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Too Certain to Invest? Public Safety Nets and Insurance Markets in Ethiopia

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Summary. — Researchers' efforts to introduce index insurance in developing countries have met with little demand despite its great potential to help farmers mitigate economic risk. I argue that researchers have overlooked institutional context's critical role in the formation of private markets when designing insurance contracts. Using micro-level evidence from Ethiopia, I show that recipients of a preexisting effective, large-scale public safety net fail to take-up a new highly subsidized private insurance offer. Government safety net programs can decrease demand for private index insurance, forming an additional barrier to index insurance take-up. A direct implication of this research is that policymakers should design private and public insurance products that account for, or even complement, each other.

Key words — index insurance, safety net, institutional context, Africa, Ethiopia

1. INTRODUCTION

Economic risk is critical for the large population living in rural areas of developing countries, where a bad harvest can mean forgoing food consumption or selling productive assets. Household-level impacts on health and well-being have aggregate effects on economic growth and broader development objectives. Despite the great potential for insurance to help farmers, numerous recent experimental studies offering index insurance were met with surprisingly low demand. This paper adds to the growing literature delineating barriers to index insurance take-up by demonstrating that pre-existing public safety net programs decreased demand for private index insurance.

Government programs change the incentives to participate in private arrangements. Policymakers and researchers are attempting to introduce index insurance to farmers, a form of insurance that is indexed to measures of weather, such as rainfall, that are highly correlated with yields. However, governments or international organizations may also be operating in this environment, providing farmers with transfers, such as food aid or cash, to help them cope with weather shocks. In some cases, the government transfers reduce households' risk exposure or provide competing state-contingent transfers that decrease demand for private insurance.

This paper uses data from a recent pilot program in the Amhara region of Ethiopia that offered farmers an insurance product to cover losses in crop inputs caused by insufficient rainfall. Adoption was extremely low despite the study farmers residing in an extremely risk-prone region and even among the subsample of farmers offered highly discounted insurance. The study region partially overlaps with villages receiving the Productive Safety Net Program (PSNP), a large public safety net program, which comprises both a transfer and insurance component, intended to increase resiliency to shocks. A propensity score-matching technique is used that attempts to isolate the characteristics of households that receive PSNP in order to present the treatment effect of PSNP on insurance take-up. Results show that in PSNP villages and among PSNP beneficiaries, demand for index insurance was significantly lower than the already low levels observed elsewhere. The provision of PSNP formed an additional barrier to index insurance take-up.

A number of additional tests, based on the rules governing PSNP's distribution, confirm that PSNP decreases demand for private index insurance. PSNP is first targeted at the village level and then at the household level, with some annual adjustments occurring among household recipients due to changes in need. Therefore, non-PSNP recipients within PSNP villages can reasonably expect to receive PSNP, or share in recipients' benefits, unlike residents of non-PSNP villages. Within the study region, individuals who reside in villages that receive PSNP purchased less private insurance than non-PSNP villagers, irrespective of their current beneficiary status. And, this effect compounds the greater the share of villagers receiving PSNP. Finally, among individuals who receive PSNP, those with a stated confidence in district government or who have political connections bought less index insurance than PSNP beneficiaries lacking such confidence or connections. These four tests support the explanation that individuals with a greater ability to access government support are less likely to purchase market index insurance.

This paper attempts to help understand the disconnect between the promise and reality of index insurance, and offers policy solutions to it, by highlighting how public programs can compete with private insurance. Although the particular index insurance offer examined here was not commercially sustainable irrespective of the public safety net program, the large and significant effects found in this study show that public programs are an important component of insurance demand. Increasing the viability of index insurance will require consid-

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ering whether preexisting risk-management arrangements will interact with index insurance and designing the products to complement each other.

2. INSTITUTIONAL CONTEXT

(a) *Institutional influences on insurance demand*

Private insurance markets are missing in many areas of developing countries despite great potential benefits. A large body of evidence exposes the debilitating impacts that vulnerability, risk, and economic shocks have on the livelihoods of the poor in developing countries (Baulch & Hoddinott, 2000; Dercon & Krishnan, 2000; Morduch, 1995; Yamano, Alderman, & Christiaensen, 2005). Lack of insurance also has economy-wide consequences as uninsured individuals are deterred from taking on loans and growth-enhancing investments, such as productivity-enhancing technologies. Moral hazard, adverse selection, and lack of contract enforcement are well-established explanations for the lack of private insurance supply in developing countries.

Policymakers' anticipation for the introduction of private insurance markets grew over the past decade with the formation of a new insurance product. The product, index insurance, overcomes the fundamental supply problems that inhibit the formation of insurance markets in developing countries: that insurance providers cannot know the risk level nor monitor the risk-taking behaviors of beneficiaries, and oftentimes, operate in an environment where they cannot enforce their contracts (Finkelstein & McGarry, 2006; Rothschild & Stiglitz, 1992). Index insurance overcomes these problems by basing individuals' payments on an exogenous, publicly observable index (such as local rainfall) that is easily measured and not manipulable (Barnett, Barrett, & Skees, 2008).

The introduction of formal, private insurance in developing countries revealed that the missing market for insurance is largely attributable to determinants of demand and not just supply. Demand for insurance products, especially to cover losses related to agriculture, should theoretically be high in developing countries: large swaths of the population are uninsured despite the vast majority of their income fluctuations deriving from frequent, observable variation in rainfall. Yet, numerous recent experimental studies offering insurance to farmers reveal that they buy the least amount of coverage possible in the rare instances that they do purchase insurance (Binswanger-Mkhize, 2012; Cole, Giné, Tobacman, Townsend, Topalova, & Vickery, 2013; Giné & Yang, 2009, with the exception of Norton *et al.*, 2014). A growing literature provides explanations for the lack of demand, including high price elasticity, liquidity constraints, and lack of trust in the product (Cole *et al.*, 2013).

The logic for private insurance markets in Ethiopia is particularly compelling. In comparison to many other African countries, Ethiopian state capacity is strong and the economy is growing (Dercon, Hoddinott, & Woldehanna, 2012) but the environment is extremely risk-prone. Ethiopia remains an agrarian-based economy that suffers from high poverty rates and frequent droughts. Demand for agricultural index insurance within the study region should be particularly high, as the study team selected the region because of its agricultural potential and susceptibility to droughts. Furthermore, the study offered price discount vouchers to a subsample of the study population.

The logic for private insurance markets in Ethiopia becomes less compelling after taking into consideration the presence of a large, institutional competitor to private insurance and its history of food aid reliance. As yet, the relationship between formal, public insurance programs and private insurance has not been explored in the index insurance demand literature despite the economic literature showing that the provision of public insurance influences participation in the private insurance market (Cutler & Gruber, 1996; Kronick & Gilmer, 2002). That government provision of insurance can substitute for private insurance may not seem surprising. However, it is difficult to isolate PSNP's causal relationship with private index insurance. The causal relationship may be under- or over-estimated without an attempt to control for selection. Even after controlling for selection, PSNP's treatment effect is uncertain: PSNP could theoretically either increase or decrease demand for private index insurance.

In order to assess the relationship between PSNP and private insurance it is important to isolate the characteristics of households that receive PSNP and compare insurance demand among comparable individuals. The different characteristics of PSNP recipients are likely to have countervailing effects on insurance demand. For example, PSNP is targeted toward very low-income households and very low-income individuals have lower demand for index insurance (see Clarke, 2011 on wealth and risk aversion and Hill, Hoddinott, & Kumar, 2013 on models of technology adoption). However, PSNP is also likely to be targeted toward households that are susceptible to droughts and such households have greater demand for index insurance.

Once all the factors that affect selection of households into PSNP are isolated, the treatment effect of PSNP on insurance demand can be determined. PSNP was designed to make households more resilient to income shocks through its two transfer features: one that lowers household sensitivity to income risk (the "risk reducing" feature) and another that compensates households in response to shocks (the "scalable" feature) (a detailed program description is provided in Section 2(b)). Both features could theoretically either increase or decrease demand for index insurance.

PSNP's first transfer feature provides known, timely transfers, year after year, to chronically food-insecure households. These transfers should prevent households from needing to sell off their productive assets in response to shocks. The transfers shift the distribution of expected losses in the event of drought away from extremely bad outcomes, reducing the amount of risk households face. Therefore, PSNP households may demand less index insurance because they are less exposed to risk. Furthermore, households' receipt of the transfers is generally contingent on their participation in public works projects. Many of the projects provide local public goods such as community roads, irrigation, and soil fertility restoration. These public works projects should also decrease households' exposure to weather shocks. Roads, for example, decrease households' sensitivity to shocks by connecting them with other unaffected markets, driving down demand for index insurance.

It is equally possible, however, that PSNP's transfer and public works aspects increase demand for index insurance. The index insurance in question in this paper provided compensation for input costs, although the logic extends to other types of index insurance (for example, index insurance that provides compensation for the value of harvest loss).[1] It may be that households spend their increased income from PSNP on agricultural activities, such as inputs. In this case, they will have increased demand for index insurance because they have larger investments to protect. Or, it may be precisely because PSNP households are less exposed to risk that they

choose to take on more risky agricultural activities, or purchase more expensive inputs, increasing their demand for index insurance. For example, irrigation and expensive inputs may be complements. Households with access to irrigation may thus choose to purchase more index insurance to protect their investments.

The second transfer component of PSNP is transfers to households that experience transitory need. This feature of PSNP can decrease demand for index insurance by forming a substitute to index insurance (a separate channel from the decrease in demand coming from PSNP's "risk reducing" feature). The scalable features of PSNP and index insurance are expected to form substitutes because they both provide state-contingent payouts, hence their payouts are likely to be correlated. PSNP households, and non-PSNP households residing in PSNP villages, receive support to help them meet their food needs when larger shocks occur (by providing extra rations and extending the number of months of support they receive). Officials identify extra PSNP support recipients according to different types of early warning information, including crop and livestock reports and nutrition assessments. The index insurance product studied here was paid out according to households' input purchases (fertilizers and improved seeds). Payments were realized if rainfall measurements at the nearest rainfall station fell below a specified threshold. Although the actual amount paid out by PSNP may be smaller or greater than the amount paid out by the private index insurance product, depending on the households' food needs and the amount of insurance they took up, in general PSNP and index insurance should pay out similarly in response to the same climatic events (e.g., a more severe drought will yield higher PSNP payments because of larger food gaps and higher index insurance payments due to larger losses in input costs).

The "scalable" feature of PSNP also, however, has the potential to increase demand for index insurance. It is possible that these PSNP payments, which depend on realized outcomes, could induce households to take on riskier agricultural activities or invest in more expensive inputs. Households may, for example, choose to invest in expensive fertilizers if they know that PSNP payments will help them meet their food gaps should a climatic contingency occur. They will also be more apt to take-up index insurance to protect their fertilizer investment.

PSNP's targeting rules facilitate additional tests for whether PSNP decreases demand for index insurance. By taking advantage of PSNP's targeting rules at the village and household level, I show that individuals with greater access to PSNP benefits demand less index insurance than those with less access to PSNP benefits.

There is geographical constancy in PSNP targeting at the village level, including for PSNP's scalable feature (e.g., only individuals residing in PSNP villages can receive PSNP).[2] Thus, only individuals in PSNP villages, whether or not they currently receive PSNP, will be likely to expect that they will get support if they experience extra need. If this feature of PSNP competes with index insurance, then individuals in PSNP villages, even if not PSNP recipients, will demand less insurance than individuals in non-PSNP villages. There may also be an indirect effect of residing in a PSNP village that causes individuals to purchase less insurance, through PSNP's risk reducing feature. Even if an individual does not receive PSNP, he may reap some of the benefits by borrowing from friends and relatives who are PSNP recipients. In addition, non-PSNP residents of PSNP villages will be able to access the local public goods generated by PSNP beneficiaries' public works participation. If, as expected, the increase in wealth and access to public works reduce households' risk exposure then these spillover effects should cause individuals who live in a PSNP village, but do not themselves receive PSNP, to take-up less insurance than individuals who live in non-PSNP villages. Furthermore, individuals who live in areas where a greater share of the village receives PSNP, but do not themselves receive PSNP, will take-up less insurance than individuals who live in areas where a smaller share of the population receives PSNP.

PSNP's household-level targeting also permits an examination of whether increased access to PSNP benefits (risk reducing and scalable) lowers demand for index insurance. Caeyers and Dercon (2012) found that in the aftermath of the 2002–03 drought, prior to the advent of PSNP, households with close associates in official positions had more than a 12% higher probability of obtaining free food aid than households that were not well connected. They find that households with local political connections not only have a higher probability of receiving free food they also "get significantly better rewarded in terms of cash or food receipts per working day than households without such connections" (Caeyers & Dercon, 2012, p. 642–3). There is no published evidence on whether or not politically connected individuals remain more likely to obtain government benefits today and, in fact, PSNP has increased targeting oversight and monitoring compared to prior food aid distribution. Nevertheless, a direct implication of Caeyers and Dercon (2012) is that individuals may still hold an expectation of the utility of political connections for receiving benefits, irrespective of whether or not such benefits actually accrue today. Consequently, individuals who get PSNP and are connected to the local political elite will be likely to take-up less insurance than individuals who receive PSNP and are not politically connected.

(b) *PSNP operations*

Beginning in 2002, the Government of Ethiopia and a consortium of donors formed PSNP as a new form of safety net to curb the massive increases in international food assistance. The objectives of PSNP are to provide transfers to the food-insecure population to prevent asset depletion at the household level and create assets at the community level. The program, originally scheduled to end in 2008, has been extended three times. Ten development partners have committed approximately US$2.3 billion for the third phase of implementation (2011–15) and the fourth, which is set to extend PSNP until the end of 2020, is projected to cost more than US$2.6 billion. PSNP covers more than seven million people through direct income support (cash transfer or food), primarily through participation in large-scale public works. Although PSNP is a large program by developing country standards, it only reaches roughly 8% of the Ethiopian population, leaving many deserving people exposed (Berhane, Hoddinott, Kumar, & Seyoum Taffesse, 2011).

PSNP began mainly as an income support program (the risk-reducing feature) and later added an explicit insurance component (the scalable feature). In normal (e.g., non-drought) years, PSNP operates as an income support program by providing transfers to eligible households. The determination of PSNP receipt occurs at both the woreda and the household level. The revised PSNP Program Implementation Manual (PIM) outlines the targeting criteria to be used by government officials and community members to identify program participants. Participation at both levels is based on a determination of being chronically food insecure. At the woreda level, woredas are included if they are located in

one of eight specified regions and if they have been recipients of food aid for a significant period prior to PSNP's advent. Kebeles (villages) located within such woredas are given PSNP.

Woreda officials receive participant numbers from the regional level and must determine how to distribute caseloads across each kebele. Caseload figures are determined broadly by following the PIM's criteria of: population size, rainfall levels and farming potential, average size of landholdings, levels of malnutrition, and the estimated size of the chronically food-insecure population. Similar to the process at the woreda level, in selecting kebele caseloads woreda officials must consider previous relief caseloads.

Household PSNP targeting is primarily a community determination although government administrators determine the number of beneficiaries. Households are considered chronically food insecure if they received food assistance prior to the formation of PSNP, face continuous food shortages, experience a severe loss of assets, and do not have other means of social protection. In assessing the "food gap," the PIM states that the determination be based on family size and number of dependents and status of expected household food production and other sources of income compared with household monthly consumption requirements.

PSNP recipients either receive direct support, if they are unable to work (e.g., elderly, disabled, post-partum women), or are compensated for their engagement in public works. In 2010, the PSNP introduced the principle of Full Family Targeting, which stipulates that every household member in a PSNP household receives a cash or food transfer. Each able adult is required to work for five days per month, six months per year. The choice of food or cash is mainly dependent on grain availability in the market, with cash being the default. Payments are made on a monthly basis with community representatives overseeing the cash payment process. Transfers are set at a level intended to smooth household consumption or fill the food gap over the annual lean period. Wage rates are reviewed annually and adjustments are made based on market food price changes. Benefits can represent the equivalent of approximately 10–40% of annual basic food needs as defined by Ethiopia's national poverty line. The transfers and community projects are intended to help households meet their food needs and prevent asset depletion in response to climate shocks, making them more resilient to future shocks.

PSNP additionally has two explicit insurance features, the contingency fund and risk financing mechanism (RFM), which allows it to scale up in times of transitory crisis. The mechanisms operate in chronically food-insecure woredas that are already receiving PSNP. Transitory needs that exceed this amount are to be covered through the Emergency Response System. In addition to these two mechanisms, PSNP administrators introduced annual retargeting to correct for inclusion and exclusion errors, thus taking into consideration changes in the relative welfare position of households.

PSNP includes a 20% budget for contingency funds. Contingency funds are used to increase caseloads to new beneficiaries or to "top-up" the amount of assistance for current PSNP beneficiaries by giving beneficiaries extra months of support. Individuals included in the contingency fund get the same amount of support as other PSNP recipients (e.g., each person in a PSNP household receives either (1) the cash equivalent of five hours of work at the local wage rate or (2) a set amount of food per person, meant to fill the food gap). Requests for use of contingency funds are justified according to the Early Warning System. The requests are based on market information on crop and livestock prices collected on a weekly basis. The Woreda Early Warning Committee coordinates pre- and post-harvest assessments. District- and village-level officials verify requests in field visits. Some districts also use nutrition surveys to verify need.

In 2009, PSNP started an additional process, the RFM, to cover transitory needs that are more acute than can be handled through the contingency fund. The RFM budget exceeds the contingency fund budget. In 2011, the RFM was triggered to address the transitory food needs for 9.6 million people, 6.5 million of whom were existing clients (who received an additional three months of rations on top of the usual six months of support). The RFM program is also linked to the Early Warning System and focuses predominantly on the distribution of free food, although it also contains elements of health, nutrition, water, and education. Households receive a full ration (2,100 kcal), which is larger than what PSNP clients normally receive. The contingency fund and RFM thus serve as explicit insurance to individuals residing in PSNP villages.

The Government of Ethiopia set Food Security Program graduation targets, including graduation from PSNP, with administratively set quotas. Households are supposed to graduate from the program if they accumulate an asset and income level that enables them to meet 12 months of food needs and to withstand modest shocks. However, understanding of the graduation process is unclear at the beneficiary level. Due to beneficiaries' confusion about the graduation process, as well as their ability to receive PSNP when they experience extra need, it is likely that despite the push for graduation, households will still take PSNP into consideration when deciding whether to purchase index insurance.

(c) *The private insurance project*

Private insurance was recently piloted via a randomized project of over 15,000 farmers in the Amhara region of Ethiopia during 2010–14. The project was designed by a research team from the University of California, the United Nations Food and Agriculture Organization (FAO), the Joint Research Center of the European Commission, University of Athens, and the Ethiopian Economics Association (EEA), an independent Ethiopian research organization. The largest private insurance company in Ethiopia, Nyala Insurance Company (Nyala), administered the insurance.

The project offered farmers rainfall index insurance which insured against losses in input costs caused by inadequate rainfall. Originally, the project sought to randomize both provision of insurance as well as interlinked insurance with credit. However, due to implementation issues, the credit was never successfully rolled out during the time period analyzed in this study, thus the treatment consisted of only a randomized insurance offer. The intent of the project was to determine whether access to index insurance would increase fertilizer use and consequently decrease poverty by spurring agricultural productivity. The research team was driven by the finding that fertilizer use, while profitable, is risky. Ethiopians farmers work under rainfed conditions and face variable rainfall. When confronted with the potential for investment loss, farmers respond by inefficiently using inputs because of lack of insurance (Dercon & Christiaensen, 2011). The research team's analysis within the study region supports these conclusions. They found that risk-related variables, such as the experience of drought in the previous year and risk aversion, as well as credit constraint variables, negatively affect farmers' demand for fertilizer (McIntosh, Sarris, & Papadopoulos, 2013).

The index insurance project farmers could purchase insurance prior to the planting season for a specified crop and

quantity of land to cover losses up to the total cost of inputs. In the event of a drought, compensation would be determined according to a calculation based on the crop grown, the location, and the amount of rainfall. A typical product offered involved paying roughly 500–1000 birr (approximately $38–75) in premiums to insure 4000 birr (approximately $300) worth of input purchases for one hectare of land.

The project's original design consisted of a randomized insurance offer in 80 treatment villages. Households within selected kebeles were randomly sampled to participate in the study. In each village, 18 cooperative households and two households that were not members of the primary cooperative were selected. The original sample thus consisted of 2,400 households, across 120 kebeles (80 treatment and 40 control). The choice of kebeles was non-random but instead was designed on the basis of the informed opinion of Nyala as to where in the Amhara region the market for insurance has the best potential. Randomization of treatment assignment was done within the selected high potential kebeles. In 2010, a baseline survey was administered to the 2,400 households in the study (the "baseline" sample). Out of the original 2,400 households, sample weights are available for 2,114 households (the "baseline with weights" sample).

There were implementation problems with the study that reduced the number of study households. Due to the limited availability of acceptable rainfall records, the number of study kebeles had to be restricted after the baseline study. Teams from Nyala traveled to the 34 (down from 80) villages that had been randomly assigned to treatment, to provide information and market the insurance product. However, the information was not directly conveyed to farmers in all the villages, but instead was sent through Ministry of Agriculture officials, "model farmers," and local extension agents. It is unclear whether the information about the nature of the insurance contracts was transmitted clearly to all farmers. Lack of product understanding is likely to be especially severe in villages that marketed interlinked insurance and credit but in the end, were only able to offer insurance. Due to these issues, this paper conducts its analysis on a subsample, described below, and additionally conducts tests on the full sample, for robustness.

The sample of households able to purchase insurance (e.g., that reside in a treatment village with an acceptable rainfall record) in the second year of sales is 654 households, of which 556 have available sample weights ("year 2 sales with weights" sample). Only individuals in treatment villages could purchase private insurance, making these individuals the relevant group for analyzing the effect of PSNP on insurance take-up. This paper focuses on second-year sales due to higher take-up rates in the second year. Additional analyses using data from first-year sales, and pooled first- and second-year sales, are also conducted for robustness.

In addition to the insurance offer, voucher coupons were distributed to study households via a lottery system. Vouchers were distributed before the time of the marketing campaign and could be subsequently redeemed if farmers bought weather insurance. The vouchers could be used to offset the cost of the insurance. The vouchers were intended to increase the variability of prices faced by potential insurance buyers (McIntosh *et al.*, 2013). In the second sales year, vouchers ranged from 0 to 300 birr. Approximately 68% of households in the "year 2 sales with weights" sample received positive (non-zero) vouchers.

Take-up of private insurance was overwhelmingly driven by the vouchers. Out of those given vouchers the take-up rate was around 36%, whereas the take-up rate was zero among those who received no voucher. The total range of subsidy amounts over the 2 years ranged from zero to a subsidy that covers 70% of the intended coverage for the average-sized farm (and up to 30% in the second sales year). Among those who purchased private insurance, only 21% of those paid any of their own cash over and above the amount of the voucher. The randomized subsidy vouchers thus largely paid for the insurance coverage provided in the study.

This paper analyzes the effect of PSNP on private insurance take-up on the full sample of 556 households able to purchase private insurance (the "year 2 sales with weights" sample) but relies primarily on estimates from a restricted subsample. The restricted sample is 365 households (the "village sales" sample) of which 349 have sample weight data (the "village sales with weights" sample). These are households that received a voucher and reside in kebeles reporting any sales in the second year in which sales were offered. The reason for restricting the sample is twofold: (1) sales only took place among voucher recipients. Restricting the sample to only voucher recipients therefore reduces noise, giving more precise estimates of the effect of PSNP on take-up; and (2) some kebeles had no sales. Kebeles without any sales are dropped as they could introduce a confound. It may be that constraints to adoption were on the supply (e.g., information about the insurance contracts was not conveyed clearly) or the demand side of the market and it is impossible to statistically distinguish between the demand-side correlates of behavior and the supply chain-driven explanations for why contracts could not be offered (McIntosh *et al.*, 2013).

3. ANALYSIS

This paper tests whether individuals who receive PSNP take-up less insurance than individuals who do not have access to PSNP. Substitution is exhibited by relative lack of demand for index insurance among beneficiaries of the government safety net as compared to demand among non-beneficiaries. The analysis proceeds as follows: first, to analyze whether PSNP acts as a substitute for index insurance, I run a reduced form regression of insurance take-up amount on PSNP, controlling for factors expected to influence both receipt of PSNP and insurance take-up. Ordinary least squares (OLS) provides a simple, easily interpretable measure of PSNP's effect on take-up. As this model is run on the small "village sales with weights" sample, I also run several additional specifications on the "year 2 sales with weights" sample for robustness, including: a tobit, to account for the large number of individuals who do not adopt insurance; a logit, to test the extensive margin of the decision to purchase; and an OLS regression, to test the intensive margin of the amount of insurance purchased, among the households who purchased insurance. Second, as PSNP is not randomly distributed across the population, a propensity score-matching technique is used to compare insurance take-up among PSNP beneficiaries and like non-beneficiaries. Finally, I run additional tests that corroborate the estimated relationship between PSNP and private insurance, by showing that those with greater access to PSNP benefits, even if not currently PSNP recipients, take-up less private insurance.

Sample weights are used to construct all estimates of summary statistics and regression analyses. The sample weights adjust the sample so it is in line with the population from which it was drawn. The weights are equal to the inverse of the probability of being included in the sample due to the sampling design, which randomly selected a fixed number of coop-

erative (18) and non-cooperative (two) members from each village. Accordingly, the weights account for differences between the sample population and the actual population with respect to population size, as well as the share of cooperative and non-cooperative members, across kebeles.[3]

Table 1 shows the summary statistics of pre-treatment observations for all households in the "baseline plus weights," "year 2 sales with weights," and "village sales with weights" samples. Only pre-treatment observations are used in the estimations below to prevent the inclusion of variables that may be affected by insurance purchase, such as income, as explanatory variables in modeling the insurance purchase decision.

Out of the "year 2 sales with weights" sample, only approximately 18% of individuals purchased insurance and the few that did insured on average 305 birr (equal to $23 at the 2010 exchange rate of 13.3 birr to 1 USD). However, study conditions seem favorable for insurance. More than half the population reported experiencing a shock that negatively affected their incomes the previous year and reported that, on average, approximately two years in the last ten their incomes were reduced by 25% or more. Although Nyala chose the study area for its high agricultural potential and relatively higher income, the population is still quite poor. Approximately 10% of individuals in the "baseline with weights" sample receive PSNP and annual average farm income is 4,531 birr ($340). In-kind and food expenditures account for 80% of total expenditures. Most of the population is illiterate and only have one year of formal education. Connection to formal financial institutions is also low; less than a quarter of the sample are members of microfinance institutions and even fewer have a bank account or were able to get credit to fund their purchases of agricultural inputs.

Although the "village sales with weights" sample is a selected subsample of the "baseline" sample, and hence is not statistically representative, the subsample is similar to the full baseline sample of households in the study across a number of dimensions, including crop production, income, and demographics. Farm income is somewhat higher in the "village sales with weights" sample (5,186 birr in the subsample compared to 4,527 birr in the full sample) but non-farm income is slightly lower in this subsample (679 birr versus 793 birr). The value of crop inputs used is lower in the "village sales with weights" sample than the "baseline with weights" sample, despite their higher farm income (570 birr versus 832 birr). The ratio of PSNP households is also slightly lower in this subsample (8% versus 9%).

(a) *PSNP and insurance take-up*

Non-PSNP beneficiaries purchase private insurance at higher rates than PSNP beneficiaries (14% versus 6%). However, PSNP beneficiaries are also likely to be poorer, reducing their financial ability to purchase insurance. To test for substitution between PSNP and private insurance, I first use OLS. I run a regression of the amount of insurance taken-up controlling for the official determinants of PSNP receipt outlined in the PSNP PIM (the "institutional determinants")[4]: total farm income, agricultural capital, negative shock, and dependency

Table 1. *Summary statistics*

Sample	(1) Baseline with weights		(2) Year 2 sales with weights		(3) Village sales with weights	
	Mean	sd	Mean	sd	Mean	sd
Insurance purchased			0.18	0.385	0.311	0.464
Amount insured			305.523	854.33	528.91	1070.703
Voucher amount			112.853	109.08	178.978	83.944
PSNP	0.095	0.293	0.07	0.256	0.076	0.265
Politically connected	0.052	0.223	0.056	0.229	0.063	0.243
Total farm income (1,000s)	4.531	9.441	5.665	14.207	5.186	14.74
Female-headed household	0.115	0.319	0.093	0.291	0.087	0.283
Negative shock	0.502	0.5	0.519	0.5	0.47	0.5
Dependency ratio	0.335	0.208	0.317	0.191	0.322	0.197
Value of agricultural capital (1,000s)	0.892	3.276	0.925	4.16	0.866	5.246
Value of crop inputs used	832.021	1403.229	636.031	1138.47	570.499	1070.43
Used improved seeds	0.214	0.41	0.26	0.439	0.245	0.431
Used chemical fertilizers	0.515	0.5	0.399	0.49	0.401	0.491
Hectares	1.286	3.297	1.496	5.819	1.144	1.302
Years of formal education	1.236	2.508	0.904	2.139	0.97	2.305
Literacy	0.454	0.498	0.443	0.497	0.32	0.467
Disabled	0.032	0.176	0.045	0.207	0.067	0.251
Non farm cash income	793.193	2296.226	565.604	2353.613	678.641	2784.952
Number of parcels cultivated	3.648	2.014	3.557	1.702	3.344	1.779
Microfinance member	0.242	0.428	0.329	0.47	0.403	0.491
Agricultural credit	0.163	0.37	0.135	0.342	0.137	0.344
Bank account	0.189	0.391	0.223	0.416	0.295	0.457
Years (in last 10) income reduced by 25%	2.223	2.297	1.566	1.676	1.566	1.855
In-kind and food expenditure share	0.803	0.119	0.793	0.115	0.789	0.114
N	2,114		556		349	
Number of villages	106		29		24	

Summary statistics shown are for (1) the baseline observations in the private insurance experiment, (2) all households able to purchase insurance in year 2, and (3) individuals that received a voucher and reside in kebeles reporting sales in year 2. Estimates have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

ratio. PSNP indicates whether a given household is a PSNP beneficiary. Total farm income and agricultural capital measure, respectively, the total farm income and value of agricultural capital owned by the household, in thousands. Negative shock indicates whether the household reported that a shock very negatively affected its consumption in the prior year (at least a 25% reduction in income). The dependency ratio measures the share of members aged 0–12 and older than 65 to total number of household members.

I also run a model controlling for potential confounding variables. I include a number of factors outside the official PSNP targeting criteria such as political capital, demographic, and economic variables. These are factors that are not specified in the PIM but could determine PSNP receipt and are also likely to influence private insurance take-up. I control for whether anyone in the household is a kebele council member or its chair. These are positions that are perceived as being intimately tied to the local political elite. I also control for whether the household is female headed, disabled, and the head's years of formal education. Finally, I control for the number of hectares the household farms.

The choice of an OLS model allows me to estimate how much insurance individuals who receive PSNP purchase compared to non-beneficiaries. Table 2 shows the OLS models including only voucher amounts (model 1), PSNP receipt (model 2), institutional determinants (model 3), and both institutional and unofficial determinants of PSNP receipt (model 4). As I run these models on the reduced "village sales with weights" sample, I additionally test three other specifications on the "year 2 sales with weights" sample. I run a tobit of the amount of insurance taken-up, to account for the large number of zero insurance purchases in the data (model 5). In order to model the sequential purchase decision (e.g., whether to purchase, and if so, how much), I run a logit model of the decision to adopt private insurance (model 6). Finally, among those households who adopt private insurance, I run an OLS model of the amount of private insurance purchased (model 7).

Results show that, on average, being a PSNP beneficiary decreases the amount of insurance purchased by approximately 930 birr (in model 4), with results significant at the 95% confidence level. Results for PSNP receipt are very stable across the different OLS specifications in the "village sales with weights" sample, even after controlling for a number of variables that are anticipated to be correlated with PSNP and insurance demand. Vouchers are by far the greatest predictor of index insurance take-up, with every birr of the cost that is subsidized spurring over four birr in insurance coverage purchase. Conversely, farm income and agricultural capital negatively influence insurance take-up. Generally, wealth has an ambiguous effect on demand for index insurance, depending on whether insurance is a normal good and individuals' risk aversion (Clarke, 2011). The negative finding here is in contrast to Hill *et al.* (2013), who found that wealth increases

Table 2. *Reduced form regression of PSNP and insurance take-up*

Model	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) Tobit	(6) Logit	(7) OLS
Sample	Village sales with weights				Year 2 sales with weights		Purchased in year 2 sales with weights
DV	Take-up (amount)				Take-up (amount)	Take-up (Y/N)	Take-up (amount)
PSNP		−800.961**	−938.841**	−929.852**	−2217.394***	−1.984***	−780.785
		(298.89)	(343.24)	(349.95)	(830.32)	(0.62)	(578.00)
Voucher amount	4.070**	4.666***	4.477***	4.389***	13.033***	0.010***	9.361***
	−1.59	−1.65	−1.48	−1.56	−3.15	0	−1.87
Total farm income (1,000s)			−9.046**	−9.847**	−37.657	−0.018	−49.606**
			(3.77)	(4.13)	(25.71)	(0.01)	(19.11)
Value of agricultural capital (1,000s)			−7.245**	−5.758**	−131.994	−0.078	−46.473
			(3.17)	(2.62)	(182.48)	(0.15)	(138.93)
Negative shock			−19.060	−1.732	391.072	0.361	47.139
			(105.56)	(110.40)	(333.30)	(0.32)	(233.86)
Dependency ratio			1151.477**	1116.711**	2444.573**	2.042**	967.098
			(431.78)	(412.17)	(949.86)	(0.94)	(638.17)
Politically connected				415.335*	464.223	−0.143	770.972*
				(215.93)	(449.51)	(0.34)	(419.56)
Female-headed household				−99.244	560.064	1.399*	−1045.648***
				(208.94)	(643.16)	(0.82)	(354.01)
Hectares				28.878	1.240	−0.000	202.897
				(41.77)	(12.01)	(0.01)	(246.17)
Years of formal education				17.973	84.360	0.033	−81.908**
				(36.82)	(89.47)	(0.07)	(38.81)
Disabled				−173.815	755.073	1.716***	−1215.798***
				(242.71)	(464.82)	(0.66)	(349.51)
Constant	−199.548	−245.492	−509.392**	−544.606**	−4341.748***	−3.907***	−318.426
	(197.91)	(201.11)	(222.99)	(219.70)	(1041.26)	(0.71)	(265.49)
N	349	349	349	349	556	556	140
Number of villages	24	24	24	24	29	29	24

* indicates significance 10%, ** at 5%, and *** at 1%. Models 1–4 samples include individuals that received a voucher and reside in kebeles reporting sales in year 2. Models 5 and 6 samples include all households able to purchase insurance in year 2. Model 7 sample includes all households that purchased insurance in year 2. Standard errors in parentheses, clustered at the kebele level. All models have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

demand for index insurance in rural Ethiopia. However, the discrepancy may be due to the fact that Hill *et al.* (2013) proxy for wealth with landholding quintile, whereas this analysis separately controls for the number of hectares the household farms. Finally, being politically connected, as measured by having a household member that is on the kebele council, positively predicts insurance take-up (significant at the 90% confidence level).

Appendix includes specifications for second-year sales without sample weights as well as pooled first and second-year sales with and without sample weights. PSNP coefficients are negative and significant without the inclusion of the weights, but the PSNP coefficient is halved without the inclusion of sample weights. These differential marginal effects indicate that the effects of PSNP are larger for individuals residing in larger kebeles and for non-coop members, who were undersampled in the survey.

Models 5, 6, and 7 test the effect of PSNP in the "year 2 sales with weights" sample, the larger sample that includes all households that were able to purchase index insurance. The tobit and logit models further confirm the negative effect of PSNP on index insurance take-up amounts as well as the decision to take-up, respectively (both significant at the 99% confidence level). Model 6 reveals that the odds of PSNP recipients purchasing insurance is almost 14% less likely than non-PSNP recipients. Model 7, however, shows a negative but insignificant effect of PSNP on take-up amounts, among those who purchased in the "year 2 sales with weights" sample. This is likely due to the overwhelming effect of the vouchers in explaining take-up amounts and the small sample size.

(b) *Insurance take-up and matched PSNP individuals*

The treatment in this study is participation in the government safety net program, however, there are numerous potentially omitted covariates that prevent making causal claims about the relationship between PSNP and index insurance demand. To address these omitted covariates, a propensity score model is estimated to evaluate the amount of insurance that PSNP beneficiaries take-up compared to their non-PSNP counterparts. Matching constructs a counterfactual using a single propensity score to compare individuals that receive PSNP (a treatment group) with individuals that do not (a control group), as developed in Rosenbaum and Rubin (1985).

To conduct propensity score matching it is necessary to first estimate a model of assignment to treatment. As described in Section 3(a), I define the logit model of PSNP households based on institutional (PIM) guidelines. Table 3 below shows the results of a logit model predicting PSNP receipt based on PIM guidelines only (model 1) and the PIM plus non-institutional determinants of PSNP receipt (model 2). Note that the "baseline with weights" sample is used in this analysis to take advantage of all heterogeneity in available determinants of PSNP. Results without the inclusion of sample weights are in Appendix.

The performance of the institutional determinants of PSNP is mixed in the logit models below. As expected, experiencing a negative consumption shock and having a higher dependency ratio positively predict receipt of PSNP. Interestingly, farm income has no effect on receipt of PSNP nor does the value of agricultural capital owned by the household. This may be due to the fact that these variables are highly skewed toward zero. Results suggest that some factors outside the PIM determine receipt of PSNP. The number of hectares the household farms, both an indicator of wealth and a productive asset, decreases the likeliness of PSNP receipt. Ties to local political elites positively predict PSNP, although the mechanisms through which this effect operates are unknown and the effect may be driven by other sources of unobserved heterogeneity. Although the pseudo-R squared is low for the models, the models correctly predict over 87% of the cases.

As seen in the results in Table 2, vouchers strongly predict insurance sales but are not determinants of PSNP receipt. To conduct propensity score matching it is thus necessary to first regress insurance sales on the voucher amounts only, and save those residuals. This saves only the variation in take-up amounts unexplained by the vouchers. Then, matching can be conducted using the residuals as the outcome variable and PSNP as the treatment variable, controlling for all the factors (in the above models) that determine receipt of PSNP. This approach estimates the difference in the sum insured, accounting for voucher amounts, between the PSNP and non-PSNP samples. If matching works, the only factor that differentiates the control from the treatment group is receipt of PSNP, enabling a determination of PSNP's causal effect on the amount of index insurance purchased. A key assumption, which must be satisfied to use matching methods, is the conditional independence assumption; conditional on the vector of observable characteristics, the outcome variable is independent of the choice of treatment, that is, that unobservables do not predict assignment to PSNP as well as the amount of private insurance purchased (Rosenbaum & Rubin, 1985).

Propensity score matching is conducted for PSNP beneficiary households, with one-to-one matching imposing a common support. Imposing a common support drops all observations with a propensity score higher than the maximum or lower than the minimum propensity score of the controls, in order to reduce the effect of any bad matches. Matching is conducted controlling for determinants of treatment specified in the PSNP PIM as well as with the non-institutional determinants of PSNP: households that are politically connected, are female-headed, the number of hectares they farm, the head's years of education, and whether or not the head is disabled. Fortunately, the logit models used perform well in generating matches that are on-support for all recipients in the first model and all but two of the PSNP recipients in the second model. There is no clear guidance in the econometric literature on how to accommodate sample weights when conducting matching. The current recommended approach is to ignore sampling weights when conducting matching since the outcome of interest is not generalizing the propensity score model to the population (Zanutto, 2006). Thus, the sample used here is the "year 2 village sales" sample since sample weights are not included.

Matched results, shown in Table 4, are of a similar magnitude to OLS results without sample weights. Matched sample estimates for PSNP recipients average approximately 440 less birr of private insurance take-up than the control group. This is the estimate of the average-treatment-effect-on-the-treated, the statistic that shows the effect of the safety net policy on private insurance take-up while controlling for sample selection bias. While it is highly unlikely that all determinants of PSNP receipt are captured in the matching model, Rosenbaum bound results show that the odds of one person receiving PSNP have to be more than 1.3 times higher (according to the fully saturated model 2 and 1.8 times according to institutional determinants-only model 1) because of different values on an unobserved covariate, despite being identical on the matched covariates, for the inference to change.

Table 5 presents a test of balance in the propensity score over the common support. The table reports results of

Table 3. *Logit model of PSNP receipt at household level*

	(1)	(2)
Sample	Baseline with weights	
DV: PSNP		
Value of agricultural capital (1,000s)	−0.028	−0.012
	(0.07)	(0.03)
Total farm income (1,000s)	−0.067	−0.033
	(0.05)	(0.04)
Negative shock	0.598**	0.561*
	(0.28)	(0.29)
Dependency ratio	0.927*	0.855*
	(0.51)	(0.51)
Politically connected		0.948**
		(0.45)
Female-headed household		0.069
		(0.30)
Hectares		−0.956***
		(0.31)
Years of formal education		−0.040
		(0.05)
Disabled		−0.348
		(0.52)
Constant	−2.675***	−1.787***
	(0.34)	(0.45)
N	2114	2114
Number of villages	106	106
Pseudo *R*-sq	0.0309	0.0763

* indicates significance 10%, ** at 5%, and *** at 1%. The sample size shown is reduced to 2,114 individuals due to missing sample weights for fourteen of 120 kebeles (villages). Standard errors in parentheses, clustered at the kebele level. All models have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

difference in means tests between the treatment and the control groups (PSNP versus non-PSNP recipients) for each correlate for all 365 observations. The table reports the difference in means and the standard errors. None of the differences are statistically significant at the 99% level.

4. DISCUSSION

The hypothesis states that individuals fail to adopt insurance because they believe that the government will protect them from shocks. To show this, the first part of the paper illustrates that individuals who receive the government safety net buy less insurance on the private market than individuals who do not get the safety net program. Matching models included a model with determinants of PSNP stipulated in official government documents as well as a model that controls for potential confounding variables.

Other factors could potentially be influencing adoption of private insurance that could also predict PSNP receipt. Risk aversion, for example, is likely to be correlated with PSNP and with demand for index insurance. PSNP recipients are likely to be among the most poor. To the extent that risk-averse individuals are also likely to be poorer, and very risk-averse individuals will choose to purchase less index insurance on account of the weight they give to the worst-case scenario, then wealthier individuals may be more likely to purchase insurance than poorer individuals (Clarke, 2011). The original survey questionnaire asked respondents "Many farmers consider new agricultural practices that give higher yields but may have unpredictable and unknown consequences. Are you generally a person who is prepared to take such risks or do you try to avoid taking risks?" Respondents who answered that they "never take such risks" are coded as risk averse. Results from both OLS regressions and propensity score-matching show that risk aversion has a negative effect on index insurance take-up, but PSNP estimates remain robust to the inclusion of risk aversion. The finding on risk aversion is consistent with other empirical studies (Giné, Townsend, & Vickery, 2008; Lybbert *et al.*, 2010) including in rural Ethiopia (Hill *et al.*, 2013). The negative effect of risk aversion on index insurance adoption, although at first counterintuitive, is potentially due to risk-averse individuals' reluctance to be early adopters of a new technology.

An alternative explanation is that individuals who receive PSNP are likely to be less educated and unlikely to understand how insurance operates. Survey questions attempted to illicit respondents' ability to reason and to apply simple numerical concepts. It asked them simple mathematical questions such as filling in the missing number in a numerical sequence or to count backward (such as "what is 40 minus 10? And that answer minus 10?"). Respondents were given no more than 1.5 min to answer each question. Only 22% of respondents were able to answer the missing number of questions correctly but 77% of respondents could answer the subtraction questions correctly. Including a measure of whether respondents answered both the subtraction and the missing number of questions correctly, or including separately a measure of the ability to correctly respond to either type of question,

Table 4. *Propensity score regression of year 2 sales and PSNP households*

	(1)	(2)
Model	PS matching PIM	PS matching PIM plus
Sample	Year 2 Sales	
Outcome: Residuals		
Treated	−435.252**	−442.77**
	(−194.44)	(−224.79)
Constant	70.021	94.563
N	365	365
Number of villages	25	25

* indicates significance 10%, ** at 5%, and *** at 1%. Standard errors in parentheses. Table shows the treatment on the treated, the effect of the safety net policy on private insurance take-up. Outcome variable is the residual from an OLS regression of the amount insured on voucher amounts only, with kebele level clustering. Both models use one-to-one matching imposing a common support. Sample includes individuals that received a voucher and reside in kebeles reporting sales in year 2. Model 1 calculates propensity score matching, matching on the determinants of PSNP specified in the PSNP PIM. Model 2 calculates propensity score matching, matching on the determinants of PSNP specified in the PSNP PIM plus additional factors expected to determine receipt of PSNP.

Table 5. *Balance table for matched observations*

Sample	Year 2 sales			
Variable	Mean treated	Mean control	*t*-Test	$p > \|t\|$
Value of agricultural capital (1,000s)	0.506	0.594	−1	0.323
Total farm income (1,000s)	3.266	3.11	0.16	0.874
Negative shock	0.567	0.667	−0.79	0.434
Dependency ratio	0.344	0.402	−1.29	0.204
Politically connected	0.067	0.133	−0.85	0.398
Female-headed household	0.167	0.133	0.36	0.723
Hectares	1.018	1.11	−0.5	0.619
Disabled	0.033	0	1	0.321
Years of education	1.133	0.933	0.38	0.706

Balance table for matched sample from one-to-one matching imposing a common support. Sample includes individuals that received a voucher and reside in kebeles reporting sales in year 2. Propensity score model calculates propensity score matching, matching on the determinants of PSNP specified in the PSNP PIM plus additional factors expected to determine receipt of PSNP.

positively affects insurance take-up but has no effect on the PSNP coefficient.

As the insurance product covered input costs only, and as PSNP recipients use less inputs,[5] it may be that non-PSNP beneficiaries had less use for the private insurance product. The PSNP coefficient does decrease with the inclusion of controls for use of improved seeds, chemicals, and organic fertilizers (792 birr) in the OLS model of insurance demand, but remains statistically significant.[6]

Finally, liquidity constraints are known to influence index insurance take-up. In addition to the above tests, I test the effects of liquidity constraints on PSNP recipients by interacting PSNP with the voucher amounts. Note that the liquidity constraint test, which interacts vouchers and PSNP status, is done on the "year 2 sales with weights" sample, as the "village sales with weights" sample only includes households that received a positive voucher. The coefficient on PSNP is negative but insignificant while the coefficient on the interaction is negative and highly significant. To explore this further, I plot the interaction effect of PSNP receipt and voucher amounts in Figure 1. The plot shows that take-up for PSNP and non-PSNP households that receive no voucher or a 100-birr voucher cannot be statistically distinguished. However, with increasing voucher amounts, there is no significant difference in the amount of insurance purchased among PSNP recipients. Rather, the figure shows that higher voucher amounts induce non-PSNP households to purchase insurance whereas they do not have that effect on PSNP households.

OLS results for the alternative explanations are presented in Table 6 below. Propensity score-matching results, including all potential confounding variables, are included in Table 13 in Appendix. Treatment on the treated effects of negative 453 birr is remarkably similar to the above estimates, and remains significant at the 95% confidence level.

(a) *Access to PSNP benefits*

To further corroborate the hypothesis that PSNP decreases index insurance demand, I run three tests to determine whether individuals with greater access to PSNP benefits purchase less private insurance. First, I estimate the halo and spillover effects of living in a village that receives PSNP, controlling for an individual's PSNP beneficiary status.[7] The PSNP village dummy should capture residents' greater access to PSNP benefits, even if they do not themselves receive it, due to: officials' capability to scale-up aid only in PSNP villages in response to crisis; residents' capacity to borrow from friends or family members who receive PSNP; and residents' ability to access the local public goods created as part of the PSNP public works projects. Second, I measure the effect of the share of the village that receives PSNP on private insurance take-up. The share measures whether the halo and spillover effects are greater when more of the village receives PSNP. Finally, I estimate the effect of individual heterogeneity in access to PSNP, conditional on receiving PSNP.

Individual heterogeneity in access to PSNP is measured in two ways. The first measure is a direct measure of connections: whether anyone in the household is a kebele council member or its chair. The dummy for political connections is interacted with a dummy for whether the individual is a PSNP beneficiary. A significant and negative interaction effect would suggest that individuals who receive PSNP, and have ties to local political elites, will expect to continue to receive PSNP and so turn to the private insurance market less than individuals who receive PSNP but are unconnected. Whether or not the expectation of benefits that derives from political connections is due to political favoritism, increased information flows to those in power, or another mechanism is beyond the scope of this paper. The second measure of individual heterogeneity in access to PSNP is based on respondents' confidence in government. The survey instrument asked respondents how much confidence they have in district government. Given

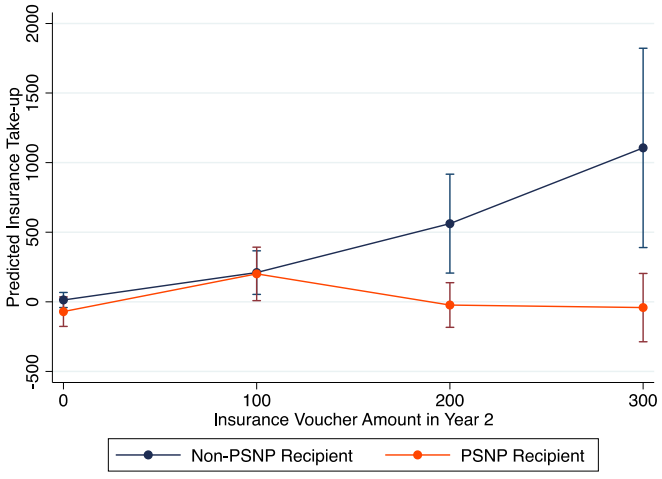

Figure 1. *Predictive margin of PSNP and voucher amount.*

Table 6. *OLS regression of year 2 sales and PSNP recipients*

	(1)	(2)	(3)	(4)
Sample	Village sales with weights			Year 2 sales with weights
DV: Take-up (Amount)				
PSNP	−928.702**	−950.521**	−938.498**	−83.840
	(335.50)	(346.84)	(343.01)	(49.64)
PSNP*voucher amount				−3.446***
				(1.20)
Voucher amount	4.468***	4.407***	4.476***	−0.181
	(1.50)	(1.48)	(1.48)	(1.68)
Total farm income (1,000s)	−9.286**	−9.349**	−9.077**	−5.916*
	(4.03)	(3.87)	(3.87)	(2.91)
Value of agricultural capital (1,000s)	−7.406**	−7.272**	−7.230**	−7.127**
	(3.19)	(3.18)	(3.16)	(3.39)
Negative shock	−29.739	−10.648	−18.446	47.825
	(103.63)	(111.19)	(106.72)	(76.04)
Dependency ratio	1137.475**	1190.509**	1151.308**	709.890**
	(410.69)	(442.58)	(432.56)	(282.14)
Numeracy	247.840			
	(172.20)			
Risk averse		−364.618*		
		(202.38)		
Value of crop inputs used			0.364	
			(2.65)	
Constant	−521.376**	−491.338**	−510.086**	−196.151*
	(221.10)	(221.88)	(223.89)	(109.51)
N	349	349	349	556
Number of villages	24	24	24	29

* indicates significance 10%, ** at 5%, and *** at 1%. Standard errors in parentheses, clustered at the kebele level. Models 1–3 samples include individuals that received a voucher and reside in kebeles reporting sales in year 2. Model 4 sample includes all households able to purchase insurance in year 2. All models have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

district governments' influence in resource allocation, including aid distribution, individuals who are connected may see the government as more responsive to their needs and hence place greater confidence in them. Respondents chose from the following: a great deal of confidence, quite a lot of confidence, not very much confidence, or none at all. These responses are collapsed into a binary indicator for whether respondents answered a great deal or quite a lot versus not very much or none at all.

Table 7 shows the results of the inclusion of the targeting variables in OLS regressions of insurance take-up in the "second year sales with weights" sample. Model 1 shows the effects of political connections conditional on receiving PSNP. The differential effect of being a PSNP recipient and having direct ties to the local political elite is a reduction of insurance sales of 627 birr. Similarly, the differential effect of both having confidence in district government and receiving PSNP (model 2) reduces insurance sales by 759 birr. Note that the number of observations in model 2 is slightly smaller, due to the small number of individuals who did not answer this survey question. Both sets of interaction effects are significant at the 90% confidence level. Undoubtedly, receipt of PSNP is influenced by other factors that are unobserved or difficult to measure, limiting the ability to estimate causal effects of PSNP on private insurance demand. Nevertheless, these interaction effects, which corroborate the explanation that access to PSNP reduces private insurance demand, are difficult to explain through alternative hypotheses. Similarly, living in a village that receives PSNP (model 3), as well as the share of the village that receives PSNP (model 4), negatively predict insurance demand at the 90% confidence level. Holding PSNP beneficiary status constant, living in a village that receives PSNP decreases private insurance demand by 452 birr. The effect of the share of the village that receives PSNP on insurance take-up is even more overwhelming (decreases by 1,613 birr).

The figures below illustrate the predicted values of having political connections, conditional on receiving PSNP. Figure 2 shows the predicted amount of insurance purchase for households with and without political connections, conditional on the household receiving PSNP, and holding all other values at their means. Results suggest that individuals who get PSNP but lack strong ties to local elites buy more insurance than individuals who get PSNP and have direct political connections. Figure 3 shows the results of stated confidence in government, conditional on receipt of PSNP. Results are consistent with the results for the measure of political connections.

It may be, however, that individuals' general levels of trust would cause them to be more trusting of a new product. The measure of trust in government would thus incorporate individuals' likeliness to be trusting, in addition to their trust in government. To account for individuals' general trust level, a measure of trust is included in the OLS regression of insurance purchase that includes an interaction of PSNP and stated confidence in government. The measure of trust is a dummy equal to one if individuals responded to the question "Generally speaking would you say that most people living in this village can be trusted or that you need to be very careful in dealing with people" by answering that "most people can be trusted." I conduct two placebo tests showing that interacting PSNP with other measures of trust, that are unrelated to the government—trust in banks and trust in the press—yield an

Table 7. *OLS regression of insurance take-up interacting PSNP and aid targeting*

	(1)	(2)	(3)	(4)
Sample	Village sales with weights			
DV: take-up (amount)				
PSNP	−892.986**	−584.781*	−603.915**	−672.701**
	(333.49)	(285.74)	(216.90)	(268.14)
Politically Connected*PSNP	−627.182*			
	(305.33)			
Confidence in district government*PSNP		−758.622*		
		(377.25)		
PSNP kebele			−452.123*	
			(234.27)	
Share of kebele receiving PSNP				−1612.584*
				(879.80)
Politically connected	513.221**		518.213**	501.139**
	(206.91)		(184.66)	(190.09)
Confidence in district government		234.663		
		(183.87)		
Voucher amount	4.257***	5.352***	4.436***	4.354***
	(1.42)	(1.59)	(1.50)	(1.47)
Total farm income (1,000s)	−9.210**	−9.079**	−9.516**	−9.354**
	(3.77)	(3.83)	(3.52)	(3.51)
Value of agricultural capital (1,000s)	−6.872**	−9.275**	−2.910	−2.172
	(3.13)	(3.46)	(2.60)	(2.86)
Negative shock	23.591	63.574	112.217	84.014
	(105.49)	(105.08)	(130.80)	(123.87)
Dependency ratio	1078.406**	1226.647**	968.462**	1018.069**
	(414.80)	(456.73)	(407.92)	(407.58)
Constant	−499.544**	−840.681**	−438.438*	−450.498**
	(211.30)	(339.51)	(214.22)	(211.73)
N	349	333	349	349
Number of villages	24	24	24	24

* indicates significance 10%, ** at 5%, and *** at 1%. Standard errors in parentheses, clustered at the kebele level. Sample includes individuals that received a voucher and reside in kebeles reporting sales in year 2. All models have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

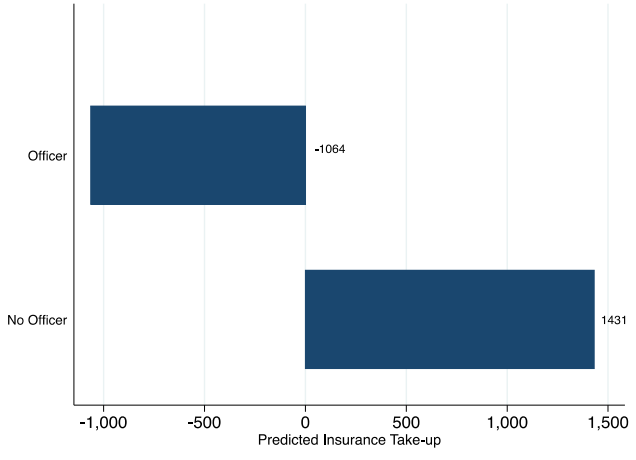

Figure 2. *Change in predicted value of being politically connected conditional on PSNP receipt.*

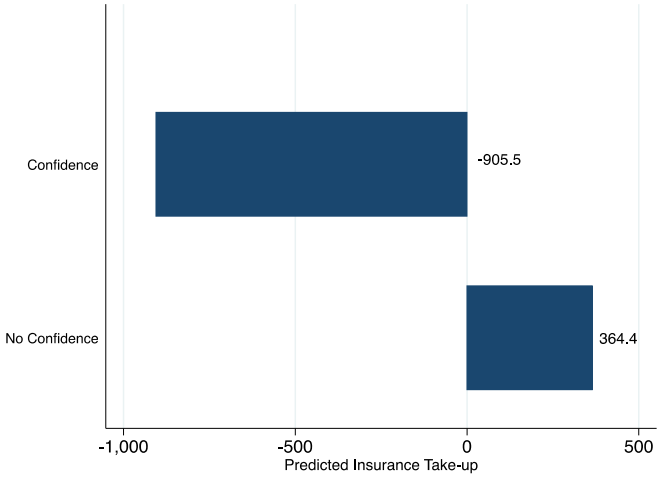

Figure 3. *Change in predicted value of having confidence in district government conditional on PSNP receipt.*

Table 8. *OLS regression of insurance take-up interacting PSNP and government credibility*

	(1)	(2)	(3)
Sample	Village sales with weights		
DV: take-up (amount)			
PSNP	−1105.301**	−627.058**	−575.918*
	(421.01)	(228.09)	(297.12)
Confidence in press*PSNP	384.226		
	(314.33)		
Confidence in banks*PSNP		−575.078	
		(398.42)	
Confidence in district Government*PSNP			−842.968*
			(450.70)
Confidence in press	13.527		
	(139.06)		
Confidence in banks		336.996	
		(223.41)	
Generalized trust			236.722
			(236.08)
Confidence in district government			236.628
			(181.18)
Voucher amount	4.634***	5.177***	5.322***
	(1.52)	(1.62)	(1.56)
Total farm income (1,000s)	−9.472**	−8.634**	−10.206**
	(3.93)	(3.67)	(4.30)
Value of agricultural capital (1,000s)	−7.808**	−9.482**	−8.859**
	(3.53)	(3.76)	(3.39)
Negative shock	−42.811	46.487	2.483
	(126.62)	(108.48)	(99.75)
Dependency ratio	1158.373**	1312.153**	1148.058***
	(438.13)	(507.95)	(404.54)
Constant	−516.231**	−923.450**	−852.541**
	(228.63)	(402.97)	(340.73)
N	334	337	332
Number of villages	24	24	24

* indicates significance 10%, ** at 5%, and *** at 1%. Standard errors in parentheses, clustered at the kebele level. Sample includes individuals that received a voucher and reside in kebeles reporting sales in year 2. All models have population adjustments using sample weights equal to the inverse of the probability that the observation is included in the sample.

insignificant interaction effect. Results are shown in Table 8 below. The number of observations slightly differ between these models due to the small number of individuals who did not answer the particular survey question on trust.

5. CONCLUSION

This paper provides evidence that is consistent with the explanation that lack of demand for private insurance is attributable in part to government provision of safety nets. It further presents evidence that individuals, who have greater access to public benefits, because they live in villages that receive aid or are politically connected, buy less private insurance. A few caveats must be presented along with these findings. First, Ethiopia is only one case, and in many respects, a most likely case to test this hypothesis. Ethiopia's history of drought, longstanding reliance on aid, and strong state capacity make it an environment where a perception of government responsiveness to economic shocks is highly likely to be found. Second, the statistical power is limited by problems with implementing the randomized control trial. Thus, although the negative effect of receiving PSNP on private insurance take-up is substantial, the size of the confidence intervals means that the effects could be far more moderate. Finally, the identification strategy relies on a matching strategy, which assumes that the model of assignment to PSNP is correctly specified. Given allegations of political targeting of PSNP it may be that the government rewards supporters with PSNP, which may also correlate with private insurance demand. As the insurance pilot survey did not collect data on voting behavior or political preferences it is not possible to rule out this confounding variable, and opposition parties were essentially non-existent during the study period. Nevertheless, as the bounds analysis shows, results for the effect of PSNP on insurance take-up are so large that unobserved variables would have to be very influential to get these effects.

Supplying insurance privately in developing countries is likely to require major expenditure in the form of subsidies. However, even highly subsidized insurance offers have been met with indifference in field experiments in part because many governments have fashioned themselves as being credible sources of aid following disasters. The reliability of government as a source of disaster relief is likely to enter individuals' demand functions when presented with a private insurance offer. Individuals may even be afraid of losing access to government benefits if they take-up the private insurance offer. Given that the introduction of insurance in developing countries has met many challenges, policymakers are strongly encouraged to consider the viability of insurance within the institutional context and incorporate pre-existing public arrangements into insurance contract design.

NOTES

1. The insurance contract studied in this paper would pay 1,000 birr (the Ethiopian currency, the exchange rate in 2010 was 13.3 birr per USD) per timad (approximately half a hectare) insured. 1,000 birr is the estimated cost of recommended inputs for such a land amount. The contract is expected to pay out in one out of every four years, so the actuarially fair price is 250 birr.

2. In examining the distribution of aid prior to the start of PSNP, both Clay, Molla, and Habtewold (1999) and Jayne, Strauss, Yamano, and Molla (2002) found evidence of geographical inertia despite potential differences in the spatial pattern of vulnerability and poverty from one year to the next. Inertia is now PSNP policy: woredas (districts) are selected upon determination of being chronically food insecure and having been a recipient of food aid for a significant period in the past. This geographical constancy stems from the regions' recurring droughts and decreases the need to conduct continual reassessments.

3. Survey observations are weighted by the number of village cooperative members, divided by 18 for cooperative members, and the number of village non-cooperative members, divided by two for non-cooperative members.

4. The PIM guidelines specify the official criteria for PSNP targeting, as described in the above PSNP Operations section.

5. Only 7% and 24% of PSNP beneficiaries used improved seeds and chemical fertilizers as compared to 31% and 65% of non-beneficiaries, respectively.

6. Similarly, the PSNP coefficient remains negative and statistically significant at the 95% confidence level with the inclusion of a measure of whether the household was able to obtain credit for agricultural inputs, which could potentially have affected the usefulness of the index insurance product. These results are available from the author by request.

7. A halo effect is a psychological term used to explain the bias shown by individuals toward certain products/individuals because of a favorable experience with other products/individuals in another area. In this context, a halo effect refers to a given villager's positive impression of the efficacy and likeliness of PSNP receipt based upon observation of other villagers' positive experience with PSNP.

REFERENCES

Barnett, B. J., Barrett, C. B., & Skees, J. R. (2008). Poverty traps and index-based risk transfer products. *World Development, 36*(10), 1766–1785.

Baulch, B., & Hoddinott, J. (2000). Economic mobility and poverty dynamics in developing countries. *The Journal of Development Studies, 36*(6), 1–24.

Berhane, G., Hoddinott, J., Kumar, N., & Seyoum Taffesse, A. (2011). *The impact of Ethiopia's productive safety nets and household asset building programme: 2006–2010*. Washington, DC: International Food Policy Research Institute.

Binswanger-Mkhize, H. P. (2012). Is there too much hype about index-based agricultural insurance?. *Journal of Development Studies, 48*(2), 187–200.

Caeyers, B., & Dercon, S. (2012). Political connections and social networks in targeted transfer programs: Evidence from rural Ethiopia. *Economic Development and Cultural Change, 60*(4), 639–675.

Clarke, D. J. (2011). *A theory of rational demand for index insurance*. Department of Economics, University of Oxford.

Clay, D. C., Molla, D., & Habtewold, D. (1999). Food aid targeting in Ethiopia: A study of who needs it and who gets it. *Food Policy, 24*(4), 391–409.

Cole, S., Giné, X., Tobacman, J., Townsend, R., Topalova, P., & Vickery, J. (2013). Barriers to household risk management: Evidence from India. *American Economic Journal. Applied Economics, 5*(1), 104.

Cutler, D. M., & Gruber, J. (1996). Does public insurance crowd out private insurance?. *The Quarterly Journal of Economics, 111*(2), 391–430.

Dercon, S., & Christiaensen, L. (2011). Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia. *Journal of Development Economics, 96*(2), 159–173.

Dercon, S., Hoddinott, J., & Woldehanna, T. (2012). Growth and chronic poverty: Evidence from rural communities in Ethiopia. *Journal of Development Studies, 48*(2), 238–253.

Dercon, S., & Krishnan, P. (2000). Vulnerability, seasonality and poverty in Ethiopia. *The Journal of Development Studies, 36*(6), 25–53.

Finkelstein, A., & McGarry, K. (2006). Multiple dimensions of private information: Evidence from the long-term care insurance market. *American Economic Review, 96*(4), 938–958.

Giné, X., Townsend, R., & Vickery, J. (2008). Patterns of rainfall insurance participation in rural India. *The World Bank Economic Review, 22*(3), 539–566.

Giné, X., & Yang, D. (2009). Insurance, credit, and technology adoption: Field experimental evidence from Malawi. *Journal of Development Economics, 89*(1), 1–11.

Hill, R. V., Hoddinott, J., & Kumar, N. (2013). Adoption of weather-index insurance: Learning from willingness to pay among a panel of households in rural Ethiopia. *Agricultural Economics, 44*(4–5), 385–398.

Jayne, T. S., Strauss, J., Yamano, T., & Molla, D. (2002). Targeting of food aid in rural Ethiopia: Chronic need or inertia?. *Journal of Development Economics, 68*(2), 247–288.

Kronick, R., & Gilmer, T. (2002). Insuring low-income adults: Does public coverage crowd out private?. *Health Affairs, 21*(1), 225–239.

Lybbert, T. J., Galarza, F. B., McPeak, J. G., Barrett, C. B., Boucher, S. R., Carter, M. R., ... Mude, A. G. (2010). Dynamic field experiments in development economics: Risk valuation in Morocco, Kenya, and Peru. *Agricultural and Resource Economics Review, 39*(2).

McIntosh, C., Sarris, A., & Papadopoulos, F. (2013). Productivity, credit, risk, and the demand for weather index insurance in smallholder agriculture in Ethiopia. *Agricultural Economics, 44*(4–5), 399–417.

Morduch, J. (1995). Income smoothing and consumption smoothing. *The Journal of Economic Perspectives*, 103–114.

Norton, M., Osgood, D., Madajewicz, M., Holthaus, E., Peterson, N., Diro, R., ... Gebremichael, M. (2014). Evidence of demand for index insurance: Experimental games and commercial transactions in Ethiopia. *Journal of Development Studies, 50*(5), 630–648.

Rosenbaum, P. R., & Rubin, D. B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician, 39*(1), 33–38.

Rothschild, M., & Stiglitz, J. (1992). *Equilibrium in competitive insurance markets: An essay on the economics of imperfect information*. Netherlands: Springer, pp. 355–375.

Yamano, T., Alderman, H., & Christiaensen, L. (2005). Child growth, shocks, and food aid in rural Ethiopia. *American Journal of Agricultural Economics, 87*(2), 273–288.

Zanutto, E. L. (2006). A comparison of propensity score and linear regression analysis of complex survey data. *Journal of Data Science, 4*(1), 67–91.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.worlddev.2015.10.034.