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Insurance and Financial Services Across Developing Countries: An Empirical Study of Coverage and Demand

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Abstract

Income fluctuations resulting from socio-economic, climate and other environmental risks are an important barrier to sustainable development particularly in developing countries with high dependence on agriculture, vulnerability to natural disasters, and lack of efficient coping mechanisms. In the last two decades, access to financial services such as savings and credit has increased across the developing world. However, use of insurance services for financial protection against these risks has stayed low across many developing countries. This paper uses a pooled dataset of 65,916 households from sixteen developing countries across Asia and Africa to examine the landscape of access to and sources of financial services. This data allows us to unpack the current levels of coverage of different kinds of financial services among the adult population. We drill down into the factors that determine the probability that a household is covered by different kinds of insurance products. Because the households in our survey very often lack any supply of formal insurance products, we employ a sample-selection model to condition coverage on the availability of supply. This enables us to compare our results with rather limited earlier evidence on determinants of demand for financial services including insurance in developing countries. This approach shows that many demographic effects are in fact not related to demand but to the supply of insurance. When one accounts for selection bias, demand for insurance coverage may be twice as sensitive to household income as previously thought. We find that an extra $1 USD of daily income for a poor household increases the probability that they will demand insurance by around 5 percentage points. Our results shed new light on how insurance uptake could be increased through more tailored and targeted products and services that are designed to meet local needs and requirements in the face of climate and other shocks.

Key words: Financial Services, Risks, Insurance, Africa, Asia, Climate Change
JEL Codes: G52, G32, D14, F63

1. Introduction

Income fluctuations resulting from socio-economic and environmental risks are an important barrier to sustainable development particularly in developing countries with high dependence on agriculture, vulnerability to natural disasters, and lack of efficient coping mechanisms (Borner et al 2014; Dercon et al 2004; Porter 2012; Yilma et al 2014). The World Development Report (2014a) finds that adverse household shocks play a major role in pushing households below the poverty line. Households are often susceptible to both idiosyncratic and covariate shocks, which can result in loss of income and welfare. For example, Beck, Demirgüç-Kunt, and Levine (2007) found that almost 30 percent of the cross-country variation in changing poverty rates can be attributed to cross-country variation in financial development. In this context, a growing body of literature suggests that managing risks through access to finance through formal mechanisms such as loans, insurance, savings can play an important role in influencing economic development and poverty reduction (Rewilak 2017; Donou-Adonsou et al 2016; Perez-Moreno, 2011; Demirgüç-Kunt, and Levine 2007; Claessens and Feijen 2006). Accordingly increasing access to financial services is seen as an important element for achieving the Sustainable Development Goals (Collins et al 2019; Demirgüç-Kunt A, et al 2017; Kalpper et al 2016; GPFI, 2011)

However, the distribution of access to financial mechanisms and services has remained uneven across the developing world (Cihak et al 2013; Beck et al 2009; World Bank, 2008). Many households rely heavily on informal mechanisms of savings and borrowing to smooth income and consumption fluctuations (MAP 2017; Seibel 2014; Kunt and Klapper 2013; Timothy 1995; Kocher, 1992; Townsend, 1994; Ghate, 1992). This is particularly relevant in the context of rural populations: According to UNCDF's (Making Access Possible) MAP Programme, "more than 50% of economically active adults in most of the MAP countries are farmers, supplement their earnings from other work by engaging in the farming sector. They are almost exclusively located in rural areas and are the poorest and most vulnerable section of the population, as increasingly they are impacted by climate shocks while having few or no resilience mechanisms." (Naidoo et al, 2018). Further, climate change is acting as a threat multiplier to many of these households, with estimates suggesting more than 100 million people who could fall into extreme poverty due to climate change related impacts (Hallegatte et al 2017). Access to finance is widely considered as a key component of helping those most vulnerable to build resilience to climate change impacts (Haworth et al 2016; Surminski, et al 2016; Armendáriz and Murdoch, 2005; Tharkom and Mirko, 2010).

In order to increase access to financial mechanisms there has been renewed attempts to understand financial inclusion through large scale improved data collection such as the Making Access Possible (MAP) programme which is a multi-country initiative to support financial inclusion through a process of evidence-based country diagnostic and stakeholder dialogue, leading to the development of national financial inclusion roadmaps that identify key drivers of financial inclusion and recommend action (MAP, 2019). This programme relies on understanding the needs and demands of poor households, so that service solutions can be developed that better serve their needs and reduce inequalities of access (Naidoo et al 2014). Such a 'needs-based' approach for measuring financial inclusion can inform and facilitate the development of policies and business models that deliver financial services that meet the needs of consumers, especially those at the bottom of the pyramid (Chamboko et al 2018).

In this paper, we examine the use of financial services using pooled survey data from sixteen 65,916 households over sixteen developing countries of the world that were derived as part of the MAP program. This data allows us to unpack the current levels of coverage of different kinds of financial services among the adult population. In particular, we drill down into the factors that determine the probability that a household is covered by different kinds of insurance products. This focus on insurance is important given the ongoing efforts to increase insurance penetration and the relatively limited success in achieving this (Jarzabkowski et al 2019; GFDRR, 2012; Surminski et. al. 2019). Lack of use of insurance as a coping mechanism in developing countries has attracted considerable policy and research attention in the past decade, especially with the emergence of micro-level products, innovative forms ofindex insurance and sovereign risk schemes. (see for example Surminski 2016; Clarke and Dercon 2016), based on the assumption that these can offer more reliable and effective protection than post-disaster aid, and help to increase risk planning and risk understanding (Hallegatte, 2014). However, despite piloting and testing of insurance products for example through the InsuResilience initiative there is a prevailing low uptake, even when insurance is subsidized, which appears to prevent the growth of commercial markets for insurance (Surminski et.al. 2019; J-Pal 2016). A series of aspects are to consider, depending on type of insurance. For example, insurance cover at a macro, sovereign level follows different rules and drivers than insurance for individuals. In this paper we focus on households and their uptake of financial instruments including insurance. Previous research on demand for insurance has mainly relied on case studies, randomized control trials (RCT), willingness to pay (WTP) studies mostly at

a national and regional level to examine different aspects of supply and demand for insurance in developing countries (Cohen et al 2003; Bendig et al 2009; Cole et al 2014; Karlan et al 2013; Tharkom and Mirko 2010; Abbas et al 2015). One of the major reasons in this regard has been the lack of data at the micro-level across countries (Klapper and Singer 2017). This paper addresses this gap.

2. Review of literature

It has long been acknowledged that households in developing countries are faced with a myriad of risks, and the coping mechanisms used to manage these differs widely according to a country's stage of economic development and other factors (WDR, 2014; Helgeson et al 2013; Gunning 2012; Dercon, 2002). In the context of developing countries, provision of more formal financial services is regarded as critical for economic growth and enable households to manage risks effectively (MAP 2016; World Bank 2015; WDR, 2014; Levine 2005; Beck et al 2000b; King and Levine 1993a; Levine1997; Jung, 1986).

Earlier debate on financial services and economic growth has emphasized the benefits of savings, insurance, and credit in coping with risks and enhancing the economy's investment efficiency (Besley, 1995; Ward and Zurbruegg 2000). The relationship between financial development and economic growth has been explained in terms of possible patterns of development between the two states described as "demand-following": lack of demand for financial services is reflected through lack of financial growth and "supply-leading": financial development causes economic growth.(Outreville 1990a; 2013). The increasing recognition of the importance of financial services has led to many global and national initiatives in the last decade seek to expand access to financial services among the poor in developing countries. However, the demand for financial services has largely remained limited in developing countries and approximately 1.7 billion adults internationally still have no access to the financial services delivered by formal institutions (World Bank 2018).

Analysis of the demand for financial services in developing countries is largely characterized by analysis of demand for savings and credit (Deaton 1992; Klaus et al 1994; Muradoglu and Taskin, 1996; Jabbar et al 2002; Pal 2002; Barslund and Tarp 2008) and demand for insurance (Hogeveen 2003; Bendig et al 2009). In practice, households may choose from a variety of formal and informal coping mechanisms (e.g. selling livestock, borrowing from money lenders

or banks, tapping into savings, borrowings from neighbours, insurance - or a mix of each). Understanding what factors determine this choice remains an ongoing research priority (Karlan et al., 2013; Gine et al. 2008; Gine and Yang, 2009; Cole et al., 2013).

One of the least well-understood aspect of a household's choice of coping mechanism(s) is the determinants of demand for insurance in developing countries. Little is known about the demand for market-based insurance in developing countries (Dercon et al 2018). One probable reason for this is the difficulty in separating the analysis of supply and demand, like so many households in the developing world lack access to a supply of formal insurance products. As compared to the demand for savings and credit, the demand for formal insurance has remained substantially low in developing countries despite the micro-insurance revolution of the last decade. This puzzling question of low uptake of formal insurance in developing countries has led to a growing body of research on the question of determinants of demand for insurance in these countries (Cole et al 2011; Platteau et al 2017).

Earlier studies examining the demand for index-based insurance in developing countries through household surveys, randomized control trials (RCTs) and choice experiments have made an important contribution to this debate (Cole et al 2013; Giné Townsend and Vickery 2008; Dercon et al. 2018; Bjerge and Trifkovic 2018). These studies have highlighted various factors for low uptake of demand for insurance such as high premium prices, low income, trust in the insurer, previous experience with insurance, level of education, financial literacy, liquidity constraints, and the effect of past shocks. The prevailing low demand for microinsurance services has also been analyzed from supply-side perspectives by examining the role of basis risk, price, transaction costs, contract design and quality of services (Karlan et al 2014; Thrton et al 2010; Mude and Barret 2016; Norton et al 2014; Basaza et al 2008; Fitzpatrcik et al 2011). Few studies have also looked into the interconnected nature of the demand for formal savings, credits and insurance among households in developing countries (Bendig et al 2009; Arun and Bendig 2010) and finds that in developing countries, poor are less likely to participate in formal financial services as compared to their better-off counterparts.

One of the recent additions to the current body of work is the role of new technologies such as use of smart/mobile phones and its impacts on financial services and inclusion in developing countries (Batchelor, S. 2012; Kim et al 2018; Kanobe, Alexander, & Bwalya, 2017; Behl et al

2016). This research has emphasized the important role mobile phones can play in increasing financial inclusion in developing countries. The increasing evidence has been backed by Findex survey which finds that between 2014 and 2017, mobile phones have contributed to a rise in the share of account owners sending or receiving payments digitally from 67 percent to 76 percent globally, and in the developing world from 57 percent to 70 percent (World Bank, 2018). However, this stream of research has largely focussed on mobile-based savings, loan accounts, and monetary transactions. Although the use of mobile phones has the potential to boost increasing use of formal insurance such as through providing insurance advisory services through mobile phones, the empirical evidence is very limited and the research is still in the nascent stage (KFW, 2016).

Overall, the price of insurance is seen as one factor amongst others determining uptake of insurance. Theory and empirical analyses show that an individual's willingness to pay for insurance is influenced by factors including (i) the price of coverage; (ii) the individual's level of risk aversion; (iii) an individual's income; and (iv) the level of risk perceived (Szpiro, 1988). The different factors are summarized in Table 1 below. Importantly, uptake is not only determined by demand, but also by the availability of a product. While determinants of supply of insurance in the context of developing countries have often been neglected by studies (Outreville, 2013) there is a growing recognition of key supply-side barriers such as lack of data or lack of technical capacity (see for example Vivid et. al. 2016) important obstacles includes factors such high transaction costs in providing commercial insurance to the poor, adverse selection and moral hazards and institutional obstacles such as regulatory and legal environment of the country (CII, 2009; Schanz, 2018).

Table 1: **Demand and Supply-side factors hampering the use of Insurance for climate risks**

Demand Side	Supply Side
Lack of financial literacy – can lead to misunderstanding of risks and the role of insurance, leading to wrong expectations about pay-outs, cover levels and limitations of insurance.	**Risk characteristics** – insuring climate and natural disaster risks is technically challenging, with a wide range of 'risk drivers' at work, such as urbanization, accumulation of assets in exposed areas such as at the coast, or changes to climate patterns because of natural vulnerability and climate

	change. Calculating the impact of these factors on risks is difficult for insurers.
Lack of trust – in the insurance mechanism or those running it, often due to lack of experience with insurance.	**Lack of data to accurately price risks** – often due to missing data collections, outdated risk information, lack of standardisation and/or access to risk data.
Limited willingness to pay – particularly for sovereign risk schemes the lack of political buy-in and political attractiveness of post disaster aid present challenges.	**'Classic' asymmetric information problems** – moral hazard and adverse selection problems imply that those that are willing to pay for insurance are usually those most at risk and hence costly to insure.
Low-income/unaffordability – insurance is often considered too expensive for those most vulnerable	**Lack of technical capacity** – risk financing and insurance require technical skills that are often not present in developing countries
Existence of alternative measures – the perception of alternative sources of finance, for example, post-disaster aid and reliance on neighbor support, post-disaster support influences the interest in insurance mechanisms.	**High operational or distribution costs**– administrative aspects and lack of distributional networks can put a burden on insurance schemes, particularly in their early phases.
Unsupportive regulatory frameworks – clarity on customer rights and transparency of how insurance functions and how it is supervised are important but often missing.	**Unsupportive regulatory frameworks** – effective regulation is a key requirement for insurance – lack of clear and transparent rules can be a deterrent for private sector involvement and can hamper the scaling up of insurance schemes.

Source: Surminski et al 2018

An important focus of insurance research has been on factors affecting the demand and uptake of insurance: Studies have investigated numerous variables that might be significant in explaining in demand for insurance (see Zietz 2003 on life insurance). Although determinants of demand for insurance might depend on the specific type of insurance i.e. life or non-life, most studies broadly agree that purchasing an insurance contract depends predominantly on

income levels, but is also influenced by wider socio-economic, demographic and region-specific characteristics (Ranger and Surminski 2013).

In the case of the life insurance market, one of the key drivers of life insurance consumption has been the level of income (Beck & Webb, 2003; Chang & Lee, 2012; Outreville, 1996; Ward & Zurbruegg, 2000). In this regard, the relation between income level and insurance penetration has often been presented as the "S-Curve model" to compare the role of income among developed and developing economies. This model indicates the existence of a non-linear relationship between income and demand for insurance because of the presence of two threshold values of income elasticity of demand for insurance (Enz, 2000). As a consequence, the income elasticity of demand for insurance should be greater for emerging economies as compared to the developed economies.

Similarly, the level of education is expected to play an important role in the demand for insurance. Earlier evidence on the role of education which is often used as a proxy for risk aversion in influencing demand for insurance has been mixed. While some studies show a significant positive impact of education on demand for life insurance (Hammond et al. 1967; Brown and Kim 1993; Chen et al. 2001; Truett and Truett 1990), other studies show ambiguity over the role of education. (Auerbach and Kotlikoff 1989; Zietz 2003; Beck and Webb 2003; Outreville, 1996). Thus, in the case of demand for life insurance a large part of literature finds a positive relationship with the level of income and education to have insignificant influence demand for life insurance (Dragos, 2014).

As compared to the life insurance sector, there has been comparatively less evidence in factors determining the demand for non-life insurance such as crop insurance at a cross country level. Recent studies on examining factors influencing demand for insurance in the non-life sector finds while education and urbanization play a significant role in influencing demand for non-life insurance, income plays a non-significant role for the non-life sector especially in Asian countries (Dragos, 2014).

3. Data and Insights

3.1 Pooled Survey Data

Our study is based on a pooled dataset of 65,916 adults in 16 developing countries in Africa and Asia surveyed during 2011-2018. The data is generated from sixteen different rollouts of the Fin Scope Consumer Survey – a nationally representative household-level questionnaire, which investigates how individual adults (15 years of age or older) source their income and manage their financial lives in the face of financial shocks. These surveys were conducted as part of the Making Access Possible (MAP) programme, initiated by the United Nations Capital Development Fund (UNCDF) and implemented in partnership with Fin Mark Trust and the Centre for Financial Regulation and Inclusion (CENFRI). (UNCDF, 2013)

Table 2: Overview of the Pooled Dataset

	Survey Year	Freq.	Percent
Botswana	2014	1,503	2.28%
Burkina Faso	2016	5,066	7.69%
Cambodia	2015	3,350	5.08%
Cameroon	2017	6,826	10.36%
DRC	2014	5,040	7.65%
Laos	2014	2,040	3.09%
Lesotho	2011	2,000	3.03%
Madagascar	2016	5,040	7.65%
Malawi	2014	3,005	4.56%
Mozambique	2014	3,905	5.92%
Myanmar	2018	5,500	8.34%
Nepal	2014	4,014	6.09%
Eswatini	2014	3,440	5.22%
Thailand	2013	5,990	9.09%
Togo	2016	5,197	7.88%
Zimbabwe	2014	4,000	6.07%
Total		65,916	100.00

Note: we have missing data and do not use all of the available data in the Econometric models (see footnotes for specific missing values).

The data includes information on income, demographics, use of financial services, formal and informal[1] coping mechanisms, and experience with health and environmental shocks. Each of the individual surveys was constructed using stratified multistage random sampling techniques and weighted to transform individual and household observations into nationally representative population estimates (see Appendix B for more details on the sampling methodology for each survey). Table 2 below describes the overall structure of the sample dataset from 16 countries. The table includes the data on the year of survey in each country and the number of adults surveyed. Table 3 presents summary statistics for selected indicators in the survey.

Table 3: Descriptive statistics of household demographics

	Mean / % of Total	Standard Dev.	Min	Max
Gender HOH (Male=1)	76.56%	0.424	0	1
Education:				
None	22.23%	-	-	-
Primary	38.03%	-	-	-
Secondary	29.18%	-	-	-
Tertiary	10.56%	-	-	-
Age HOH	47.4	14.389	17	78
Marital Status HOH (Married = 1)	75.91%	0.428	0	1
Size of household (# of people)	4.99	2.387	1	16
Formally Employed (“Yes”=1)	10.37%	0.305	0	1
Daily Income (USD)	5.230461	7.506	0	62.6
Farming Household (Yes=1)	62.28%	0.485	0	1

[1] In this study, formal sources of finance refer to households that use at least one service provided by a formally regulated or registered entity, such as banks and insurers. Informal refers to households that use at least one service provided by an unregistered entity, which may exclude micro insurance providers in some countries.

Rural Household (Yes=1)	65.10%	0.477	0	1

3.2 Insurance and Financial inclusion

In this section, we provide an overview of the landscape of financial inclusion[2]by assessing the use of savings, credit and insurance instruments including both formal and informal[3] sources of finance.

Savings

We begin with the results on savings behaviour in the sampled countries presented as savings categories in Table 4 below. People in developing countries save for different purposes such as for education, as a buffer for old age, or for consumption during future periods of food shortages and lack of employment. According to the Global Findex Database 2017 (Demirgüç-Kunt A, et al 2017), 21% of the adults in developing economies were saving formally in a bank or any other financial institution. Our results show that 14.45% of the adults in our sample were savings through banks. It was highest for Thailand (36.33%), followed by Lesotho (31.75%), Botswana (29.57%) and the lowest in Cameroon (5.97%). Country-wise results show Asian countries have a higher level of savings through banks (20.81%) than the African countries (14.23%). The use of non-bank financial institutions for savings was found to be highest for Thailand (21.59%) followed by Togo (16.47%) and Cameroon (15.33%). On average 10.21% of the sample adults were using non-bank financial institutions for savings activities. Overall, our results show 24.63% of surveyed adults using formal financial institutions (bank and non-bank) for saving purposes.

Results on access to savings through informal financial institutions such as co-operatives, and savings group shows to be highest for Laos (36.08%) followed by Burkina Faso (29.30%), Madagascar (28.13%) and Cambodia (23.40%). Overall, the use of informal financial services

2 Financially Included: Adults who have/ use financial products and /or services-formal and /or informal.

3 Formally Served: Adults who have/ use financial products and /or services provided by a financial institution (bank and/or non-bank). Informally served: Adults who have/ use financial products and /or services which are not regulated i.e. co-operatives, farmers association, savings clubs' groups, private money lenders

for saving purpose was found to be higher for Asian countries (21.85%) as compared to African countries (19.09 %) in the sample. Our results show differences among countries in the use of formal and informal financial institutions for saving purposes. For example, after excluding savings at home and looking only at formally and informally served[3], our data shows that in Thailand, savings served through formal institutions were used by around 58%, while the share of saving served through informal sources was only 5.7%. On the other hand, in countries such as DRC, Mozambique, and Cambodia the share of formally served savings was only around 10%.

Table 4: Savings Pattern among the surveyed Adults

Country	Bank	Other Formal	Informal	Saving at Home	Not saving
Thailand	36.33	21.59	5.71	0	36.38
Lesotho	31.75	1.7	15.85	7.35	43.35
Botswana	29.67	15.9	12.97	3.53	37.92
Nepal	29.17	13.75	16.92	1.49	38.66
Eswatini	27.65	10.96	14.16	11.42	35.81
Laos	25.54	0.74	36.08	13.92	23.73
Zimbabwe	10.55	10.7	14.18	12.28	52.3
Mozambique	8.53	0.72	17.72	8.17	64.87
Madagascar	8.06	6.81	28.13	15.87	40.42
Burkina Faso	6.81	9.22	29.23	6.79	47.95
DRC	6.76	2.54	21.18	26.24	43.28
Togo	6.64	16.47	12.68	8.14	56.07
Cambodia	6.54	3.59	23.4	11.81	54.67
Myanmar	6.49	6.33	27.18	9.6	50.4
Cameroon	5.93	15.53	24.76	10.67	43.11
Asia	20.81	9.2	21.86	7.37	40.77
Africa	14.23	9.05	19.09	11.05	46.51
Total	14.42	10.21	19.99	9.96	45.42

Credit

Borrowing from formal and informal sources is an important part of managing risks in developing countries. Earlier evidence on how people borrow shows that while borrowing through formal financial institutions is highly prevalent in high-income countries, borrowing from family and friends are the most common source in low-income countries (Demirgüç-Kunt A, et al 2017). Our analysis of how adults borrow in the surveyed countries has been presented in Table 5 below. Like savings, the sources of borrowing are also divided into formal and informal sources and percentages of adults who are not borrowing in the sample.

First, our results from borrowings from commercial banks show that 5.57% of the surveyed adults in our sample relied on banks for borrowing purposes. While it was 7.85% among the Asian countries, it was found to be lower for African countries at 4.40%. It was highest for Myanmar at 14.73% followed by Botswana (13.84%) and Nepal (10.71%). Second, the data shows how people borrow from other formal non-bank financial institutions such as regulated microfinance institutions. It was found to be comparatively higher for Asian countries (12.40%) as compared to African countries (3.08%). Data shows that non-bank financial institutions play a greater role in countries of South East Asia such as Cambodia (23.62%) and Thailand (19.58%) and Myanmar (12.93%). It was found to be negligible in many of the African countries except Zimbabwe and Lesotho. Third, borrowing from family and friends is well known as a source of finance for poor people in developing countries due to its characteristics of low cost and low-interest rate (Tsai 2004). Our results found borrowing from family and friends as an important source of credit in many of the surveyed developing countries of Asia (7.68%) and Africa (12.16%).

Table 5: Borrowing pattern among the Surveyed Adults

Country	Bank	Other Formal	Informal	Family and Friends	Not borrowing
Myanmar	14.73	12.93	13.8	6.6	51.95
Botswana	13.84	1.66	5.66	3.46	75.38
Nepal	10.71	8.4	30.37	0	50.52
Laos	8.48	0.78	7.4	4.07	79.26
Eswatini	6.4	2.12	18.87	14.85	57.76
Cambodia	6.22	23.62	7.9	7.46	54.79
Mozambique	5.33	0.61	0.15	3.66	90.24

Thailand	4.94	19.58	3.84	0	71.64
Zimbabwe	4.28	9.08	7	23.25	56.4
Lesotho	3.45	8.45	21.35	28.5	38.25
Cameroon	2.18	1.01	12.73	7.81	76.27
Togo	2	9.06	16.11	0	72.83
Madagascar	1.96	2.72	3.99	19.84	71.49
Burkina Faso	1.86	1.82	2.16	3.04	92.33
DRC	0.3	0.28	3.02	5	91.4
Asia	7.85	12.40	13.24	3.02	63.50
Africa	4.40	3.08	8.32	12.16	72.17
Total	5.17	7.16	9.91	7.68	70.08

Insurance

The paper investigated the uptake of different types of insurance and their sources among the sample adults in Tables 6 and 7 below.

First, results show 16.30% of the sample adults being formally insured in the whole dataset. It reveals high formal insurance in Thailand (58.70%) followed by Lesotho (40.00%), Zimbabwe (26.70%) and Botswana (25.60%). At the bottom of the list of formally insured adults were DRC (0.85%), Madagascar (2.69%) and Cambodia (4.73%). However, results on the uptake of insurance from Table 6 clearly shows higher influence of few countries such as Thailand and Lesotho on the average of the having any formal insurance in the pooled dataset. Our results need to be interpreted with care while talking about average rate of insurance uptake. Second, results indicate that the formal insurance market in developing countries are mostly driven by funeral (11.60%) and life (6.20%) insurance sectors, except countries such as Zimbabwe and Botswana where the coverage of medical insurance is higher as compared to rest of the countries in the dataset. Access to crop, medical and property insurance has been substantially low across the countries considered in this survey.

Third, the country-wide result on the access to different kinds of insurance products shows that funeral and life insurance have overall higher penetration among all the countries. Funeral insurance was found to be highest for Thailand (51.50%) followed by Lesotho (40.10%), Zimbabwe (23%) and Eswatini (22.70%). In the case of life and medical insurance among the sample countries, results show the highest life insurance coverage in Thailand (23.20% %) and Nepal (10.20 %). Among the African countries, we found higher life insurance coverage in

Botswana (5.11%) and Eswatini (5.52%) Coverage of medical insurance, it was highest for Zimbabwe (12.00 %), followed by Botswana (11.10%) and Thailand (9.71%%). Fourth, the percentage of adults formally not insured was found to be 83.70% among all the countries. Except for five countries of Thailand, Lesotho, Zimbabwe, Botswana, and Eswatini, in all other countries' percentage of adults not under any formal insurance was higher than 80% pointing towards a very low coverage of insurance products across the developing world.

Table 6: Insurance Coverage by Product and Country

	Any Formal	Crop	Medical	Life	Property	Funeral	Formally Not Insured
Thailand	58.70%	9.18%	9.71%	23.20%	2.48%	51.50%	41.30%
Lesotho	40.00%	0.18%	1.29%	2.37%	0.50%	40.10%	60.00%
Zimbabwe	26.70%	1.10%	12.00%	2.15%	0.33%	23.00%	73.30%
Botswana	25.60%	-	11.10%	5.11%	0.46%	21.90%	74.40%
Eswatini	23.00%	1.56%	4.51%	5.52%	0.89%	22.70%	77.00%
Laos	17.00%	0.19%	7.12%	1.71%	0.36%	2.16%	83.00%
Nepal	11.40%	0.37%	0.49%	10.20%	0.27%	0.02%	88.60%
Togo	8.04%	-	6.16%	2.11%	0.31%	0.00%	91.96%
Cameroon	7.65%	0.08%	3.01%	1.46%	0.06%	0.00%	92.35%
Burkina Faso	6.05%	0.37%	2.43%	1.31%	0.34%	0.00%	93.95%
Myanmar	5.46%	0.11%	0.29%	2.61%	0.15%	3.43%	94.54%
Mozambique	5.08%	-	0.53%	1.27%	-		94.92%
Cambodia	4.73%	-	2.19%	0.81%	0.09%	2.36%	95.63%
Madagascar	2.69%	-	2.22%	1.48%	0.24%	-	97.31%
DRC	0.85%	0.00%	0.24%	0.75%	0.66%	0.00%	99.15%
Total	16.30%	1.82%	3.36%	6.20%	0.71%	11.60%	83.70%

Note: Households have multiple types of Insurance. Certain types of Insurance such as farming equipment insurance has not been considered for analysis.

Table 7: Sources of Insurance

Country	Bank	Other formal	Informal
Lesotho	0.0	33.75	24.10
Thailand	0.0	55.79	15.16
Myanmar	0.0	5.51	10.45
Togo	0.0	8.31	8.89
Botswana	0.9	24.28	5.12
Madagascar	0.0	3.15	4.98
Eswatini	0.0	21.10	4.94
Laos	0.0	15.78	4.90
Zimbabwe	0.0	27.13	3.90
Burkina Faso	0.0	3.91	3.59
Cameroon	0.0	7.87	3.31
Mozambique	0.0	6.20	3.05
Cambodia	0.0	4.54	1.46
DRC	0.0	1.70	0.02
Nepal	0.0	11.19	0.00
Africa	0.1	12.92	6.33
Asia	0.0	18.99	6.15
Total	1.9	16.45	5.72

Further, we also analysed the sources of insurance products in the sample. The results have been provided in table 7. The analysis shows while banks seem to play a very negligible role in providing insurance products across the sample countries, it is observed to be driven mostly by informal (7.72%) and non-bank (other formal) (16.45%) financial institutions. Among all the countries non-bank financial institutions seem to play a bigger role in Thailand (55.79 %), followed by Lesotho (33.8%), Zimbabwe (27.1%) and Botswana (24.3%).

4 Insurance Coverage and Demand: Methodology and Analysis

In order to investigate the factors affecting the demand for insurance among the sample adult households, we used econometrics analysis. Two main econometric specifications i.e. a probit model and Heckman's sample selection model has been used for this paper. In both models,

the dependent variable is binary (yes/no) and captures whether a household has some form of formal insurance (i.e. an insurance product). Our first specification uses a Probit model to estimate the relationship between demographic (age, marital status, education, etc.) and income on the probability of a household having insurance. However, in this model, we cannot identify the impact of our regressor separately on the supply and demand determinants of insurance uptake. We addressed this issue in our second econometric specification by using a Heckman-corrected probit model. This is in the spirit of Heckman's (1979) sample selection model, the Heckprobit model has the caveat that both the selection equation and the outcome equation are fitted using a binary dependent variable structure. This can be thought of as a 'two-step' procedure[4], which first considers the supply-side determinants and then, conditional on having supply, estimates the demand-side drivers. For a full overview of the econometric models employed in this paper, see Appendix C.

In our case, a key requirement of the Probit-Heckman specification is the knowledge of the supply of insurance. With a lack of data on the rate of supply of insurance on such a local level in our sample countries, to construct this measure, we used the survey data on supply indicators. We first break down the household data into subgroups, which we call 'markets'. These are groups of households located in similar areas, with an average group size of around 350 households. We treat the entire market as having no Supply of insurance if 80% or more of households in the market responded to the question "why don't you have insurance?" with a response as "it is not available to me". The 80% threshold is employed to not be too strict on the sample of selected households, but also to ensure we have a decent proportion of selected and unselected households. Our results are robust to 70% and 90% thresholds. The measure of selection and having some formal insurance has a 0.427 unconditional correlation. Table 8 below shows the breakdown of households we categorized having no supply and households having actual insurance coverage.

Table 8: Lack of supply (interpolated) vs Observed Lack of Coverage

	The households having some form

[4] While the logic follows a 'two-step' procedure, we estimate the model using full-information maximum likelihood which fits the models simultaneously and allows for cross-correlation between the selection and outcome equations.

Household categorized as having no supply of insurance	formal insurance coverage		Total:
	No	Yes	
No	29,574	2,393	31,967
Yes	24,260	9,689	33,949
Total:	53,834	12,082	65,916

Our results show that just 3.6% of households who we categorized to be without supply do indeed have some coverage. While more micro evidence on the supply side would be preferable, we are limited by data availability and argue that this approach helps us identify demand from the supply of insurance.

5 Econometric Results

5.1 Factors Affecting the Probability of having Insurance

In this section, we present the marginal effects in our probit model of household demographics and economic variables and its conditional correlation on the probability of having insurance products. Details of the econometric specification can be found in Appendix C. Table 9 below reports the results, which we should interpret as conditional correlation.

Table 9: Average Marginal Effects of Simple Probit Model

Insurance:	(1) Any	(2) Crop	(3) Medical	(4) Life	(5) Property	(6) Funeral
Male HOH	0.00927	0.00137	0.00319	0.00768	-0.000740	0.0259**
	(0.00524)	(0.00568)	(0.00356)	(0.00459)	(0.00186)	(0.00946)
Primary Education	0.0138*	0.00259	-0.00279	0.00410	0.000644	0.000444
	(0.00652)	(0.00824)	(0.00498)	(0.00529)	(0.00174)	(0.0111)
Secondary Education	0.0432***	-0.00276	0.00966*	0.0188***	0.00193	-0.0164
	(0.00676)	(0.00840)	(0.00481)	(0.00564)	(0.00189)	(0.0135)
Tertiary Education	0.0991***	-0.00605	0.0254***	0.0395***	0.0113***	-0.0845***
	(0.0100)	(0.00846)	(0.00675)	(0.00740)	(0.00332)	(0.0130)
Age	0.000417**	0.000103	0.000235**	0.000613***	0.0000852	0.00120***
	(0.000140)	(0.000173)	(0.0000778)	(0.000121)	(0.0000446)	(0.000255)

Married	0.00946	0.00424	-0.000216	-0.000674	0.000580	0.00162
	(0.00513)	(0.00532)	(0.00369)	(0.00448)	(0.00204)	(0.00997)
Household size	-0.00250**	-0.000257	-0.00237***	-0.00249**	-0.000129	-0.0127***
(# of people)	(0.000908)	(0.000982)	(0.000536)	(0.000815)	(0.000281)	(0.00192)
Formally Employed	0.0610***	0.00207	0.0203***	0.0213***	-0.0000854	0.0257*
	(0.00549)	(0.00505)	(0.00271)	(0.00414)	(0.00129)	(0.0105)
Log Daily Income	0.0371***	0.00512**	0.0103***	0.0192***	0.00506***	0.0181***
	(0.00233)	(0.00192)	(0.00138)	(0.00200)	(0.00148)	(0.00365)
Farming Household	0.00434	0.0330***	-0.00270	0.00606	-0.00474**	0.0594***
	(0.00488)	(0.00648)	(0.00299)	(0.00371)	(0.00177)	(0.00985)
Rural Household	-0.0207***	0.00579	-0.0138***	-0.0172***	-0.00258	0.00118
	(0.00527)	(0.00535)	(0.00330)	(0.00373)	(0.00173)	(0.0135)
Country Dummies	Yes (13)	Yes (13)	Yes (8)	Yes (13)	Yes (13)	Yes (7)
N	49,531	29,376	49,531	49,531	46,345	22,251
Pseudo R-sq	0.388	0.291	0.242	0.292	0.249	0.436
df_m	13	13	13	13	13	13

Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10. Standard errors clustered at the survey stratum level (2,592 clusters in full dataset). We use a Probit model specification, presenting the average marginal effects above, with standard errors recovered via the delta method. Household survey weights used. Both Age and Ln (Daily Income) have been demeaned at the country level and winsorised at the 0.05 and 0.95 percentile. Education dummy variables relative to No Education. The difference in sample size reflects the fact that some of our country surveys did not include questions on certain products. Botswana, Lesotho, and Malawi dropped from estimation in all cases (missing data). Cambodia, DRC, Madagascar, Mozambique, and Togo dropped for (2) due to missing dependant variables. Likewise, in (6) for Botswana, Burkina Faso, DRC, Lesotho, Madagascar, Malawi, Nepal, and Togo. For coefficient estimates rather than marginal effects, see Appendix A.

Table 9 looks at the probability of a household being covered by at least one type of formal insurance product (column 1) as well as the probability of households having specific types of coverage (column 2-6). Our results show that having a higher income, being older, or being formally employed all positively and significantly correlated to the probability of a typical household having insurance coverage across the entire range of products. Having a male head-of-household appears to have no significant impact other than for funeral insurance, where it increases the probability of coverage significantly.

Looking across insurance types, we see that funeral insurance is the only product type for which the probability of coverage for an average household is negatively related to education level, whereas for all other products the relationship is positive (i.e. greater education results in a higher probability of coverage). This result supports earlier findings on funeral insurance which indicates a strong link between funeral insurance uptake and the culture of the societies rather than level income and education (Hougaard et al 2011). From Table 9 we also see that

being formally employed has a strong association with coverage of medical, life and funeral insurance.

In order to further investigate the effects of several variables on the probability of insurance coverage, we estimated the predicted probabilities of an average household in each of our countries at different income levels and education categories. The results have been described below in Tables 10 and 11. The model in these tables follows specification (1) from Table 9 but also introduces additional interaction effects on those variables of interest. The model also has quadratic terms in income and age (see Appendix A for the coefficient list for model structure).

Table 10: Predicted Probabilities of Having Some Formal Insurance at different income levels across countries

	Predicted Probability of an average household having Some formal insurance coverage by income levels and country.					
Daily Income ($USD)	$2	$4	$6	$8	$10	Mean ($USD)
Burkina Faso	0.08***	0.31*	0.77	0.99***	1.00***	$1.17
	(0.019)	(0.166)	(0.564)	(0.123)	(0.001)	
Cambodia	0.04***	0.05***	0.05***	0.05***	0.06***	$ 6.24
	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)	
Cameroon	0.04***	0.06***	0.09***	0.12***	0.16***	$ 3.84
	(0.005)	(0.006)	(0.009)	(0.013)	(0.017)	
DRC	0.00***	0.01***	0.01***	0.01***	0.02***	$ 3.73
	(0.001)	(0.001)	(0.002)	(0.003)	(0.004)	
Laos	0.09***	0.11***	0.13***	0.16***	0.19***	$ 8.10
	(0.015)	(0.015)	(0.017)	(0.021)	(0.026)	
Madagascar	0.02***	0.03***	0.05***	0.06***	0.08***	$ 1.94
	(0.004)	(0.008)	(0.012)	(0.014)	(0.022)	
Myanmar	0.05***	0.05***	0.06***	0.07***	0.08***	$ 3.86
	(0.008)	(0.008)	(0.009)	(0.009)	(0.010)	
Nepal	0.07***	0.14***	0.23***	0.31***	0.37***	$ 3.36
	(0.009)	(0.016)	(0.022)	(0.033)	(0.069)	
Eswatini	0.12***	0.17***	0.30***	0.55***	0.85***	$ 3.149
	(0.013)	(0.021)	(0.025)	(0.075)	(0.102)	
Thailand	0.45***	0.48***	0.52***	0.55***	0.58***	$ 15.65
	(0.028)	(0.024)	(0.022)	(0.021)	(0.020)	
Togo	0.07***	0.09***	0.10***	0.12***	0.14***	$ 2.75
	(0.007)	(0.010)	(0.014)	(0.017)	(0.019)	
Zimbabwe	0.22***	0.28***	0.35***	0.42***	0.48***	$ 5.44
	(0.021)	(0.020)	(0.022)	(0.024)	(0.025)	

N=49,531. Standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.10. All other explanatory variables held at their means. Probit regression specification used included interactions between income and country dummy variables for full flexibility. Standard errors clustered at the stratum level. Botswana, Malawi and Lesotho are all omitted because they lack enough power in the data, or the income categories are so out-of-sample that the reliability might be questioned. We include country income mean (survey-weighted) to help caution interpretation of out-of-sample predictions (for example, one should be cautious about interpreting predictions at very high incomes relative to the average).

From the above, we see how within-country income relates to the probability of insurance. In Eswatini, the difference in probability of having some formal insurance between households earning $2USD/day and those earning $10USD/day is substantial, increasing from 12% to 85%. Thailand, on the other hand, only rises from 45% to 58%, and in Myanmar from only 5% to 8%. Overall, our results indicate that the elasticity of insurance coverage probability with respect to income is quite heterogeneous across countries. Countries such as Cambodia,

Cameroon, Madagascar, Eswatini, and Nepal show a high level of elasticity whereas Thailand, Myanmar, and Laos show a low level of elasticity.

Table 11: Predicted Probability of Having Some Formal Insurance at different education levels across countries

	Probability of having some formal insurance at different educational levels			
Highest Education:	None	Primary	Secondary	Tertiary
Burkina Faso	0.04***	0.05***	0.19***	0.34***
	(0.013)	(0.012)	(0.030)	(0.036)
Cambodia	0.05***	0.04***	0.03***	0.05***
	(0.014)	(0.008)	(0.006)	(0.018)
Cameroon	0.04***	0.05***	0.10***	0.21***
	(0.010)	(0.007)	(0.010)	(0.018)
DRC	0.00	0.00*	0.01**	0.04***
	(0.001)	(0.002)	(0.003)	(0.010)
Laos	0.05***	0.09***	0.15***	0.31***
	(0.015)	(0.017)	(0.026)	(0.039)
Madagascar	0.04***	0.02***	0.05***	0.08***
	(0.010)	(0.006)	(0.009)	(0.021)
Mozambique	0.05***	0.04***	0.10***	0.20***
	(0.013)	(0.006)	(0.016)	(0.059)
Myanmar	0.05***	0.06***	0.07***	0.10***
	(0.014)	(0.011)	(0.010)	(0.018)
Nepal	0.09***	0.11***	0.16***	0.28***
	(0.015)	(0.022)	(0.018)	(0.056)
Eswatini	0.20***	0.17***	0.25***	0.56***
	(0.030)	(0.023)	(0.012)	(0.023)
Thailand	0.43***	0.48***	0.56***	0.58***
	(0.038)	(0.026)	(0.041)	(0.033)
Togo	0.03***	0.06***	0.14***	0.29***
	(0.007)	(0.012)	(0.013)	(0.035)
Zimbabwe	0.23***	0.27***	0.53***	0.74***
	(0.041)	(0.019)	(0.038)	(0.076)

N=49,531. Standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.10. All other explanatory variables others held at their means. Botswana, Malawi and Lesotho are all omitted because they lack enough power in the data, or because of missing data. regression specification used included interactions between education and country dummy variables for full flexibility. Standard errors clustered at the stratum level.

Table 11 reveals many cross-country differences in sensitivity to education categories. The relationship is also non-monotonic in certain countries. For example, in Cambodia households with primary or secondary education levels have a lower predicted probability of coverage relative to households with no-education. The difference in the probability of having some

insurance decreases from no education (5%) to primary (4%) and secondary education (3%). Likewise, in Madagascar (2%) and Mozambique (4%) have lower predicted levels of insurance coverage for primary educated individuals than uneducated at 4% and 5% respectively. Once we look at the upper-end of education level distribution, we see a more monotonic result – the tertiary-educated individuals have the highest predicted coverage level in all countries. In Table 12 below, we examine the interaction effects of education and income on insurance uptake.

Table 12: Predicted Probabilities of Having Some Formal Insurance at different income levels across education categories

	Probability of having some formal insurance at different income levels				
Daily Income ($USD)	$2	$4	$6	$8	$10
No education	0.03***	0.04***	0.06***	0.07***	0.09***
	(0.004)	(0.005)	(0.006)	(0.008)	(0.011)
Primary	0.05***	0.06***	0.07***	0.08***	0.10***
	(0.004)	(0.004)	(0.005)	(0.006)	(0.007)
Secondary	0.07***	0.09***	0.10***	0.12***	0.13***
	(0.005)	(0.005)	(0.006)	(0.007)	(0.009)
Tertiary or trade	0.13***	0.15***	0.17***	0.20***	0.22***
	(0.013)	(0.013)	(0.013)	(0.014)	(0.016)

N=49,531. Standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.10. All other explanatory variables others held at their means. Results using the baseline Probit regression specification with additional interactions between income and education dummy variables for full flexibility. Standard errors clustered at the stratum level.

These results indicate that adults with no education have higher sensitivity of income to the probability of coverage. The table reveals that for households with no education, going from $2 USD/day to $10 USD/day gives a threefold increase in the predicted probability of coverage. This drops to a two-fold increase for all other education categories. The predicted coverage levels all follow are all very linear in both household income and education level, suggesting these two channels are important for all education and income groups.

4.3 Factors Affecting the Probability of Being Insured

In this section, we describe the results of our Heckman-Probit model. This model explicitly tries to identify the impact of our household demographic variables on the demand for insurance. In the context of developing countries of Asia and Africa, this poses an important

methodological challenge due to the limited supply of any kind of formal insurance. The concern arises with the issue of 'selection bias', namely the problem that certain areas lack the supply of insurance and have demographics that can confound the results of a simple analysis of correlations. For example, if a high proportion of female-headed households live in regions that lack any supply – data correlates female-headed households to low coverage, even if they have the same preferences as male-headed households. To address this, we use a Heckman-corrected Probit model (see Section 3 and Appendix C for details of this specification). We found this model to be better suited argue that this model better to identifies how our demographic variables relate to the underlying demand for formal insurance and move the results closer to a study of the household's choice to insure.

In Table 13 we present the results of the sample-selection corrected Heckman-probit model. Column (1) provides the baseline Probit (with no correction for sample selection). Formally, this shows how each of our economic and demographic regressors drives the unconditional probability of insurance coverage. Column (2) does the same as (1) but includes dummy variables for each of the 248 markets we identify in our data. Column (3) and (4) report the first stage results of the Heckman-probit approach. In these specifications, we take the market-level mean of each demographic variable and see how it affects the probability that a household has some supply of insurance. Column (5) reports the results of the Heckman sample selection model and gives us the effect each regressor has the probability of having coverage conditional on having available supply. In other words, Column (5) shows the impact of each regressor on the household's choice to insure, e.g. a model of demand.

Table 13: Results of the Heckman Probit selection model for insurance uptake

	(1) Probit: Country dummy variables	(2) Probit: Market dummy variables	(3) 1st Stage Heckprobit: Market-level means used for all regressors, Country dummy variables	(4) 1st Stage Heckprobit: Market-level means used for all regressors, Market dummy variables	(5) Full Heckprobit (Using (4) as the first stage)
Dependent Variable:	Probability of being insurance)	(Probability of being insurance)	(Probability of having access to insurance)	(Probability of having access to insurance)	(Probability of being insured, conditional on having access)
Male HOH	0.00927 (0.00524)	0.00968 (0.00588)	0.0361 (0.215)	0.127 (0.168)	0.0188 (0.0108)
Primary Education	0.0138* (0.00652)	0.0131 (0.00749)	0.172* (0.0760)	0.0339 (0.0660)	0.0196 (0.0142)
Secondary Education	0.0432*** (0.00676)	0.0469*** (0.00776)	0.268 (0.141)	0.111 (0.0887)	0.0680*** (0.0149)
Tertiary Education	0.0991*** (0.0100)	0.111*** (0.0113)	0.0257 (0.187)	0.162 (0.126)	0.150*** (0.0192)
Age	0.000417** (0.000140)	0.000407* (0.000164)	-0.000818 (0.00577)	0.00637* (0.00276)	0.000555 (0.000294)
Married	0.00946 (0.00513)	0.0125* (0.00588)	0.0713 (0.144)	-0.0506 (0.172)	0.0208* (0.0104)
Household size (# of people)	-0.00250** (0.000908)	-0.00100 (0.00110)	0.0259 (0.0202)	-0.0337 (0.0192)	-0.00321 (0.00192)
Formally Employed	0.0610*** (0.00549)	0.0681*** (0.00600)	0.0393 (0.153)	0.250** (0.0905)	0.0955*** (0.0122)
Log Daily Income	0.0371*** (0.00233)	0.0437*** (0.00277)	-0.0774 (0.0441)	-0.0293 (0.0664)	0.0724*** (0.00579)

Farming Household	0.00434 (0.00488)	0.00562 (0.00551)	-0.309** (0.0956)	0.127 (0.168)	0.0218* (0.0102)
Rural Household	-0.0207*** (0.00527)	-0.325*** (0.0293)	0.0999** (0.0373)	0.0339 (0.0660)	0.00261 (0.0125)
Location Dummy:	Country (13)	Sub-country (248)	Country (13)	Sub-country (248)	Country (13)
N	49,531	46,686	58,994	56,353	56,607 (30,121 selected)
Pseudo R-sq	0.388	0.383	0.334	0.376	
Log Likelihood (1k)	6,962	6,640	16,803	13,690	19,373
df_m	25	174	23	176	205
Chi Squared (1k)	2.8	-	1.5	-	296,620

Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10. Standard errors clustered at the survey stratum level (2,592 clusters in full dataset). We use a Probit model specification (1)-(4), and a Heckman-Probit model (5), presenting the average marginal effects above, with standard errors recovered via the delta method. Household survey weights used in all columns. Both Age and Ln(Daily Income) have been demeaned at the country level and winsorized at the 0.05 and 0.95 percentile. Education dummy variables relative to No Education. Botswana, Lesotho, and Malawi dropped from estimation in all cases (missing data). For coefficient estimates rather than marginal effects, see Appendix A.

Looking at the selection equations in (4) and (5), we see that the demographic variables have very little significance across the board. This is as expected since we would anticipate that accounting for a geographical location (through country-level dummy variables in (4) and market-level dummy variables in (5) leaves little to be explained about the factors related to lack of supply. In (4) we see that the mean age of households within a market, and the mean proportion of formally employed households in a market, have a positive marginal effect on a typical household's probability of having some supply of formal insurance. Results indicate that older, more formally employed markets have the more developed public infrastructure and therefore it is easier for private firms to establish themselves and provide a supply of insurance. This may also explain the effect of market-meaned primary education (relative to no education) in (4).

Moving to a comparison of (1) and (2) shows that the geographic size of the dummy variables has little role in moving the estimates for the simple probit model. The only effect that completely loses significance when we use market-level dummy variables is the impact of household size. This suggests that a larger household may in fact not have a lower probability of no cover relative to a smaller household, but rather that larger households tend to be clustered in areas that lack supply of insurance. We gain support for the above conclusion when we see that the effect of household size in the sample-selection corrected 'Heckprobit' model in (5) shows no significant effects of household size.

Comparing (1) and (5) reveals many further insights into the role of sample selection in the initial correlations. Household age, size, and primary education show no significance in (5), suggesting the results from (1) were all driven by sample selection and not underlying demand drivers. The effect of secondary education strengthens slightly, and the effect of tertiary education strengthens substantially when we account for selection. Further, we see a small positive and significant marginal effect of a household being married on the demand for insurance.

Finally, the role that income and formal employment play are shown to have been underestimated before we account for selection. Column (5) suggests that an average household that is formally employed compared to an informally or unemployed household has nearly a ten-percentage point higher probability of having some formal insurance coverage. We further drill down into the impact of income on the demand for formal insurance,

(Appendix D). Here, we see that the probability of cover conditional on having supply is monotonically increasing in income. At the most extreme, when a household from Burkina Faso who has one less dollar of daily income than the average, who is otherwise typical in their characteristics, would have a 5% increase in their probability of conditional coverage from an extra $1 USD of income. The is also true for a household in Nepal. Overall, a $1USD increase in daily income typically increases probability of insurance coverage by 1 percentage point conditional on supply.

6 Conclusion and Discussion

This paper examined the landscape of financial services, focusing specifically on the coverage and demand for formal insurance from a cross-country individual level dataset collected from sixteen developing countries in Asia and Africa. This first of its kind analysis of such a large individual-level dataset from sixteen countries gave us the ability to gain a snapshot of financial inclusion and its drivers, particularly among poor countries and people. Increasingly the impacts of climate change and migration as a result of globalisation are being felt throughout communities, impacting those that are the poorest and most vulnerable the worst. Thus, a study of this nature allows for the investigation of key demographic and economic factors influencing the uptake of financial services that can enable poor people to cope with shocks, build risk and develop resilience in a fast-changing world. Our results offer insights into three dimensions of financial services i.e. savings, borrowings and formal insurance across sixteen developing countries. Our data shows that of all survey respondents 44 percent use some form of savings, 30.46 percent use borrowing, and 16 percent have insurance. There are clear differences across regions as we found higher formal savings rate among Asian countries (29.83 %) as compared to African countries (21.28%). However, the rate of informal saving was similar for both Asian (29.23%) and African countries (30.14%). For borrowings, we found higher rate of formal borrowing among Asian countries (20.25%) as compared to African countries (7.84%)), while borrowing from informal sources was higher for Africa (20.48%) as compared to Asian countries (16.26%). Further, our results show low rate of borrowings from Commercial Banks (5.17%) across all the countries surveyed. Overall, we found that savings and borrowing from informal sources play an important role in the financial planning of adults in many developing countries of Asia and Africa. The lack of healthcare or healthcare products across the survey respondents in both Asia and Africa was a notable absence, which will significant impact household risk mitigation.

For insurance the overall uptake of any kind of insurance products across the sample was 16%. Importantly the overall results were largely influenced by high uptake of funeral insurance as compared to other insurance such as crops and property. In some countries such as Lesotho and Thailand we found the entire uptake of insurance market to be largely driven by funeral insurance products, indicating large asymmetry in uptake of different insurance products. Although examining all the factors leading to such skewed demand patterns of certain type of insurance was beyond the scope of the paper, we investigated individual characteristics affecting the probability of having insurance in the surveyed countries.

Confirming earlier studies on demand for insurance, we found that income, education level, age and formal employment all positively and significantly influence the probability of having insurance across all countries surveyed. However, the income elasticity to probability being insured is heterogeneous across countries, and our results do indicate that higher level of income might not necessarily translate into higher probability of being insured across all countries. Countries such as Cambodia, Cameroon, Madagascar, Eswatini, and Nepal show a high level of income elasticity to probability of being insured whereas Thailand, Myanmar, and Laos show a low level of elasticity. Our results on income elasticity indicates that, while in some countries such as Cambodia and Cameroon increasing income levels or higher economic growth can boost higher insurance uptake, in some other countries such as Thailand and Myanmar, higher income might not lead to higher uptake of insurance uptake implying roles of many other factors influencing insurance uptake.

Our approach of examining bivariate relationship between probability of being insured and income require further research and cannot capture all other country specific economic characteristics such as the demographic and socio-economic characteristics. This also underlines why it is important to look beyond demand side factors: our analysis on drivers of demands for insurance, conditional on having supply of insurance through the sample selection model reveal that correcting for the selection bias of availability of insurance, demographic variables play a limited role in affecting demand for insurance. However, when we look at the probability of having supply of formal insurance, we found positive marginal effect of mean age and mean proportion of formally employed adults. This result indicates that supply of insurance tends to be concentrated in areas with higher formally employed and older adults.

Environmental and health shocks can have potentially negative impacts on the poor and vulnerable population in the developing countries. Our analysis also investigated the impacts of environmental shocks on income and their coping mechanisms to deal with these risks. (Appendix E and F). Our regression analysis reveals that experiencing a flooding or storming event reduces income by 3.5% and experiencing flood/drought reduces income by 6% and experiencing drought or low rainfall makes a household about 4% more likely to be in poverty. Although further research is needed our results indicate income reducing impacts of shocks. Our analysis of the coping mechanism to shocks reveals that while savings and borrowings are important coping mechanism for health shocks, relying on savings and insurance is more common for environmental shocks such as droughts.

Our analysis underlines the importance of better understanding the needs and requirements of those exposed to shocks in order to support financial inclusion. Access to finance is an important aspect in addressing poverty, however it is not a panacea and there are many examples of failed attempts where financial services and products were not designed with local needs and requirements in mind. It is therefore essential to consider what type of products are most suitable in economic terms as well as socially and with a view on wider societal resilience in the face of climate change. Far too often the question about effectiveness, value for money and wider development benefits remain unanswered (Surminski et.al. 2019). In trying to make financial instruments work for better poverty alleviation, it is critical to consider the realities of the consumers from a demand perspective and creating inclusive financial markets by removing supply bottlenecks for those most in need. In addition there remain questions about equity and fairness, particularly in the context of climate change and dealing with risks: what social contracts exist to address rising risks, are instruments based on solidarity or responsibility concepts of dealing with shocks, what distinctions are being made between the poor and most vulnerable and others at risk? (Lynnerooth- Bayer et.al. 2018) These questions go beyond this paper but are important when considering if and how existing efforts to increase financial inclusion can be utilized to deal with climate change risks.

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Appendices

Appendix A: Output from Regressions with Coefficients not Marginal Effects

Table A1: Table 3 but with Coefficients not Marginal Effects

Insurance:	(1) Any	(2) Crop	(3) Medical	(4) Life	(5) Property	(6) Funeral
Male HOH	0.0697	0.0265	0.0556	0.0985	-0.0545	0.156**
	(0.0394)	(0.110)	(0.0614)	(0.0586)	(0.135)	(0.0568)
Primary Education	0.114*	0.0483	-0.0568	0.0609	0.0803	0.00265
	(0.0548)	(0.155)	(0.0985)	(0.0798)	(0.230)	(0.0661)
Secondary Education	0.329***	-0.0551	0.166	0.248**	0.206	-0.0991
	(0.0546)	(0.167)	(0.0901)	(0.0782)	(0.229)	(0.0812)
Tertiary Education	0.667***	-0.127	0.374***	0.458***	0.673**	-0.546***
	(0.0650)	(0.175)	(0.107)	(0.0869)	(0.226)	(0.0865)
Age	0.00511***	0.00547	0.00526**	0.0102***	0.00884	0.0110***
	(0.00120)	(0.00315)	(0.00169)	(0.00167)	(0.00461)	(0.00165)
Age^2	-0.000497***	-0.000352	-0.000454***	-0.000325**	-0.000508	-0.000553***
	(0.0000746)	(0.000227)	(0.000112)	(0.000111)	(0.000278)	(0.000106)
Married	0.0711	0.0821	-0.00377	-0.00864	0.0427	0.00974
	(0.0387)	(0.103)	(0.0642)	(0.0574)	(0.150)	(0.0601)
Household size (# of people)	-0.0188**	-0.00498	-0.0414***	-0.0319**	-0.00947	-0.0768***
	(0.00684)	(0.0191)	(0.00921)	(0.0105)	(0.0204)	(0.0117)
Formally Employed	0.459***	0.0401	0.353***	0.273***	-0.00629	0.155*
	(0.0406)	(0.0977)	(0.0469)	(0.0529)	(0.0948)	(0.0632)

Log Daily Income	0.251***	0.111**	0.151***	0.217***	0.207***	0.120***
	(0.0160)	(0.0392)	(0.0184)	(0.0200)	(0.0441)	(0.0219)
Log Daily Income ^2	0.0667***	0.0304	0.0452***	0.0610***	0.120***	0.0490***
	(0.00726)	(0.0299)	(0.00924)	(0.0112)	(0.0231)	(0.0104)
Farming Household	0.0326	0.638***	-0.0471	0.0778	-0.349**	0.358***
	(0.0367)	(0.107)	(0.0522)	(0.0474)	(0.115)	(0.0611)
Rural Household	-0.155***	0.112	-0.240***	-0.221***	-0.190	0.00712
	(0.0397)	(0.0994)	(0.0594)	(0.0485)	(0.121)	(0.0815)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	49,531	29,376	49,531	49,531	46,345	22,251
Pseudo R-sq	0.388	0.291	0.242	0.292	0.249	0.436
df_m	13	13	13	13	13	13

Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.10. Standard errors clustered at the survey stratum level (2,592 clusters in full dataset). We use a Probit model specification, presenting the average marginal effects above, with standard errors recovered via delta method. Household survey weights used. Both Age and Ln(Daily Income) have been demeaned at the country level and winsorised at the 0.05 and 0.95 percentile. Education dummy variables relative to No Education. The difference in sample size reflects the fact that some of our country surveys did not include questions on certain products.

Table A2: Table 7 but with Coefficients not Marginal Effects

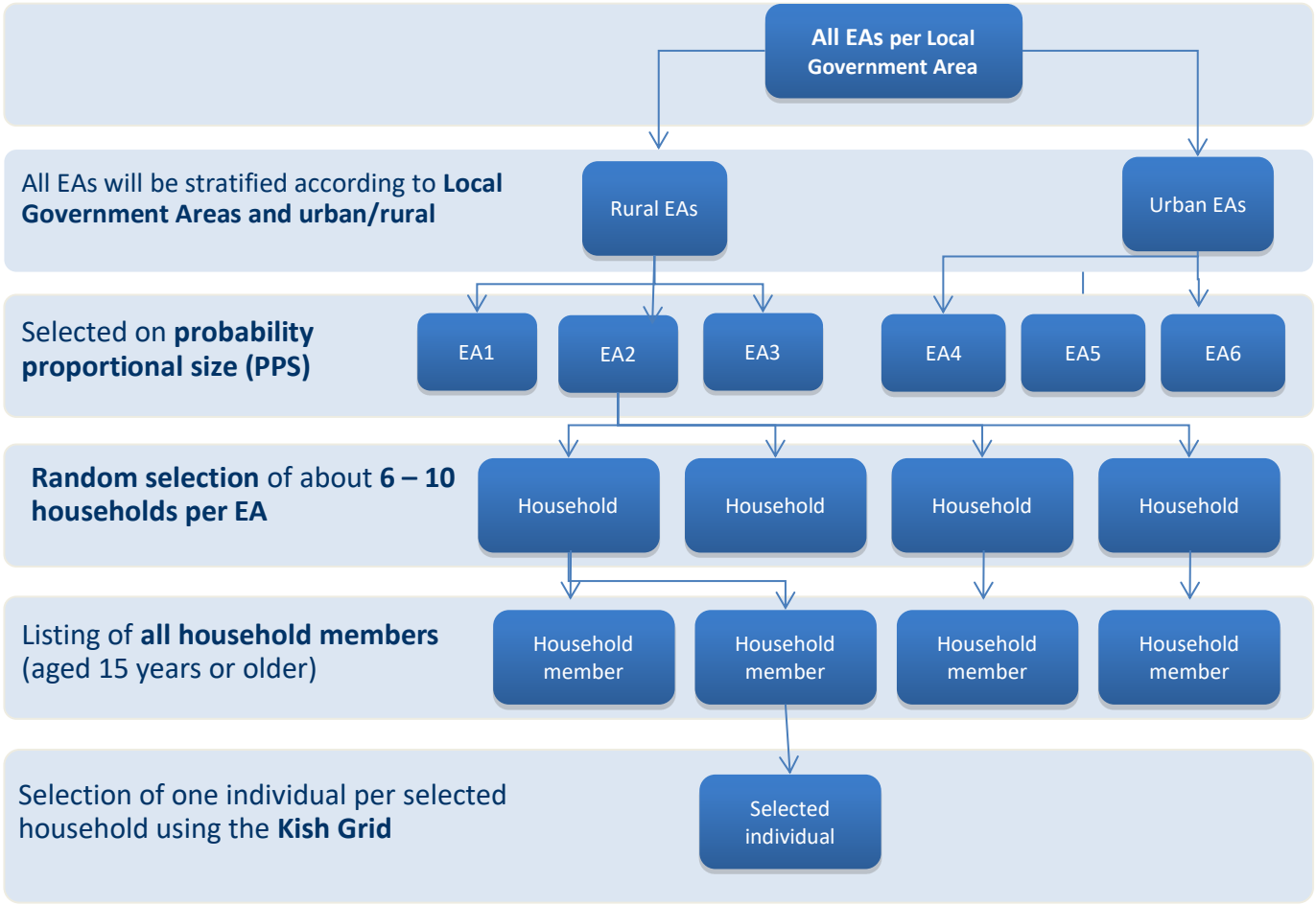
	(1) Probit: Country dummy variables	(2) Probit: Market dummy variables	(3) 1st Stage Heckprobit: Market-level means used for all regressors, Country dummy variables	(4) 1st Stage Heckprobit: Market-level means used for all regressors, Market dummy variables	(5) Full Heckprobit (Using (4) as first stage)
Dependant Variable:	Probability of being insurance)	(Probability of being insurance)	(Probability of having access to insurance)	(Probability of having access to insurance)	(Probability of being insured, conditional on having access)
Male HOH	0.0697 (0.0394)	0.0653 (0.0398)	0.139 (0.827)	0.527 (0.694)	0.0810 (0.0462)
Primary Education	0.114* (0.0548)	0.0971 (0.0561)	0.662* (0.290)	0.140 (0.273)	0.0892 (0.0652)
Secondary Education	0.329*** (0.0546)	0.320*** (0.0557)	1.032 (0.551)	0.461 (0.367)	0.292*** (0.0650)
Tertiary Education	0.667*** (0.0650)	0.678*** (0.0671)	0.0986 (0.719)	0.672 (0.524)	0.598*** (0.0742)
Age	0.00511*** (0.00120)	0.00459*** (0.00123)	-0.00314 (0.0222)	0.0264* (0.0114)	0.00368** (0.00140)
Age Squared	-0.000497*** (0.0000746)	-0.000471*** (0.0000773)	-	-	-0.000493*** (0.0000882)
Married	0.0711 (0.0387)	0.0845* (0.0398)	0.274 (0.552)	-0.209 (0.712)	0.0895* (0.0444)
Household size (# of people)	-0.0188** (0.00684)	-0.00675 (0.00742)	0.0995 (0.0775)	-0.140 (0.0795)	-0.0138 (0.00826)
Formally Employed	0.459*** (0.0406)	0.460*** (0.0406)	0.151 (0.590)	1.034** (0.374)	0.410*** (0.0465)

Log Daily Income	0.251*** (0.0160)	0.267*** (0.0168)	-0.298 (0.173)	-0.0680 (0.104)	0.285*** (0.0185)
Log Daily Income^2	0.0667*** (0.00726)	0.0666*** (0.00749)	-	-	0.0702*** (0.00875)
Farming Household	0.0326 (0.0367)	0.0379 (0.0372)	-1.187*** (0.359)	-0.122 (0.275)	0.0938* (0.0429)
Rural Household	-0.155*** (0.0397)	-2.196*** (0.195)	0.384** (0.142)	1.614** (0.581)	0.0112 (0.0533)
Fisher's Correlation Coefficient	-	-	-	-	0.136 (0.118)
Location Dummy:	Country (14)	Sub-country (248)	Country (14)	Sub-country (248)	Country (14)
N	49,531	46,686	58,994	56,353	56,607 (30,121 selected)
Pseudo R-sq	0.388	0.383	0.334	0.376	
LogLikelihood (1k)	6,962	6,640	16,803	13,690	19,373
df_m	25	174	23	176	205
Chi Squared (1k)	2.8	-	1.5	-	296,620

Appendix B: Sampling Methodology for the Fin Scope surveys

Our study is based on a unique pooled dataset of 65,916 adults in 16 developing countries in Africa and Asia surveyed during 2011-2018. The data is generated from sixteen different rollouts of the Fin Scope Consumer Survey – a nationally representative household-level questionnaire, which investigates how individual adults (15 years of age or older) source their income and manage their financial lives in the face of financial shocks. These surveys were conducted as part of the Making Access Possible (MAP) programme, initiated by the United Nations Capital Development Fund (UNCDF) and implemented in partnership with Fin Mark Trust and the Centre for Financial Regulation and Inclusion (Cenfri). Each of the individual surveys was constructed using stratified multistage random sampling techniques, and weighted to transform individual and household observations into nationally representative population estimates. The sampling design has been described in Figure 1 below:

Figure B1: Diagram of generic Fin Scope sampling design



For each country, the FinScope survey employed systematic random sampling with the following procedure: (Refer to Figure 1)

Step 1: The household lists and maps for each selected enumeration areas (EAs) was provided to the supervisors and then the supervisors updated the lists with the village/ ward administrator.

Step 2: The total number of households (within the selected cluster) was divided by sample size to get an interval.

Step 3: A random number between 1 and the interval was generated.

Step 4: Suppose the random number was 2, the third household from the starting point on the list was selected for the first interview. The next household was identified by adding the interval.

Appendix C: Econometric Specifications

This appendix outlines the econometric models we use – which underpin all our findings on what household characteristics are associated with higher or lower probability of having insurance cover. We also discuss how we approach the Heckman-Probit model to get a better identification of the demand-side drivers of insurance coverage.

Econometric Specification 1: Probit

The lack of supply and demand identification not-withstanding, we can learn a lot from the simple Probit model. Most of the covariates are plausibly exogenous (e.g. gender). We also utilize country-level dummy variables, as well as adjust all continuous variables (income, age, household size) to be demeaned at the country level. Below we provide the probit model specification using a latent variable approach:

$$y_i^* = x_i'\beta + z_k'\gamma + \varepsilon_i \quad \varepsilon_i \sim N(0, \sigma_k^2),$$
$$y_i = \begin{cases} 1 & y_i^* > 0 \\ 0 & o.w. \end{cases}$$

Where *i* is the individual/household index, and *k* is the country-index used for clustering of the standard errors. Here y_i^* is an axillary random variable for the conditional probability of insurance. Then the observed binary outcome y_i inherits the sign of the latent variable, with $y_i = 1$ denoting that household *i* holds the relevant insurance product. x_i is a matrix of demographic variables for household *i* (including age, income, household size, farming/non-farming, rural/urban, etc). The vector z_i contains country dummy variables, meaning we should interpret all the marginal effects derived from the β coefficients as within-country deviations.

Econometric Specification 2: Heckman Sample Selection Model

Second, we run a Probit-Heckman sample selection model to estimate the factors affecting the choice to hold insurance. Unlike the simple Probit model, here we attempt to correct for the conditional probability that an individual has no access to insurance. The equation structure is given as:

$$y_i^* = x_i'\beta + z_k'\gamma + \varepsilon_i$$
$$d_i = m_i'\delta + v_i$$

$$y_i = \begin{cases} 1 & y_i^* > 0,\ d_i > 0 \\ 0 & o.w. \end{cases}$$

$$\begin{pmatrix} \varepsilon_i \\ v_i \end{pmatrix} \sim N\left(\mathbf{0}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right)$$

The first equation above is the same latent equation as in the Probit model. The second equation is our selection equation, where d_i is a dummy variable for whether an individual has insurance coverage available in their market (1 = yes) The error structure for the selection and outcome equation allows for correlation, ρ , between selection and uptake unobserved effects (although we find no significant evidence in our application to support that $\rho > 0$).

A key part of the methodology for the Heckman-Probit model is the construction of our selection variable, d_i . To back-out selection from our survey data we first break the data into 'markets' which are geographic groups of between approximately 20-600 households (the median market size is 146). Next, we let $d_i = 0$ for all households that belong to a market where 80% or more of households stated the reason they didn't have insurance was "they had never heard of it", "did not know what it was", or "do not believe it is available to them". We have this data for almost all of the survey respondents and take it as a measure of the market having some supply of insurance. The 80% threshold[5] is employed so as to not be too strict on the sample of selected households, but ensure we have a decent proportion of selected and unselected households. In the selection equation, m_i' is a vector of *market-level* covariates for each household. This includes all the same variables as in the outcome equation but takes their market-level means instead of the household-specific value. For example, if a given household is in a market with 50 formally employed households and 50-informally employed households then the value of the variable $\text{formal employment}_i = 0.5$. The logic of this approach is that individual household characteristics will not impact the probability of a given market being supplied, but the overall demographics of this market may well have an impact. We also use market-level dummy variables in the first stage. The upside of this is we get a very good fit for predicting whether a household is supplied. The downside is that, because have 1,319 distinct markets, we do not gain much insight into the drivers of supply. A separate first-stage regression without the market dummy variables is given to offer some guidance on this supply issue, but our focus in this paper will be on contrasting the simple probit results with the Heckman-Probit final results.

5 We check the robustness of the results to the 0.8 threshold, and we also test for other market definitions. The results are robust to thresholds of 0.7-0.9. When we increase the market size (e.g. to areas with an average size of 1,000) the results begin to loose significance as we are drastically reducing the variation in the data at that point.

Appendix D: Predicted Probability of Insurance Cover conditional on having some supply (Demand)

	Probability of having some formal insurance, conditional on available supply (Demand) at different income levels										
Deviation from within country mean income ($USD)	-$5	-$4	-$3	-$2	-$1	$0	$1	$2	$3	$4	$5
Burkina Faso	0.00	0.00	0.01	0.02	0.05**	0.10***	0.17***	0.25***	0.33	0.40	0.45
	(0.002)	(0.008)	(0.021)	(0.031)	(0.023)	(0.028)	(0.039)	(0.054)	(0.225)	(0.517)	(0.913)
Cambodia	0.15***	0.16***	0.16***	0.17***	0.18***	0.18***	0.18***	0.19***	0.19***	0.19***	0.19***
	(0.038)	(0.039)	(0.040)	(0.042)	(0.044)	(0.046)	(0.048)	(0.049)	(0.051)	(0.052)	(0.053)
Cameroon	0.06***	0.07***	0.08***	0.10***	0.11***	0.13***	0.15***	0.18***	0.20***	0.23***	0.26***
	(0.021)	(0.021)	(0.020)	(0.021)	(0.023)	(0.025)	(0.029)	(0.033)	(0.037)	(0.040)	(0.044)
DRC	0.01	0.01*	0.01**	0.02***	0.02***	0.03***	0.03***	0.04***	0.04***	0.05***	0.06***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.007)	(0.008)	(0.010)	(0.011)	(0.013)
Laos	0.25***	0.26***	0.28***	0.30***	0.32***	0.33***	0.35***	0.37***	0.38***	0.40***	0.42***
	(0.049)	(0.047)	(0.047)	(0.047)	(0.048)	(0.050)	(0.053)	(0.055)	(0.058)	(0.060)	(0.062)
Madagascar	0.03	0.03	0.04*	0.04***	0.05***	0.05***	0.06***	0.07***	0.07***	0.08***	0.09***
	(0.029)	(0.024)	(0.019)	(0.014)	(0.011)	(0.011)	(0.013)	(0.017)	(0.020)	(0.022)	(0.024)
Myanmar	0.14***	0.15***	0.16***	0.17***	0.18***	0.18***	0.19***	0.20***	0.21***	0.21***	0.22***
	(0.046)	(0.045)	(0.045)	(0.045)	(0.046)	(0.047)	(0.048)	(0.049)	(0.049)	(0.050)	(0.050)
Nepal	0.02**	0.03***	0.05***	0.08***	0.12***	0.17***	0.22***	0.28***	0.34***	0.41***	0.47***
	(0.009)	(0.011)	(0.013)	(0.016)	(0.020)	(0.025)	(0.031)	(0.037)	(0.044)	(0.055)	(0.071)
Eswatini	0.22**	0.19***	0.18***	0.18***	0.19***	0.22***	0.27***	0.35***	0.44***	0.57***	0.70***
	(0.091)	(0.054)	(0.032)	(0.025)	(0.029)	(0.035)	(0.039)	(0.041)	(0.044)	(0.057)	(0.078)
Thailand	0.64***	0.66***	0.67***	0.68***	0.70***	0.71***	0.72***	0.73***	0.74***	0.75***	0.76***
	(0.019)	(0.020)	(0.020)	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Togo	0.10***	0.11***	0.12***	0.14***	0.15***	0.17***	0.18***	0.20***	0.22***	0.24***	0.26***
	(0.034)	(0.031)	(0.029)	(0.028)	(0.029)	(0.031)	(0.033)	(0.037)	(0.040)	(0.043)	(0.046)
Zimbabwe	0.18***	0.21***	0.25***	0.28***	0.32***	0.36***	0.40***	0.43***	0.47***	0.50***	0.53***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)
Global:	0.21***	0.22***	0.23***	0.24***	0.25***	0.26***	0.27***	0.28***	0.29***	0.30***	0.31***

	(0.023)	(0.024)	(0.025)	(0.026)	(0.027)	(0.027)	(0.028)	(0.029)	(0.030)	(0.031)	(0.032)

N=49,531. Standard errors in parenthesis. ***p<0.01, **p<0.05, *p<0.10. All other explanatory variables held at their means. These results are obtained from the estimation of the 'Heckprobit' model (Table 13 (4)-(5)), with additional interactions between income and country dummy variables for full flexibility. Standard errors clustered at the stratum level. Botswana, Malawi and Lesotho are all omitted because they lack enough power in the data, or because of missing data. Standard errors recovered using the delta method.

Appendix E: Overview of Environmental shocks and coping mechanisms

Coping Strategies	**Environmental Risks (Total %)**	**Health Shocks (Total %)**
Borrowed	17.19%	12.60%
Savings	22.24%	17.82%
Insurance	18.74%	8.77%
Family and Friends	1.07%	4.32%
Sold Assets	7.09%	7.55%
Did Nothing	9.67%	2.21%

Note: Multiple Response on Coping Mechanisms

Appendix F: **The economic impact of environmental and health shocks on poverty**

Dependent Variables	USD_DAILY	USD_DAILY	USD_DAILY	USD_DAILY	Probability above poverty line	Probability above poverty line	Probability above poverty line	Probability above poverty line
Gender = 2, Male	0.477*	0.742***	0.765***	0.959***	0.134***	0.202***	0.156***	0.242***
	(0.261)	(0.242)	(0.264)	(0.251)	(0.0280)	(0.0303)	(0.0358)	(0.0395)
Education_HOH = 2, Primary	1.051***	-0.396*	1.131***	-0.273	0.326***	0.0457	0.357***	0.0378
	(0.223)	(0.237)	(0.217)	(0.237)	(0.0342)	(0.0395)	(0.0408)	(0.0487)
Education_HOH = 3, Secondary	1.835***	1.593***	1.568***	1.106***	0.224***	0.216***	0.249***	0.180***
	(0.621)	(0.555)	(0.348)	(0.320)	(0.0383)	(0.0423)	(0.0496)	(0.0549)
Education_HOH = 4, Tertiary	7.141***	5.776***	4.735***	3.062***	0.595***	0.467***	0.741***	0.544***
	(0.844)	(0.825)	(0.723)	(0.658)	(0.0685)	(0.0802)	(0.114)	(0.138)
Main_income_source = 3, Formal	3.161***	1.868**	4.097***	3.177***	0.578***	0.520***	0.618***	0.580***
	(0.719)	(0.726)	(1.002)	(0.938)	(0.0535)	(0.0590)	(0.0721)	(0.0821)
Main_income_source = 5, Informal	-1.011***	-1.554***	-0.740***	-1.117***	0.109**	0.105*	0.0808	0.0344
	(0.352)	(0.369)	(0.250)	(0.262)	(0.0549)	(0.0556)	(0.0760)	(0.0744)
Main_income_source = 6, None	-63.61***	-63.06***	-36.82***	-36.38***	-3.131***	-3.589***	-3.053***	-3.346***
	(20.35)	(20.38)	(7.183)	(7.233)	(0.113)	(0.115)	(0.148)	(0.156)
Main_income_source = 7, Other	-2.989**	-3.045***	-2.793***	-2.951***	0.133***	-0.288***	-0.00332	-0.381***
	(1.306)	(1.139)	(0.886)	(0.865)	(0.0498)	(0.0555)	(0.0661)	(0.0711)
Main_income_source = 8, Pension	-3.661***	-0.391	-2.304***	0.858	0.263	1.195***	0.139	1.148***
	(1.040)	(1.096)	(0.656)	(0.649)	(0.174)	(0.184)	(0.261)	(0.296)
Main_income_source = 9, Remittances / transfers	-0.418	-1.357***	-0.247	-1.012***	0.0186	-0.215***	0.0117	-0.231***
	(0.340)	(0.421)	(0.332)	(0.315)	(0.0389)	(0.0427)	(0.0453)	(0.0499)
Main_income_source = 10, Self	3.229***	2.611***	3.353***	2.852***	0.374***	0.245***	0.360***	0.258***
	(0.544)	(0.536)	(0.535)	(0.521)	(0.0464)	(0.0522)	(0.0601)	(0.0704)
Marital_hoh = 2, Unmarried	-1.465***	-1.211***	-1.113***	-0.871***	-0.125***	-0.0938**	-0.137***	-0.131**
	(0.415)	(0.404)	(0.218)	(0.221)	(0.0329)	(0.0364)	(0.0459)	(0.0520)
Age_hoh	0.0501**	0.00936	0.0296***	-0.00776	0.00706***	-0.00109	0.00946***	0.000269

	(0.0250)	(0.0269)	(0.00683)	(0.00808)	(0.00107)	(0.00118)	(0.00143)	(0.00160)
House_members	-0.155**	0.0367	-0.133***	0.0585	-0.0209***	-0.00110	-0.0201***	-0.00291
	(0.0753)	(0.0758)	(0.0382)	(0.0408)	(0.00517)	(0.00574)	(0.00623)	(0.00706)
Rural_urban = 2, Urban	2.120***	2.819***	2.219***	-	0.193***	0.311***	0.264***	0.357***
	(0.529)	(0.597)	(0.601)		(0.0327)	(0.0376)	(0.0454)	(0.0553)
Farmer_HH = 2, Yes	-1.028*	-0.739	-	-0.242	-0.0517	-0.0164	-	-
	(0.548)	(0.515)		(0.274)	(0.0356)	(0.0382)		
Environmental_shock_biary	0.418	-0.101	0.116	-1.559***	-0.121***	0.0124	-0.149***	0.00961
	(0.301)	(0.284)	(0.244)	(0.285)	(0.0285)	(0.0305)	(0.0324)	(0.0332)
Health_shock_binary	-2.711***	-0.897*	-3.031***	-0.0760	-0.2898***	-0.168***	-0.305***	-0.145***
	(0.416)	(0.464)	(0.302)	(0.628)	(0.0255)	(0.0270)	(0.0331)	(0.0351)
Country Fixed Effects	No	Yes	No	Yes	No	Yes	No	\Yes
Farming Households Only	No	No	Yes	Yes	No	No	Yes	Yes
Constant	3.314***	-1.350	3.664***	-0.0760	-0.130	-0.837***	-0.312***	-0.945***
	(1.124)	(1.736)	(0.463)	(0.628)	(0.0793)	(0.0983)	(0.0915)	(0.111)
Observations	36,486	36,487	22,177	22,177	36,496	36,496	22,103	22,103
Robust standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

	(1) Log Daily Income (USD)	(2) Log Daily Income (USD, Demeaned)	(3) Probability (Below Poverty Line)
Flooding, Storms	-0.116***	-0.0356	-0.0103
	(0.0330)	(0.0267)	(0.0140)
Drought, Low Rainfall	-0.150***	-0.0616**	0.0399**
	(0.0287)	(0.0239)	(0.0144)
Control variables	All / No fixed effects	All / Fixed effects	All / Fixed effects

N	57,152	57,152	62,391
R-sq	0.058	0.045	0.210
F	86.32	126.8	54.90
df_m	9	9	9
df_r	7,814	7,814	8,406

Standard errors in parentheses. Standard errors clustered at the survey stratum level (2,592 clusters)