisation and abortion in Ghana. The estimates show that the introduction of health insurance increases maternal healthcare use and reduces abortion among young and unmarried women in Ghana.

In the literature on maternal healthcare utilisation, the timing of the antenatal visits has been given little attention, most studies concentrate on the number of antenatal check-ups (frequency of the antenatal visits) and place of delivery. But the timing of the antenatal visit is quite critical for pregnant women's survival. The WHO recommends the first antenatal check-up to fall within the first three months of the pregnancy. The argument is that early visits help to detect and resolve pregnancy-related complications. Identifying pregnancy-related complications and solving them in the early stage helps to reduce the maternal mortality rate. The results show that providing women with health insurance does not only encourage the frequency of antenatal check-ups, it also increases the likelihood of having an antenatal check-up within the first three months of the pregnancy and the use of other maternal healthcare services. These would help to reduce the incidence of maternal mortality by easily detecting and rectifying complications that affect the mother and the unborn child.

The study also reveals the existence of a rural-urban heterogeneity in maternal healthcare utilisation specifically for the number of antenatal check-ups before delivery. Thus, women with NHIS in rural areas are more likely to visit an ANC at least four times for a check-up before delivery compared with those without health insurance but the study find insignificant effects for insured women in urban centres.

This suggests that there is a need to expand Community-based Health Planning and Service (CHPS) and clinics to emerging communities in urban centres, especially slums areas, and the hinterland in rural areas where they are not available, to improve healthcare access. This will also reduce pressure on hospitals in urban areas.

The study observed that place of residence and educational status do not have a large influence on maternal healthcare utilisation, although significant differences in maternal healthcare utilisation are observed for married and unmarried women. The encouragement and support (both physical and financial) married women receive from their partners may account for this difference, because most women in developing countries tend to work in the informal sector of the economy which is characterised by low income and this affects their day-to-day activities. The study also recommends the provision of mobile clinics to new communities and slum areas. This will help to curb immediate healthcare challenges because most people residing in these areas are indigent and sometimes cannot even afford the cost of transportation to a health facility. Therefore, providing mobile clinics will reduce the financial barriers, which in turn improves healthcare access. Education about the NHIS should be targeted at female-dominated places such as market centres, churches, mosques and communities with a low level education. Providing women in these areas with information about the health benefits associated with NHIS participation would encourage enrolment, which would in turn improve maternal healthcare use.

Examining the impact of health insurance on abortion, the results of the full sample analysis show that abortion does not respond to health insurance participation. This suggests that women's participation in the NHIS does not influence their decision to have an abortion in Ghana. The result is not surprising, because the health insurance package excludes the abortion procedure and cost. The exclusion of free abortions from the package and its illegality (although common) has given women, particularly young and unmarried women, a limited choice when pregnant. They either keep the baby and deliver it or terminate the pregnancy through unlawful procedures. When terminating a pregnancy, those who cannot afford formal abortion procedures usually resort to unsafe procedures, which

sometimes lead to death or complications. Despite the introduction of NHIS in 2003, the incidence of unsafe abortion is high among married women and women with no education. There have been several calls by civil societies and non-government organisations for the NHIS authorities to include free abortion in the insurance package in order to reduce unsafe abortions and the maternal mortality rate.

The analysis of abortion by women's age groups reveals that having health insurance reduces the number of abortions among young women aged 15-19 years. These estimates suggest that the financial burden, especially the antenatal and postnatal care expenses that hinder most pregnant women particularly young women from getting regular antenatal check-ups, has been reduced significantly by the NHIS. This may have encouraged young women to keep their baby rather than terminate the pregnancy. Women aged 15-19 years are mostly students, therefore, there is a trade-off between their education and the pregnancy. Thus, a young pregnant woman is faced with the decision to either terminate her pregnancy in order to pursue her education or to stop schooling, see the pregnancy through and deliver the baby. The results suggest that most of the young women drop out of school in order to take care of their pregnancy, this also has an implication for women's education. However, the study observed an increase in abortions among women aged 30-39 years, and most women in this age group are married. Whether this is a form of birth control for women in this age group is unknown. Further study is needed to ascertain if that is the case.

There are other factors besides reduction in expenditure on antenatal and postnatal care that contribute to women's decision to abort or continue their pregnancy. One is the cost of the formal abortion procedure, which is high for most young and unmarried women, and therefore they cannot afford it. The high cost of legitimate formal abortions has made unsafe abortion the predominant choice among most young and unmarried women in developing countries such as Ghana. The unsafe abortion procedures also has some consequences, and this sometimes affects young women's decision to terminate or continue their pregnancies. It is therefore recommended that abortion be decriminalised and free abortion be included in the

NHIS package to help young and unmarried women to make a proper decision that will help to improve their lives and welfare. Policymakers should also take practical steps to enforce mandatory enrolment in the NHIS for all women in Ghana because its voluntary nature allows women to opt out of the scheme, and this could affect Ghana's quest of achieving the SDG target of reducing the global MMR to less than 70 deaths per 100,000 live births.

Overall, the results suggest that providing women with health insurance increases maternal healthcare utilisation and reduces the incidence of abortion among young and unmarried women. Different estimation techniques were employed to check the robustness and sensitivity of the baseline results and the estimates show that the baseline results are robust. The IV estimates also show the robustness after considering the potential endogeneity issue in the analysis.

The study has some limitations. First, the data captured abortion in general, but failed to capture formal and unsafe abortion separately in order to understand the clear difference between the two in terms of the NHIS effect. Second, the PSM controlled for observed factors, but there may be confounding factors influencing the unobserved time-varying factors which could affect the estimates. Finally, most of the healthcare outcomes in the DHS survey are self-reported and may suffer from measurement errors. These reporting errors could correlate with other covariates that can lead to biased estimates. Despite the limitations, our study makes some important contributions to the literature on health insurance, abortion and maternal healthcare utilisation in the developing countries context.

4.7 Conclusion

Maternal healthcare access and abortion contribute immensely to maternal mortality in sub-Saharan Africa. Unsafe abortion is the second largest cause of maternal mortality in Africa, and alone it accounts for about one-third of maternal deaths in Ghana. Despite these challenges, the study on the relationship between health insurance and abortion in sub-Saharan Africa context is limited. This study, therefore, employs non-parametric and parametric estimation strategies to examine

the effects of health insurance on maternal healthcare utilisation and abortion in Ghana. The study finds that health insurance increases maternal healthcare utilisation and also reduces abortion numbers among young and unmarried women. Increases in abortion are also observed among married women and those women with no formal education. These mixed results suggest that abortion is still an issue of concern. Further studies need to focus on the impact of health insurance on unsafe abortion and education among women in sub-Saharan Africa.

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Appendix C:

Table C1: Combined CEM and NNMDM estimates of heterogeneous effects of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Living in urban areas				
Health insurance	0.022	-0.017	0.034	0.012
	(0.014)	(0.021)	(0.022)	(0.018)
Observations	3,991	3,991	1,738	3,991
Living in rural areas				
Health insurance	0.064**	0.046***	0.139***	0.054***
	(0.012)	(0.017)	(0.022)	(0.018)
Observations	4,579	4,579	2,759	4,579
Married				
Health insurance	0.043***	0.028	0.110***	0.037***
	(0.011)	(0.019)	(0.017)	(0.018)
Observations	5,353	5,353	3,943	5,353
Unmarried				
Health insurance	0.030**	-0.100	0.134**	0.017
	(0.011)	(0.014)	(0.045)	(0.012)
Observations	3,217	3,217	554	3,217
Formal education				
Health insurance	0.017**	-0.009	0.076**	0.014
	(0.007)	(0.016)	(0.028)	(0.017)
Observations	5,251	5,251	2,244	5,251
No formal education				
Health insurance	0.045**	0.043**	0.166**	0.046**
	(0.015)	(0.023)	(0.027)	(0.025)
Observations	3,319	3,319	2,253	3,319

Standard errors are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: Results in panel A and B are for combined Coarsened Exact Matching (CEM)and Nearest Neighbour Mahalanobis Distance Matching (NNMDM) estimates.

Table C2: NNMDM estimates of heterogeneous effect of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Living in urban areas				
Health insurance	0.021	-0.017	0.032**	0.013
	(0.014)	(0.022)	(0.020)	(0.017)
Observations	4,735	4,735	2,069	4,735
Living in rural areas				
Health insurance	0.066**	0.029**	0.149***	0.062***
	(0.011)	(0.017)	(0.020)	(0.018)
Observations	5,485	5,485	3,384	5,485
Married				
Health insurance	0.041***	0.021	0.111***	0.043**
	(0.010)	(0.019)	(0.017)	(0.017)
Observations	6,321	6,321	4,669	6,321
Unmarried				
Health insurance	0.028**	-0.015	0.126**	0.012
	(0.011)	(0.014)	(0.037)	(0.013)
Observations	3,899	3,899	784	3,899
Formal education				
Health insurance	0.014**	-0.019	0.054**	0.007
	(0.007)	(0.015)	(0.026)	(0.017)
Observations	5,999	5,999	2,571	5,999
No formal education				
Health insurance	0.050***	0.030	0.165***	0.048**
	(0.014)	(0.023)	(0.024)	(0.023)
Observations	4,221	4,221	2,882	4,221

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: Results in Panel A and B are for Nearest Neighbour Mahalanobis Distance Matching (NNMDM) only.

Table C3: Combined CEM and NNPSM estimates of heterogeneous effect of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Living in urban areas				
Health insurance	0.018**	0.015	0.050**	0.064**
	(0.009)	(0.024)	(0.018)	(0.015)
Observations	3,991	3,991	1,738	3,991
Living in rural areas				
Health insurance	0.066**	0.027*	0.179**	0.065***
	(0.010)	(0.015)	(0.020)	(0.015)
Observations	4,579	4,579	2,759	4,579
Married				
Health insurance	0.057**	0.021	0.126**	0.081
	(0.008)	(0.016)	(0.015)	(0.016)
Observations	5,353	5,353	3,943	5,353
Unmarried				
Health insurance	0.017***	-0.026**		-0.005
	(0.007)	(0.011)		(0.011)
Observations	3,217	3,217		3,217
Formal education				
Health insurance	0.020***	0.031	0.086***	0.050**
	(0.006)	(0.015)	(0.024)	(0.014)
Observations	5,251	5,251	2,224	5,251
No formal education				
Health insurance	0.063**	0.045**	0.040**	0.096
	(0.012)	(0.015)	(0.022)	(0.019)
Observations	3,319	3,319	2,253	3,319

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: Results in Panel A and B are for combined coarsened exact matching (CEM)and nearest neighbour propensity score matching (NNPSM) estimates.

Table C4: NNPSM estimates of heterogeneous effect of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Living in urban areas				
Health insurance	0.009	-0.003	0.025**	0.034**
	(0.017)	(0.019)	(0.019)	(0.019)
Observations	4,735	4,735	2,069	4,735
Living in rural areas				
Health insurance	0.048**	0.055***	0.123***	0.068***
	(0.011)	(0.019)	(0.021)	(0.018)
Observations	5,485	5,485	3,384	5,485
Married				
Health insurance	0.047***	0.045**	0.087**	0.068**
	(0.009)	(0.019)	(0.017)	(0.021)
Observations	6,321	6,321	4,669	6,321
Unmarried				
Health insurance	0.008	-0.009	0.111***	-0.004
	(0.009)	(0.017)	(0.042)	(0.013)
Observations	3,899	3,899	784	3,899
Formal education				
Health insurance	0.001	0.001	0.077**	0.011
	(0.006)	(0.029)	(0.044)	(0.029)
Observations	5,999	5,999	2,571	5,999
No formal education				
Health insurance	0.045**	0.071***	0.094***	0.102***
	(0.013)	(0.019)	(0.025)	(0.021)
Observations	4,221	4,221	2,882	4,221

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: Results in panel A and B are for nearest neighbour propensity score matching (NNPSM) only.

Table C5: Marginal effect estimates of heterogeneous effects of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Living in urban areas				
Health insurance	0.018***	-0.002	0.050***	0.024**
	(0.006)	(0.013)	(0.015)	(0.013)
Observations	4,735	4,735	2,069	4,735
Living in rural areas				
Health insurance	0.075***	0.028**	0.178***	0.085**
	(0.009)	(0.12)	(0.015)	(0.011)
Observations	5,485	5,485	3,384	5,485
Married				
Health insurance	0.064***	0.038**	0.132***	0.093**
	(0.008)	(0.013)	(0.012)	(0.013)
Observations	6,321	6,321	4,669	6,321
Unmarried				
Health insurance	0.023***	-0.017	0.125***	-0.001
	(0.006)	(0.010)	(0.030)	(0.010)
Observations	3,899	3,899	784	3,899
Formal education				
Health insurance	0.023***	0.002	0.075***	0.030**
	(0.005)	(0.011)	(0.015)	(0.011)
Observations	5,999	5,999	2,571	5,999
No formal education				
Health insurance	0.072***	0.030**	0.157***	0.087**
	(0.011)	(0.015)	(0.016)	(0.014)
Observations	4,221	4,221	2,882	4,221

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*:Results in panel A and B are for Simple probit without CEM weight. Coefficients are marginal effects measured at the mean.

Table C6: Marginal effect estimates of the effects of health insurance on abortion

Outcome variables	Abortion	15-19	20-29	30-39	40-49	
Panel A	(1)	(2)	(3)	(4)	(5)	
Health insurance	0.011	-0.017**	0.008	0.033	0.029	
	(0.008)	(0.009)	(0.014)	(0.018)	(0.021)	
Observations	10,220	1,492	3,533	2,965	1,929	
Outcome variables	Married	Unmarried	Urban	Rural	Formal education	No formal education
Panel B	(1)	(2)	(3)	(4)	(5)	(6)
Health insurance	0.038**	-0.026**	0.001	0.016	-0.003	0.025**
	(0.011)	(0.011)	(0.013)	(0.010)	(0.011)	(0.012)
Observations	6,321	3,899	4,735	5,485	5,999	4,223

Standard errors, clustered by region, are shown in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: Results in panel A and B are for Simple probit without CEM weight. Coefficients are marginal effects measured at the mean.

Table C7: The IV estimate of the effects of health insurance on maternal healthcare utilisation

	At least 4 ANC visits	First 3 ANC visits	Facility delivery	Professional check-ups	Abortion
	(1)	(2)	(3)	(4)	(5)
Second stage IV estimates					
2SLS	0.047**	0.106	0.282***	-0.207**	-0.039
	(0.027)	(0.96)	(0.072)	(0.049)	(0.045)
First stage IV estimates					
Regional-level average NHIS	1.117***	1.117***	0.988***	1.117***	1.117***
	(0.057)	(0.057)	(0.079)	(0.057)	(0.057)
F-statistics	384.2	384.2	157.5	384.2	384.2
Stock&Yogo critical value(15%)	8.96	8.96	8.96	8.96	8.96
Under-identification test(χ^2)	347.5	347.5	146.1	347.5	347.5
Observations	10,220	10,220	5453	10,220	10,220

Standard errors are in parentheses. *** p<0.01, **p<0.05, * p<0.1. The Kleibergen-Paap Wald rank F-statistic is a weak IV test. The under-identification test is the Kleibergen-Paap rank LM-statistic. The Stock and Yogo critical values correspond to the maximal rejection rate one is willing to tolerate if the true rejection rate is 5%.

Table C8: The IV estimates of heterogeneous effect of health insurance on maternal healthcare utilisation

Outcome variables	At least 4 ANC visits (1)	First 3 ANC visits (2)	Facility delivery (3)	Postnatal check-ups (4)
Urban				
Health insurance	-0.013	0.068	0.164**	-0.199***
	(0.025)	(0.061)	(0.072)	(0.062)
F-statistics	251.7	251.7	103.5	251.7
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	4,735	4,735	2069	4,735
Rural				
Health insurance	0.108**	0.131*	0.407***	-0.230***
	(0.051)	(0.078)	(0.121)	(0.078)
F-statistics	147.4	147.4	68.3	147.4
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	5,485	5,485	3,384	5,485
Married				
Health insurance	0.075**	0.162**	0.266***	-0.309***
	(0.042)	(0.075)	(0.081)	(0.077)
F-statistics	218.8	218.8	127.8	218.8
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	6,321	6,321	4,669	6,321
Unmarried				
Health insurance	0.008	0.026	0.360**	-0.072
	(0.029)	(0.051)	(0.160)	(0.049)
F-statistics	173.3	173.3	34.08	173.3
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	3,899	3,899	784	3,899
Formal education				
Health insurance	-0.067**	-0.044	0.188**	-0.286***
	(0.027)	(0.059)	(0.090)	(0.061)
F-statistics	244.7	244.7	81.21	244.7
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	5,999	5,999	2,571	5,999
No formal education				
Health insurance	0.228	0.330	0.398***	-0.077
	(0.057)	(0.086)	(0.111)	(0.082)
F-statistics	146.3	146.3	79.18	146.3
Stock&Yogo critical value	8.96	8.96	8.96	8.96
Observations	4,221	4,221	2,882	4,221

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*:Results in panel A and B are for Simple probit without CEM weight. Coefficients are marginal effects measured at the mean.

Table C9: The IV estimates of the effect of health insurance on abortion

Outcome variables	Abortion	15-19	20-29	30-39	40-49
Second stage IV estimates					
2SLS	-0.039	0.132	-0.211***	0.057	-0.065
	(0.045)	(0.057)	(0.092)	(0.088)	(0.097)
First stage IV estimates					
Regional-level average NHIS	1.117***	1.085***	0.943***	1.223	1.326***
	(0.057)	(0.142)	(0.098)	(0.101)	(0.131)
F-statistics	58.90	58.90	88.04	147.6	103.1
Stock&Yogo critical value(15%)	8.96	8.96	8.96	8.96	8.96
Under-identification test(χ^2)	347.5	54.02	88.04	128.3	89.21
Observations	10,220	1,793	3,533	2,965	1,929

Standard errors, are in parentheses: *** p<0.01, **p<0.05, * p<0.1. *Note*: The Kleibergen-Paap Wald rank F-statistic is a weak IV test. The under-identification test is the Kleibergen-Paap rank LM-statistic. The Stock and Yogo critical values correspond to the maximal rejection rate one is willing to tolerate if the true rejection rate is 5%.

Table C10: The IV estimates of heterogeneous effect of health insurance on abortion

Outcome variables	Married	Unmarried	Urban	Rural	Formal education	No formal education
Second stage IV estimates						
2SLS	-0.134**	0.066	-0.141***	0.079	0.015	-0.111
	(0.067)	(0.056)	(0.062)	(0.066)	(0.057)	(0.073)
First Stage IV estimates						
Regional-level average NHIS	1.044***	1.125***	1.221**	1.027***	1.113***	1.143
	(0.071)	(0.096)	(0.077)	(0.085)	(0.071)	(0.095)
F-statistics	198.75	164.9	251.7	147.4	244.7	146.3
Stock&Yogo critical value(15%)	8.96	8.96	8.96	8.96	8.96	8.96
Under-identification test(χ^2)	197.1	157.4	222.3	128.3	222.0	131.6
Observations	6,321	3,899	4,735	5,485	5,999	4,221

Standard errors are in parentheses. *** p<0.01, **p<0.05, * p<0.1. The Kleibergen-Paap Wald rank F-statistic is a weak IV test. The under-identification test is the Kleibergen-Paap rank LM-statistic. The Stock and Yogo critical values correspond to the maximal rejection rate one is willing to tolerate if the true rejection rate is 5%.

Table C11: Description of the estimated propensity score in region of common support

Estimated propensity score				
	Percentage	Smallest		
1%	0.2676	0.1037		
5%	0.3451	0.1095		
10%	0.4235	0.1165		
25%	0.5205	0.1165		
50%	0.6143			
		Largest	Mean	0.6138
75%	0.7208	0.9267	Std.Dev	0.1450
90%	0.8078	0.9271	Variance	0.0210
95%	0.8486	0.9276	Skewness	-0.2442
99%	0.8960	0.9377	Kurtosis	2.7382

Table C12: Propensity Score Estimates- probit regression

Variables	Coefficient	Standard error	p-value
Age	0.040	0.010	0.000
Age at first sex	0.002	0.002	0.330
Employment	0.093	0.034	0.006
Electricity	0.486	0.033	0.000
Ref. Rural			
Urban	0.141	0.031	0.000
Ref. Traditionalist			
Christians	0.580	0.072	0.000
Muslims	0.527	0.075	0.000
No religion	0.267	0.096	0.005
Ref.Other Tribe			
Akans	-0.082	0.100	0.414
Ga Dangbe	-0.028	0.114	0.802
Ewe	0.007	0.107	0.949
Northerners	0.078	0.122	0.526
Other tribe	0.038	0.100	0.706
Ref.Divorce			
Married	0.154	0.058	0.008
Unmarried	0.231	0.047	0.000
Ref.Two Ideal Children			
One Ideal Child	-0.181	0.275	0.511
Three	-0.239	0.213	0.261
Four	-0.234	0.209	0.263
Five	-0.284	0.208	0.173
Six	-0.338	0.210	0.108
Seven	-0.425	0.210	0.043
Ref.Central Region			
Western	0.352	0.057	0.000
Greater Accra	0.083	0.062	0.183
Volta	0.464	0.073	0.000
Eastern	0.523	0.061	0.000
Ashanti	0.060	0.056	0.289
Brong-Ahafo	0.831	0.062	0.000
Northen	0.632	0.070	0.000
Upper East	0.809	0.073	0.000
Upper West	1.066	0.079	0.000
Number of obs	10,224	$PseudoR^2$	0.069
$LR\chi^2(30)$	938.11	$Prob\chi^2$	0.000

Table C13: Overall covariates balancing tests

Outcome variables	(1) Samples	(2) Pseudo-R^2	(3) LRχ^2	(4) P>χ^2	(5) Mean Bias	(6) Median Bias	(7) B	(8) R
At least 4 ANC visit	UnMatched	0.142	675.45	0.000	10.5	9.6	0.7	1.11
	Matched	0.007	148.65	1.000	1.2	1.0	8.6	1.26
First 3 month ANC visit	Un Matched	0.057	260.97	0.000	11.2	10.7	58.4	1.12
	Matched	0.001	9.72	1.000	1.1	0.9	8.6	1.28
Delivery	UnMatched	0.056	260.56	0.000	11.1	10.7	58.4	1.12
	Matched	0.001	9.66	1.000	1.1	0.9	8.5	1.29
Postnatal check-ups	UnMatched	0.056	260.56	0.000	11.1	10.7	58.4	1.12
	Matched	0.001	9.66	1.000	1.1	0.9	8.5	1.29
Abortion	UnMatched	0.087	747.86	0.000	14.1	11.0	77.2	0.62
	Matched	0.002	8.42	0.998	1.3	0.9	9.8	1.45

Standard errors are in parentheses. * significant at *** p<0.01, **p<0.05, * p<0.1. The Pseudo-R^2 shows the extend covariate explain the probability of participation. Likelihood ratio test shows a joint significant before and after matching and is expected to be statistically significant before matching indicating differences between treated and control groups, and insignificant after matching. Mean and the median biases in the model are expected to be reduced considerably after matching and sufficient bias reduction should not exceed 5%. B is the absolute standard difference of mean propensity score index in treated and control group and is expected to be less than 25%. R is the ratio of treated to control group of the propensity score index and also expect to fall within the range between 0.5 and 2 for the sample to be considered balanced

Table C14: Individual covariate balancing test

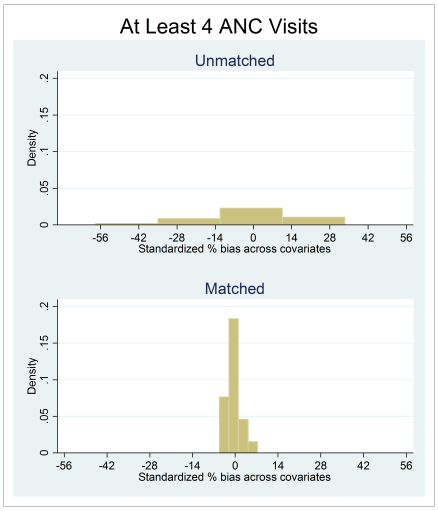
	Sample	Treated	Control	% Bias	% Bias Reduction	t-Stat	p-value
Age	Unmatched	29.82	29.37	4.8		2.37	0.018
	Matched	29.80	29.62	1.8	62.2	1.00	0.316
Age at first sex	Unmatched	15.58	15.28	4.6		2.25	0.024
	Matched	15.51	15.40	1.7	63.5	0.93	0.354
Electricity	Unmatched	0.695	0.565	27.3		13.54	0.000
	Matched	0.690	0.668	4.6	83.1	2.62	0.009
Expected children	Unmatched	0.683	0.627	11.7		3.33	0.001
	Matched	0.682	0.692	-1.9	83.4	-0.73	0.468
Christians	Unmatched	0.748	0.740	1.8		0.88	0.378
	Matched	0.750	0.751	-0.4	76.3	-0.24	0.812
Muslims	Unmatched	0.202	0.154	12.6		6.13	0.000
	Matched	0.199	0.193	1.7	86.7	0.89	0.371
Traditionalist	Unmatched	0.023	0.061	-18.6		-9.61	0.000
	Matched	0.024	0.025	-0.7	96.2	-0.51	0.610
No Religion	Unmatched	0.027	0.046	-10.1		-5.11	0.000
	Matched	0.027	0.031	-1.7	83.5	-103	0.303
Other religion	Unmatched						
	Matched						
Akans	Unmatced	0.371	0.436	-13.4		-6.61	0.000
	Matched	0.375	0.383	-1.4	89.6	-0.78	0.435
Ga Dangbe	Unmatched	0.052	0.057	-2.1		-1.06	0.290
	Matched	0.053	0.054	-0.6	71.6	-0.34	0.734
Ewe	Unmatched	0.123	0.124	-0.2		-0.09	0.927
	Matched	0.125	0.130	-1.4	-655.5	0.77	0.442
Northern	Unmatched	0.029	0.029	0.6		0.29	0.774
	Matched	0.029	0.030	-5	11.8	-0.28	0.779
Other tribe	Unmatched	0.407	0.335	15.0		7.37	0.000
	Matched	0.398	0.384	3.0	80.3	1.62	0.104
Employed	Unmatched	0.269	0.240	6.6		3.25	0.001
	Matched	0.268	0.275	-1.6	76.0	-0.86	0.387
Unemployed	Unmatched	0.731	0.760	-6.6		-3.25	0.001
	Matched	0.732	0.725	1.6	76.0	0.86	0.387
Married	Unmatched	0.291	0.294	-0.8		-0.37	0.709
	Matched	0.293	0.300	-1.6	-107.6	-0.87	0.385
Unmarried	Unmatched	0.630	0.600	6.2		3.04	0.002
	Matched	0.627	0.615	2.3	62.3	1.29	0.197
Divorce	Unmatched	0.079	0.106	-9.2		-4.58	0.000
	Matched	0.080	0.084	-1.4	84.4	-0.83	0.404
One Ideal Child	Unmatched	0.006	0.006	-0.6		-0.31	0.753
	Matched	0.005	0.004	1.2	-82.3	0.68	0.497
Two	Unmatched	0.005	0.003	2.4		1.14	0.255
	Matched	0.005	0.005	0.5	72.2	0.28	0.782
Three	Unmatched	0.074	0.069	1.9		0.92	0.359
	Matched	0.074	0.075	-0.3	82.1	-0.18	0.855
Four	Unmatched	0.206	0.186	5.1		2.52	0.012
	Matched	0.204	0.203	0.2	96.6	0.09	0.925
Five	Unmatched	0.334	0.329	1.2		0.61	0.542
	Matched	0.333	0.334	-0.4	69.4	-0.21	0.833
Six	Unmatched	0.149	0.153	-1.0		-0.48	0.634
	Matched	0.151	0.151	-0.1	94.8	-0.03	0.978
Seven	Unmatched	0.226	0.255	-6.7		-3.32	0.001
	Matched	0.229	0.228	0.2	96.6	0.13	0.899
Urban	Unmatched	0.496	0.411	17.0		8.36	0.000
	Matched	0.487	0.468	3.9	77.1	2.14	0.032
Rural	Umatched	0.504	0.589	-17.0		-8.36	0.000
	Matched	0.513	0.532	-3.9	77.1	-2.14	0.032
Western	Unmatched	0.103	0.110	-2.4		-1.21	0.228
	Matched	0.105	0.106	-0.6	76.6	-0.32	0.751
Central	Unmatched						
	Matched						
Greater Accra	Unmatched	0.905	0.114	-7.8		-3.90	0.000
	Matched	0.092	0.098	-1.8	77.3	-1.02	0.309
Volta	Unmatched	0.089	0.087	0.8		0.39	0.694
	Matched	0.091	0.096	-1.9	-131.7	-1.00	0.317
Eastern	Unmatched	0.101	0.083	6.2		3.04	0.002
	Matched	0.102	0.103	-0.2	96.5	-0.11	0.910
Ashanti	Unmatced	0.092	0.146	-16.6		-8.36	0.000
	Matched	0.094	0.102	-2.5	85.0	-1.50	0.134
Brong-Ahafo	Unmatched	0.120	0.070	17.1		8.18	0.000
	Matched	0.112	0.115	1.3	92.4	0.65	0.514
Northen	Unmatched	0.122	0.120	-2.5		-1.24	0.217
	Matched	0.123	0.122	0.4	85.5	0.20	0.839
Upper East	Unmatched	0.114	0.085	9.8		4.77	0.000
	Matched	0.113	0.110	1.1	89.2	0.56	0.574
Upper West	Unmatched	0.098	0.044	21.2		10.05	0.000
	Matched	0.088	0.070	7.1	66.5	3.72	0.000
No Education Women	Unmatched	0.349	0.377	-5.8		-1.63	0.103
	Matched	0.350	0.358	-1.6	71.5	-0.60	0.547
Education Women	Unmatched	0.182	0.244	-15.3		-4.42	0.000
	Matched	0.184	0.182	0.1	99.6	0.02	0.980
Secondary	Unmatched	0.419	0.361	11.6		3.25	0.001
	Matched	0.419	0.417	0.4	96.9	0.13	0.896
Higher	Unmatched	0.048	0.015	19.4		4.96	0.000
	Matched	0.047	0.042	3.4	82.6	1.04	0.300

Bias: standardized Standard percentage difference in means between treated and control.

Table C15: Estimates of covariate balance

		Controls			Controls	
Covariate	Treated	Pre	Post	Treated	Pre	Post
	(1)	(2)	(3)	(4)	(5)	(6)
Age	29.82	29.37	29.82	89.18	89.00	88.13
Age at first sex	15.58	15.29	15.58	43.77	37.38	37.34
Electricity	0.695	0.565	0.695	0.212	0.246	0.212
Expected children						
Christian	0.748	0.739	0.747	0.189	0.193	0.189
Muslim	0.202	0.154	0.202	0.161	0.130	0.161
Traditionalist	0.023	0.060	0.023	0.023	0.057	0.023
No religion	0.027	0.046	0.027	0.026	0.044	0.026
Other religion						
Akans	0.371	0.436	0.371	0.233	0.246	0.233
Ga-Dangbe	0.052	0.057	0.052	0.049	0.053	0.049
Ewe	0.123	0.124	0.123	0.108	0.108	0.108
Northen	0.407	0.407	0.407	0.242	0.242	0.242
other tribe	0.018	0.018	0.018	0.018	0.018	0.018
Employed	0.269	0.241	0.269	0.197	0.183	0.197
Married	0.291	0.294	0.291	0.206	0.206	0.208
Unmarried	0.639	0.600	0.639	0.233	0.240	0.233
One ideal child	0.005	0.003	0.005	0.005	0.003	0.005
Two	0.074	0.074	0.070	0.069	0.065	0.069
Three	0.206	0.186	0.206	0.164	0.151	0.164
Four	0.335	0.335	0.328	0.223	0.221	0.223
Five	0.149	0.153	0.149	0.127	0.129	0.127
Six	0.226	0.255	0.226	0.175	0.190	0.175
Urban	0.496	0.412	0.496	0.250	0.240	0.250
Western	0.103	0.110	0.103	0.092	0.098	0.092
Central	0.071	0.132	0.071	0.066	0.114	0.066
Greater-Accra	0.090	0.115	0.090	0.082	0.102	0.082
Volta	0.089	0.087	0.089	0.081	0.079	0.081
Eastern	0.101	0.082	0.101	0.090	0.076	0.090
Ashanti	0.092	0.146	0.092	0.084	0 .125	0.084
Brong-Ahafo	0.120	0.070	0.120	0.105	0.065	0.105
Northern	0.122	0.130	0.122	0.107	0.113	0.107
Upper East	0.114	0.085	0.114	0.101	0 .078	0.101
Upper West						

Note Columns (1) to (3) are means and (4) to (6) are variance.



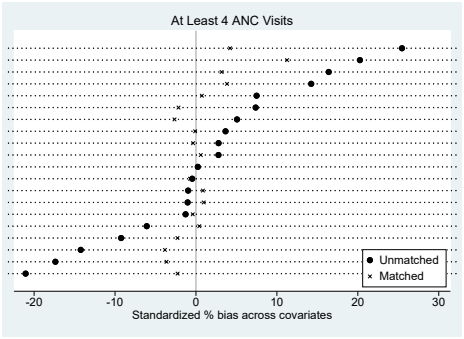
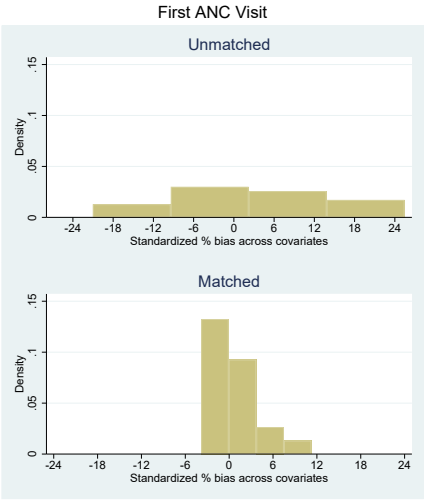


Figure C1: Differences in standard bias before and after matching for at least 4 ANC visits



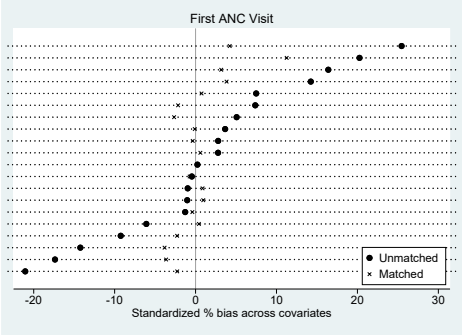


Figure C2: Differences in standard bias before and after matching for first 3 month ANC visits

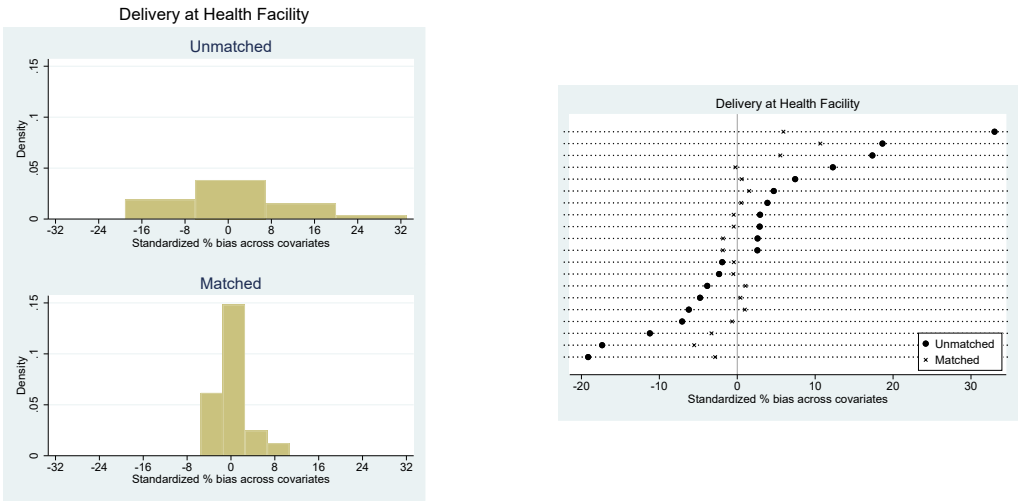


Figure C3: Differences in standard bias before and after matching for facility delivery

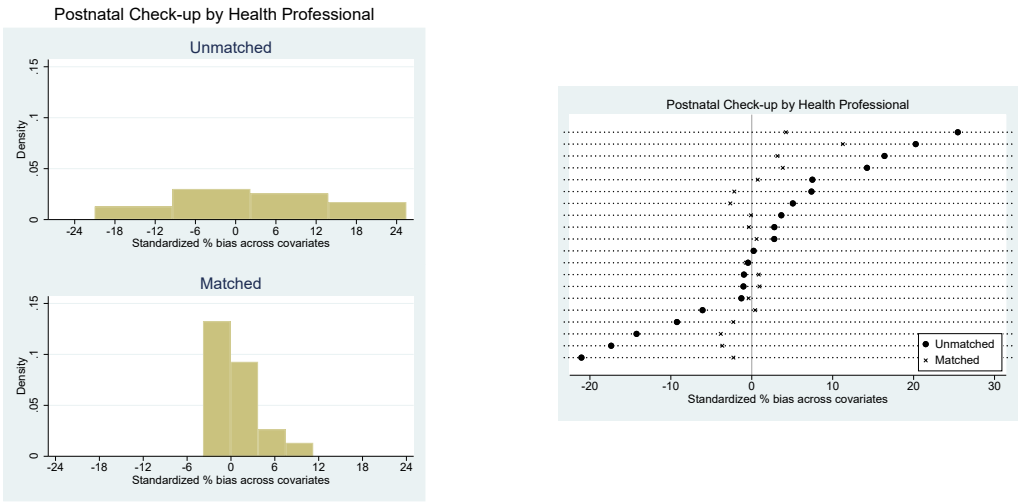


Figure C4: Differences in standard bias before and after matching for postnatal check-ups by health professional

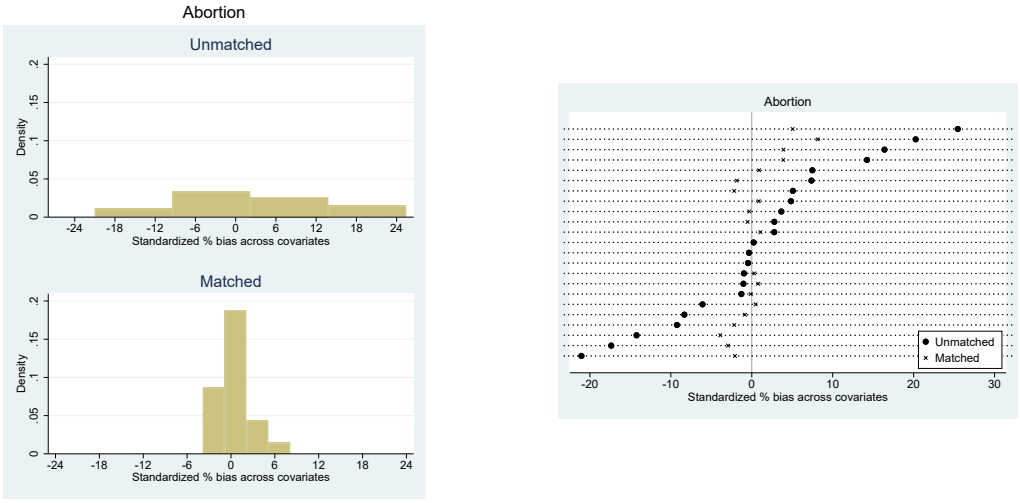


Figure C5: Differences in standard bias before and after matching for abortion

Chapter 5

Conclusion

Most people in sub-Saharan Africa are in the low-income group, therefore, they struggle to generate adequate resources to pay for their healthcare expenses. Ghana introduced health insurance in 2003 to improve health care and health. Health insurance has been shown to improve healthcare utilisation and general health. If health insurance is positively related to healthcare utilisation and health, and health influences an individuals' ability to work. Then, it is important to understand the effect of health insurance on individuals' labour market outcomes, labour productivity and healthcare use, particularly in a society where the majority of people are more vulnerable to illness.

In Chapter 2, the study finds that having health insurance increases the elderly's use of healthcare services particularly the number of visits to a health facility and the probability of being treated by health professionals. This increases the number of hours worked and earnings of the elderly, which in turn increases their food consumption. The size of the increase is slightly larger for the elderly in the high-wealth group than for those in the low-wealth group. This indicates that subsidising expenditure on health relieves the elderly, especially those within the low-wealth group, from catastrophic healthcare spending, and the the money that would have been spent on health care would be channelled to other household expenditures, such as consumption. The improvement in the elderly's healthcare access, earnings and consumption also improves their welfare and this helps to reduce poverty and the inequality gap that characterises the elderly in Ghana.

In Chapter 3, the study finds that health insurance has a positive effect on labour productivity by reducing the extent of illness-related absenteeism at the workplace. Thus, workers with health insurance miss fewer workdays than workers without health insurance, with the reduction being statistically significant for male workers but insignificant for female workers. Overall, the estimates indicate that workers with health insurance are absent from work less often, and are more productive compared with workers without health insurance. This suggests that having the NHIS reduces output loss and increases a country's production, which in turns increases economic growth and development.

In Chapter 4, the study finds that, on average, health insurance causes a sizeable and significant increase in maternal healthcare use. The estimates indicate that women with health insurance are more likely to meet the WHO recommendation on maternal healthcare utilisation than women without health insurance. With regard to abortion, the study finds that irrespective of government interventions to improve access to healthcare, there is no evidence that the abortion rate responds to health insurance. However, in subgroup analysis, the study finds a significant reduction in abortion among young insured women aged 15-19 years and unmarried women. The increases in maternal healthcare utilisation and the reduction in abortion among women, particularly those young and unmarried women (who studies show are more likely to terminate their pregnancies) suggest that health insurance plays a significant role in quest of reducing maternal mortality in Ghana.

In conclusion, the findings indicate that health insurance significantly increases healthcare utilisation. This improves the elderly's labour market outcomes (hours, earnings and consumption expenditure), which in turn improve the welfare of the elderly population in Ghana. It reduces illness-related absenteeism at the workplace and this increases the country's production through a reduction in output lost. It is also found that health insurance reduces abortion among young and unmarried women.

5.1 Limitations

The study has some limitations and strength. First, the data used for this study are observational, therefore, the results should not be interpreted as causal. The focus of study is to observe the relationship between health insurance and healthcare utilisation, hours of work, earnings, consumption and productivity to determine whether the association between them is consistent with the available literature and economic theory. Second, most of the outcome variables are self-reported and may suffer from measurement errors which can lead to biased estimates. Some variables (e.g. hours of work and earnings in the informal sector) are not constant over time, making it very difficult to validate the self-reported earnings and hours of work from an independent source. This can bias the estimates. Third, in the PSMDID estimates, the study acknowledged that the combination between PSM and DID would control for observed and unobserved factors, but there may be confounding factors influencing the unobserved time-varying factors. Though the study tested for the validity of our DID, PSM and PSMDID results, there might be a bias which could affect the estimates. Fourth, other factors may be available to individuals and households that have not been accounted for in this study and which can also affect the estimates. Finally, the investigation of the effect of health insurance on labour market outcomes and productivity in developing countries, particularly in sub-Saharan Africa, is very limited even though the elderly in these countries are the source of the labour force in the agriculture sector. A major reason for this limitation is data availability. This study may have some data challenges in terms of the sample size and time intervals of the survey, but understanding the impact of the Ghana NHIS and its implications is very important in the context of developing countries' growth and development. Despite these limitations, the study makes some important contributions to the literature on health insurance and labour market outcomes in the informal sector in a developing country.

Despite the contribution of health insurance to healthcare access and health in Ghana and sub-Saharan Africa, the mortality and morbidity rate remain high, therefore, further research is needed on the effects of health insurance to mortality

and household savings, it is necessary to compare those with free healthcare and those without it to understand the contribution of insurance on mortality rate. In terms of health insurance and labour productivity, future research could focus on illness-related absenteeism in individual firms to investigate and quantify the actual cost of this absenteeism at the workplace. In relation to health insurance and abortion, the study finds a significant reduction of abortion among young women aged 15-19 years. Women aged 15-19 are mostly students, therefore, there is a trade-off between their education and the pregnancy. The finding suggests that most of the young women drop out of school in order to take care of their pregnancy, this also has an implication for women's education. Further studies need to focus on the impact of health insurance on abortion and education among women in sub-Saharan Africa.

5.2 Policy application

The findings of the thesis have some practical policy applications. The strong positive effect of health insurance on healthcare utilisation among the elderly working in the informal sector suggests that the government should extend the exemption of health insurance premium payments to a large section of the elderly. This could be achieved by reducing the eligibility age for free healthcare to 60 years, which is the average age of farmers in Africa. The medical needs, health expenditure and labour force participation of the elderly aged 60-69 are no different from those of the elderly aged 70 and over. The majority of people aged 60-69 years tend to be engaged in cocoa and other cash crop production, which contributes largely to Ghana's economy. As such, these constitute a large section of the labour force in the country's agricultural sector. Therefore, including this age group in the free healthcare policy has the potential to affect Ghana's economy positively in the long term.

In Ghana and Africa as a whole, the majority of workers, especially the older workers, are also household heads and breadwinners of their families, therefore, issues that affect their health have implications for the entire household. For instance, if illness incapacitates them in their daily activities, it affects the entire household's earnings and consumption. On the other hand, improvement in earnings and

consumption also improves the welfare of the entire household, which in turn reduces poverty and the inequality gap that characterises Ghana's population. It is hoped that the findings of this study will encourage the government to extend subsidisation of the health insurance premium to people who cannot afford the current premium payments. These measures would increase participation in the NHIS and reduce illness-related absenteeism at workplaces, and thereby improve labour productivity, earnings and food consumption. With improved labour productivity, the economy will grow and workers' welfare will also be enhanced.

The significant increase in healthcare utilisation and the reduction in abortion found with current NHIS uptake also point to a significant contribution of health insurance towards a reduction in the maternal mortality ratio in Ghana. This implies that policy makers should take practical steps to enforce mandatory enrolment in the NHIS for all women in Ghana, because its voluntary nature allows women to opt out from the scheme. This could contribute to reducing Ghana's global maternal mortality ratio to less than 70 deaths per 100,000 live births to meet the United Nations Sustainable Development Goal (SDG) target envisioned for 2030.

The study observed heterogeneous effects of health insurance on healthcare utilisation in terms of individuals' place of residence. The findings suggest that the introduction of the NHIS has contributed to healthcare utilisation among people residing in rural areas. There are communities, specifically emerging communities, slums and hinterlands, where the nearest health facilities are some distance away and this sometimes affects healthcare use. The provision of mobile clinics to these communities will help to curb immediate healthcare challenges, because most people residing in these areas are indigent and sometimes they cannot even afford the cost of transportation to a health facility. Therefore, providing mobile clinics to these areas will reduce financial barriers, which in turn will improve healthcare access and the health of the citizenry.

List of abbreviations

ANC Antenatal clinic

ATE Average treatment effect

ATET Average treatment effect of the treated

CEM Coarsened exact matching

CHPS Community-based Health and Services Programme

CIA Conditional independence assumption

DID Difference-in-difference

DMHIS District Mutual Health Insurance Scheme

GDHS Ghana Demographic and Health Surveys

GLSS Ghana Living Standard Survey

GSS Ghana Statistical Service

MDG Millennium Development Goals

MMR Maternal Mortality Ratio

NHIS National Health Insurance Scheme

NLS Nonlinear least squares

NNMDM Nearest neighbour Mahalanobis distance matching

NNPSM Nearest neighbour propensity score matching

PSM Propensity score matching

PSMDID Propensity score matching and difference-in-difference

RMHC Rural Mutual Health Care

SDG Sustainable Development Goal

UCI Union of confidence intervals

USAID United States Agency for International Development

US United States

WHO World Health Organization

CIs Confidence intervals