BANKWEST CURTIN ECONOMICS CENTRE

WORKING PAPER SERIES

17/02: Cost-sharing in health insurance and its impact in a developing country - Evidence from a quasi-natural experiment

Ha Trong Nguyen and Luke B Connelly

bcec.edu.au

Bankwest Curtin Economics Centre Working Paper Series
ISSN: 2202-2791
ISBN: 978-1-925083-55-2

Ha Trong Nguyen[1], Luke B Connelly[2,]

[1] Bankwest Curtin Economics Centre, Curtin University

[2] The University of Queensland

Suggested Citation

Ha Trong Nguyen and Luke B Connelly 2017 "Cost-sharing in health insurance and its impact in a developing country- Evidence from a quasi-natural experiment," Bankwest Curtin Economics Centre Working Paper 17/02, Perth: Curtin University.

Cost-sharing in health insurance and its impact in a developing country– Evidence from a quasi-natural experiment

Ha Trong Nguyen[*]

Curtin University

Luke B. Connelly

The University of Queensland

Abstract: Though the impact of cost-sharing on health care demand is well documented in developed countries, evidence from developing countries is rare. This paper's contribution is to analyse the impact of increasing coinsurance in a developing nation -Vietnam – by exploiting a quasi-natural experiment in that country. In 2007, the Vietnam government reintroduced a 20 percent coinsurance for individuals who hold voluntary health insurance policies. As individuals with compulsory health insurance were exempt from this re-imposition of coinsurance, this policy change may be regarded as a quasi-natural experiment. To exploit this change, we use a difference-in-difference approach to examine whether the increase in coinsurance effectively reduced the demand for health care services among those affected. We find it has no statistically significant effect on the quantity of health care demanded. We however find that those who were under 18 or in low income households reduced their health care use after the increase in coinsurance. These findings hold – at least in the short-run, with a variety of different outcomes and estimators.

Keywords: Health insurance, Difference-in-difference, Cost-sharing, Developing country, Vietnam.

JEL classification: G22, I11, I18

[*]**Acknowledgements**: The authors would like to thank Nicole Au, Anirban Basu, Deborah A. Cobb-Clark and participants at the 3rd Australasian Workshop on Econometrics & Health Economics and the 8th Australasian Development Economics Workshop for comments on the paper.

[*] **Corresponding author**: Bankwest Curtin Economics Centre | Curtin Business School | Curtin University | Tel:+61 8 9266 5711 | Fax:+61 8 9266 2373 | Postal: GPO Box U1987, Perth WA 6845, Australia | Email: ha.nguyen@curtin.edu.au.

1. Introduction

Out-of-pocket (OOP) payments continue to be the major source of health financing in most low and middle income countries (O'Donnell *et al.*, 2008). Unsurprisingly, there are widespread interests in expanding health insurance in these countries to provide their citizens with financial protection against health risks. One challenge is that the main advantage of health insurance for a family is the financial protection the insurance provides, which may trade off against public policy goals of increasing access, since greater access means higher premiums relative to the value of health benefits. In theory, cost-sharing[1] can be used to deal with this challenge since it is considered both as a means of reducing health care over-use and as an important source of health care financing (Zweifel and Manning, 2000). In practice, it is important to understand whether and to what extent cost-sharing achieves this end.

There is a large literature on the impact of cost-sharing on demand for health services in the developed world.[2] The dominant view in the literature on health economics is that cost-sharing does reduce moral hazard, as intended (Remler and Greene, 2009). The most lauded study on this topic, the 1974-1982 RAND Health Insurance Experiment in the US (Manning *et al.*, 1987; Newhouse, 1993), randomised subjects between insurance plans, and demonstrated that the use of medical services does indeed decrease with consumer coinsurance provisions, with stronger effects on the quantity of outpatient care demanded than the quantity of inpatient care demanded. Other US studies also find that co-payments for ambulatory services or physical visits reduce health care utilization (Cherkin *et al.*, 1989; Zweifel and Manning, 2000; Chandra *et al.*, 2010a, 2014).

Studies conducted outside the US have, however, produced mixed results. For instance, in Europe, the evidence that co-payments affect health service consumption is ambiguous. Several studies for Germany (Winkelmann, 2004a, b), Belgium (Voorde *et al.*, 2001) and Chile (Duarte, 2012), for instance, find that co-payments reduce health care utilization, while other studies for France (Chiappori *et al.*, 1998), Belgium (Cockx and Brasseur, 2003), Germany (Schreyögg and Grabka, 2010) and the Netherlands (van Dijk *et al.*, 2013) find that co-payments have little or no effect on physician visits in general and specialist visits in particular.

[1] There are three basic types of cost-sharing: co-payments (payment of a fixed amount for each medical service), coinsurance (payment of a fixed percentage of the health care expenditure), and deductibles (payment of the first $ x of care each year).
[2] See Remler and Greene (2009), for example, for a recent literature review on the impact of cost-sharing.

In the developing world a lack of some basic health care facilities (James *et al.*, 2006) and higher levels of OOP expenditure (Musgrove *et al.*, 2002; O'Donnell *et al.*, 2008) are common, so evidence on the impact of cost-sharing from developed countries is not readily applicable to developing countries. However, there is a paucity of empirical evidence from the developing world and thus there is a need for more research in this area (Karlan and Morduch, 2010; O'donnell and Jones, 2016).

One possible explanation for the limited evidence on the effects of health insurance cost-sharing on health care demand in developing countries is that health insurance markets are, themselves, generally underdeveloped. Furthermore, even when data on cost-sharing, coverage and utilization are available, researchers using data from developed and developing countries alike find it difficult to isolate the causal effect of cost-sharing on utilization due to the potential and concomitant adverse selection problem. Adverse selection refers to the case where the insured choose more generous plans because they expect their health expenditure to be higher (Arrow, 1963; Akerlof, 1970; Rothschild and Stiglitz, 1976). In an attempt to establish causality some researchers have used random experiments (like the RAND Health Insurance Experiment) and natural experiments (Cockx and Brasseur, 2003; Winkelmann, 2004a; Zhang, 2007; Chandra *et al.*, 2010a; Schreyögg and Grabka, 2010; Siminski, 2011).

As far as we are aware, Zhang's (2007) study is the only one that explicitly examines the impact of cost-sharing on health care demand in a developing country.[3] Zhang (2007) took advantage of differential changes in co-payments for private sector employees and government employees to isolate the causal effects of changes in co-payments for inpatient treatment. Because the changes to co-payments were determined exogenously, the author was able to abstract from the typical selection problems of most observational studies. Using a difference-in-difference (DID) method and data from a single hospital in a city in China, Zhang (2007) found that a reduction in co-payments increased inpatient treatment claims. The generalisability of that paper's findings to the developing world is limited for several reasons. First, Zhang (2007) was able only to observe inpatient treatment claims at a single hospital (an A + class hospital). It is likely that due to cross-price effects, the insured patients who were affected by the reduction in co-payments at this hospital might have altered their consumption of complementary (e.g., outpatient) and/or substitute health care services (e.g.,

[3] Duarte (2012) provides evidence on price elasticity of health expenditure for a middle income country (Chile). A related field of study is the impact of user fees on health care demand in developing countries. For a review, see, for example, James *et al.* (2006) and Lagarde and Palmer (2008).

inpatient services provided by other hospitals with different co-payment provisions). Second, since the result depends on a single city in China, its findings are not reasonably generalisable to other parts of the developing world where the majority of people live in rural areas. In this paper, we contribute to the literature by analyzing the impact of an *increase* in coinsurance (unlike the impact of a *reduction* in co-payments examined by Zhang (2007)) on the number of outpatient and inpatient treatments using a quasi-natural experiment and a nationally representative data set from Vietnam. Coinsurance and co-payments are different and they may produce different effects. In addition, our richer dataset is amenable to an analysis that may shed light on the effects of cost-sharing on health care utilization at the national level for a developing country.

Vietnam also offers an interesting case study of the impact of cost-sharing on health care utilisation for several other reasons. It is currently undertaking health financing reforms in an attempt to achieve universal health insurance (Wagstaff *et al.*, 2016). Over the last decade, significant changes in health insurance policies have been implemented and have resulted in a rapid growth in coverage and health care utilisation: in the period 2004 to 2006, the number of Vietnamese people with private health insurance doubled (World Bank, 2007). This rapid increase coincided with a deficit[4] for the first time in the health insurance fund in late 2006, suggesting that asymmetric information problems may exist in the health insurance system. To encourage the financial sustainability of the health insurance fund, the government of Vietnam adopted a variety of supply-side strategies such as the introduction of prospective reimbursement for hospitals and the creation of a list of reimbursed drugs. On the demand side, policies that increased health insurance premiums and coinsurance rates were also instituted (Lieberman and Wagstaff, 2009). In particular, the coinsurance rate for the insured under voluntary schemes increased from zero to 20 percent as of April 2007. The reform can be considered as a quasi-natural experiment because it affected only those insured who were enrolled in voluntary health insurance policies and did not affect those who are either insured under compulsory schemes or not insured at all.

This paper uses panel data from two Vietnam Household Living Standard Surveys (VHLSSs) that were undertaken in 2006 and 2008 and a DID method to examine the impact of the increase in coinsurance on health care demand. We find that the increase in coinsurance caused no significant reduction in the quantity of health care demanded. We however find

[4] The health insurance fund switched from a surplus of 1,989 billion VND in June 2006, which was accumulated over the previous ten years, to a deficit of 1,200 billion VND at the end of 2006. The health insurance fund also experienced a deficit of 1,839 billion VND (in 2007), 651 (2008) and 2,446 (2009).

that those who are under 18 or in low income households reduced their health care use after the increase in coinsurance. These findings are robust across different sets of outcomes and estimators.

The paper is structured as follows. Section 2 provides an overview of Vietnam's health insurance system as well as the change in cost-sharing policies in 2007. Section 3 describes the data and sample. The empirical model and econometric methodology used to investigate the impact of the increase in coinsurance are introduced in Section 4. Empirical results are discussed in Section 5. Section 6 presents robustness checks for our empirical results. Finally, Section 7 summarises and discusses the findings.

2. Health insurance policy in Vietnam

2.1. Overview of Vietnam's health insurance

Table 1 summarises the structure of Vietnam's health insurance system, which can be classified into two main schemes: compulsory health insurance (CHI) and voluntary health insurance (VHI). The compulsory scheme includes two sub-schemes: a mandatory earnings-related, contribution-based social health insurance (SHI) scheme and a non-contributory scheme. The SHI scheme mainly covers public servants, employees in state-owned enterprises and those in the private formal sector. The non-contributory scheme was initially aimed at pensioners, war veterans, mothers, widows or orphans of veterans. A health care for the poor (HCFP) program was added to this group in 2003. This HCFP program was established to provide free access to individuals in households classified as poor; households in especially disadvantaged communes; and ethnic minorities living in six northeast mountainous areas and five highland provinces (Wagstaff, 2010). From 2005, the non-contributory scheme was extended to include children under six.

The voluntary component of the health insurance system was introduced in 1994 to cover students, the dependents of those covered by CHI, the self-employed and farmers. In 2006, enrolment in VHI was largely group based. Individuals who belonged to households with all members participating in some form of health insurance or living in a commune with at least 10 percent of households participating in VHI could join the scheme. Similarly, students could join the VHI scheme as long as the institute where they were studying had at least 10 percent of students participating. These group enrolment requirements were dropped in early 2008.

The contribution rules for these schemes are also summarised in Table 1. The contribution rate for workers is set at 3 percent of salary, of which the employer contributes 2 percent and the employee 1 percent.[5] The non-contributory scheme is calculated at 3 percent of the minimum wage and is paid out of the state budget. The premium rates for VHI are set according to the ability-to-pay, which is measured by rural/urban and student status, and range between VND 100,000 (US$ 6.25) per year for students in rural areas and VND 320 (US$ 20) per year for household members in urban areas.

[Table 1 about here]

The benefit package covers most outpatient and inpatient treatment delivered by public health care providers or private health care providers who have signed a contract with Vietnam Social Security (VSS). The package covers the costs of consultations, diagnoses, treatment and rehabilitation during the time of treatment at the care facility, laboratory tests, diagnostic imaging; medicines promulgated on the Ministry of Health's list; blood and transfusions; medical procedures and surgery; use of materials, medical equipment and treatment beds.

2.2. Cost-sharing regulations and the policy experiment in 2007

Cost-sharing regulations have changed from time to time. From 2003 to September 2005, 20 percent of treatment costs were shared by the insured. The benefits for the insured were more generous from September 2005 to April 2007 as all expenditures under VND 7 million (US$ 438) per treatment were covered by the insurer. For treatment expenditures above VND 7 million, a 40 percent coinsurance provision applied to the excess of expenditures (or rear-end deductible). The 20 percent coinsurance requirement was then reintroduced in 2007 but applied only to policy-holders insured under the voluntary scheme (see Table 1).[6] As this policy change did not affect policy-holders who were insured under the compulsory schemes, this group may be used as a control group for our analysis and invites the use of the DID method to assess the effect of the April 2007 changes in the coinsurance provisions under the voluntary scheme.

[5] The 2008 Health Insurance Law, which was passed by the Vietnam National Assembly in November 2008 to take effect on 1 July 2009, increased the contribution rate to 6 percent of salary, in which employers pay 4 percent and employees 2 percent. The contribution rate for the non-contributory scheme was also adjusted similarly.

[6] This policy change is stated in an inter-ministry circular number 06/2007/TTLT-BYT-BTC dated 30 March 2007. The insured under the compulsory schemes were "forgotten" in this policy change until October 2009. Since 1/10/2009, they have had to pay from 5 to 20 percent of total treatment costs.

2.3. Studies on the impact of health insurance in Vietnam

There has been no study of the impact of cost-sharing on health care quantities demanded in Vietnam, *per se*, but some work has shown that Vietnamese who have insurance have benefited. For instance, Sepehri *et al.* (2006b) find a positive influence of health insurance on hospital admission and length of stay. In terms of financial protection, voluntary health insurance is found to reduce the average OOP expenditure by between 20 percent (Sepehri *et al.*, 2006a) and 200 percent (Jowett *et al.*, 2003). More recently, Nguyen (2012) finds that having voluntary health insurance increases the insured's number of outpatient and inpatient treatments. His study however does not find any significant impact of having VHI on OOP expenditure. In addition, Axelson *et al.* (2009) finds that HCFP increases health care utilisation, reduces household OOP expenditure and reduces the risk of catastrophic health expenditure. However, using the same data set but a different method, Wagstaff (2010) finds no statistically significant impact of having HCFP on the use of health services. The impact of health insurance on the behaviour of the insured in choosing care providers has also been studied. For example, insured patients have been found to be more likely to use outpatient facilities and public providers than the uninsured (Jowett *et al.*, 2004). Furthermore, health insurance has been reported to decrease self-treatment among the insured (Chang and Trivedi, 2003). Health insurance is also found to have a positive impact on the nutritional status of the insured (Wagstaff, 2007).

3. Data and sample

3.1. Data

For our analysis, we use two waves of the panel VHLSSs that were undertaken in 2006 and 2008. The VHLSS is a nationally representative panel covering 9,189 and 9,186 households, respectively. Both surveys contain information on demographics, education, health, employment (at an individual level), income, assets, expenditure (on a household level) and a range of community-level infrastructural and institutional variables (for rural communes only). These two VHLSSs provide detailed information on the insurance schemes under which individuals are covered and their health care utilisation, thus making them amenable to the analyses we propose to use.

Moreover, the timing of the two surveys suits the purpose of this study well. In both surveys, the interviews took place between May and September each year. Therefore, the quantity of health care utilisation in 2006, which has been reported for a period of 12 months prior to the

survey time, refers to health care utilization exclusively before the increase in coinsurance in April 2007. Similarly, the reported number of treatments in 2008 refers exclusively to treatments after the increase in coinsurance in April 2007.

3.2. Sample

The sample comprises individuals who were aged seven years or older in 2006. Children aged under seven are excluded from the sample because they are exempted from hospital fees even if they are uninsured (World Bank, 2007). Control and treated groups are defined using the individual's health insurance status which is identified at the time of survey. However, health care use was measured for a period of 12 months prior to the survey time. If individuals changed their health insurance status (e.g., switched from VHI to CHI or became uninsured) within 12 months prior to the survey time of the VHLSS 2008, we cannot precisely identify to which group they belonged since they were not affected by the increase in coinsurance for the whole 12 months. To address the difference in measurement time of health insurance status and the use of health care services, we use panel data since it provides the history of health insurance enrolment for each individual between 2006 and 2008. The VHLSSs are particularly useful as they follow a panel of 15,777 individuals in 4,091 households. The use of a panel sample also allows us to apply panel data econometric methods that are more robust (e.g. to unobserved heterogeneity) than cross-sectional data methods.

3.3. Treatment and control groups

While the uninsured were not affected by the increase in coinsurance, they are not used as a control group in this study for several reasons. First, there are other changes in health insurance policies during the study period (see Section 1) which may have different impact on the insured and uninsured. For example, there was an increase in premiums charged at the same time that coinsurance changed, which could impact health care demand. Moreover, the use of health care of the uninsured does not depend on waiting time requirements or an understanding of the health insurance system as that of the insured (either under CHI or VHI).[7] As a result, we only use the insured under CHI as a control group.

[7] We experimented with using the uninsured as an alternative control group. Estimates show that compared with the uninsured, the VHI group in some cases appears to increase its health care demands following the introduction of the coinsurance provision. For this unexpected positive impact, it is possible that in a health care system characterised by complicated procedures it may take time for the insured to become eligible for more expensive (most likely inpatient) treatments as well as becoming conversant with the health insurance benefits; the impact of time is more important than that of price (Nguyen, 2008).

The DID method applied to panel data requires no change in the distribution of the control and treatments groups due to the increased coinsurance provision. We therefore focus on a panel of individuals who were continuously insured in their schemes during the same period.[8] In using a sample of individuals who did not change their health insurance status between 2006 and 2008, however, we may face a sample selection problem if movements between these schemes were driven by the changed coinsurance provisions themselves. Although most individuals did not change their health insurance status during the study period we address the possible issues associated with this selection problem in Section 6. With the foregoing sample restriction, we have a sample of 1,801 individuals continuously insured under VHI (the treated group) and 3,686 individuals continuously insured under CHI (the control group).

3.4. Measures of outcomes

The 20 percent increase in coinsurance applied to both outpatient and inpatient treatment for the VHI group. We therefore directly assess the impact of the increase in coinsurance by analyzing the price responsiveness to the number of treatments.[9] In addition, since the quasi-experiment sets slightly different measures on outpatient and inpatient treatment, we accordingly assess the policy impact separately for these two types of treatment. These two measures are commonly used in studies on the impact of health insurance in Vietnam using the same data sets (Sepehri *et al.*, 2006a; Wagstaff, 2010; Nguyen, 2012). In addition to these two outcomes, we use the number of times the insured use their health insurance card to pay for treatment as an additional outcome. We do this because there is evidence that insured patients in Vietnam do not always use their health insurance cards to claim for treatment even when they are eligible for health insurance benefits (Nguyen, 2008; Sepehri *et al.*, 2009). Compared with the total number of treatments, the number of times the insured patients use health insurance cards better captures the impact of the increase in coinsurances on the behaviour of the insured.

4. Empirical model

4.1. Estimation model and econometric method

We set up the empirical model to evaluate the impact of the increase in coinsurance in 2007 as follows. Let y_{it} be the outcome of interest for individual i at time t. At $t = 2006$, no

[8] A continuous enrollment sample restriction is commonly used in the literature (Zhang, 2007; Chandra *et al.*, 2010b; Duarte, 2012).

[9] Alternatively, we can use the per treatment claim as an outcome. Unfortunately, there is no such information in the VHLSS 2006.

insured individual had to share the cost of treatment. At $t = 2008$, the insured under VHI had to share 20 percent of the treatment cost and are assigned to the treated group, while all others form the control group. Let VHI_i be a binary indicator equal to one if individual i is covered under the VHI scheme in 2008 and zero if otherwise. Therefore, an unobserved health care demand model is:

$$y_{it} = \alpha_0 + \alpha_1 d2_t + \alpha_2 VHI_{it} + \alpha_3 d2_t * VHI_{it} + \gamma X_{it} + c_i + u_{it} \quad (1)$$

where $d2_t$ is a dummy variable equal to one if $t = 2008$, and zero if $t = 2006$, and c_i is an unobservable time-invariant individual variable. The inclusion of the time dummy variable $d2_t$ is to control for any time trend in health care demand unrelated to the increase in coinsurance such as changes in availability of health care services or living environment. The presence of the individual heterogeneity, c_i, in equation (1) recognises that enrolment in VHI might be correlated with individual characteristics that also affect health care utilisation. X_{it} is a vector of all other individual socio-economic characteristics that are controlled for in the regression and u_{it} is an error term. We assume that $E(u_{it}|X_i, VHI_i, c_i) = 0, t = 2006, 2008$.

To eliminate the unobserved effect, c_i, we first-difference equation (1) as

$$\Delta y_{i2} = \alpha_1 + \alpha_3 VHI_{i2} + \Delta X_{i2}\gamma + \Delta u_{i2} \quad (2)$$

The effect of the increase in coinsurance then can then be obtained by regressing the change in y on the change in the X_i variables and the VHI dummy. With panel data of two periods in time as in our study, the estimate of α_3 from equation (2) is the DID estimator: it measures the effect of the introduction of the coinsurance provision for people covered under VHI. The first-difference (FD) estimator produces identical DID estimates as a fixed-effect estimator while both enjoy the advantage of panel data methods that control for unobserved time-invariant factors that may affect both the control and treated groups (Wooldridge, 2010). Our difference-in-difference approach to study the impact of coinsurance is similar to that in Winkelmann (2004b), Zhang (2007), Chandra *et al.* (2010a) and Schreyögg and Grabka (2010). In our study, first-differencing is preferred since it also helps us to deal with the econometric issues associated with excess zeros of health outcomes (Winkelmann, 2008; Trivedi and Munkin, 2010).

First-difference regressions help remove the endogeneity bias due to time-invariant unobserved characteristics such as attitudes toward risk, medical care and previous

experience with the health care system. The first-difference regression will, however, fail to remove all endogeneity bias if the unobserved variables that affect VHI enrolment and health care consumption are time-variant. There may be remaining time-varying shocks that could affect both VHI enrolment and health care consumption such as health care demand or supply shocks.

To deal with possible endogeneity of continuous enrolment in VHI, we also employ an instrumental variable (IV) approach to estimating the first-difference equation (2). The challenge associated with this approach is to find a valid instrument that is correlated with enrolment in VHI but not with health care demand. At the time of this study, enrolment in VHI was group-based (see Section 2), so we follow Nguyen (2012) to use the proportion of people in the commune having VHI as an instrument variable for the VHI enrolment equation. For each individual, this variable is calculated as the ratio of people ages seven or older living in other households in the same commune having VHI. This commune-based variable is then used in association with a household-based dummy variable indicating whether any household member aged over seven, excluding the individual being considered, had CHI to predict the probability of a household member's enrolment in VHI. Since this measure is commune-based it is arguably beyond the individual's influence. The latter, however, seems appropriate since enrolment in CHI in Vietnam is sometimes considered as exogenous (Sepehri *et al.*, 2006b). Together or in isolation, these measures are expected to be correlated with individuals' enrolment in VHI but not with the error terms (Δu_{i2}). If they are valid instruments for the VHI equation, DID estimates of the first-difference model using instrumental variable methods will be consistent. In Section 5.2 we conduct tests for weak instruments and demonstrate their suitability for our purpose.

4.2. Explanatory variables

Given that the characteristics of individuals in the treated group may differ from those in the control groups, it is necessary to augment our specifications with the inclusion of a vector (X) of additional explanatory variables. Throughout the models, we control for a number of socio-economic factors, which have been shown to influence the demand for health care (Grossman, 2000).[10] In particular, we include age and gender implying that hospital visits increase with age and that women tend to have higher demand for health care. We further

[10] In the first-difference model, time-invariant variables such as gender, ethnicity, chronic disease, smoking and residential location are dropped. For completeness, these variables are explained here and will be used in Section 6.

control for household income to consider that demand for health care may increase with income. Following the literature dealing with income in developing countries, where income data are relatively scarce and may also be unreliable where they exist, we use per capita household expenditure as a proxy for income. We also include type of dwelling in the regressions to measure the impact of household assets on health care demand.

We use both long-term and short-term indicators of health status: our long-term health status indicator is the existence of any chronic disease or limitation in functional ability[11] and our short-term health status measure is a dummy variable that indicates whether the individual had had any illness in the 12 months before the survey period. In addition, the number of days the individuals had any illness in the previous 12 months provides another indicator of health status. Following the literature on health care demand, we also use information on smoking behaviour[12] as a proxy for lifestyle decisions that may also affect the demand for health care (Doiron *et al.*, 2008).

The control variables also include the highest level of education attained, marital status, majority ethnicity, and household size. The inclusion of regional and rural/urban variables in the regressions is to control for heterogeneity in health care utilisation between regions (see Appendix Table 1 for variable definitions and Appendix Table 2 for summary statistics of main variables).

5. Results

5.1. Descriptive statistics

Table 2 illustrates how health care utilisation for the treated and control groups developed between 2006 and 2008. In both years, individuals covered by CHI had higher health care utilisation as both outpatients and inpatients. For outpatient treatment, the number of visits decreased from 2006 to 2008 and this trend is statistically significant for the VHI group. A similar (but statistically insignificant) pattern is observed when the outcome is measured as the number of times the insured patients used their health insurance cards to pay for treatment. In contrast, we observe no clear pattern in the change of the number of inpatient

[11] The VHLSS 2006 provides a comprehensive description of an individual's overall functional health on the basis of vision, hearing, memory or concentration, ambulation (ability to get around), dexterity (use of hands and fingers) and communication attributes. For each attribute, four possible responses are recorded: not difficult, a little difficult, very difficult and impossible. We classify an individual as one with any limitation in functional ability if having a little difficulty or more in any of above attributes.

[12] Information on smoking, chronic disease or disability is only available in the VHLSS 2006. We make use of our individual panel to assume that individuals who reported having ever smoked or having any chronic disease or being disabled in 2006 also had the same status in 2008.

treatments. Table 2 also shows the difference in the change in the outcomes between the treated group and the control group over the 2006-2008 period (DID). DID figures suggest that the re-introduction of the coinsurance provision in the VHI group reduced their outpatient visits by 0.26, as compared with the CHI group. This reduction is statistically significant. We however do not observe any significant reduction for other outcomes. We test whether these patterns hold when characteristics of individuals in the treated and control groups are accounted for in the next section.

[Table 2 about here]

5.2. Regression results

Table 3 presents DID estimates of the impact of the increase in coinsurance on health care demand using the CHI as a control group. The results are reported separately by treatment type (inpatient, outpatient) and estimator (FD and IV-FD).[13]

[Table 3 about here]

Table 3 shows that prior to using the IV we obtain a negative and insignificant estimate for the impact of the coinsurance provision on the number of outpatient treatments. A positive and insignificant impact, however, is observed when the outcome is measured by the number of times the insured patients use health insurance cards to pay for treatment. Instrumenting for VHI enrolment has a pronounced effect on the estimated impact. Specifically, it decreases the impact of coinsurance on the number of outpatient treatments. In addition, the estimated impact turns from positive to negative when the outcome is represented by the number of times that insured patients use their health insurance cards to pay for treatment. For both outcomes, however, the IV estimates are statistically insignificant.

Prior to instrumenting we obtain a positive and insignificant estimate for inpatient treatment. This pattern holds when the outcome is measured by either the number of treatment or the number of times the health insurance card is used to pay for treatment. Instrumenting for VHI turns the impact from positive to negative but the impact is still statistically insignificant. We note that the OLS estimate was biased upward. This is consistent with a positive estimate of

[13] We implement a maximum likelihood (ML) estimator derived by Maddala (1983) to estimate the system of two equations: a probit equation for the probability of enroling in VHI and an OLS equation for the change in outcomes. We account for possible endogeneity of the VHI variable in the change in outcome equation by allowing errors in the two equations to be correlated. The endogeneity of the treatment variable can be tested using a *t* test for the significance of the correlation term. *p* values for this test are reported under the DID estimates. Instrumental variable first-difference estimates are obtained using treatreg syntax in Stata version 13.0.

the correlation (rho) between errors in the treatment and outcome equations. The size of the bias is not negligible but the likelihood-ratio test at the bottom of the DID estimates indicates that in most cases we cannot reject the null hypothesis that the two error terms are uncorrelated. An exception is observed when the outcome is measured by the number of times the insured patients use health insurance cards to pay for outpatient treatment. In this case, a positive and significant correlation between change in errors in the outcome equation and errors in the treatment equation is observed.

Given the significant change in the estimated impact associated with the coinsurance provision in the instrumented regressions, special scrutiny of the results is warranted. First, we test for strength of the instruments by using a Likelihood Ratio (LR) test for joint significance of instruments. The results are reported in Table 3 and suggest that the instruments are empirically strong (Staiger and Stock, 1997). Second, we test for the assumption that the instruments are not correlated with the error term in the equation (2) by using an over-identification test. In all cases, Chi-squared test statistics in Table 3 show that we cannot reject the null hypothesis that the error term is uncorrelated with the instruments. Third, we use the proportion of people in the commune having VHI as a sole instrument, the results are almost the same as when two instruments are used. Finally, we implement a two-stage estimator[14] and compare the results with those obtained from the maximum likelihood estimator. Again the estimated impact is almost the same.

In summary, we cannot find the expected (negative) impact of the increase in coinsurance provisions on the quantity of health care demanded by individuals covered under the voluntary scheme. This result is robust even when we account econometrically for the endogeneity of enrolment in VHI.

5.3. Variation between sub-groups

We examine whether the results are heterogeneous to sub-groups by reapplying the above regression models to each sub-group. We first examine whether price sensitivity varies with health status, as represented either by limitation in functional ability or having any illness, both measured in 2006.[15] A priori, the heterogeneity in response to coinsurance by

[14] In the first stage, probit estimates are obtained for the treatment equation. From these estimates, the hazard is calculated for each observation. Consistent estimates of the first difference equation in the second stage are obtained by augmenting the regression equation with the hazard. Standard errors of the second stage are adjusted using a formula derived by Maddala (1983). We use treatreg syntax in Stata version 13.0 to produce two-stage instrumental variable estimates. Estimated results will be available upon request.

[15] We do not use the existence of any chronic condition to represent long term health condition in this experiment because only a small number of the VHI insured (86) have a chronic condition.

individual's health status is vague. On the one hand, individuals with worse health may be more price sensitive because of potentially larger income effects. On the other hand, those with worse health may be less price sensitive because they may value health more. Results (reported in Table 4 – Panel 1) indicate that there is no noticeable difference in responses to the increase in coinsurance by disability status (for both outpatient and inpatient treatment) and by illness status (for inpatient treatment). We however observe some significant difference in responses when health status is measured by having any illness for outpatient treatment (Table 4 – Panel 2). In particular, individuals with better health (i.e. having no illness) appear to cut their number of outpatient treatment by 0.13 while those with worse health do not. This difference while not highly significant (at a 10 percent level) still holds when the endogeneity of VHI enrollment is dealt with since no endogeneity of VHI enrollment is detected.[16] We also observe a similar trend when the outcome is measured by the number of times the health insurance card is used to pay for outpatient treatment. This difference however turns to insignificant when the endogeneity of VHI enrollment, which appears to be present, is controlled for.

[Table 4 about here]

We next investigate whether there is any difference in response to the imposition of coinsurance by gender. Results (reported in Table 4 – Panel 3) indicate no significant difference by gender for outpatient treatment. In contrast, significant difference in the effect of coinsurance by gender is noted for inpatient treatment when the endogeneity of VHI enrollment is not dealt with. Instrumenting for VHI enrollment however turns this gender difference to insignificant. The statistical significance of the correlation between the treatment and outcome equations suggests that the IV-FD result is preferred in this case, indicating there is no significant difference across genders for inpatient treatment.

We also compare the influence of coinsurance across three different age groups: under 18, prime age (between 18 and 55), and old age (age over 55).[17] Results (reported in Table 5 – Panel 1) show that when faced with a coinsurance provision, individuals under 18 years old were more likely to reduce treatment than were older individuals. In particular, individuals age under 18 cut their number of outpatient treatment by 0.6 (FD-IV result, which is preferred) while older individuals did not. Individuals age under 18 also decreased their times

[16] We also implement usual tests for the instrumental method as discussed in Section 5.2. Results of these tests which indicate that our instruments are valid will be available upon request.

[17] 55 (60) is the legal retirement age for females (males) in Vietnam at the time of study. The results are robust when we use male legal retirement age.

to use the health insurance cards to pay for outpatient (by 0.3, FD-IV result) and inpatient (by 0.4, FD-IV result) treatment while older individuals did not. Our finding of a different impact by age is in line with some other studies (Cherkin *et al.*, 1989; Hsu *et al.*, 2006; Duarte, 2012) which also find that older individuals are less likely to respond to cost-sharing than younger individuals.

[Table 5 about here]

Finally, we consider variation in response to the increase in coinsurance by three different income groups, measured by three household per capita expenditure quintiles which are in turn set at the 2006 level. Results (reported in Table 5 – Panel 2) show some significant differences in the impact of coinsurance increase on health care demand by income groups. For example, as compared to the CHI insured, the VHI insured decreased their number of outpatient treatment by about 0.9 after the increase in coinsurance if they were in the lowest income quintile. Similarly, they also reduced the number of times using their health insurance cards to pay for outpatient treatment by one (result from the regression controlling for endogeneity of VHI enrolment). In contrast, we observe some increase in the number of times the health insurance benefits are used for the insured under VHI in higher income groups. This difference in responses to coinsurance suggests that coinsurance would have a greater financial impact on low income individuals, a finding that is similar to the one found in Duarte (2012).

6. Robustness checks

6.1. Selection issues

The key assumption of the DID methodology is that the allocation of the treatment and control groups does not change during the study period. Data show that, in practice, while most individuals did not change their health insurance status, some did switch between the treated and control groups from 2006 to 2008 (see Table 6). By selecting the sample of continuously insured individuals, we face a risk of excluding those whose response to the changed coinsurance provisions of the VHI scheme was to change their insurance status. If individuals dropped out of VHI schemes which had increased coinsurance provisions, and the individuals who moved have a higher-than-average price elasticity of health care demand our estimated impact will be biased downwards. This switch is more likely for those who anticipated using more health care after the increased coinsurance provisions were introduced.

[Table 6 about here]

While the incentives just mentioned do exist, there are various factors suggesting that they will have small impact on the composition of the treated and control groups in our study. Firstly, we are able to observe movement between the treated and control groups (See Table 6). Secondly, we directly test whether health factors affect the composition of the treated and control groups between 2006 and 2008.

We apply the Multinomial Logit (MNL) model to a panel sample of individuals to examine the determinant of switching among treated and control groups during the 2006-2008 period. We begin investigating the dynamics of health insurance enrolment by specifying a baseline model that contains only variables measuring initial conditions (measured in 2006). These variables such as age, gender, smoking, sector of employment, schooling status and income are shown to be important in deciding health insurance enrolment. We then include variables that capture 'changes' in employment sector, schooling and income. The key variables we use to explore the possibility of adverse selection are measures of long-term and short-term health, our hypothesis being that ailing individuals are less likely to drop out of the VHI scheme after the increase in coinsurance.[18]

Results for the impact of health variables on the movement among various states (uninsured, insured under CHI and insured under VHI) reported in Table 7 show that in all cases, we cannot find evidence to support the hypothesis that ailing individuals are more likely to drop out of VHI. Indeed, our health measures play no statistically significant role for those who switched from VHI to CHI (Column 6). In contrast, individuals with bad health as measured by the number of days ill are more likely to switch from CHI to VHI (Column 4). This health impact suggests that if the selection problem exists it may increase the estimated impact of coinsurance. It thus strengthens our result of no significantly negative impact of the increase in coinsurance on health care demand when the CHI is used as the control group.

[Table 7 about here]

Given that individuals with bad health are less likely to move out of the health insurance system (by remaining insured under either CHI (Column 3) or VHI (Column 5), it is not clear how this may influence the estimate using a sample of continuously insured under CHI or VHI. If individuals with bad health are more price sensitive than those in good health, our

[18] See Nguyen and Leung (2013) for details about model specifications and interpretations of the health insurance dynamics models.

DID estimate using the sample of continuously insured could underestimate the true impact of the coinsurance provision.

Finally, we check for sample selection problems by applying a DID estimator to a cross section of data achieved by pooling data from two years. A DID estimator applied for repeated cross-section data in this robustness check is specified as follows:

$$y_{it} = \beta_0 + \beta_1 VHI_i + \beta_2 d2_t + \beta_3 VHI_i * d2_t + \eta X_{it} + \mu_{it} \quad (3)$$

The notation for equation (3) is similar to that of equation (1). In equation (3), the effect of the increase in coinsurance is identified by β_3, which measures the change in health care demand of those with an increase in coinsurance compared with those who were exempt from coinsurance. Note that, as discussed in the sample restriction section (Section 3) when the pooled cross-section data are used, the timing of the movement among the treated and control groups is not taken into consideration.

DID estimates for the pooled sample (reported in Table 8) show that the coinsurance provision has no significant impact on reducing health care demand.[19] This result holds for different health care utilisation outcomes. An unexpected impact is observed when the number of inpatient treatments increases by about 0.021 for the treated group. However, this impact is not highly significant (at the 10 percent level).

[Table 8 about here]

6.2. Difference-in-difference matching

In this section, we estimate the impact of the coinsurance provision by employing a DID matching strategy to the panel sample. To apply for a panel sample, the standard DID matching estimator proposed by Heckman *et al.* (1997) and Heckman *et al.* (1998) requires that there is no switch or change between the treated and control groups from 2006 to 2008. We thus apply it directly to our previously defined treated and control groups as we have done in Section 5 (i.e. continuously insured). Standard matching estimators assume that, after controlling for a set of observable characteristics, outcomes are conditionally mean independent of treatment. A DID matching strategy allows for invariant difference in unobserved characteristics between treated and control individuals (Heckman *et al.*, 1997; Heckman *et al.*, 1998). Smith and Todd (2005) find that the DID matching estimator for

[19] We use the OLS model to run this robust check. The results from the Poisson model are very similar to OLS results so we do not report them here.

panel data is more robust than traditional cross-section matching estimators. In addition, compared with the DID estimator, the DID matching estimator has the advantage of avoiding the imposition of functional form restrictions on the outcomes which usually require appropriate count data models. Thus it helps to avoid bias caused by misspecification of outcome functions. Furthermore, the DID method assumes that all other temporal factors affecting health care demand have the same impact for the insured under VHI and those in the control group. Thus we assume that any changes over time that we do not control for influence all individuals in the same way. The DID matching thus provides an indirect check for the common trend assumption since it matches individuals with similar characteristics which are measured in 2006.

We use a probit regression to estimate the propensity score. To set the variables for the probability equation, we follow two rules. First, included explanatory variables should affect both treatment and outcomes. We therefore include gender, age, ethnicity, marital status, health status, achieved educational levels, household head status, house types, household size, household income, and regional and urban variables in the probit equation. Second, explanatory variables should be exogenous to the treatment so we measure them in 2006 before the treatment.

To assess the matching quality we use a two sample *t*-test to check if there are significant differences in variable means for both groups (Rosenbaum and Rubin, 1983). After matching, the *t*-test shows no significant differences in covariates for both groups. Additionally, we use the likelihood ratio test on the joint significance of all variables in the propensity score function on the matched sample as suggested by Sianesi (2004). The test shows that after matching, the assumption of the joint significance of all variables is rejected.

Results for the probit regressions of treatment are presented in Appendix Table 5. As compared with those remaining insured under CHI, individuals remaining insured under VHI are younger, wealthier, more likely to belong to an ethnic majority, be at school or work for formal economic sectors. No significant difference in health status between the two groups is observed.

[Table 9 about here]

DID matching estimates are reported in Table 9. All impact estimates shown in Table 9 are statistically insignificant, indicating that our findings are robust to some functional form of outcomes.[20]

6.3. Timing of VHLSS2006

Some individuals in our sample were surveyed between May and August 2006 so some of their treatment could have been undertaken before the *decrease* in coinsurance in September 2005 (see Section 2.2). Since we have no information about the timing of each treatment, it is likely that some of insured patients had to share 20 percent of costs of treatments that were undertaken between May and August 2005. Their shorter period of zero coinsurance experience before the increase in coinsurance in 2007 may explain why we could not find any significant impact above. In this section, we check for this possibility by excluding those surveyed between May and August 2006 from the panel sample and reapplying the regression models used in Section 5 to this sample. The results of this robustness check (reported in Table 10) show that, in all cases, there was no significant reduction impact of the re-introduction of coinsurance provisions on health care demand.

[Table 10 about here]

6.4. The impact of 40 percent coinsurance for treatment above VND 7 million

Recall, from Section 2.2, that before April 2007 a 40 percent coinsurance applied for VHI treatment costs above VND 7 million. This rear-end deductible is unlikely to have an impact on our results because insured patients are unlikely to know how much above the excess their treatment cost would be before deciding whether to receive treatment. Therefore, while the deductible may have some impact on OOP expenditure, it seems unlikely to have much impact on the probability of having a treatment. Note that our outcomes as measured by the number of visits also limit the impact of this coinsurance structure on the results.

Furthermore, the excess benchmark is expected to apply to a small number of insured patients. This is because VND 7 million is high as it constitutes about 60 percent of Vietnam GDP per capita in 2006. From the VHLSS2006 data, although we do not know how much additional fee each insured patient had to pay when receiving treatment, we do know that only a small number of insured patients (13 percent) had to pay any extra for their treatment

[20] We examine the sensitivity of the DID matching estimates by using different matching methods including 1 nearest neighbour, 5 nearest neighbours and kernel matching with a different bandwidth (0.0008). The estimated results are very similar. We do not report results for this sensitivity check here for brevity but the results will be available upon request.

cost possibly because their treatment cost was over VND 7 million. In an additional robustness check, we make sure that our results are not driven by this small number of individuals by dropping them from the panel sample and reapplying the regression models used in Section 5 to this sample. Results of this check, which are reported in Table 11, show our findings are still robust.

[Table 11 about here]

6.5. The common trend assumption

The assumption of common trends in the impact evaluation literature using DID method requires that the change between 2006 and 2008 in health care use would have been the same for those in the treated group and the control group if the coinsurance had not changed in 2007. In an ideal world, we would test this assumption by using data in two time periods before the policy change and demonstrate that the DID around a year in which policy did not change was zero. Unfortunately, given the available data in Vietnam and the change in cost-sharing policy in 2005, this assumption is not easily tested. While there were some events that might have had different impact on health care demand between the treated group and the control group during the study period, as discussed below, they are unlikely to have any significant impact on our findings.

For example, a different change in the health care provider incentive between the control and treated groups during the study period may violate the common trend assumption of the DID method. In Vietnam, while the scope for providers to induce demand for unnecessary services exists when they are paid on a fee-for-service basis (World Bank, 2007; Lieberman and Wagstaff, 2009; Nguyen *et al.*, 2017), this payment basis was not changed during the study period. In addition, treatment fees for patients were unchanged during the study period. We therefore expect no change in provider – induced demand, for at least insured patients.

Another event which may lead to a possible violation of the common trend assumption is the premium growth during the study period. Premiums for the insured under VHI were raised by around 80 percent between September 2005 and April 2007. At the same time, the nominal minimum wage which is used to calculate the salary and hence heath insurance premiums for the insured under CHI increased by about 41 percent. When we account for growth in the salary base of wage earners, the premium growth is almost the same for the insured under

VHI and CHI.[21] We therefore expect that changes in premium during the study period to have a similar impact on health care demand of the insured under VHI and CHI.

7. Discussion and conclusions

In this study, we examine the impact of re-introducing a 20 percent coinsurance provision for VHI holders on health care demand in Vietnam. We apply a DID, DID instrumental variable and DID matching framework to the 2006 and 2008 VHLSS data by using the insured under compulsory schemes as a control group.

The results suggest that there was no significant reduction in health care demand for the VHI group following the re-introduction of co-insurance. This finding holds for both outpatient and inpatient treatment. Our finding is robust when the movement among treated and control groups is taken into account. Overall, the 20 percent coinsurance provision is found to have no intended impact on health care demand. By sub-group, we find insignificant differences in responses by health status and gender. We however find that those who were under 18 or in low income households reduced their health care use after the increase in coinsurance.

The finding that the 20 percent coinsurance provision did not reduce the quantity of health care demanded is not in line with what has usually been found in developed countries. This finding however is consistent with health care conditions in the developing world. Possibly, at a lower level of development, people only go to see a doctor when it is very necessary (O'Donnell, 2007), and this kind of demand is rather inelastic (Manning *et al.*, 1987; Duarte, 2012). This lack of impact may also be due to the presence of other monetary and non-monetary costs associated with any medical treatment in the developing world. Such costs include those monetary costs not covered by the insurance policy, transportation time and costs, and waiting costs may represent an important fraction of total costs faced by the patients. This is true for Vietnam since for those who were supposed to be exempted from treatment free (the CHI insured) in 2008, OOP payments still accounted for more than half of total treatment cost.[22] A 20 percent coinsurance provision thus induces a small relative change in total costs, but may be too small to induce observable change in behaviour. In addition, there is a lack of adequate health care, especially at high levels of the health care

[21] Wages for wage earners are calculated as the product of the minimum wage and a salary base. The latter is proxy for a labourer's productivity and assumed to increase overtime.

[22] In particular, according to the 2008 VHLSS data (see Appendix Table 6), for the insured under CHI, OOP payment represents 54 percent of total treatment cost for inpatient treatment and 53 percent for outpatient treatment. The figure is higher for the insured under VHI who have to pay 66 percent of total treatment cost for outpatient treatment and 59 percent for inpatient treatment.

system,[23] and therefore this limits the over-use of health care in Vietnam, which may also explain the insignificant impact of the coinsurance provision on health care demand. It is also possible that this coinsurance policy is immature so the impact may not yet be observable. The result is consistent with the status of the health fund as in 2009 the fund was still in deficit despite efforts such as increasing the coinsurance rate. Our result is thus consistent with that of other studies on the impact of user fees on health care demand in developing countries where it usefulness depends on meeting several quantity, quality, information and cultural conditions (James *et al.*, 2006).

Our findings, and those of a number of other studies, suggest that cost-sharing is a blunt instrument for controlling moral hazard among the insured in developing countries. These findings may have important policy implications for health care financing in developing countries: a requirement that insured patients share the costs of treatment can be implemented without reducing their utilisation of health care. Thus setting co-payments according to the ability of insureds to pay offers a way of extending health care financing and perhaps insurance coverage. Of course, it is also well-known that out-of-pocket payments are usually regressive sources of health care financing in the developing world. In further work, the effect of the policy change on the distribution of health care services and health care financing is thus also deserving of further attention.

[23] In 2009, central, provincial and district hospitals on average operated at 150, 125 and 115 percent over the capacity (as measured by bed occupancy rates over allowable beds), respectively (Vietnamnet, 2009).

References

Akerlof, G.A., 1970. The Market for "Lemons": Quality Uncertainty and the Market Mechanism. The Quarterly Journal of Economics 84, 488-500.

Arrow, K.J., 1963. Uncertainty and the Welfare Economics of Medical Care. The American Economic Review 53, 941-973.

Axelson, H., Bales, S., Minh, P., Ekman, B., Gerdtham, U.-G., 2009. Health financing for the poor produces promising short-term effects on utilization and out-of-pocket expenditure: evidence from Vietnam. International Journal for Equity in Health 8, 20.

Chandra, A., Gruber, J., McKnight, R., 2010a. Patient Cost-Sharing and Hospitalization Offsets in the Elderly. American Economic Review 100, 193-213.

Chandra, A., Gruber, J., McKnight, R., 2010b. Patient Cost Sharing in Low Income Populations. American Economic Review 100, 303-308.

Chandra, A., Gruber, J., McKnight, R., 2014. The Impact of Patient Cost-Sharing on the Poor: Evidence from Massachusetts. Journal of Health Economics 33, 57-66.

Chang, F.-R., Trivedi, P.K., 2003. Economics of self-medication: theory and evidence. Health Economics 12, 721-739.

Cherkin, D.C., Grothaus, L., Wagner, E.H., 1989. The Effect of Office Visit Copayments on Utilization in a Health Maintenance Organization. Medical Care 27, 1036-1045.

Chiappori, P.-A., Durand, F., Geoffard, P.-Y., 1998. Moral hazard and the demand for physician services: First lessons from a French natural experiment. European Economic Review 42, 499-511.

Cockx, B., Brasseur, C., 2003. The demand for physician services: Evidence from a natural experiment. Journal of Health Economics 22, 881-913.

Doiron, D., Jones, G., Savage, E., 2008. Healthy, wealthy and insured? The role of self-assessed health in the demand for private health insurance. Health Economics 17, 317-334.

Duarte, F., 2012. Price elasticity of expenditure across health care services. Journal of Health Economics 31, 824-841.

Grossman, M., 2000. Chapter 7 The human capital model, In: Anthony, J.C., Joseph, P.N. (Eds.), Handbook of Health Economics: Elsevier, pp. 347-408.

Heckman, J., Ichimura, H., Todd, P., 1997. Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program. Review of Economic Studies 64, 605-654.

Heckman, J.J., Ichimura, H., Todd, P., 1998. Matching as an Econometric Evaluation Estimator. The Review of Economic Studies 65, 261-294.

Hsu, J., Price, M., Brand, R., Ray, G.T., Fireman, B., Newhouse, J.P., Selby, J.V., 2006. Cost-Sharing for Emergency Care and Unfavorable Clinical Events: Findings from the Safety and Financial Ramifications of ED Copayments Study. Health Services Research 41, 1801–1820.

James, C.D., Hanson, K., McPake, B., Balabanova, D., Gwatkin, D., Hopwood, I., Kirunga, C., Knippenberg, R., Meessen, B., Morris, S.S., Preker, A., Souteyrand, Y., Tibouti, A., Villeneuve, P., Xu, K., 2006. To Retain or Remove User Fees?: Reflections on the Current Debate in Low- and Middle-Income Countries. Applied Health Economics & Health Policy 5, 137-153.

Jowett, M., Contoyannis, P., Vinh, N.D., 2003. The impact of public voluntary health insurance on private health expenditures in Vietnam. Social Science & Medicine 56, 333-342.

Jowett, M., Deolalikar, A., Martinsson, P., 2004. Health insurance and treatment seeking behaviour: evidence from a low-income country. Health Economics 13, 845-857.

Karlan, D., Morduch, J., 2010. Chapter 71 - Access to Finance, In: Dani, R., Mark, R. (Eds.), Handbook of Development Economics. Amsterdam, The Netherlands: Elsevier, pp. 4703-4784.
Lieberman, S.S., Wagstaff, A., 2009. Health Financing and Delivery in Vietnam: Looking Forward. Washington, DC: The World Bank.
Maddala, G.S., 1983. Limited-dependent and Qualitative Variables in Econometrics. Cambridge: Cambridge University Press.
Manning, W.G., Newhouse, J.P., Duan, N., Keeler, E.B., Leibowitz, A., 1987. Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment. The American Economic Review 77, 251-277.
Musgrove, P., Zeramdini, R., Carrin, G., 2002. Basic patterns in national health expenditure. Bulletin of the World Health Organization 80, 134-146.
Newhouse, J.P., 1993. Free for All? Lessons from the Rand Health Insurance Experiment. Cambridge, Massachusetts.: Harvard University Press.
Nguyen, C.V., 2012. The impact of voluntary health insurance on health care utilization and out-of-pocket payments: new evidence for Vietnam. Health Economics 21, 946-966.
Nguyen, H.T., 2008. The economics of not using the health insurance card: a case study of Vietnam. Paper presented at the 4th Vietnam Development Forum-Tokyo Conference.
Nguyen, H.T.H., Bales, S., Wagstaff, A., Dao, H., 2017. Getting Incentives Right? The Impact of Hospital Capitation Payment in Vietnam. Health Economics 26, 263–272
Nguyen, T.-H., Leung, S., 2013. Dynamics of health insurance enrollment in Vietnam, 2004–2006. Journal of the Asia Pacific Economy 18, 594-614.
O'Donnell, O., 2007. Access to health care in developing countries: breaking down demand side barriers. Cadernos de saude publica / Ministerio da Saude, Fundacao Oswaldo Cruz, Escola Nacional de Saude Publica 23, 2820-2834.
O'donnell, O., Jones, A.M., 2016. Symposium: Efforts to Extend Effective Coverage in Asia. Health Economics 25, 647-649.
O'Donnell, O., van Doorslaer, E., Rannan-Eliya, R.P., Somanathan, A., Adhikari, S.R., Akkazieva, B., Harbianto, D., Garg, C.C., Hanvoravongchai, P., Herrin, A.N., Huq, M.N., Ibragimova, S., Karan, A., Kwon, S.-m., Leung, G.M., Lu, J.-f.R., Ohkusa, Y., Pande, B.R., Racelis, R., Tin, K., Tisayaticom, K., Trisnantoro, L., Wan, Q., Yang, B.-M., Zhao, Y., 2008. Who pays for health care in Asia? Journal of Health Economics 27, 460-475.
Remler, D.K., Greene, J., 2009. Cost-Sharing: A Blunt Instrument. Annual Review of Public Health 30, 293-311.
Rosenbaum, R., Rubin, D., 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70, 41 - 55.
Rothschild, M., Stiglitz, J., 1976. Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information. The Quarterly Journal of Economics 90, 629-649.
Schreyögg, J., Grabka, M., 2010. Copayments for ambulatory care in Germany: a natural experiment using a difference-in-difference approach. The European Journal of Health Economics 11, 331-341.
Sepehri, A., Sarma, S., Simpson, W., 2006a. Does non-profit health insurance reduce financial burden? Evidence from the Vietnam living standards survey panel. Health Economics 15, 603-616.
Sepehri, A., Simpson, W., Sarma, S., 2006b. The Influence of Health Insurance on Hospital Admission and Length of Stay - the Case of Vietnam. Social Science & Medicine 63, 1757-1770.

Sepehri, A., Sisira, S., John, S., 2009. Who is giving up the free lunch? The insured patients' decision to access health insurance benefits and its determinants: Evidence from a low-income country. Health Policy 92, 250-258.
Sianesi, B., 2004. An Evaluation of the Active Labour Market Programmes in Sweden. The Review of Economics and Statistics 86, 133-155.
Siminski, P., 2011. The price elasticity of demand for pharmaceuticals amongst high-income older Australians: a natural experiment. Applied Economics 43, 4835-4846.
Smith, R.J., Todd, P.E., 2005. Does matching overcome LaLonde's critique of nonexperimental estimators? Journal of Econometrics 125, 305-353.
Staiger, D., Stock, J.H., 1997. Instrumental Variables Regression with Weak Instruments. Econometrica 65, 557-586.
Trivedi, P.K., Munkin, M., 2010. Recent Developments in Cross-Section and Panel Data Models of Event Counts, In: Giles, D., Ullah, A. (Eds.), The Handbook of Empirical Economics and Finance. Boca Raton, FL, United States CRC Press, Francis and Taylor pp. 87-131.
van Dijk, C.E., van den Berg, B., Verheij, R.A., Spreeuwenberg, P., Groenewegen, P.P., de Bakker, D.H., 2013. Moral hazard and supplier-induced demand: Empirical evidence in general practice. Health Economics 22, 340–352.
Vietnamnet, 2009. Chính sách BHYT khiến bệnh viện … quá tải thêm (health insurance policies put more pressures on the hospital overload).
Voorde, C.V.D., Doorslaer, E.V., Schokkaert, E., 2001. Effects of cost sharing on physician utilization under favourable conditions for supplier-induced demand. Health Economics 10, 457-471.
Wagstaff, A., 2007. The economic consequences of health shocks: Evidence from Vietnam. Journal of Health Economics 26, 82-100.
Wagstaff, A., 2010. Estimating health insurance impacts under unobserved heterogeneity: the case of Vietnam's health care fund for the poor. Health Economics 19, 189-208.
Wagstaff, A., Nguyen, H.T.H., Dao, H., Bales, S., 2016. Encouraging Health Insurance for the Informal Sector: A Cluster Randomized Experiment in Vietnam. Health Economics 25, 663-674.
Winkelmann, R., 2004a. Co-payments for prescription drugs and the demand for doctor visits - Evidence from a natural experiment. Health Economics 13, 1081-1089.
Winkelmann, R., 2004b. Health care reform and the number of doctor visits - an econometric analysis. Journal of Applied Econometrics 19, 455-472.
Winkelmann, R., 2008. Econometric Analysis of Count Data, fifth ed. Berlin Heidelberg: Springer.
Wooldridge, J.M., 2010. Econometric Analysis of Cross Section and Panel Data, 2 ed. Cambridge, Mass: MIT Press.
World Bank, 2007. Vietnam Development Report 2008: Social Protection, Joint Donor Report to the Vietnam Consultative Group Meeting. Hanoi: World Bank.
Zhang, J., 2007. A DID analysis of the impact of health insurance reform in the city of Hangzhou. Health Economics 16, 1389-1402.
Zweifel, P., Manning, W.G., 2000. Chapter 8 Moral hazard and consumer incentives in health care, In: Anthony, J.C., Joseph, P.N. (Eds.), Handbook of Health Economics: Elsevier, pp. 409-459.

Table 1: Components of Vietnam health insurance system, 2006 - 2008

Scheme	Targeted population	Financing	Cost-sharing policies		Percent of population insured under(*)	
			Before 2007 reform	After 2007 reform	2006	2008
Compulsory health insurance (CHI)	Civil servants and employees in the formal sector (SHI)	3 percent salary (2 percent paid by employer and 1 percent by employee)	- 0 percent coinsurance for treatment costing under 7 mil VND - 40 percent coinsurance for treatment costing more than 7 mil VND - Claim limit of 20 mil VND per treatment	The same as before	9	10
	Pensioners	3 percent of monthly allowances, paid by VSS with subsidies from state budget	- 0 percent coinsurance for treatment costing under 20 mil VND -Claim limit of 20 mil VND per treatment	The same as before	3	5
	Meritorious people	3 percent of minimum wage, paid from state budget	- 0 percent coinsurance - No claim limit per treatment	The same as before		
	Health care for the poor (HCFP)	Central government budget (75 percent) and provincial budget (25 percent)	- 0 percent coinsurance for treatment costing under 20 mil VND -Claim limit of 20 mil VND per treatment	The same as before	19	14
	Free health care for children age below six	Central government budget	- 0 percent coinsurance - No claim limit per treatment	The same as before	3	7
Voluntary health insurance (VHI)	Students	VND 120,000 (urban). VND 100,000 (rural). Paid by parents.	- 0 percent coinsurance for treatment costing under 7 mil VND - 40 percent coinsurance for treatment costing more than 7 mil VND - Claim limit of 20 mil VND per treatment	- Outpatient treatment: 0 percent coinsurance for treatment costing under 100,000 VND; 20 percent coinsurance for treatment costing above - Inpatient treatment: 20 percent coinsurance with claim limit of 20 mil VND per treatment	15	15
	Others (non-students)	VND 320,000 (urban). VND 240,000 (rural). Paid by enrollee.			4	6

Notes: (*) Calculations from VHLSS 2006 and 2008, sample weights are used. Premiums are measured in 2006.

Table 2: Health care utilization by treated - control groups and year

Type of treatment	Outcome	Treated group (VHI)			Control group (CHI)			
		2006	2008	08-06[(a)]	2006	2008	08-06[(a)]	DID[(a)]
Outpatient	A	1.18	0.89	-0.29***	1.32	1.29	-0.03	-0.26***
	B	0.56	0.53	-0.03	0.87	0.85	-0.02	-0.01
Inpatient	A	0.08	0.10	0.02	0.14	0.14	0.00	0.02
	B	0.05	0.07	0.02	0.12	0.11	-0.01	0.03

Notes: - Outcomes: A - Number of treatment; B - Number of times the health insurance card is used to pay for treatment.

- DID: the difference in the outcome between the treated and respective control groups after and before the increase in coinsurance.

- [(a)] t tests were performed on the significance of the difference between the sample mean between two years within the group and between the treated and respective control groups over two years. The symbol * denotes significance at the 10 % level, ** at the 5 % level, and *** at the 1 % level.

Table 3: Impact of increase in coinsurance on health care utilization - FD versus IV-FD method

		Outpatient treatment		Inpatient treatment	
Outcome	Estimate	FD	IV-FD	FD	IV-FD
A	DID	-0.190	-0.460	0.051	-0.004
		(-1.11)	(-1.29)	(1.01)	(-0.08)
	Rho		0.051		0.063
	P value		0.302		0.173
	Chi squared 1		281.8		283.2
	P value 1		0.000		0.000
	Chi squared 2		3.457		1.002
	P value 2		0.178		0.606
B	DID	0.182	-0.349	0.031	-0.023
		(1.30)	(-0.50)	(1.30)	(-0.43)
	Rho		0.127**		0.068
	P-value		0.042		0.145
	Chi squared 1		251.2		283.9
	P value 1		0.000		0.000
	Chi squared 2		0.465		0.945
	P value 2		0.793		0.623

Notes:

- FD estimate is obtained by means of an OLS regression of the change in the outcome on the treatment dummy and change in X's.
- IV estimate is obtained by means of a maximum likelihood regression of the change in the outcome on the treatment dummy (endogenous variable) and change in X's.
- X's include age, marital status, number of days ill last year, achieved education levels, household head status, house types, household size, household income and urban.
- Results for remaining variables are reported in Appendix Table 3 and 4.
- Robust t-statistics are in brackets and adjusted for clustering at the household level. *** p<0.01, ** p<0.05, * p<0.1.
- Rho is the estimate of correlation between errors in the treatment and outcome equations.
- P value from the LR test for the null hypothesis that the two error terms are uncorrelated (rho=0).
- Chi squared 1: Chi squared values of LR tests for joint significance of instruments; Chi squared 2: Chi squared values of LR tests for over-identification restrictions; P value: probability value for the LR test.
- Outcomes: A - Number of treatment; B - Number of times the health insurance card is used to pay for treatment.

Table 4: Impact of increase in coinsurance on health care utilization, by health status and gender

		Outpatient treatment				Inpatient treatment			
		FD	IV-FD	FD	IV-FD	FD	IV-FD	FD	IV-FD
Panel 1: by disability		No disability		Any disability		No disability		Any disability	
A	DID	-0.207	-0.330*	-0.115	-3.534	0.035	-0.075	1.137*	-4.731
		(-1.29)	(-1.73)	(-0.17)	(-0.89)	(0.29)	(-0.39)	(1.95)	(-1.21)
	Rho		0.03		0.30		0.04		0.62
	P value		0.46		0.25		0.43		0.00
B	DID	0.016	-0.043	0.223	0.217	-0.003	-0.022	0.208	0.124
		(0.84)	(-0.81)	(1.43)	(1.48)	(-0.18)	(-0.40)	(1.32)	(0.71)
	Rho		0.09		0.00		0.03		0.05
	P value		0.12		0.98		0.62		0.66
	Observations	4573	4573	910	910	4573	4573	910	910
Panel 2: by illness		No illness		Any illness		No illness		Any illness	
A	DID	-0.133*	-0.019	-0.066	-0.203	0.020	0.033	0.094	-0.026
		(-1.74)	(-0.02)	(-0.21)	(-0.33)	(1.14)	(1.07)	(1.04)	(-0.21)
	Rho		-0.06		0.02		-0.03		0.10
	P value		0.65		0.80		0.63		0.15
B	DID	-0.150**	0.409	0.591**	-0.443	0.011	0.017	0.063	-0.048
		(-2.41)	(0.76)	(2.24)	(-0.28)	(0.69)	(0.72)	(1.42)	(-0.44)
	Rho		-0.35		0.18		-0.02		0.10
	P value		0.01		0.07		0.81		0.14
	Observations	2620	2620	2865	2865	2620	2620	2865	2865
Panel 3: by gender		Female		Male		Female		Male	
A	DID	-0.234	-0.157	-0.150	-0.874	0.076**	-0.154	0.016	0.059
		(-0.98)	(-0.33)	(-0.68)	(-1.01)	(2.19)	(-1.09)	(0.45)	(1.49)
	Rho		-0.01		0.14		0.25		-0.05
	P value		0.85		0.10		0.00		0.37
B	DID	0.146	-0.196	0.201	-1.480	0.065*	-0.165	-0.014	0.017
		(0.79)	(-0.60)	(1.21)	(-0.39)	(1.95)	(-0.62)	(-0.44)	(0.49)
	Rho		0.09		0.38		0.27		-0.04
	P value		0.18		0.03		0.00		0.45
	Observations	2761	2761	2724	2724	2761	2761	2724	2724

Notes: see Table 3.

Table 5: Impact of increase in coinsurance on health care utilization, by age and income

		Outpatient treatment						Inpatient treatment					
		FD	IV-FD	FD	IV-FD	FD	IV-FD	FD	IV-FD	FD	IV-FD	FD	IV-FD
Panel 1: by age		Age <18		Age 18-55		Age>55		Age <18		Age 18-55		Age>55	
A	DID	-0.243**	-0.624***	-0.320	-0.347	0.081	0.609	0.020	0.038	0.082*	-0.025	0.097	0.121
		(-2.28)	(-3.32)	(-0.76)	(-0.84)	(0.10)	(0.60)	(1.14)	(1.02)	(1.70)	(-0.41)	(0.68)	(0.94)
	Rho		0.15		0.00		-0.05		-0.04		0.12		-0.02
	P value		0.00		0.93		0.45		0.53		0.07		0.75
B	DID	-0.041	-0.266*	0.176	0.113	1.167	1.128	0.011	-0.365**	0.059	0.010	0.021	-0.000
		(-0.48)	(-1.90)	(0.66)	(0.37)	(1.60)	(1.07)	(0.66)	(-2.50)	(1.38)	(0.18)	(0.16)	(-0.00)
	Rho		0.13		0.02		0.00		0.74		0.06		0.01
	P value		0.03		0.75		0.96		0.00		0.37		0.82
	Observations	2190	2190	2479	2479	815	815	2190	2190	2478	2478	815	815
Panel 2: by income		Low		Medium		High		Low		Medium		High	
A	DID	-0.679**	-0.917**	0.203	0.221	0.570	0.631	-0.004	0.009	0.093**	-0.018	0.122*	0.116*
		(-2.51)	(-2.45)	(0.62)	(0.38)	(0.96)	(1.07)	(-0.07)	(0.13)	(2.04)	(-0.08)	(1.85)	(1.78)
	Rho		0.06		-0.00		-0.01		-0.02		0.12		0.01
	P value		0.38		0.97		0.88		0.79		0.31		0.92
B	DID	-0.134	-0.971***	0.130	0.209	1.302**	1.284**	0.015	0.016	0.019	-0.512*	0.100*	0.108*
		(-0.97)	(-3.00)	(0.49)	(0.45)	(2.36)	(2.28)	(0.28)	(0.25)	(0.50)	(-1.77)	(1.66)	(1.81)
	Rho		0.27		-0.02		0.00		-0.00		0.61		-0.01
	P value		0.00		0.82		0.95		0.98		0.01		0.88
	Observations	2368	2368	1465	1465	1651	1651	2368	2368	1463	1463	1652	1652

Notes: see Table 3.

Table 6: Transition matrix in health insurance status (frequency and relative frequency)

		Insurance status in 2008			
		Uninsured	CHI	VHI	Total
Insurance status in 2006	Uninsured	5,157	804	815	6,776
		(78)	(17)	(29)	(48)
	CHI	686	3,686	186	4,558
		(10)	(78)	(7)	(32)
	VHI	738	242	1,801	2,781
		(11)	(5)	(64)	(20)
	Total	6,581	4,732	2,802	14,115
		(100)	(100)	(100)	(100)

Notes:

- Number in parentheses is the percent of respective column (relative frequency).
- Sample: panel sample of individuals whose age in 2006 was seven or more.

Table 7: Impact of health variables on health insurance dynamics

	Uninsured in 2006[(a)]		Insured under CHI in 2006[(b)]		Insured under VHI in 2006[(c)]	
	to CHI 2008	to VHI 2008	to uninsured 2008	to VHI 2008	to uninsured 2008	to CHI 2008
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Ill last year	0.94	0.97	0.73***	0.76	0.79**	1.29
	(-0.39)	(-0.26)	(-2.98)	(-1.29)	(-2.05)	(1.13)
Number of days ill	1.00	1.00	1.00	1.01**	1.02**	1.01
	(0.10)	(1.35)	(0.95)	(2.20)	(2.45)	(0.66)
Disable	1.08	1.43**	0.78**	0.68	1.01	0.98
	(0.50)	(2.13)	(-2.28)	(-1.44)	(0.05)	(-0.06)
Chronic	1.34	1.37**	0.78	1.11	0.70***	1.73
	(1.36)	(2.16)	(-1.13)	(0.33)	(-2.90)	(1.52)

Notes:

[(a)] Remaining uninsured is set as the base group

[(b)] Remaining insured under CHI is set as the base group

[(c)] Remaining insured under CHI is set as the base group

- Regression from multinomial logit model; Relative Risk Ratios are reported; Robust t-statistics are in brackets and adjusted for clustering at the household level. *** p<0.01, ** p<0.05, * p<0.1.
- Results for remaining variables are reported in Appendix Table 5.

Table 8: Impact of increase in coinsurance on health care demand - DID estimates for the pooled sample

Outcome	Outpatient	Inpatient
A	-0.104	0.021*
	(-1.15)	(1.67)
B	0.032	0.018
	(0.48)	(1.65)

Notes:

- Sample size: 26,276 with 3,097 individuals in treated group in 2008
- OLS estimate is obtained by means of a regression of the outcome on the treatment dummy, year dummy, interaction between treatment and year dummies and X's.
- X's include gender, age, ethnicity, marital status, ill last year, number of days ill last year, achieved education levels, household head status, house types, household size, household income, regions and urban.
- Robust t-statistics are in brackets and adjusted for clustering at the household level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
- Outcomes: A - Number of treatment; B - Number of times the health insurance card is used to pay for treatment.
- Sample: pool sample of all individuals age 7 or older in each year.

Table 9: Impact of increase in coinsurance on health care demand - DID matching estimates

Outcome	Outpatient	Inpatient
A	-0.027	0.025
	(-0.09)	(0.65)
B	0.248	-0.003
	(1.22)	(-0.09)

Notes:

- Results from DID matching using kernel matching method with bandwidth = 0.0004.
- T-statistics are reported in brackets and calculated using bootstrap with 500 replications. *** p<0.01, ** p<0.05, * p<0.1.
- Outcomes: A - Number of treatment; B - Number of times the health insurance card is used to pay for treatment.
- Sample: balanced panel of individuals age 7 or older in 2006.

Table 10: Impact of increase in coinsurance on health care utilization - Robustness check 3

		Outpatient treatment		Inpatient treatment	
Outcome	Estimate	FD	IV-FD	FD	IV-FD
A	DID	-0.122	-0.103	0.052*	-0.040
		(-0.43)	(-0.22)	(1.68)	(-0.20)
	Rho		-0.003		0.108
	P value		0.961		0.323
B	DID	0.269	0.327	0.026	0.005
		(1.18)	(0.91)	(0.95)	(0.03)
	Rho		-0.014		0.026
	P-value		0.818		0.812

Notes: - Sample size: 2,722 with 909 individuals in treated group.

- Other notes: See Table 3.

Table 11: Impact of increase in coinsurance on health care utilization - Robustness check 4

		Outpatient treatment		Inpatient treatment	
Outcome	Estimate	FD	IV-FD	FD	IV-FD
A	DID	-0.150	-0.432	0.047*	0.053
		(-0.88)	(-1.15)	(1.88)	(1.27)
	Rho		0.054		-0.008
	P value		0.286		0.868
B	DID	0.201	-0.320	0.028	0.038
		(1.42)	(-0.45)	(1.26)	(1.12)
	Rho		0.128**		-0.013
	P-value		0.044		0.768

Notes: - Sample size: 5,240 with 1,725 individuals in treated group.

- Other notes: See Table 3.

Appendix Table 1: Variable definitions

Variable name	Variable definitions
Age	Current age (in years)/10
Age squared	Age squared (in years squared)/100
Male	Dummy = 1 if male, = 0 if female (the base group)
Married	Dummy = 1 if married, widowed, divorced or separated; =0 if otherwise (the base group)
Kinh	Ethnicity Dummy = 1 if Kinh or Chinese; = 0 if otherwise (the base group)
Education	Achieved levels of education: no education (the base group), primary, lower secondary, upper secondary, university or higher
Training	Dummy = 1 if obtained long-term vocational training or professional high school, = 0 if otherwise (the base group)
Ill last year	Dummy = 1 if have any illness in the last 12 months; = 0 if have no illness (the base group)
Number of days ill	The number of days ill last year
Chronic	Dummy = 1 if has any chronic disease, e.g. diabetes, hepatitis, = 0 if have no chronic disease (the base group)
Disable	Dummy = 1 if have any difficulty in one of the seven functional ability; = 0 if have no difficulty (the base group)
Smoking	Dummy = 1 if have ever smoked; = 0 if otherwise (the base group)
Private sector	Dummy = 1 if working for wage in the private sector; = 0 if not working for wage in this sector (the base group)
Public sector	Dummy = 1 if working for wage in the public sector (including SOEs); = 0 if not working for wage in this sector (the base group)
At school	Dummy = 1 if currently at school or on vacation, = 0 if currently not at school (the base group)
Household head	Dummy = 1 if is the head of the household, = 0 if otherwise (the base group)
Household size	Number of household members
Household income	Comparable real total expenditure per capita in Mil VND (adjusted for monthly and regional price differences)
Semi-permanent house	Dummy = 1 if is the dwelling is classified as semi-permanent, = 0 if otherwise (the base group)
Permanent house	Dummy = 1 if is the dwelling is classified as permanent, = 0 if otherwise (the base group)
Any CHI in the household	Dummy variable = 1 if any household member age over 6, excluding the individual being considered, has CHI, = 0 if otherwise (the base group)
Commune VHI ratio	The ratio of people age seven or older living in other households at the same commune having VHI
Region	Eight residential regions: Northeast (the base group), Red River Delta, Northwest, North Central Coast, South Central Coast, Central Highlands, Southeast and Mekong River Delta
Urban	Dummy = 1 if residential area is urban, = 0 if rural (the base group)

Appendix Table 2: Summary statistics table by treated - control status

	VHI			CHI		
Variables	Total	2006	2008	Total	2006	2008
Male	0.48	0.48	0.48	0.50	0.50	0.50
Age/10	2.00	1.90	2.10	3.91	3.82	4.01
Kinh	0.97	0.97	0.97	0.58	0.58	0.58
Married	0.15	0.15	0.15	0.71	0.70	0.72
Disable	0.08	0.08	0.08	0.21	0.21	0.21
Chronic	0.05	0.05	0.05	0.12	0.12	0.12
Smoking	0.05	0.05	0.05	0.30	0.30	0.30
Ill last year	0.50	0.53	0.47	0.52	0.52	0.52
Number of days ill	1.06	0.60	1.52	2.56	2.03	3.08
Primary education	0.38	0.39	0.37	0.23	0.23	0.23
Lower secondary education	0.28	0.26	0.30	0.21	0.20	0.22
Upper secondary	0.17	0.11	0.23	0.15	0.14	0.15
College and higher	0.01	0.00	0.01	0.10	0.10	0.10
Has training	0.01	0.01	0.01	0.10	0.11	0.10
Household head	0.06	0.06	0.06	0.36	0.35	0.36
Public sector employee	0.01	0.01	0.01	0.19	0.20	0.18
Private sector employee	0.01	0.00	0.01	0.04	0.04	0.05
At school	0.80	0.83	0.77	0.16	0.18	0.14
Semi-permanent house	0.59	0.60	0.58	0.60	0.58	0.62
Permanent house	0.34	0.32	0.36	0.20	0.20	0.20
Income per capita	7.85	6.73	8.96	6.12	5.23	7.02
Household size	4.76	4.79	4.73	4.97	5.01	4.93
Northeast	0.10	0.10	0.10	0.23	0.23	0.23
Northwest	0.01	0.01	0.01	0.14	0.14	0.14
North central coast	0.14	0.14	0.14	0.11	0.11	0.11
South central coast	0.14	0.14	0.14	0.08	0.08	0.08
Central highlands	0.06	0.06	0.06	0.13	0.13	0.13
Southeast	0.17	0.17	0.17	0.08	0.08	0.08
Mekong River Delta	0.16	0.16	0.16	0.10	0.10	0.10
Urban	0.33	0.32	0.34	0.23	0.22	0.23
Any CHI in the household	0.37	0.37	0.37	0.48	0.48	0.48
Commune VHI ratio	0.29	0.29	0.29	0.13	0.13	0.13
Number of observations	3602	1801	1801	7372	3686	3686

Appendix Table 3: Impact of increase in coinsurance on health care utilization - FD versus IV-FD method: results for remaining variables

	Outpatient						Inpatient					
	A			B			A			B		
	FD	IV-FD		FD	IV-FD		FD	IV-FD		FD	IV-FD	
Variables		Outcome	Treatment		Outcome	Treatment		Outcome	Treatment		Outcome	Treatment
Any CHI in the household			-0.257***			-0.256***			-0.264***			-0.264***
			(-3.64)			(-3.66)			(-3.71)			(-3.72)
Commune VHI ratio			3.143***			3.128***			3.143***			3.145***
			(16.28)			(15.28)			(16.28)			(16.30)
Age	-0.917	-0.968	-0.561	-0.118	-0.219	-0.588	0.049	0.039	-0.538	-0.109	-0.120	-0.559
	(-0.74)	(-0.79)	(-0.80)	(-0.12)	(-0.22)	(-0.84)	(0.21)	(0.17)	(-0.77)	(-0.52)	(-0.56)	(-0.80)
Married	0.041	0.018	-0.226	0.029	-0.017	-0.219	0.035	0.030	-0.207	0.039	0.034	-0.209
	(0.16)	(0.07)	(-0.91)	(0.22)	(-0.13)	(-0.88)	(0.65)	(0.56)	(-0.85)	(0.83)	(0.72)	(-0.85)
Number of days ill	0.005	0.005	0.001	0.002	0.002	0.001	0.007***	0.007***	0.001	0.006***	0.006***	0.001
	(0.99)	(1.01)	(1.06)	(0.58)	(0.62)	(0.95)	(4.52)	(4.51)	(0.96)	(3.75)	(3.74)	(0.88)
Education	-0.105	-0.098	0.086*	-0.017	-0.003	0.089*	0.016	0.018	0.086*	0.028**	0.030**	0.086*
	(-1.17)	(-1.08)	(1.79)	(-0.21)	(-0.04)	(1.84)	(1.10)	(1.19)	(1.78)	(2.16)	(2.27)	(1.79)
Training	0.343	0.348	0.178	0.226	0.237	0.171	0.044	0.045	0.183	0.059**	0.060**	0.185
	(1.61)	(1.63)	(1.36)	(1.42)	(1.49)	(1.29)	(1.36)	(1.39)	(1.40)	(2.08)	(2.12)	(1.41)
Household head	-0.263	-0.270	-0.119	0.074	0.060	-0.142	0.228	0.226	-0.135	0.240	0.239	-0.138
	(-0.42)	(-0.43)	(-0.45)	(0.13)	(0.10)	(-0.53)	(1.52)	(1.51)	(-0.52)	(1.39)	(1.38)	(-0.54)
House type	0.056	0.055	-0.051	0.067	0.065	-0.052	-0.009	-0.009	-0.048	-0.012	-0.013	-0.049
	(0.51)	(0.50)	(-0.73)	(0.79)	(0.76)	(-0.75)	(-0.52)	(-0.54)	(-0.69)	(-0.76)	(-0.77)	(-0.70)
Household size	-0.095	-0.093	0.043	-0.113	-0.110	0.042	0.007	0.007	0.041	0.004	0.005	0.041
	(-1.13)	(-1.11)	(1.04)	(-1.58)	(-1.56)	(1.03)	(0.57)	(0.60)	(1.00)	(0.45)	(0.48)	(1.00)
Income	0.006**	0.006**	0.004*	0.001	0.002	0.004*	0.001**	0.001**	0.004*	0.001*	0.001**	0.004*
	(2.22)	(2.28)	(1.88)	(0.60)	(0.88)	(1.90)	(1.97)	(2.06)	(1.90)	(1.90)	(1.98)	(1.89)
Urban	0.183	0.239	0.738	0.001	0.111	0.745	-0.024	-0.013	0.780	0.098	0.110	0.775
	(0.30)	(0.39)	(1.44)	(0.00)	(0.18)	(1.49)	(-0.10)	(-0.05)	(1.46)	(0.47)	(0.53)	(1.45)
Enrolling school[(d)]	-0.104	-0.042	1.170***	-0.305*	-0.183	1.173***	-0.057	-0.045	1.171***	-0.069*	-0.056	1.167***
	(-0.53)	(-0.20)	(7.05)	(-1.90)	(-0.77)	(7.12)	(-1.39)	(-1.06)	(7.06)	(-1.79)	(-1.43)	(7.04)

	Outpatient						Inpatient					
	A			B			A			B		
	FD	IV-FD		FD	IV-FD		FD	IV-FD		FD	IV-FD	
Variables		Outcome	Treatment		Outcome	Treatment		Outcome	Treatment		Outcome	Treatment
Leaving school[(d)]	-0.025	0.049	1.081***	-0.222	-0.077	1.084***	0.009	0.024	1.087***	-0.002	0.013	1.087***
	(-0.14)	(0.26)	(12.16)	(-1.51)	(-0.31)	(12.29)	(0.25)	(0.68)	(12.18)	(-0.05)	(0.38)	(12.19)
Remaining at school[(d)]	-0.099	0.065	1.914***	-0.316**	0.007	1.913***	-0.050*	-0.017	1.917***	-0.040*	-0.007	1.917***
	(-0.59)	(0.26)	(30.76)	(-2.31)	(0.02)	(30.79)	(-1.96)	(-0.46)	(30.75)	(-1.68)	(-0.19)	(30.75)
Becoming a wage earner (public) [(e)]	0.165	0.129	-0.920***	-0.303	-0.373	-0.920***	-0.031	-0.038	-0.917***	-0.061*	-0.068**	-0.918***
	(0.39)	(0.30)	(-2.77)	(-1.22)	(-1.45)	(-2.80)	(-0.66)	(-0.81)	(-2.75)	(-1.86)	(-2.04)	(-2.75)
Becoming a non-wage earner (public) [(e)]	-0.259	-0.281	-0.826**	-0.018	-0.061	-0.813**	-0.067	-0.071	-0.813**	-0.068	-0.072	-0.813**
	(-0.58)	(-0.63)	(-2.19)	(-0.08)	(-0.27)	(-2.11)	(-1.26)	(-1.32)	(-2.19)	(-1.28)	(-1.35)	(-2.20)
Remaining a wage earner (public) [(e)]	0.094	0.053	-2.078***	-0.042	-0.123	-2.057***	0.000	-0.008	-2.092***	-0.015	-0.023	-2.083***
	(0.49)	(0.28)	(-7.85)	(-0.33)	(-0.85)	(-7.64)	(0.00)	(-0.30)	(-7.96)	(-0.60)	(-0.85)	(-7.85)
Becoming a wage earner (private) [(f)]	0.397	0.400	-0.066	-0.268	-0.261	-0.065	-0.073	-0.072	-0.063	-0.083	-0.082	-0.064
	(0.94)	(0.94)	(-0.25)	(-0.93)	(-0.90)	(-0.25)	(-1.05)	(-1.04)	(-0.24)	(-1.21)	(-1.21)	(-0.25)
Becoming a non-wage earner (private) [(f)]	-0.472	-0.466	-0.433	0.133	0.146	-0.421	-0.065	-0.063	-0.450	0.019	0.020	-0.444
	(-1.00)	(-0.99)	(-1.34)	(0.62)	(0.69)	(-1.31)	(-1.04)	(-1.02)	(-1.40)	(0.38)	(0.41)	(-1.38)
Remaining a wage earner (private) [(f)]	-0.642*	-0.669*	-1.150***	-0.196	-0.249	-1.134***	-0.037	-0.043	-1.153***	-0.026	-0.031	-1.153***
	(-1.77)	(-1.83)	(-3.88)	(-0.77)	(-0.97)	(-3.81)	(-0.63)	(-0.71)	(-3.88)	(-0.47)	(-0.56)	(-3.88)
Constant	0.131	0.172	-1.630***	0.061	0.141	-1.626***	-0.020	-0.012	-1.636***	0.011	0.019	-1.632***
	(0.49)	(0.63)	(-10.49)	(0.27)	(0.61)	(-10.45)	(-0.41)	(-0.24)	(-10.51)	(0.23)	(0.40)	(-10.49)

Notes:

- FD estimate is obtained by means of an OLS regression of the change in the outcome on the treatment dummy and change in X's.
- IV-FD estimate is obtained by means of a ML regression of the change in the outcome on the treatment dummy (endogenous variable) and change in X's.
- Robust t-statistics are in brackets and adjusted for clustering at the household level. *** p<0.01, ** p<0.05, * p<0.1.
- Outcomes: A - Number of treatment; B - Number of times the health insurance card is used to pay for treatment.
- [(d)]: never at school; [(e)]: never be a wage-earner in the public sector; [(f)]: never be a wage-earner in the private sector are set as the base group, respectively.

Appendix Table 4: Determinants of health insurance dynamics (remaining variables)

	Uninsured in 2006[a]		Insured under CHI insured in 2006[b]		Insured under VHI in 2006[c]	
	to CHI 2008	to VHI 2008	to uninsured 2008	to VHI 2008	to uninsured 2008	to CHI 2008
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Male	1.00	0.85	1.01	0.83	0.88	1.26
	(-0.02)	(-1.63)	(0.10)	(-0.87)	(-1.40)	(1.44)
Age	0.88	0.98	1.04	0.88	1.77**	0.97
	(-0.68)	(-0.08)	(0.20)	(-0.34)	(2.23)	(-0.11)
Age squared	1.05***	1.02	0.98	1.02	0.92***	1.03
	(2.58)	(0.88)	(-1.05)	(0.68)	(-3.11)	(0.90)
Kinh	0.46***	2.24*	3.27***	3.29**	0.40***	0.15***
	(-2.71)	(1.86)	(4.07)	(2.13)	(-3.10)	(-4.04)
Married	0.77	1.50*	1.38	1.28	0.78	0.90
	(-1.52)	(1.76)	(1.40)	(0.85)	(-0.71)	(-0.18)
Smoke	0.84	0.80	1.03	0.99	1.01	0.71
	(-1.34)	(-1.45)	(0.19)	(-0.06)	(0.04)	(-1.20)
Primary education	1.03	1.07	1.04	2.02***	1.11	1.15
	(0.25)	(0.80)	(0.35)	(3.99)	(0.62)	(0.66)
Lower secondary	0.97	1.18	1.20	1.76**	1.00	1.10
	(-0.22)	(1.37)	(0.96)	(2.28)	(0.01)	(0.39)
Upper secondary	1.26	1.30*	0.94	1.72	1.71**	2.49***
	(1.21)	(1.72)	(-0.21)	(1.38)	(2.45)	(3.02)
College or higher	7.90***	2.58***	0.43**	0.27***	1.06	6.71**
	(5.85)	(2.96)	(-2.26)	(-2.79)	(0.06)	(2.40)
Has training	1.80**	1.23	0.45***	0.48*	0.78	1.62
	(2.38)	(0.66)	(-2.69)	(-1.95)	(-0.65)	(0.82)
Household head	1.11	1.04	0.76***	0.95	0.93	1.89*
	(0.88)	(0.32)	(-3.30)	(-0.22)	(-0.38)	(1.77)
Semi-permanent house	0.71*	1.25	0.99	1.23	1.25	2.65**
	(-1.71)	(1.07)	(-0.05)	(0.73)	(0.97)	(2.04)
Permanent house	0.47***	1.40	0.92	2.03	1.05	2.22
	(-3.45)	(1.42)	(-0.28)	(1.56)	(0.19)	(1.64)
Household size	0.93*	0.99	1.06	0.97	0.96	0.88*
	(-1.69)	(-0.28)	(1.03)	(-0.54)	(-0.93)	(-1.74)
Income	0.89**	1.04***	0.96**	1.01	0.95***	0.89***
	(-2.55)	(3.74)	(-2.23)	(0.28)	(-4.07)	(-3.34)
Enrolling school[d]	1.50	24.14***	1.20	6.28***	0.14***	0.41
	(0.99)	(11.38)	(0.39)	(3.66)	(-4.58)	(-1.20)
Leaving school[d]	2.16**	3.42***	1.29	1.92	1.22	1.44
	(2.33)	(3.55)	(1.19)	(1.20)	(0.55)	(0.67)
Remaining at school[d]	3.50***	33.30***	0.40***	10.37***	0.13***	0.51

	Uninsured in 2006[a]		Insured under CHI insured in 2006[b]		Insured under VHI in 2006[c]	
	to CHI 2008	to VHI 2008	to uninsured 2008	to VHI 2008	to uninsured 2008	to CHI 2008
Variables	(1)	(2)	(3)	(4)	(5)	(6)
	(4.49)	(13.73)	(-3.15)	(5.52)	(-4.79)	(-1.39)
Becoming a wage earner (public) [e]	12.80***	1.20	0.48	0.16	0.73	47.80***
	(9.30)	(0.34)	(-1.38)	(-1.53)	(-0.37)	(7.20)
Becoming a non-wage earner (public) [e]	3.62***	1.41	0.86	0.61	0.71	1.12
	(3.26)	(0.69)	(-0.52)	(-0.66)	(-0.57)	(0.10)
Remaining a wage earner (public) [e]	18.10***	3.50**	0.17***	0.32**	0.51	10.14***
	(7.52)	(2.25)	(-5.70)	(-2.55)	(-0.76)	(3.56)
Becoming a wage earner (private) [f]	4.74***	1.06	0.79	1.06	1.59	11.74***
	(5.96)	(0.16)	(-0.82)	(0.07)	(1.49)	(7.27)
Becoming a non-wage earner (private) [f]	1.83**	1.07	3.04***	3.19***	0.97	0.51
	(2.10)	(0.19)	(3.40)	(2.60)	(-0.08)	(-0.88)
Remaining a wage earner (private) [f]	11.95***	1.41	0.73	0.75	1.56	29.33***
	(7.53)	(0.81)	(-1.36)	(-0.51)	(0.53)	(2.81)
Income increase	0.95**	1.02*	0.97*	1.03	0.96**	0.95*
	(-2.55)	(1.74)	(-1.64)	(1.02)	(-2.23)	(-1.79)
No of observations	6774		4557		2780	
Log pseudo-likelihood	-3943		-2245		-1869	
Pseudo R-Square	0.19		0.16		0.21	

Notes:

[a] Remaining uninsured is set as the base group

[b] Remaining insured under CHI is set as the base group

[c] Remaining insured under CHI is set as the base group

[d]: never at school; [e]: never be a wage-earner in the public sector; [f]: never be a wage-earner in the private sector are set as the base group, respectively.

- Regression from multinomial logit model; Relative Risk Ratios are reported; Robust t-statistics are in brackets and adjusted for clustering at the household level. *** p<0.01, ** p<0.05, * p<0.1.
- Urban and regional variables are included.

Appendix Table 5: Probit model for the probability of remaining insured under VHI

Variables	CHI as control
Male	-0.03
	(-0.45)
Age	-0.16
	(-1.40)
Age squared	0.01
	(0.54)
Kinh	1.97***
	(18.73)
Married	0.31**
	(2.18)
Disable	-0.15
	(-1.62)
Chronic	-0.07
	(-0.66)
Number of days ill	-0.01
	(-1.46)
Ill last year	-0.02
	(-0.33)
Smoke	-0.15
	(-1.51)
Primary education	0.21***
	(2.82)
Lower secondary	0.28***
	(3.18)
Upper secondary	0.34***
	(2.95)
College or higher	-1.21***
	(-4.68)
Has training	-0.94***
	(-6.17)
Public sector employee	-1.67***
	(-11.34)
Private sector employee	-1.63***
	(-8.38)
At school	1.57***
	(13.23)
Household head	-0.24***
	(-2.68)
Semi-permanent house	0.82***
	(9.39)
Permanent house	1.23***
	(11.26)
Household size	-0.03
	(-1.56)
Income	0.02***
	(4.24)
Pseudo R squared	0.61
Number of observations	5487

Notes: Robust t-statistics are in brackets and adjusted for clustering at the household level. *** p<0.01, ** p<0.05, * p<0.1. Urban and regional variables are included.

Appendix Table 6: Total health expenditures and claims in 2008

Treatment type	Total	VHI	CHI
Outpatient			
Total expenditure (VND1000/treatment)	613	700	565
Amount claimed (VND1000/treatment)	150	159	146
Claim/total expenditure (%)	42	34	47
Out-of-pocket expenditure/total expenditure (%)	58	66	53
Inpatient			
Total expenditure (VND1000/treatment)	2574	3383	2236
Amount claimed (VND1000/treatment)	922	990	894
Claim/total expenditure (%)	45	41	46
Out-of-pocket expenditure/total expenditure (%)	55	59	54

Notes: Conditional on having any treatment, having health insurance, positive expenditure; Total expenditures for outpatient treatment include diagnostic, testing, medicine, micro-surgery, immunization, tips, travelling expenses, motorbike and bicycle parking, nutrition food outside the normal meal intake, and buying plastic utensils. Total expenditures for inpatient treatment also include treatment fee, hospital bed, and accommodation for relatives accompanies taking care of the patients.

Source: VHLSS 2008.

The Bankwest Curtin Economics Centre is an independent economic and social research organisation located within the Curtin Business School at Curtin University. The Centre was established in 2012 through the generous support from Bankwest (a division of the Commonwealth Bank of Australia), with a core mission to undertake high quality, objective research on the key economic and social issues of relevance to Western Australia.

The Centre's research and engagement activities are designed to influence economic and social policy debates in state and Federal Parliament, regional and national media, and the wider Australian community. Through high quality, evidence-based research and analysis, our research outcomes inform policy makers and commentators of the economic challenges to achieving sustainable and equitable growth and prosperity both in Western Australia and nationally.

The Centre capitalises on Curtin University's reputation for excellence in economic modelling, forecasting, public policy research, trade and industrial economics and spatial sciences. Centre researchers have specific expertise in economic forecasting, quantitative modelling, microdata analysis and economic and social policy evaluation.

A suite of tailored and national economic models and methods are maintained within the Centre to facilitate advanced economic policy analysis: these include macroeconomic and time series models, micro(simulation) models, computable general equilibrium (CGE) models, spatial modelling methods, economic index analysis, and behavioural modelling methods.

CONTACT

Bankwest Curtin Economics Centre
Curtin University
Kent Street Bentley WA 6102
GPO Box U1987 Perth WA 6845

Tel: +61 8 9266 2873

bcec@curtin.edu.au
bcec.edu.au