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The effects of access to health insurance: Evidence from a regression discontinuity design in Peru☆

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ABSTRACT

In many countries large parts of the population do not have access to health insurance. Peru has made an effort to change this in the early 2000s. The institutional setup gives rise to the rare opportunity to study the effects of health insurance coverage exploiting a sharp regression discontinuity design. We find large effects on utilization that are most pronounced for the provision of curative care. Individuals seeing a doctor leads to increased awareness about health problems and generates a potentially desirable form of supplier-induced demand: they decide to pay themselves for services that are in short supply.

1. Introduction

In developing countries, a large number of individuals is not covered by health insurance (Banerjee et al., 2004; Banerjee and Duflo, 2007). The reasons for this are manifold. On the one hand, individuals are often used to relying on informal forms of risk-sharing instead of being covered by formal health insurance and therefore do not demand insurance.[2] On the other hand, it has in the past not been seen as the role of the government to provide health insurance. Moreover, the World Health Organization and the World Bank stress that, even when there is public health insurance, it often does not reach large parts of the population and especially not the poorest families because it is only provided to the minority of employees in the formal sector (WHO, 2010; Hsiao and Shaw, 2007). For instance, until the late 1990s, only 23% of the individuals in Peru had health insurance (CEPLAN, 2011).

This may be a cause of concern, because health insurance does not only protect individuals against catastrophically high health expenditures (Wagstaff and Doorslaer, 2003). It also encourages them to see a doctor instead of simply buying medication, and thereby promotes appropriate treatment of illnesses that is often argued to be absent

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[2] See for instance Fafchamps (1999), Jowett (2003), Chankova et al. (2008), Giné et al. (2008) and Dercon et al. (2008).

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(Commission on Macroeconomics and Health, 2001; International Labour Office et al., 2006).

In reaction, many low and middle income countries have recently introduced Social Health Insurance (SHI) targeted to the poor, with the goal to improve their health and also to provide them with protection against the financial consequences of health shocks. Coverage by SHI may or may not be free and typically means that individuals receive medical attention from a service provider. The costs are usually paid out of a designated government budget that is completely or partially funded by taxes.

However, to date, it is not well understood through which channels health insurance coverage contributes to the well-being of individuals and how this relates to the incentives provided to health care providers and patients and, more generally, to the institutional environment.[3] Important questions in this context are to what extent it is possible to encourage individuals to seek medical attention rather than simply buying medication in a pharmacy, how they can be motivated to invest into preventive care, and what the effects of medical attention are on care consumption and out-of-pocket spending.[4]

Answering those questions is challenging for at least two reasons. First, we lack detailed data on health care utilization and out-of-pocket expenditures, and second, it is challenging to control for selection into insurance. The second problem means that a regression of utilization or expenditure measures on insurance coverage will yield biased results and will not estimate the causal effects of health insurance. In this paper, we make progress in both directions. We use unusually rich data from the National Household Survey of Peru ("Encuesta Nacional de Hogares", ENAHO) to evaluate the impact of access to the Peruvian SHI called "Seguro Integral de Salud" (SIS) for individuals outside the formal labor market on a variety of measures for health care utilization and out-of-pocket expenditures. We account for selection by exploiting a sharp regression discontinuity design.

The Peruvian case is interesting because SIS resembles Western public health insurance systems and private insurance products in that it covers health care expenditures related to both curative use and preventive care, but does not provide extra incentives to invest in preventive care. Coverage is free for eligible individuals, and those who are not covered by SIS typically lack insurance coverage.[5] SIS was created in 2001 and subsequently reformed. *Prima facie*, these reforms have been successful, as coverage by SIS is comprehensive and the fraction of the population making use of it has increased from 20% in 2006 to 45% of the total population in 2011, reaching a relatively high rate among the SHI programs in low and middle income countries (Acharya et al., 2013). Yet, even though aggregate data suggest that some health outcomes improved since the program has been implemented—between 2000 and 2010 total maternal mortality rates decreased from 185 to 93 per 100,000 children born and child mortality rates decreased from 33 to 17 per 1000 children born[6]—to date there is little evidence on the effects of insurance coverage that is based on micro level data. A notable exception is the paper by Neelsen and O'Donnell (2017) who study the effects of introducing SIS by means of a differences-in-differences analysis.[7]

In this paper, we instead study the effects of an upgraded version of the program and make use of the opportunity to control for selection by exploiting the institutional setup in Peru that gives rise to a sharp regression discontinuity design (RDD). It originates in a reform that was agreed upon in 2009. Since the end of 2010, an individual who is not formally employed is eligible for free public health insurance if a welfare index called Household Targeting Index ("Índice de Focalización de Hogares", IFH) that is calculated by Peruvian authorities from a number of variables is below a specific threshold. We have access to this information and use it to re-calculate the composite index of economic welfare. Variation in this index around the threshold provides the natural experiment that we exploit.

Two aspects of the institutional background in combination with our research design are particularly appealing. First, all individuals who are eligible for the program can be considered covered by it. The reason for this is that enrollment is easy and quick, as it can take place at the facility at which individuals seek treatment. It does not involve any fees, and as individuals can usually receive free treatment within a few days, often on the next day. Second, for our population of interest, crossing the eligibility threshold implies coverage. This means that we will estimate the local average treatment effects of insurance coverage for those individuals whose welfare index has a value close to the eligibility threshold. The evidence we provide is policy-relevant, as it addresses the question what would happen to individuals who are just not covered if eligibility would be expanded by increasing the threshold.

Making use of the rich data from the ENAHO of Peru and the discontinuity generated by the institutional rules, we find large effects on several measures of curative care use in combination with increases in out-of-pocket spending. Individuals are more likely to receive medicines, it is more likely that a medical analysis is performed, they are more likely to visit a hospital, and it is more likely that they receive surgery.

We shed light on the underlying mechanisms by characterizing who pays for each of these forms of care. We show that the increased access to doctors who perform medical analysis and prescribe medicines is usually fully financed by SIS. At the same time, we find that medicines, hospital visits and/or surgeries are financed by households themselves.

In line with this, insurance coverage leads to increases in out-of-pocket spending for medicines, hospital visits and/or surgery that are likely driven by limitations faced by the health care suppliers. Using an estimator of quantile treatment effects, we find that the effects on spending are particularly pronounced in the top end of the distribution.

[3] See for instance Abel-Smith (1992), International Labour Office et al. (2006), Pauly et al. (2006), and Acharya et al. (2013). Also for developed countries, our understanding in that respect has increased substantially over the last decades, but is still far from being complete.

[4] We interchangeably use the terms spending and expenditures in combination with out-of-pocket, health care, or health.

[5] The latter may, however, seek medical attention on a pay-as-you-go basis in the same national hospitals or healthcare centers, or buy medication without a prescription.

[6] National Institute of Statistics and Informatics (INEI)-National series, http://series.inei.gob.pe:8080/sirtod-series/. Dow and Schmeer (2003) perform an analysis of the effect of health insurance in Costa Rica on infant and child mortality. They use aggregate level data at the county level and control for fixed effects. As in Peru, increases in insurance coverage over time went along with decreases in infant and child mortality. Gruber et al. (2014) find evidence for similar effects in Thailand.

[7] They estimate the effects of introducing a previous benefit plan called "Listado Priorizado de Intervenciones Sanitarias" (LPIS). In this paper, we study the effects of a comprehensive package of health care benefits, composed of a basic plan of health benefits called "Plan Esencial de Aseguramiento en Salud" (PEAS) and two highly generous supplementary plans. There are other studies relating enrollment to health care utilization and outcomes. For instance, Parodi (2005) finds that SIS enrollment increases the probability that poor pregnant women give birth in a formal institution. However, he does not control for selection into insurance. Bitrán and Asociados (2009) find that SIS increases utilization for both preventive and curative services (with biggest impacts on treatments for diarrhea and acute respiratory infections for children) and that SIS reduces the likelihood that insured individuals incur in out-of-pocket health expenditures. The authors control for selection into insurance but they do not use the means test used by SIS at the period of analysis. Instead, they use consumption per capita to evaluate eligibility. There are also studies that are more policy-oriented. For example, Arróspide et al. (2009) discuss the design and effectiveness of the SIS's institutional budget and provide policy recommendations. Francke (2013) analyzes whether the implementation of the SIS program has played a role in extending health coverage in Peru.

We interpret these findings in more detail by looking at them through the lens of a simple conceptual framework that we present in Section 3 below. The main contribution of our paper is that we provide evidence in favor of two arguments that are less common in economics.[8] First, insurance coverage leads to increased awareness about health problems, because it increases the likelihood that individuals see a doctor; and second, this even generates a willingness to pay for services that are not covered or not available, which in the context of Peru is a potentially desirable form of supplier-induced demand.

There is a huge literature on the effects of health insurance coverage in the developed world. It is beyond the scope of this paper to summarize this literature. Cutler and Zeckhauser (2000) provide an excellent survey. One of the most important general findings is that more generous insurance coverage leads to increases in health care utilization. This has been convincingly documented in the context of the RAND Health Insurance Experiment (Newhouse, 1974, 1993; Aron-Dine et al., 2013) and more recently in the context of the Oregon Health Insurance Experiment (Finkelstein et al., 2012).

In comparison, the literature on the effects of SHI in low and middle income countries is scarce, but growing.[9] The evidence points towards large effects on utilization. At the same time, the picture is still blurred when it comes to out-of-pocket spending. In part, this is because earlier contributions have not focused on linking evidence on the effects on spending by type of care to the institutional environment. Our data allow us to make progress in this direction and thereby shed light on the underlying pathways.

For Peru, Neelsen and O'Donnell (2017) find positive effects of an earlier form of SIS on receipt of ambulatory care and medication, but no impact on inpatient care and average out-of-pocket expenditures.

Thornton et al. (2010) find that initial take-up of subsidized, but for-pay insurance "Seguro Facultativo de Salud" among informally employed individuals in Nicaragua was as low as 20%. Moreover, after the subsidy expired most individuals who previously signed up cancelled their insurance. The results for the few who did sign up and kept their insurance suggest that insurance could have a positive effect in the sense that average health care expenditures, which are generally seen as too low, increased. This could, however, also be the case because those who bought insurance and kept it constitute a negative selection of risks for whom the effect of insurance is particularly high.

Next to this, there are a number of studies on Mexico, including Barros (2008), King et al. (2009), Sosa-Rubi et al. (2009), and Galárraga et al. (2010). All of them investigate the effects of the "Seguro Popular" program, whose aim is—as the SIS's in Peru—to improve access to health insurance for the poor. Unlike in the Peruvian, but like in the Nicaraguan program, coverage in the Mexican program is not for free. The findings in all four papers consistently suggest that the demand for medical care has shifted to providers that are part of the system, and in line with this, individual health care expenditures have been reduced, including catastrophic health expenditures. In that sense, the program was successful in being a transfer program, but less so in encouraging individuals to seek care when ill. The findings do not suggest that utilization has increased for types of care other than obstetric utilization.

Turning to China, Lu (2014) shows supplier-induced demand to be potentially important. She finds that when doctors expect to obtain a proportion of patients' drug expenditures, then they write more expensive prescriptions to insured patients. Wagstaff et al. (2009) find that the launch of a heavily subsidized voluntary health insurance program in the rural parts of the country led to increased outpatient and inpatient utilization, but has not reduced out-of-pocket expenditures.

In contrast, Wagstaff (2010) finds for Vietnam that insurance coverage led to a reduction of out-of-pocket spending and no impact on utilization.

The design of the program in Georgia is very similar to the one in Peru. However, and in contrast to our findings, Bauhoff et al. (2011) find no effect of insurance coverage on utilization. They argue that the reason for this is that individuals were not aware of being covered, or that there were administrative problems that caused them to indeed not be covered, that they did not make use of the services because the program did not cover drugs, and because the perceived quality of the services was low. Therefore, it is not surprising that their findings are different from ours for Peru.

Next, turning to Colombia, and comparing the results to the ones in this paper for Peru, it becomes clear that the effects of insurance coverage depend on the design of the system. In Colombia, private insurers mainly receive a capitation fee and therefore have incentives to increase preventive services on the one hand and to limit total medical expenditures on the other. And indeed, Miller et al. (2013) mainly find effects on preventive care. In Peru, SIS covers both preventive and curative services and doctors are reimbursed on the basis of the treatments they provide. Hence, participating hospitals and health care facilities do not have an incentive to discourage curative treatments or medical procedures in favor of preventive services. This explains why in Peru most of the effects are on curative use.

Finally, two recent papers, Gruber et al. (2014) and Limwattananon et al. (2015), investigate the effect of a large-scale increase in health insurance coverage for the poor in Thailand. They find that the program had positive effects on health care utilization, negative effects on out-of-pocket expenditures, and negative effects on child mortality rates. These findings are similar to ours for Peru, except that we find positive effects on health expenditures at the top end of the distribution. Our explanation for this is that individuals, once covered, became aware of additional health care needs and payed for some of them out-of-pocket.

We proceed as follows. Section 2 discusses the institutional background and provides details on the SIS program. We present a conceptual framework—an informal sketch of a model of demand for health insurance and health care utilization—in Section 3. In Section 4 we provide information on our data and in Section 5 we describe the econometric approach. Results are presented in Section 6. A number of robustness checks are conducted in Section 7. Section 8 concludes. Additional results are presented in an Online Appendix.

2. Institutional background

2.1. Seguro Integral de Salud

The public health insurance program "Seguro Integral de Salud" (SIS), whose effect we study in this paper, was introduced in 2001. Its overarching goal is to improve access to health care services for

[8] An exception is Wagstaff and Lindelow (2008) who focus on the effects of health insurance on financial risk in China and find that health insurance coverage increases the risk of incurring high and catastrophic spending, respectively. They argue that this is because insurance encourages individuals to seek care and this ultimately leads to higher expenditures that they then cover themselves.

[9] The selection of papers we discuss here is necessarily incomplete, but we believe it is to some extent representative. Acharya et al. (2013) systematically examine 64 papers on the effects of health insurance and present a review on the 19 papers that correct for selection into insurance. The review concludes that there is little evidence on the impact of insurance on health status, some evidence on utilization, weak evidence on out-of-pocket health expenditures, and unclear effects for the poorest. However, arguably, given the large variation in incentives provided by the respective institutions, it is not surprising that there is heterogeneity in the effect across countries. Giedion et al. (2013) also provide a comprehensive review classifying papers according to findings and research design. They also conclude that specific features of the design have a large impact on the likelihood that specific goals, such as increasing access or improving health, are reached. See also Abel-Smith (1992), International Labour Office et al. (2006), Pauly et al. (2006) and Dercon et al. (2008), and the references therein, for a review of the more policy-oriented literature.

individuals who lack health insurance, giving priority to vulnerable groups of the population who live in extreme poverty and are not formally employed (Arróspide et al., 2009).

The creation of SIS and subsequent reforms led to a substantial increase of health insurance coverage over time. Bitrán and Asociados (2009) and Francke (2013) provide interesting descriptive analyses of this increase and its relevance within the Peruvian health system in general. Between 2006 and 2011 the fraction of the population making use of services provided by SIS increased from 20 to 45%, which means that by then SIS was the main health insurance provider in Peru.[10]

2.2. Eligibility and benefit package

The aim of the government was to target poor groups in the population. For this, ideally, eligibility should be based on accurate information on income at the level of the individual or family. However, such information is typically not available in developing countries because a large part of the population works outside the formal sector and therefore does not pay income taxes and social security contributions. Eligibility for SIS is therefore based on the so-called Household Targeting System ("Sistema de Focalización de Hogares", SISFOH). A unified household registry is maintained and is used to calculate targeting indicators at the level of the family.[11] Data are collected by government officials on a continuous basis and using a standardized form. There are questions on, among other things, housing characteristics, asset possessions, human capital endowments and other factors.

The IFH index is the main eligibility criterion for the sample of non-formally employed individuals we consider in this paper. It is a linear combination of the variables in the household registry that takes on lower values for households that are poorer. Eligibility for SIS is based on SISFOH in the capital Lima from 2011 on, and in the rest of the country from 2012 on. Online Appendix F explains in detail how the IFH is constructed, including the complete list of variables and their weights. Individuals are eligible if it is below a regional-specific threshold.[12] Importantly, whereas potential beneficiaries intuit the importance of their answers to the questions of the government official, they do not know how exactly the IFH index is calculated and what their cutoff value for eligibility is. SISFOH does not inform households about the value of their index and only provides the result of the eligibility evaluation. If eligible, individuals have the possibility to enroll into SIS at a number of places, including the Ministry of Health ("Ministerio de Salud", MINSA) facilities. They are covered as soon as eligibility is confirmed, which is usually a matter of days, often only one. Then, they receive the health services that are offered at MINSA facilities and that are part of the benefit package. In this sense, eligibility also means coverage.[13] In urban areas, the eligibility evaluation is valid for a period of 3 years (4 years in rural ones). This means in practice that re-enrollment after a year is automatic provided that individuals are not covered by another health insurance, individuals do not ask to be un-enrolled in the meantime, an individual changes address, and provided that there is no evidence for fraud. It is not related to the IFH index and in practice, exclusion of individuals after a period of enrollment is very uncommon.

SIS offers a comprehensive package of health care benefits, composed of a basic plan of health benefits called PEAS and two supplementary plans. The PEAS plan is based on a wide-ranging list of needs that any public and private insurance plan (including SIS) must address, grouped in the following six categories: healthy population (preventive care), obstetric and gynecological care, as well as care related to pediatric conditions, neoplasm conditions, transmittable conditions and non-transmittable conditions.[14] There is an extensive list of benefits related to each listed need. The plan covers ambulatory patient services, hospitalization and emergency care. Table A.1 in Online Appendix B shows that PEAS covers 994 out of the 12,421 possible needs listed in International Statistical Classification of Diseases and Related Health Problems (ICD-10), that is, up to 8.0% of all possible needs.[15] It is estimated that PEAS covers 65% of the total disease burden (Francke, 2013). Importantly, for individuals covered by SIS, benefits included in PEAS cannot be subject to exclusions, waiting times or latent periods.[16] Moreover, there are no co-payments, coinsurance, deductibles, or similar fees.[17]

PEAS includes theoretical limits to the number of times an individual can receive each listed benefit. However, these limits are effectively annulled by the two SIS supplementary plans. Individuals enrolled to SIS are automatically covered by these plans, that is, they do not need to sign up to them nor to fulfill new requirements. The Regular Supplementary Plan[18] adds 1640 more needs to the PEAS list, that is, an additional 13.2% of needs included in ICD-10 (see Table A.1). This plan includes a monetary limit by event close to US$ 1875. [19] Next to this, the Extraordinary Coverage Supplementary Plan[20] is particularly generous as it allows SIS to go beyond the list of needs established by the previous two plans in a discretionary way, and also beyond the established limits. This supplementary plan states a new extremely generous monetary limit: costs for an individual must not exceed 2.5% of the annual SIS budget. There is an application procedure to access benefits using standardized forms.

In sum, SIS covers more than 2634 needs (21.2% of needs included in ICD-10) and, through supplementary plans, the stated limits are offset so that SIS offers a very generous package of health care benefits.[21]

[10] This increase was higher than the one in other countries, such as Colombia. One of the reasons for this could be that the price for insurance was truly zero. Although there is no economic reason why there should be a substantial difference between a zero price and a small positive price, behavioral aspects that lead to individuals perceiving a big difference between the two may play an important role (Shampanier et al., 2007).

[11] See SISFOH (2010) and Law 29626, "Decreto de Urgencia 048-2010" and "Resolución Jefatural 063-2011/SIS" for specific regulations that mandate to use SISFOH's rules for eligibility to SIS.

[12] At the same time, it is required that water and electricity expenditures are both below some specific thresholds. We control for this in our analysis, as we explain in Section 5. For Lima, the thresholds are 55 for the IFH, 20 Soles for water expenditures, and 25 Soles for electricity expenditures. This corresponds to 7.3 and 9.1 U.S.~dollars, respectively. According to the Central Bank of Peru, the average informal exchange rate (Nuevos Soles per U.S. Dollar) in 2011 was 2.755. As a reference, the interbanking rate was 2.754. Table A.10 in Online Appendix F provides the complete set of IFH thresholds by geographic areas. Fig. A.8 shows the relationship between water and electricity expenditures and the IFH index. The Online Appendix also contains further details on the eligibility rules.

[13] It could be that some individuals are not aware of being eligible and therefore think of themselves as not being covered by health insurance. If this is the case, then we will estimate lower bounds of the effect sizes, as explain in Section 7.7 below.

[14] See "Decreto Supremo 016-2009/SA" for detail information on this "Plan Esencial de Aseguramiento en Salud", PEAS.

[15] The table also shows how these covered needs distributes according to the ICD-10 classification.

[16] See articles 89 and 90 of "Reglamento de la Ley 29344. Ley Marco de Aseguramiento Universal en Salud", approved by "Decreto Supremo 008-2010-SA" .

[17] See article 80 of "Reglamento de la Ley 29344. Ley Marco de Aseguramiento Universal en Salud", approved by "Decreto Supremo 008-2010-SA" .

[18] See "Resolución Jefatural 133-2010/SIS" for detail information on this Regular Supplementary Plan.

[19] The precise limit is 1.5 times the Peruvian Tax Unit (PTU), a reference value used in tax rules to calculate tax bases, deductions and tax limits. As a reference, the PTU is almost US$1250 in 2017.

[20] See "Resolución Jefatural 134-2010/SIS" for detailed information on this Extraordinary Coverage Supplementary Plan.

[21] The only explicit exclusions are three: surgery not oriented towards improvement of health status, medical attentions with other financing source, and medical attentions outside the Peruvian territory.

2.3. Supply side

The Ministry of Health (MINSA) runs a network of health care centers and hospitals that provides services to individuals covered by SIS. They also serve individuals who are not covered by SIS, who pay for this themselves. Patients usually first visit a health care center and are referred to a hospital when the health care center cannot provide a proper diagnosis or treatment. Health care centers do however not act as gatekeepers. That is, individuals can also directly visit a hospital.

Each MINSA facility is reimbursed by SIS on the basis of the treatments it provides. Reimbursement rates are based on estimates of the variable costs plus a markup.[22] There is no capitation fee and there are no extra incentives to either limit curative care use or encourage investments in preventive care, as it is the case in Colombia, for example.

Importantly for our findings, some MINSA facilities suffered from a number of substantial supply limitations.[23] They originate in a cut that SIS experienced in its budget, which in turn resulted in a failure to transfer resources for reimbursement to MINSA facilities during the entire year of 2011.

The effects of those supply limitations are not systematically documented, but there is evidence that in response, especially hospitals charged money for medicines and treatments to insured patients.[24] To counteract this, "SIS agents" were put in place, who are supposed to ensure that hospitals stop this practice in later years.[25]

Besides, there has been a shortage of dentists and ophthalmologists. The rate of odontologists per ten thousand inhabitants is one of the lowest among all medical professionals (Giovanella et al., 2012) and it is even lower when they work as providers for SIS (Defensoría del Pueblo, 2013). In addition to that, at that time, only a small number of ophthalmologists provides services to SIS participants, which in turn limits the use of ophthalmological care. Only recently, after our study period, the National Ophthalmological Institute, the largest provider in Peru, joined the list of SIS providers.

In sum, even though SIS offers a comprehensive package of health care benefits, supply limitations and institutional problems related to the transfer of resources from SIS to MINSA facilities made some medicines and treatments not fully available and free for the insured. It is an empirical question how this affects care consumption and out-of-pocket expenditures. We turn to this question in our analysis below.

3. Conceptual framework

It is instructive to interpret our empirical results through the lens of a conceptual framework. We provide a formal model complementing this framework in Online Appendix A. The primary purpose of this framework is to discuss the implications the institutional setup has on health care demand, with a focus on individuals not being aware of some of their health care needs when they are not covered by health insurance.

Without them seeing a doctor individuals are aware of some health care needs, but not all. Sen (2002) distinguishes in this context between "internal" and "external" views of health and stresses that "the patient's internal assessment may be seriously limited by his or her social experience", such as seeing a doctor or not.[26]

Importantly, and in contrast to what is common in developed countries, in Peru the individual can buy all drugs at the pharmacy. That is, there are no prescription drugs. Therefore, the baseline case is that she buys drugs at the pharmacy to treat the health care needs she is aware of and pays for this herself. This has been common practice for a long time and may of course ultimately have adverse effects on health. However, evidence on this is scarce (Laing et al., 2001).

Suppose now that the individual considers seeking professional care at some cost. Because of the cost, she will only do so if the health care needs she is aware of are important enough to her. She will be more inclined to do so when insured, because she will expect that at least some treatments will be covered by the insurance once she visits a doctor.

Suppose she decides to visit the doctor and the treatment is indeed covered by insurance. Then it could be that because of this she will consume more care than she would if she would have to pay for it herself, which could be due to the fact that individuals are liquidity-constrained and health insurance helps them pay for health care, or because of *moral hazard*.[27]

The value associated to this generates an additional incentive to see a doctor in the first place.

Conversely, one reason not to visit a health care center is the perception that—even though health insurance gives individuals access to doctors—this is not valuable because advice obtained from them is often of low quality, and therefore making use of insurance coverage is not worth its (opportunity) cost, including the time it takes to register.[28]

[22] In addition, direct governmental budget transfers to MINSA are supposed to cover fixed costs.

[23] Defensoría del Pueblo (2013) reports that in 2012, 20% of the hospitals lack at least one piece of equipment required for inpatient surgery and 15% report to face problems with at least one other input needed for performing surgery.

[24] The survey underlying our data, described in Section 4 below, contains one question that is asked to individuals who report having a health incident and seek medical attention at MINSA facilities or other places. Individuals are asked whether they found the prescribed drugs at the facility. 43.6% answer with no, suggesting that they may have bought them themselves in a pharmacy. We have also conducted a small informal survey in two health care facilities, in October and December 2014. We asked 19 individuals about their experiences. Their answers revealed that the facilities did not have enough drugs in 2011, so that the individuals bought them themselves at private pharmacies. They also confirmed that the lack of equipment meant that certain treatments could not be undertaken, which resulted in patients paying themselves for treatment that was received elsewhere. For instance, one person needed to receive prostate surgery and said that he will probably get it elsewhere instead of waiting until the next year.

[25] See the Annual Report to Parliament made by the "Defensoría del Pueblo" (Defensoría del Pueblo, 2011) for evidence for the year 2011 and "Resolución Jefatural 091-2013/SIS" for evidence for the year 2012 and the creation of "SIS agents". The agents were located at hospitals to supervise the entire process of health care provision to SIS affiliates, especially whether procedures were effectively free and individuals received all prescribed medicines. In the beginning, SIS hired 22 agents to supervise hospitals of Lima and Callao. In the rest of the country, more agents were hired over time. Other tasks of the agents were to ease the coordination between hospitals and SIS when there were problems and to provide information to and receive complaints from individuals covered by SIS. One may wonder whether the behavior of hospitals was illegal. Regulation was not clear in this respect. Only at the end of 2011, it was established that SIS and providers have joint legal responsibility for effectively providing coverage to SIS affiliates. See "Resolución de Superintendencia 160-2011-SUNASA/CD" for further details.

[26] See also the discussion of various biases in self-assessed health measures in Murray and Chen (1992).

[27] This increase in the demand for medical care is commonly termed *ex post* moral hazard. In contrast, a reduction of preventive effort or care that is due to them being covered by health insurance is termed *ex ante* moral hazard. If higher risk types, in the absence of moral hazard, buy insurance, then one speaks of adverse selection, following Akerlof (1970). See for instance Zweifel and Manning (2000). The empirical literature on moral hazard and adverse selection is still scarce, but growing. Chiappori (2000) provides a broad review of the early literature. Chiappori and Salanié (2000), Abbring et al. (2003a), and Abbring et al. (2003b) investigate moral hazard in the market for car insurance. Finkelstein and Poterba (2004), Bajari et al. (2006), Fang et al. (2006), Aron-Dine et al. (2015) and Einav et al. (2013) study adverse selection and moral hazard in the context of health insurance in developed countries. Einav et al. (2013) study the interrelation between adverse selection and moral hazard and term it "selection on moral hazard".

[28] Das et al. (2008) provide evidence pointing towards such low quality advice, at least in other low-income countries. Non-enrollment into free (net of the opportunity cost of time) health insurance is a well-documented phenomenon in the U.S. See, for instance, Blank and Card (1991), Blank and Ruggles (1996), and Currie and Gruber (1996). Also in other contexts, it is argued that individuals make dominated choices (see for example Choi et al., 2011, and the references therein).

An important additional effect is that once individuals visit a doctor, he may make them aware of additional health care needs. This is a form of what has been termed supplier-induced demand (McGuire, 2000). Strauss and Thomas (1998) argue that this is an important potential determinant of health care expenditures in developing countries. The additional care consumption may or may not be provided to them for free, even though there are effectively no formal coverage limits. As we explain in Section 2.3 above, the reason for this is that some facilities suffered from severe supply limitations. This could lead to patients paying for some treatments or buying drugs elsewhere, for instance at a pharmacy. If this is the effect of insurance coverage, then, as long as one thinks of doctors as not providing misinformation to patients, one can make the argument that spending money reveals the preference of the individual for these increased expenditures and that the supplier-induced demand is therefore beneficial to the individual.

To summarize the empirical predictions, we expect utilization to increase once individuals are covered by health insurance, and out-of-pocket health care expenditures to either increase (when individuals are made aware of many useful expenditures) or decrease (when the majority of the treatments are provided by the health care facilities and the overall out-of-pocket expenditures decrease because less money is spent at the pharmacy and in health care centers together).

4. Data

This paper uses cross-sectional data from the ENAHO household survey for the year 2011, which is representative at the level of each of the 24 departments in Peru. It is the only data set that provides the information needed to re-compute the IFH index and, at the same time, on health care utilization, its financing and out-of-pocket expenditures.[29] Online Appendix D contains details on the way we define our outcome variables.

Data are collected using face-to-face interviews with one or more respondents per household, who are also asked to provide information on the other household members. Online Appendix C describes the interview procedure related to the health questions. In brief, the part of the survey related to health has two branches. In the first branch, individuals are first asked whether they experienced health problems and then what they did in response. In the second branch, individuals are asked which health care services they used and then who paid for it. This means that individuals may be asked twice whether they visited a doctor, for instance. Importantly, the set of outcomes in the first branch is finer than in the second branch, which is why information on the financing source is not available for all variables we use in our analysis.

Our data also contain information on the level of out-of-pocket expenditures by financing source.

We construct three mutually exclusive categories for the financing source: 1) fully insured, if the individual indicates only a governmental program or other insurance program as the financial source; 2) out-of-pocket, if the individual points only at a member of her household or a member of other household as the financial source; 3) partially insured, if the individual reports the financial source by combining alternatives of the first and second categories.

SIS is targeted to individuals who work in the informal sector. For these individuals, the IFH index is the most important criterion to determine eligibility. Therefore, for our analysis, we select individuals that belong to a household in which no member is formally employed.[30] This group comprises approximately 60% of the entire sample.

In 2011, almost one third of the population lived in the Lima Province and half of Peru's Gross Domestic Product (GDP) was generated there. For two reasons, we focus on individuals from that province. First, in 2011 the IFH targeting rule was only applied in this area, before this was gradually extended to the rest of the country (Ministerio de Salud, 2011). In other parts of the country and in later years it was less strictly applied. Second, the Lima Province is very densely populated and therefore there are enough health care centers and medical professionals so that we can exclude that either a large distance or absence of the staff explain that individuals do not demand health care.[31] This means, however, that our results do not necessarily apply to the rest of the country.

Our sample contains information on 4161 individuals after the two exclusion criteria are applied. Tables A.4 through A.6 in Online Appendix E provide summary statistics for the full sample. In our main analysis below we use a more local sample to carry out regressions and report our estimate of the baseline level for each outcome along with our estimate of the effect of insurance coverage. As described in Section 5 below, this baseline is the expected outcome for individuals who are just not eligible for SIS. It is a more meaningful statistic than the raw mean in our sample, because it is for the same group of individuals for whom we estimate the effects by means of exploiting the RDD.

5. Econometric approach

In this paper, we estimate the impact of SIS coverage on a host of variables characterizing health care utilization and out-of-pocket expenditures. Based on the institutional setup described in Section 2.2 we do this by means of a RDD using the IFH index as the continuous forcing variable.[32]

An individual is eligible for public insurance if she lives under poor conditions, which is measured at the household level. In the Lima Province, the condition for this is that the IFH index is below or equal to a value of 55, provided that both, water and electricity expenditures do not exceed 20 and 25 Soles, respectively. Hence, provided that the condition on water and electricity expenditures holds, we have a sharp RDD.

[29] There are also data for the years 2012, 2013 and 2014. For political reasons, however, the eligibility criteria were not applied strictly anymore in those later years. Therefore, unlike in 2011, we cannot exploit a regression discontinuity design for those later years.

[30] We define formality as having monetary income from dependent employment. This does not include any other monetary income or income from self-employment. This definition is close to the one used by the authorities: they distinguish between individuals whose wage is observable by them (available in governmental databases) and others. We have also explored other definitions, including having a formal contract in the main occupation, working in an enterprise that keeps accounting books and being affiliated to a pension system. Results remain qualitatively the same.

[31] According to Banerjee et al. (2004) these are two prime reasons why households in Rajasthan in India spend a considerable fraction of their budget on health care, essentially buying drugs. In other parts of Peru, utilization of health services has been limited by supply constraints. The Office of the Ombudsman reports that most of the 4500 health care centers around the country are not sufficiently equipped to provide inpatient care (Defensoría del Pueblo, 2013). An official technical committee concludes that the biggest challenge faced by the Peruvian health system between 2009 and 2011 is the shortage of supply of health services in many parts of the country, because it lacks adequate capacity infrastructure, equipment and human resources (Comité Técnico Implementador del AUS, 2010). Finally, also statistics from the World Bank shows that, while the average of hospital beds per 1000 people is 1.83 for Latin America, it is only 1.55 for Peru. This also occurs with other measures of supply health services, including the number of health workers such as physicians, nurses and midwives (World Bank, 2013).

[32] This approach goes back to at least Thistlethwaite and Campbell (1960). See Hahn et al. (2001) for a more modern exposition and Imbens and Lemieux (2008) for a discussion of practical issues.

We will impose linearity around the eligibility threshold and estimate the effects using the standard ordinary least squares estimator with estimation equations of the form

$$y_i = \beta_0 + \beta_1 z_i + \beta_2 elig\_IFH_i + \beta_3 z_i \cdot elig\_IFH_i + \beta_4 not\_elig\_WE_i + \beta_5 not\_elig\_WE_i \cdot elig\_IFH_i + \beta_6 not\_elig\_WE_i \cdot z_i + x_i'\beta_7 + \varepsilon_i.$$

Here, z_i is the IFH index centered at its threshold, $elig\_IFH_i$ is an indicator for eligibility based on the IFH index (that is, an indicator for $z_i \leq 0$), and $not\_elig\_WE_i$ is an indicator for *in*eligibility based on water and electricity consumption. x_i is a vector of controls that are de-meaned. The parameter of interest is β_2, which is the effect of health insurance coverage for individuals who become covered because their IFH index crosses from above to just below the eligibility threshold. This parameter is policy-relevant because it is directly related to the question what the effects of expanding insurance coverage through increasing the threshold value would be for the individuals who would then receive coverage.[33] We also report estimates of β_0. Recall that x_i is de-meaned. This means that what we report is the baseline level of the outcome, when z_i is just above the threshold for eligibility.

The first assumption we need to make for our analysis is that if no insurance or insurance would be assigned to everybody around the threshold, then the respective distribution of the outcome conditional on the index would be smooth in the index z_i around zero.[34] Then, β_2 is indeed the effect of coverage. This assumption cannot be tested directly and is therefore the main assumption we will make. As we have argued before, the institutional rules suggest that it holds, as no other programs or rules are based on this eligibility threshold. Moreover, this assumption is supported by further evidence that we present in Section 7 below.[35]

The second assumption is that insurance status is monotone in eligibility. This holds by construction, as we are facing a sharp regression discontinuity design and therefore, changing from a value of the index slightly higher than the threshold to a value lower than the threshold will directly make an individual eligible for insurance coverage.[36] The final, third assumption is an exclusion restriction. It is that in a small neighborhood around the eligibility threshold, the value of the index, z_i, is independent of the outcomes, and in particular ε_i.[37] It would be violated if households would manipulate their answers to the government official in order to influence the value of the IFH index. As discussed in Section 2 this is unlikely to be the case. We nevertheless test for manipulation in Section 7.1.

Under the same assumptions, it is also possible to exploit the RDD and estimate quantile treatment effects, as described in Frandsen et al. (2012). The underlying idea is straightforward. Instead of an average, the quantile treatment effect is the change in, say, the median of the distribution of an outcome that results from being covered by public health insurance. Results are presented in Section 6.2.

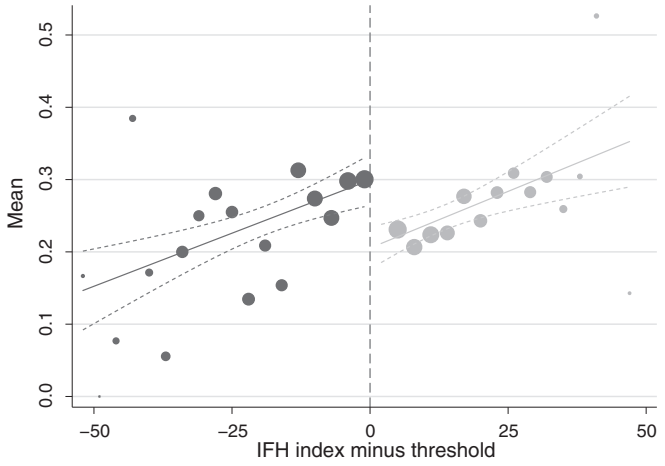

Fig. 1. Receives curative care. Notes: Based on ENAHO data for the year 2011 for the Lima Province. See Section 4 and Online Appendix E and F for details on the data and on how the IFH index is computed. The dots denote averages, with a bin width of 3. Their size represents the number of observations. The regression lines with corresponding 95% confidence intervals stem from separate linear regressions to the left and to the right of the threshold using the individual-level data.

Before presenting the results, it is worth noting that our econometric approach does not involve a "first stage", as it is usually the case in similar studies exploiting a regression discontinuity design. It is easiest to see this by inspecting the estimation equation above. If individuals are anyway not eligible and hence not covered by health insurance because of their water or electricity consumption, then we will control for this.[38] Consequently, β_2 is the effect of becoming eligible due to crossing the IFH eligibility threshold for all other individuals. As we have explained above, given the institutional rules eligibility essentially implies coverage. Hence, this is not only the effect of eligibility, but also the effect of coverage. This is as if the first stage is one, which is always the case in a sharp regression discontinuity design (Hahn et al., 2001). Alternatively, as we discuss in Section 7.7 below, our estimates can be interpreted as intent-to-treat effects, or lower bounds of effect sizes.

6. Results

6.1. Health care utilization

We start by showing the relationship between the probability to receive curative care and the IFH index in Fig. 1.[39] Recall that higher values of the index indicate a higher level of welfare. Individuals are covered by SIS when the index is below the eligibility threshold. In the figure, we plot estimates of the probability to receive curative care against the IFH index minus the eligibility threshold, which is why we expect the downward jump of utilization at zero that we also observe in the figure. The interpretation is that insurance coverage has a positive effect on the probability to consume curative care.

[33] For individuals ineligible due to their high consumption of water and electricity, the effect of the IFH index crossing from above to just below the eligibility threshold is the sum of β_2 and β_5. Our results show that this sum is generally not significantly different from zero.

[34] See Frandsen et al. (2012) for a precise statement. This is slightly stronger than needed. Usually, it is enough to assume that the two conditional expectations are smooth around the threshold (Imbens and Lemieux, 2008). We make this stronger assumption here in order to be able to estimate quantile treatment effects as well, as described below.

[35] For instance, we show in Fig. A.8 and Table A.14 below that water and electricity consumption do not exhibit a discontinuity at the eligibility threshold. This means that there is independent variation in the IFH index.

[36] In that sense, monotonicity automatically holds. It does not automatically hold when some individuals are unaware of being covered. This becomes relevant in Section 7.7. See also Battistin et al. (2009) and Klein (2010) for related discussions.

[37] Again, for the same reason as above, mean independence suffices for most of our analysis, but we make this stronger assumption in order to also estimate quantile treatment effects.

[38] We did not drop these observations in order to be able to estimate β_7 and consequently the effects of interest more precisely. Dropping them instead led to very similar point estimates. Moreover, the estimated effect of crossing the eligibility threshold should be zero for individuals who live in households with high enough water or electricity consumption. This is testable and generally, we found that $\beta_2 + \beta_5$ was not significantly different from zero.

[39] See Figs. A.2 to A.7 in Online Appendix H for additional outcomes. Notice that we use a linear specification for the fit. We have tested whether coefficients on higher order term were significantly different from zero and they were generally not.

Table 1
Effect of health insurance on health care utilization.

	General		Effect by financing source		
	Effect	Baseline	Fully insured 7/.	Partially insured 8/.	Out of pocket 9/.
More general forms of care usually provided by health care center					
Doctor visits	0.0887*	0.2961***	0.0591**	0.0097	0.0191
	(0.0501)	(0.0330)	(0.0248)	(0.0098)	(0.0475)
Medicines	0.1455***	0.4195***	0.0293	0.0129	0.1039**
	(0.0524)	(0.0351)	(0.0227)	(0.0126)	(0.0523)
Analysis	0.0548**	0.0187	0.0332**	−0.0025	0.0241
	(0.0256)	(0.0159)	(0.0166)	(0.0022)	(0.0202)
X-rays	0.0340*	0.0203*	0.0068	0.0087	0.0178
	(0.0200)	(0.0121)	(0.0115)	(0.0054)	(0.0158)
Other tests	−0.0051	0.0197**	−0.0136		0.0085
	(0.0145)	(0.0098)	(0.0107)		(0.0099)
Glasses 1/.	0.0223	0.0142	0.0053		0.0170
	(0.0187)	(0.0125)	(0.0037)		(0.0184)
Other treatments	−0.0210	0.2134***	0.0044	−0.0081	−0.0115
	(0.0431)	(0.0302)	(0.0179)	(0.0086)	(0.0398)
Care provided by hospital					
Hospital and/or surgery	0.0776***	0.0397**	0.0044	−0.0002	0.0636***
	(0.0283)	(0.0168)	(0.0200)	(0.0097)	(0.0178)
Hospital	0.0564**	0.0396**			
	(0.0264)	(0.0156)			
Surgery	0.0482**	0.0120			
	(0.0202)	(0.0118)			
Child birth 2/.	0.0581	0.0521**	0.0558	0.0017	0.0006
	(0.0482)	(0.0249)	(0.0477)	(0.0082)	(0.0016)
Dental care	0.0362	0.0868***	0.0170	0.0013	0.0180
	(0.0320)	(0.0203)	(0.0172)	(0.0013)	(0.0278)
Ophthalmological care	0.0187	0.0475***	0.0142	0.0003	0.0038
	(0.0238)	(0.0167)	(0.0087)	(0.0004)	(0.0225)
Likely preventive care					
Vaccines	0.0685*	0.1050***	0.0653*	0.0000	0.0119*
	(0.0352)	(0.0218)	(0.0343)	(0.0001)	(0.0070)
Birth control	−0.0164	0.0805***	0.0141	0.0034	−0.0338*
	(0.0260)	(0.0181)	(0.0173)	(0.0034)	(0.0200)
Pregnancy care 2/.	0.0909	0.1215***	0.0860*	0.0183	−0.0133
	(0.0641)	(0.0373)	(0.0467)	(0.0261)	(0.0415)
Kids check 3/.	0.0193	0.2410***	0.0017	0.0154	0.0022
	(0.1022)	(0.0672)	(0.1008)	(0.0133)	(0.0907)
Planning 2/.	0.1135*	0.0704**			
	(0.0593)	(0.0339)			
Iron 4/.	0.0046	0.1609*			
	(0.1221)	(0.0909)			
Preventive campaign	−0.0456**	0.0475***			
	(0.0201)	(0.0157)			
Care use					
Seek medical attention 5/.	0.0784*	0.1643***			
	(0.0427)	(0.0277)			
Receives curative care 6/.	0.1231***	0.1940***			
	(0.0464)	(0.0301)			

Notes: We selected individuals with an IFH index that is at most 20 points away from the eligibility threshold. N = 2799 (N = 792 for childbirth and pregnancy care; N = 436 for kids check; N = 791 for planning; 229 for iron). See Table A.2 for variable definitions. 1/. Not covered by SIS. 2/. Questions applied for women in fertile age. 3/. Question applied for kids under 10. 4/. Question applied for pregnant women and kids under 3. 5/. Experience any symptom, illness, relapse or accident and seek medical attention. 6/. Receives curative care if any of the following eight variables is one: doctor visit interacted with seek medical attention, medicines interacted with seek medical attention, analysis interacted with seek medical attention, X-rays interacted with seek medical attention, other tests interacted with seek medical attention, hospital, surgery or childbirth. 7/. Health care fully funded by government programs like SIS. 8/. Health care funded by government and household. 9/. Health care fully funded by household (either the own household or another one). Estimates by financing source are not available for some outcomes due to lack of information on the financing source or to lack of variability in the dependent variable (see Table A.7 for the exact number of ones by variable). Robust standard errors in parentheses.

* p<0.10.
** p<0.05.
*** p<0.01.

Next, Table 1 shows estimates of the effect of SIS on the utilization of a number of health services, including the one in Fig. 1.[40] These are local in the sense that we select individuals with an IFH index that is at most 20 points away from the eligibility threshold and, as described in Section 5 above, we control for the value of the index separately to the left and to the right of the eligibility threshold. We also control for age, gender, whether the head of the household is female, the number of household members, and years of education. We also report respective baselines in the second column, which are estimates of the mean outcome conditional on the IFH index being just above the threshold so that individuals are just not covered by health insurance. The last three columns use interactions between the financing source and the outcome variable. Here, we make use of

[40] Sensitivity analyses are carried out in Section 7 below.

the fact that individuals report on both jointly. For instance, individuals are asked whether they visited a doctor and then, if they say yes, whether the service they received was fully covered by insurance, whether they paid part of it out-of-pocket, or whether they paid everything out-of-pocket. This allows us to for instance construct the joint outcome "went to the doctor and services received were fully insured". Table A.7 in Online Appendix E shows the respective numbers of instances in our data.

We start by looking at more general forms of care, typically provided by easily accessible health care centers. The first row shows that health insurance coverage has a positive effect on the probability of visiting a doctor in the four weeks prior to the interview. It increases by 9 percentage points from a baseline of 30%(significant at the 10% level). This is driven by fully insured doctor visits (6 percentage points at the 5% level of significance), while the effect on doctor visits that individuals have to at least partially pay for is not significantly different from zero.

The second row shows that coverage also increases the probability to receive medicines in the four weeks prior to the interview by 15 percentage points, from a baseline of 42%. In contrast to the effect on doctor visits, most of the effect—10 percentage points—is related to medicines that individuals pay for out-of-pocket. The third row shows that coverage increases the probability that medical analysis is performed in the last four weeks, by 5 percentage points from a baseline that is not significantly different from zero. More than half of this effect—3 percentage points—is explained by fully covered access. As for doctor visits, the effect on the probability of receiving medical analysis and at least partly paying for it is not significantly different from zero.

As described in Section 2.3, MINSA health care centers provide only basic services. As for care provided by hospitals, health insurance coverage leads to an 8 percentage points increase in the probability to be hospitalized or to receive surgery, from a baseline of about 4%. The survey does not contain information on the financing source for both separately, but for both together. The last column suggests that households paid at least for part of this themselves.

So far, these results suggest that coverage lead to increased access to doctors who perform medical analysis and prescribe drugs. While the increases in doctor visits and medical analysis are usually fully financed by SIS, drugs, hospitalization and/or surgery are at least partly financed by households themselves—even though these can actually be considered covered by insurance (see Section 2.2). The discrepancy can be explained by the supply limitations we describe in Section 2.3.

The results presented here shed some more light on the underlying mechanism. They suggest that individuals are not getting all the drugs they need at the MINSA facilities and therefore, they go elsewhere to buy them, for instance at private pharmacies.[41]

Table 1 also shows that health insurance coverage has no significant effects on utilization of dental and ophthalmological care during the previous three months. This can be explained by yet another supply limitation described in Section 2.3, namely the shortage of dentists and ophthalmologists.

Turning to care that is more likely of a preventive nature, we generally find no significant effects. As we explain in Section 2, the system does not provide extra incentives for that. In fact, the only significant effect we find is on the probability to see a doctor to receive information on the prevention of a sickness (preventive campaign), and this effect is actually negative. This could be an indication of moral hazard, in the sense that patients invest less in their health in case they are covered by health insurance. It is interesting to contrast these results to the ones by Miller et al. (2013) for Colombia, where the system provides larger incentives to invest in preventive care, as already discussed in Section 1. And indeed, Miller et al. (2013) find stronger positive effects on preventive care.

Overall, the picture that emerges is that the effects of health insurance coverage are positive for forms of care that are of a more general nature and can be provided by MINSA health care centers at relatively low cost, such as doctor visits and medical analysis. We provide evidence that these services are indeed free to the patient. We also find positive effects on receiving medicines, hospitalization and surgery, but here it turns out that individuals pay for these services themselves. This suggests that insurance coverage may have positive effects on out-of-pocket expenditures. In Section 6.2 below we follow up on this by estimating the effects on out-of-pocket spending by type of care.

Peru is a country in which poor individuals are accustomed to not receiving any professional diagnosis and where drugs can also be bought in a pharmacy without a prescription. Therefore, taken together, our findings point towards the expansion of the program being a success in the sense that it had a positive effect on health care utilization, even if this is at least partly paid for by the individuals themselves.

6.2. Expenditures

We argue in Section 3 that individual out-of-pocket spending could be positively affected by health insurance coverage if receiving medical attention motivates individuals to actually spend more on their health themselves, because they become aware of additional health care needs. This positive effect could originate in, or be reinforced by the supply side limitations described in Section 2.3. We have shown above that health insurance coverage has positive effects on the likelihood that individuals receive medicines that they pay for out-of-pocket, and also on the probability that they visit a hospital and/or surgery is performed and that patients pay for out-of-pocket. Obviously, health insurance coverage could also reduce out-of-pocket spending because individuals do not have to pay for certain treatments anymore, or pay less. So, whether the overall effect is positive or negative is an empirical question.

In this section, we characterize the effect of health insurance coverage on the full distribution of out-of-pocket spending and also perform an analysis by spending category. Starting with mean spending, Fig. 2 suggests that total out-of-pocket expenditures actually increased with insurance coverage.

In Table 2, we use a variety of outcome measures related to moments of the distribution of health expenditures that have also been used in other studies.[42] They either attempt to measure expected health expenditures, their cross-sectional variability—interpreted as health risk—, or the likelihood to incur catastrophic health expenditures.[43]

[41] Facilities are not supposed to charge money to individuals covered by SIS. We could test whether this is true for medicines. When individuals say that they received medicines, then the questionnaire also asks them whether a household member paid for them and if so, where they bought them, at a MINSA facility or at a private pharmacy. Using this, we construct two outcome variables: bought medicines at a MINSA facility and bought medicines at a private pharmacy. If they did not buy any medicines then both of them are coded as zero. Using the same specification as in Table 1, the effect is not significantly different from zero for buying medicines at a MINSA facility (−0.0037 with a standard error of 0.018), but positive and significantly different from zero for buying them at a private pharmacy (0.108 with a standard error of 0.051). This can be seen as a decomposition of the reported effect of 0.1039 in the last column of Table 1.

[42] See Table A.3 in the Online Appendix for detailed variable definitions. We also experimented with more sophisticated variability measures and found similar results.

[43] Most studies measure the cross-sectional variability of health expenditures and then interpret it as health risk at the individual level. This is only valid if there is no persistence in health expenditures. Otherwise, health risk is overestimated. See for instance French and Jones (2004) for evidence in favor of such persistence in the U.S.

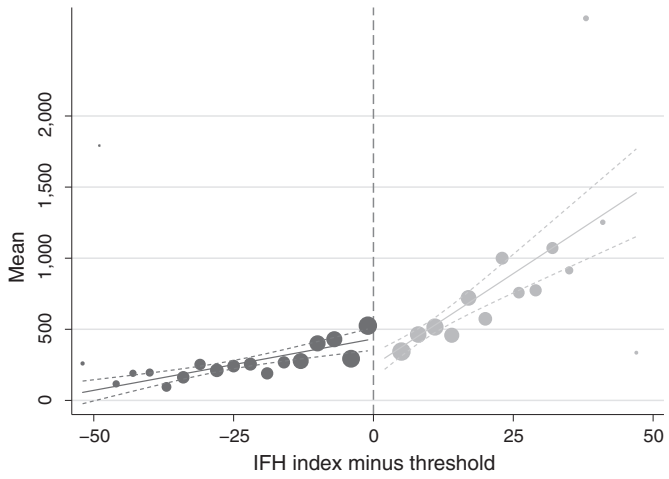

Fig. 2. Total health care expenditure. Notes: Annual expenditure in Soles. See also notes to Fig. 1.

Table 2 presents the results. The first dependent variable is an indicator for incurring at least some health expenditures. We find no significant effect on this outcome, suggesting that health expenditures are, if at all, mainly affected at the intensive margin.

Turning to the intensive margin, the second outcome is the level of annual health care expenditures. We find that insurance coverage leads to an increase of annual spending by about 282 Soles on average, which corresponds to 102 U.S. dollars, —in line with the idea that individuals are motivated to spend more on their health when using medical services more often (which they do according to Table 1 in the Online Appendix). This is about 1.5% of the average household income among the insured (18,800 Soles according to Table A.4). The effect is not significantly different from zero when we use log expenditures.

With our next outcome measure, we examine a possible effect on the variability of medical spending in the cross section. It is the mean absolute deviation of health expenditures, calculated separately by insurance status, and similar to the one used by Miller et al. (2013). Health insurance has no significant effect on it.

The fifth and sixth measures are constructed from residuals obtained from a regression of health expenditures on the value of the index, insurance status and the interaction of these two variables. Our aim is to measure the variation of health care expenditures in a different way, and therefore we use the absolute value and square of the residual instead of the more commonly used absolute value of the expenditures and their square, respectively. Effects are significant at the 5 and 10% level, respectively.

Looking at the results for the next two outcome measures, we find significant effects on the probability that health expenditures exceed the median or the 75th percentile of the distribution of health expenditures in the entire population.

In order to control for possible income differences we also analyze the effect of insurance on the share of annual health expenditures spent out-of-pocket at the individual level, relative to the annual *per capita* household income. We find significant effects on the expenditure shares and also on the absolute deviation of the share and the absolute value of the residual of the share. For the last two outcomes in the second panel, we calculate the 50th and 75th percentile of the distribution of the share and find that health insurance increases the probability that this share exceeds the 50th and 75th percentile by respectively 14 and 13 percentage points.

Finally, we look into whether SIS changes the probability of an individual incurring catastrophic health expenditures. Health expenditures are defined to be catastrophic if the share of the expenditures relative to *per capita* household income exceeds pre-defined threshold values. We follow Wagstaff and Lindelow (2008) and use the thresholds 5, 10, 15, 20 and 25% for this. We find that the probability that individual health expenditures exceed 5% of the *per capita* household income increases by 12 percentage points, from a baseline of 20%. We also find highly significant effects for higher cutoffs.

Table 2
Effect of health insurance on the distribution of out-of-pocket expenditure.

	Estimates	Ste.	Baseline	Ste.
Any health expenditures	0.0527	(0.0522)	0.5773***	(0.0357)
Health care expenditures				
Health expenditures	282.2370**	(116.0619)	216.5952***	(67.7158)
Logarithm of health expenditures	0.4810	(0.3043)	2.9580***	(0.2065)
Absolute deviation health expenditures	35.1882	(103.2521)	516.0123***	(55.8416)
Absolute value residual expenditures	249.8391**	(101.7011)	385.6647***	(57.6521)
Squared residual expenditures	2.016e+06*	(1.062e+06)	−4707.6350	(5.546e+05)
Expenditures exceed median	0.1462***	(0.0527)	0.4236***	(0.0357)
Expenditures exceed 75th percentile	0.1780***	(0.0428)	0.1070***	(0.0261)
Health expenditures as a share of income				
Share expenditures	0.0529**	(0.0238)	0.0421***	(0.0108)
Absolute deviation share	0.0379*	(0.0219)	0.0707***	(0.0093)
Absolute value residual share	0.0440**	(0.0218)	0.0697***	(0.0093)
Squared residual expenditures	0.0904	(0.0784)	0.0110	(0.0170)
Share exceeds median	0.1419***	(0.0528)	0.4358***	(0.0355)
Share exceeds 75th percentile	0.1328***	(0.0449)	0.1905***	(0.0287)
Catastrophic health expenditures				
Exceeds 5% of *per capita* household income	0.1241***	(0.0456)	0.2011***	(0.0295)
Exceeds 10% of *per capita* household income	0.0768**	(0.0380)	0.1150***	(0.0244)
Exceeds 15% of *per capita* household income	0.0869***	(0.0316)	0.0525***	(0.0193)
Exceeds 20% of *per capita* household income	0.0891***	(0.0271)	0.0215	(0.0158)
Exceeds 25% of *per capita* household income	0.0740***	(0.0250)	0.0189	(0.0140)

Notes: We selected individuals with an IFH index that is at most 20 points away from the eligibility threshold. N = 2799. See Tables A.2 and A.3 in the Online Appendix for variable definitions. Standard errors in parentheses.

* p<0.10.
** p<0.05.
*** p<0.01.

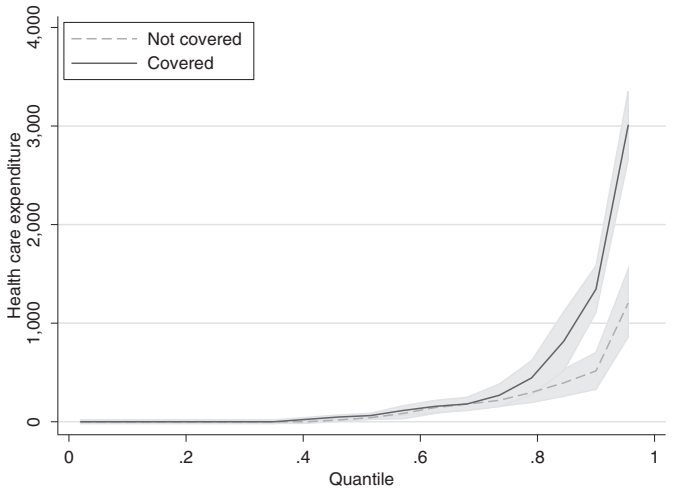

Fig. 3. Effect of health insurance on the distribution of out-of-pocket expenditure. Notes: Out-of-pocket expenditure in annual Soles. We selected individuals with an IFH index that is at most 20 points away from the eligibility threshold and excluded those with high consumption of electricity and water. N = 1380. The figure shows the percentiles of the distribution of expenditures with and without health insurance, along with 95% confidence intervals. See Frandsen et al. (2012) for details on the implementation.

Overall, the evidence presented in this section and the previous one suggests that health insurance coverage has positive effects on the level and the variability of out-of-pocket spending and that this is partly driven by supply limitations that led to individuals paying for medicines, hospital visits and/or receiving surgery. Fig. 3 complements this evidence with estimates of the quantiles of the distribution of health expenditures with and without health insurance coverage. As explained in Section 5, also these estimates are obtained exploiting the discontinuity at the eligibility threshold.[44] Interestingly, we find that insurance has only a positive effect on the higher end of the distribution.

It is remarkable that we never find a significant negative effect on either expected health expenditures or measures of variability or risk of high expenditures. Miller et al. (2013), in contrast, find for Colombia that insurance lowers both mean inpatient medical spending and its variability. Likewise, Limwattananon et al. (2015) find that health insurance coverage leads to a decrease in out-of-pocket spending in Thailand. To see what drives this and whether some types of spending were negatively affected, Table 3 reports estimates using the log of spending plus 1 in different categories as the dependent variable so that the reported effects are (approximately) average percentage changes in spending. Consistently with our results shown in Table 1, we find that spending on medicines increased by approximately 55% on average and that spending on care provided by the hospital and/or receiving a surgery increased by approximately 41%.[45] In light of our discussion in Sections 2.2, 2.3 and 6.1 these results suggest that the out-of-pocket expenditures are driven by the fact that individuals did not receive all medicines at the facilities and went elsewhere to buy them, and had to pay for some services at the hospitals even though they were covered by insurance. This seems to be mainly explained by supply limitations, in particular the short provision of medicines and budget constraints faced for some hospitals.

[44] Recall that we have a sharp regression discontinuity design, which means that coverage changes from 0 to 100% at the eligibility threshold.

[45] We have also conducted the analysis underlying Fig. 3 separately for each type of health expenditures. Fig. A.9 in the Online Appendix shows the results for the two types of health expenditures for which we have found an effect here. We can see that the effects are driven by increases in the upper spending quantiles.

Table 3
Effect of health insurance on out-of-pocket expenditure by type of care.

	Estimates	Ste.	Baseline	Ste.
More general forms of care usually provided by health care center				
Doctor visits	0.1178	(0.2189)	1.2312***	(0.1481)
Medicines	0.5520**	(0.2772)	1.9117***	(0.1879)
Analysis	0.1444	(0.1218)	0.0659	(0.0775)
X-rays	0.1707*	(0.0999)	0.0691	(0.0591)
Other tests	0.0547	(0.0623)	0.0291	(0.0333)
Glasses 1/.	0.1206	(0.1049)	0.0676	(0.0700)
Other treatments	−0.1108	(0.1745)	0.7175***	(0.1252)
Care provided by hospital				
Hospital and/or surgery	0.4100***	(0.1247)	0.0022	(0.0715)
Child birth 2/.	−0.0040	(0.0242)	0.0256	(0.0303)
Dental care	0.1570	(0.1495)	0.3395***	(0.0947)
Ophthalmological care	0.0417	(0.1020)	0.2028***	(0.0702)
Likely preventive care				
Vaccines	0.0509	(0.0312)	0.0006	(0.0049)
Birth control	−0.1398	(0.0921)	0.2241***	(0.0695)
Pregnancy care 2/.	0.0388	(0.1535)	0.2496**	(0.1025)
Kids check 3/.	0.1134	(0.3375)	0.2323	(0.2370)

Notes: We selected individuals with an IFH index that is at most 20 points away from the eligibility threshold. N = 2799 (N = 792 for childbirth and pregnancy care; N = 436 for kids check). All dependent variables are out-of-pocket spending in logs by health care service (see Table A.2 for definitions). 1/. Not covered by SIS. 2/. Questions applied for women in fertile age. 3/. Question applied for kids under 10. Robust standard errors in parentheses.
* p<0.10.
** p<0.05.
*** p<0.01.

Rises in health care expenditures as we find them are usually seen in a critical way, especially if some treatments are formally covered but individuals have to nevertheless pay for them. However, one may question whether this is justified here. On the one hand, this increase in expenditures can be seen as an additional burden to the individuals, possibly also increasing the variability of expenditures in the cross-section. On the other hand, the alternative could also be that individuals are not treated at all because they are not aware of their health care needs. In that sense the increase in spending for medicines as well as hospital care and/or surgery could also be seen as a desirable consequence of insurance coverage, which leads to increased accessibility, and thereby gives individuals the idea of using medical services in response to being insured.[46] Moreover, looking at it in yet another way, some treatments are at least partly covered by SIS, or a complement to it such as a doctor visit or a medical analysis is, so that the overall price of being treated is generally lower, which means that the law of demand (that lower prices mean more demand) would also predict an increase in usage. So also in that sense our findings could be less worrying than they may first seem.

7. Sensitivity analysis

In this section, after having presented the main results, we assess whether they are sensitive to the particular specifications we have used, and whether the identifying assumptions we have made can be supported by additional empirical evidence. We start by examining whether households may have manipulated the IFH index in order to become eligible for public insurance. Thereafter, second, we perform the analysis for a bigger sample. Throughout the analysis, we have controlled for covariates. Therefore, third, we also conduct the analysis without controlling for covariates and we assess whether there were jumps in the expectations of covariates at the eligibility threshold. In passing, we confirm that also the expectation

[46] It would be undesirable if doctors would give patients misinformation.

of water and electricity consumption, respectively, do not exhibit such a jump. Fourth, we assess whether there were discontinuities at other values of the welfare index. This would raise concerns, as our approach builds on the premise that there is only one discontinuity of the expected outcomes in the welfare index, at least locally. After that, fifth, we conduct a non-parametric analysis. Sixth, we assess whether the existence of other programs could challenge the validity of our results. And finally, seventh, we discuss when our results could be considered lower bounds of the effects of interest. All corresponding tables and figures can be found in Online Appendix I.

7.1. Manipulation of the running variable

A common threat to studies based on a RDD is the incentive to manipulate the running variable. For this, individuals need information on how the IFH is calculated. Then, they need to use this knowledge to manipulate their answers to the questions posed by the government official in order to qualify for SIS. This is unlikely to be the case for two reasons. First, even though the information on how the index is computed is, technically speaking, public, it is not easy to obtain and process it. Second, the set of variables included in the IFH construction are verified by the government officials and therefore difficult to manipulate.

We nevertheless analyze this potential thread using the McCrary (2008) test. The idea is that if manipulation takes place, then the density of the running variable will be discontinuous at the cutoff. In our context, the density function would show many households barely qualifying for SIS, that is, to the left of the cutoff, and fewer failing to qualify, that is, to the right of the cutoff. The formal procedure is twofold: first, a finely gridded histogram is obtained and then this histogram is smoothed with a local linear regression on each side of the cutoff.[47]

Fig. A.10 presents the results. There is no evidence for a jump of the density at the eligibility threshold, supporting the assumptions made in the main analysis.

7.2. Analysis for the full sample

Our main results have been obtained under the assumption that expected outcomes are approximately linear in the welfare index, separately to the left and the right of the eligibility threshold. In order to alleviate the concern that this assumption is strong, we have performed the analysis locally, selecting a sample of individuals for whom the index is at most 20 points away from the threshold. In general, there is a tradeoff between precision and bias, and using a bigger sample has the advantage that the precision of our estimates may increase. Therefore it is interesting to also perform the analysis for the full sample and to compare the results to the main ones reported above.

The first column of, respectively, Tables A.12 and A.13, shows the results. Comparing Table A.12 to Table 1 we see that the magnitudes of the estimated effects are slightly lower when we use the full sample while the precision increases. But qualitatively, the results are very similar. Comparing Table A.13 to Tables 2 and 3 we find a similar pattern, with the exception of the results on health expenditures as a share of income and catastrophic health expenditures. For the full sample, the magnitude of the estimated effects decreases by more than the standard errors and hence some of them are not found to be significantly different from zero.

Overall, the picture remains qualitatively and also quantitatively the same: the effects on utilization are strongest, in particular for curative use, health expenditures increase in terms of levels and variability, driven by increases in out-of-pocket spending for medicines.

7.3. Testing for discontinuities in household characteristics

For our approach to be valid it is necessary that the covered and non-covered individuals who have a value of the IFH index close to the eligibility threshold are similar to one another (Section 5). It is standard practice to test whether the expectation of covariates such as age or gender is a continuous function in the welfare index around the eligibility threshold. When it is found not to be, then one may be concerned that the assumptions underlying our analysis do not hold and one may want to conduct the analysis without controlling for covariates.

We first conduct both a graphical and a formal analysis in which we replace the dependent health variables by the observed covariates gender, age, years of education, the number of household members, and whether the woman is the head of the household. These are the variables that we use as controls in order to be able to obtain more precise estimates. We also tested for discontinuities in household income, total household expenditure, and also water and electricity consumption. We would be concerned if water and electricity consumption would exhibit a discontinuity because eligibility is only based on the index if both of them are not big enough.

Fig. A.8 and Table A.14 summarize the results. The latter reports estimates of the effect of insurance on these variables, conducted either at the household or at the individual level, depending on the variable. We do not find evidence for discontinuities.

We also conducted the main analysis without controlling for covariates. Tables A.12 and A.13 show that results are actually very similar and that the main conclusions we have drawn remain the same.

7.4. Jumps at non-discontinuity points

Our analysis implicitly assumes that the only discontinuities occur at the eligibility threshold, 55, as we have specified conditional expectations to be linear in the forcing variable, separately to the left and to the right of this threshold. A first way of assessing this is to conduct a graphical inspection. Figs. A.2 through A.7 suggest that the discontinuities do indeed mainly arise at the eligibility threshold.

Besides, following Imbens and Lemieux (2008) we conduct separate additional RDD analysis for the samples of covered and non-covered individuals and use the midpoints of the index in the respective samples as the threshold values. That is, we test for a discontinuity at values of the index other than the actual threshold. Recall that in our main analysis we use only individuals whose index is at most 20 points away from the eligibility threshold. Here, we now use a sample of individuals with an index that is between 40 points lower than the threshold and the threshold, and another sample of individuals for whom the index lies between the eligibility threshold and 40 points above that.

Results are presented in Tables A.15 and A.16. In general, we observe no significant effects on health outcome variables when we run the regressions using those hypothetical thresholds, with the exception of a few cases.[48] Figs. A.2 through A.7 suggest that what is

[47] The IFH index is measured at the household level. Therefore, we conduct the analysis here also at the household level.

[48] Actually, here—and in fact throughout the paper—we face a problem of multiple testing. For the results presented in Tables A.15 and A.16, if the null hypothesis were true, then we would expect 1 of them to be significantly different from zero at the 1% level (2 are), 5–6 at the 5% level (2 are at the 1% level plus 5 at the 5% level), and 11 at the 10% level (2 plus 5 plus 4, so 11 are). The number of significant results is thus very close to what one would expect. There are ways to correct for this, but if test statistics are likely to be highly dependent, which in our case they are (think of the outcomes "hospital and/or surgery", "hospital", and "surgery"), these procedures may be too conservative.

picked up by this robustness check is that the linearity assumption may be too strong for some outcomes. At the same time, we find many more effects to be significantly different from zero when we use the actual thresholds instead of the hypothetical ones. Next, we at least partially address a related concern by carrying out a nonparametric analysis.

7.5. Non-parametric analysis

To address the concern that linearity is too strong of an assumption even in smaller subsamples we conduct a non-parametric analysis. For this we follow Calonico et al. (2014). The main difference in terms of implementation is that we drop individuals for whom either water or electricity consumption is too high to be eligible for health insurance.

Comparing the results reported in Tables A.17 through A.19 to the ones in Tables 1 though 3 we again find that the strongest and most robust effects are on receiving medicines and hospital care and/or surgery, financed out-of-pocket, and positive effects on the level and the variability of out-of-pocket health care expenditures.

7.6. Juntos and food aid program

Our identification strategy is based on the assumption that discontinuities at the eligibility threshold can be attributed to SIS. There are some programs whose presence could in principle challenge this assumption.

One of them is Juntos, a conditional cash transfer program. It combines a geographic targeting of the poorest districts with individual targeting, based on the IFH index and the presence of children up to the age of 14. However, Juntos is a rural program and our study focuses on the Lima Province, and our data confirm that no individual in the sample belongs to Juntos.

Besides, there is a number of food aid programs oriented to the poor. To be precise, they are oriented to different groups of the population, such as mothers, children and school students. Our data show that 29% of the individuals of our sample receive at least support from one of them.[49] Importantly, since these programs do not use SISFOH's targeting rules and in particular not the IFH index, it is unlikely that a discontinuity at the eligibility threshold can be attributed to them. Our finding in Section 7.3 that household expenditures do not exhibit a discontinuity at the insurance threshold provides additional support for this interpretation.

7.7. Re-interpreting our results as intent-to-treat effects or lower bounds of the effect sizes

In our analysis, we estimate the effect of becoming eligible for SIS due to crossing the eligibility threshold. As we describe in Section 5, we control for ineligibility that is due to other reasons and explain why we therefore face a sharp regression discontinuity design and estimate the average effect of becoming eligible. We argue in the Introduction and in Section 2.2 that this effect is essentially the effect of insurance coverage, because enrolling involves filling in a form and if eligible, individuals can usually come back the next day to receive treatment.

It could nevertheless be that individuals do not know whether or not they are actually covered by health insurance. This by itself would not be a problem if they would always try to enroll and then learn that they are actually not eligible. If they wrongly believe that they are not eligible and therefore do not even try to enroll, then they may behave as if they are not covered by health insurance. Our analysis, however, assumes that they are covered. Consequently, the effects we estimate can be re-interpreted as intent-to-treat effects or lower bounds of effect sizes for those who know that they are covered. To see this, suppose that among those individuals with a value of the index that is very close to the threshold, 40% of the eligible individuals believe that they are not eligible and therefore the effect of becoming eligible is zero for them. The effect we then estimate is the intent-to-treat effect, which is a weighted average of the zero effect for those 40% who wrongly believe that they are not covered and the actual effect for the remaining 60% of the individuals. The intent-to-treat effect is always of the same sign but smaller in magnitude than the actual effect for those who know that they are eligible and in that sense we are estimating lower bounds of the effect sizes.[50,51]

8. Conclusions

Until recently, large parts of the population in developing countries did not have access to public health insurance. While it is commonly believed that the effects of health insurance coverage are positive, opportunities to control for selection by exploiting natural experiments or by conducting field experiments are rare, and therefore we still lack empirical evidence on its impact on health care utilization and out-of-pocket expenditures. Besides, it is not yet fully understood through which channels health insurance coverage ultimately leads to better health outcomes and to what extent it is possible to encourage individuals to invest into preventive care.

In this paper, we use rich survey data from Peru to study the effects of the large-scale social health insurance program called "Seguro Integral de Salud" (SIS). The SIS program is targeted to poor individuals working in the informal labor market. We make use of the institutional details that give rise to a sharp regression discontinuity design. We estimate the effect of insurance coverage on a wealth of measures for health care utilization and health expenditures.

We find strong effects of insurance coverage on arguably desirable, from a social welfare point of view, treatments such as visiting a hospital and receiving surgery and on forms of care that can be provided at relatively low cost, such as medical analysis in the first place and receiving medication. Effects on preventive care are much less pronounced. This is not surprising, as the system does not provide any extra incentives to actually use them. Furthermore, we find positive effects of health insurance coverage on the level and the variability of out-of-pocket spending that are mostly driven by increased spending for medicines and for hospital care and/or surgery, resulting from supply limitations.

Based on this evidence, we develop two arguments that are less common in economics. First, access to health care centers leads to increased awareness about health problems. Once covered, individuals see a doctor and learn about the needs they were unaware of. Second, this even generates a willingness to pay for services that are

[49] The percentage of individuals that receive food aid is 29% among those not covered by SIS and 51% among those who are covered. There is no information on the reception of food aid for 874 individuals, or 20% of our sample.

[50] Note that if the effect is negative, then these are upper bounds of the effects, but lower bounds of the effect sizes. Note also that the effect the program would have had on those who wrongly believe that they are not covered, had they been covered, will never play a role here. Instead, the intent-to-treat effect contains a zero effect for them.

[51] One may think that we could use an instrumental variables estimator where we treat SIS enrollment as the endogenous variable and eligibility as the instrument, to estimate the actual effect insurance coverage has. This, however, will only estimate the effect of coverage if all individuals who are covered also enroll. If, to the contrary, there are some individuals who do only enroll if they need health insurance, we will instead estimate the effect of health insurance for the subpopulation of those who enroll when becoming eligible and have medical needs at that point. This effect is likely higher than the overall effect of insurance coverage for individuals close to the threshold.

in short supply, which in the context of Peru is a potentially desirable form of supplier-induced demand. By spending out-of-pocket, individuals reveal their preference for medical care.

Overall, the evidence suggests that when compared to health care systems in other developing countries, the Peruvian one is a notable exception. It seems to reach its goal to provide access to medical care to a sizable fraction of the poor. A key determinant of this success seems to be that the monetary cost of enrolling is zero, instead of being small but positive, which it is elsewhere. As of now, there is no evidence on the effects this will have on objectively measured health, but it is imaginable that increased access will ultimately lead to better health outcomes.

Supplementary information

The Online Appendix and a replication package can be found online at http://dx.doi.org/10.1016/j.jpubeco.2017.08.008.

References

Abbring, J., Chiappori, P., Pinquet, J., 2003a. Moral hazard and dynamic insurance data. J. Eur. Econ. Assoc. 1 (4), 767–820.

Abbring, J., Heckman, J., Chiappori, P., Pinquet, J., 2003b. Adverse selection and moral hazard in insurance: can dynamic data help to distinguish? J. Eur. Econ. Assoc. 1 (2-3), 512–521.

Abel-Smith, B., 1992. Health insurance in developing countries: lessons from experience. Health Policy Plan. 7 (3), 215–226.

Acharya, A., Vellakkal, S., Taylor, F., Masset, E., Satija, A., Burke, M., Ebrahim, S., 2013. The impact of health insurance schemes for the informal sector in low and middle income countries. Policy Research Working Paper. The World Bank.,

Akerlof, G.A., 1970. The market for lemons: quality uncertainty and the market mechanism. Q. J. Econ. 84, 488–500.

Aron-Dine, A., Einav, L., Finkelstein, A., 2013. The RAND health insurance experiment, three decades later. J. Econ. Perspect. 27 (1), 197–222.

Aron-Dine, A., Einav, L., Finkelstein, A., Cullen, M., 2015. Moral hazard in health insurance: do dynamic incentives matter?. Rev. Econ. Stat. 97 (4), 725–741.

Arróspide, M., Rozas, K., Valderrama, J., 2009. Evaluated Budget: Integrated Health Insurance. Ministry of Economics and Finance, Peru.

Bajari, P., Hong, H., Khwaja, A., 2006. Moral hazard, adverse selection and health expenditures: a semiparametric analysis. NBER Working Paper 12445. National Bureau of Economic Research, Cambridge, MA, U.S.A.

Banerjee, A., Deaton, A., Duflo, E., 2004. Wealth, health, and health services in rural Rajasthan. Am. Econ. Rev. 94 (2), 326–330.

Banerjee, A.V., Duflo, E., 2007. The economic lives of the poor. J. Econ. Perspect. J. Am. Econ. Assoc. 21 (1), 141.

Barros, R., 2008. Wealthier but not much healthier: effects of a health insurance program for the poor in Mexico. Working Paper. Stanford University, Stanford, CA.

Battistin, E., Brugiavini, A., Rettore, E., Weber, G., 2009. The retirement consumption puzzle: evidence from a regression discontinuity approach. Am. Econ. Rev. 99 (5), 2209–2226.

Bauhoff, S., Hotchkiss, D., S.O., 2011. The impact of medical insurance for the poor in Georgia: a regression discontinuity approach. Health Econ. 20, 1362–1378.

Bitrán, Asociados, 2009. Impact of Health Insurance on Access to Health Services, Health Services Use and Health Status in the Developing World. Global Health Financing Initiative - The Brookings Institution.

Blank, R.M., Card, D.E., 1991. Recent trends in insured and uninsured unemployment: is there an explanation? Q. J. Econ. 106 (4), 1157–1189.

Blank, R.M., Ruggles, P., 1996. When do women use aid to families with dependent children and food stamps? The dynamics of eligibility versus participation. J. Hum. Resour. 57–89.

Calonico, S., Cattaneo, M.D., Titiunik, R., 2014. Robust nonparametric confidence intervals for regression-discontinuity designs. Econometrica 82 (6), 2295–2326.

CEPLAN, 2011. Evolución socioeconómica del Perú 1990-2010. Centro Nacional de Planeamiento Estratégico, Lima, Peru.

Chankova, S., Sulzbach, S., Diop, F., 2008. Impact of mutual health organizations: evidence from West Africa. Health Policy Plan. 23 (4), 264–276.

Chiappori, P., 2000. Econometric models of insurance under asymmetric information. In: Dionne, G. (Ed.), Handbook of Insurance, Huebner International Series on Risk, Insurance, and Economic Security. Kluver, Boston, MA, U.S.A., pp. 365–393.

Chiappori, P., Salanié, B., 2000. Testing for asymmetric information in insurance markets. J. Polit. Econ. 108 (1), 56–78.

Choi, J.J., Laibson, D., Madrian, B.C., 2011. $100 bills on the sidewalk: suboptimal investment in 401 (k) plans. Rev. Econ. Stat. 93 (3), 748–763.

Comité Técnico Implementador del AUS, 2010. Avances del proceso de implementación del aseguramiento universal en salud (2009-2011).

Commission on Macroeconomics and Health, 2001. Macroeconomics and Health: Investing in Health for Economic Development. World Health Organization, Geneva, CH.

Currie, J., Gruber, J., 1996. Health insurance eligibility, utilization of medical care, and child health. Q. J. Econ. 111 (2), 431–466.

Cutler, D., Zeckhauser, R., 2000. The Anatomy of Health Insurance. Handbook of Health Economics, Vol i, Ch 1. aj culyer and jp newhouse.

Das, J., Hammer, J., Leonard, K., 2008. The quality of medical advice in low-income countries. J. Econ. Perspect. 22 (2), 93–114.

Pueblo, Defensoría del, 2011. Decimoquinto Informe Anual de la defensoría del Pueblo al Congreso de la República.

Pueblo, Defensoría del, 2013. Informe defensorial no. 161. Serie de Informes Defensoriales.

Dercon, S., Kirchberger, M., Gunning, J.W., Platteau, J.P., 2008. Literature Review on Microinsurance. Microinsurance Paper No. 1, International Labor Office, Geneva.

Dow, W.H., Schmeer, K.K., 2003. Health insurance and child mortality in Costa Rica. Soc. Sci. Med. 57 (6), 975–986.

Einav, L., Finkelstein, A., Ryan, S.P., Schrimpf, P., Cullen, M.R., 2013. Selection on moral hazard in health insurance. Am. Econ. Rev. 103 (1), 178–219.

Fafchamps, M., 1999. Risk sharing and quasi-credit. J. Int. Trade Econ. Dev. 8 (3), 257–278.

Fang, H., Keane, M., Silverman, D., 2006. Sources of advantageous selection: evidence from the medigap insurance market. NBER Working Paper No. 12289. National Bureau of Economic Research, Cambridge, MA, U.S.A.

Finkelstein, A., Poterba, J., 2004. Adverse selection in insurance markets: policyholder evidence from the UK annuity market. J. Polit. Econ. 112 (1), 183–208.

Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J.P., Allen, H., Baicker, K., O. H. S. Group, et al. 2012. The Oregon health insurance experiment: evidence from the first year. Q. J. Econ.qjs020.

Francke, P., 2013. Peru's Comprehensive Health Insurance and New Challenges for Universal Coverage. Universal Health Coverage Studies, The World Bank.

Frandsen, B., Frolich, M., Melly, B., 2012. Quantile treatment effects in the regression discontinuity design. J. Econ. (168), 382–395.

French, E., Jones, J.B., 2004. On the distribution and dynamics of health care costs. J. Appl. Econ. 19 (6), 705–721.

Galárraga, O., Sosa-Rubí, S.G., Salinas-Rodríguez, A., Sesma-Vázquez, S., 2010. Health insurance for the poor: impact on catastrophic and out-of-pocket health expenditures in Mexico. Eur. J. Health Econ. 11 (5), 437–447.

Giedion, U., Andrés Alfonso, E., Díaz, Y., 2013. The Impact of Universal Coverage Schemes in the Developing World: A Review of the Existing Evidence. Universal Health Coverage Studies Series No. 25.

Giné, X., Townsend, R., Vickery, J., 2008. Patterns of rainfall insurance participation in rural India. World Bank Econ. Rev. 22 (3), 539–566.

Giovanella, L., Feo, O., Favia, M., Tobar, S., 2012. Instituto Suramericano de Gobierno en Salud ISAGS.

Gruber, J., Hendren, N., Townsend, R.M., 2014. The great equalizer: health care access and infant mortality in Thailand. Am. Econ. J. Appl. Econ. 6 (1), 91.

Hahn, J., Todd, P., van der Klaauw, W., 2001. Identification and estimation of treatment effects with a regression-discontinuity design. Econometrica 69 (1), 201–209. (January).

Hsiao, W.C., Shaw, P., 2007. Social Health Insurance for Developing Countries. The World Bank.

Imbens, G., Lemieux, T., 2008. Regression discontinuity designs: a guide to practice. J. Econ. 142, 615–635.

World Health Organization, Zusammenarbeit, Deutsche Gesellschaft für technische, 2006. Berlin recommendations. International Conference on Social Health Insurance in Developing Countries Berlin, 05-07 December 2005. Final version 3 July 2006.

Jowett, M., 2003. Do informal risk sharing networks crowd out public voluntary health insurance? Evidence from Vietnam. Appl. Econ. 35 (10), 1153–1161.

King, G., Gakidou, E., Imai, K., Lakin, K., Moore, T., Nall, C., Ravishankar, N., Vargas, M., Tellez-Rojo, M., Hernandez Avila, J., Hernandez Avila, M., Hernandez Llamas, H., 2009. Public policy for the poor? A randomized assessment of the Mexican universal health insurance programme. Lancet 373, 1447–1454.

Klein, T.J., 2010. Heterogeneous treatment effects: instrumental variables without monotonicity? J. Econ. 155 (2), 99–116.

Laing, R., Hogerzeil, H., Ross-Degnan, D., 2001. Ten recommendations to improve use of medicines in developing countries. Health Policy Plan. 16 (1), 13–20.

Limwattananon, S., Neelsen, S., O'Donnell, O., Prakongsai, P., Tangcharoensathien, V., van Doorslaer, E., Vongmongkol, V., 2015. Universal coverage with supply-side reform: the impact on medical expenditure risk and utilization in Thailand. J. Public Econ. 121, 79–94. January.

Lu, F., 2014. Insurance coverage and agency problems in doctor prescriptions: evidence from a field experiment in China. J. Dev. Econ. 106, 156–167.

McCrary, J., 2008. Manipulation of the running variable in the regression discontinuity design: a density test. J. Econ. 142 (2), 698–714.

McGuire, T.G., 2000. Physician agency. Handb. Health Econ. 1, 461–536.

Miller, G., Pinto, D., Vera-Hernandez, M., 2013. Risk protection, service use, and health outcomes under Colombia's health insurance program for the poor. Am. Econ. J. Appl. Econ. 5 (4), 61–91. (October).

Ministerio de Salud, 2011. Informe de gestión - Avances del proceso de implementacion del Aseguramiento Universal en Salud. Serie Informes Defensoriales - Informe Defensorial No. 161.

Murray, C.J., Chen, L.C., 1992. Understanding morbidity change. Popul. Dev. Rev. 481–503.

Neelsen, S., O'Donnell, O., 2017. Progressive universalism? The impact of targeted coverage on health care access and expenditures in Peru. Health Econ.break(forthcoming).

Newhouse, J., 1974. A design for a health insurance experiment. Inquiry 11, 5–27.

Newhouse, J., 1993. Free for All? Lessons From the RAND Health Insurance Experiment. Harvard University Press.
Parodi, S., 2005. Evaluating the Effects of the Integrated Health Insurance Over Maternal Health Equity Within the Context of Non-economics Barriers on Service Access. CIES, GRADE.
Pauly, M.V., Zweifel, P., Scheffler, R.M., Preker, A.S., Bassett, M., 2006. Private health insurance in developing countries. Health Aff. 25 (2), 369–379.
Sen, A., 2002. Health: perception versus observation. Br. Med. J. 324 (7342), 860–861.
Shampanier, K., Mazar, N., Ariely, D., 2007. Zero as a special price: the true value of free products. Mark. Sci. 26 (6), 742–757.
SISFOH, 2010. Methodology to Calculate the Household Targeting Index, IFH. Ministry of Economics and Finance, Peru.
Sosa-Rubi, S.G., Galarraga, O., Harris, J.E., 2009. Heterogeneous impact of the "Seguro Popular" program on the utilization of obstetrical services in Mexico, 2001–2006: a multinomial probit model with a discrete endogenous variable. J. Health Econ. 28 (1), 20–34.
Strauss, J., Thomas, D., 1998. Health, nutrition and economic development. J. Econ. Lit. 36, 766–817.
Thistlethwaite, D., Campbell, D., 1960. Regression-discontinuity analysis: an alternative to the ex post facto experiment. J. Educ. Psychol. 51, 309–317.
Thornton, R., Hatt, L., Field, E., Islam, M., Solis Dias, F., Gonzales, M., 2010. Social security health insurance for the informal sector in Nicaragua: a randomized evaluation. Health Econ. 19, 181–206.
Wagstaff, A., 2010. Estimating health insurance impacts under unobserved heterogeneity: the case of Vietnam's health care fund for the poor. Health Econ. 19 (2), 189–208.
Wagstaff, A., Doorslaer, E. v., 2003. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. Health Econ. 12 (11), 921–933.
Wagstaff, A., Lindelow, M., 2008. Can insurance increase financial risk?: The curious case of health insurance in China. J. Health Econ. 27 (4), 990–1005.
Wagstaff, A., Lindelow, M., Jun, G., Ling, X., Juncheng, Q., 2009. Extending health insurance to the rural population: an impact evaluation of China's new cooperative medical scheme. J. Health Econ. 28 (1), 1–19.
WHO, 2010. World Health Statistics 2010. World Health Organization.
World Bank, 2013. World Development Indicators.
Zweifel, P., Manning, W.G., 2000. Moral hazard and consumer incentives in health care. Handb. Health Econ. 1, 409–459.