Does the More Educated Utilize More Health Care Services? Evidence from Vietnam Using a Regression Discontinuity Design

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Abstract

In 1991 Vietnam implemented a compulsory schooling reform that provides this paper a natural experiment to estimate the causal effect of education on health care utilization measured by the probability of doctor visit, the frequency of doctor visit and per visit out-of-pocket expenditure with a regression discontinuity design. The paper finds that schooling induces considerable impacts on health care utilization although the signs of the impacts changes with specific types of health care service examined. In particular, increased education aggrandizes inpatient utilization whereas it reduces outpatient health care utilization for both public and private health sectors. The estimates are strongly robust to various windows of the sample choice. The paper also discovers that the links between education and health insurance or income play very essential roles as potential mechanisms to explain the causal impacts of education on health care utilization in Vietnam.

JEL Classifications: I12, I21, J13
Keywords: Education; health care utilization; regression discontinuity design; Vietnam

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1 Introduction

Education can have massive positive impacts on health-related outcomes such as raised nutritional status, prolonged livies, or fewer but better children, lower risks of illness, or greater health habits. The health returns to education has been well-documented from the literature (Cutler & Lleras-Muney 2008; Grossman 1976, 2006, 2008, 2015).

Previous studies focus on health status or outcomes. For example, health outcomes can be risks of sickness (Leuven et al., 2016) and health habits (Li & Powdthavee, 2015). However, there is very limited studies that focus on the causal link between education and health care utilization such as the probability of doctor visits, the frequency of doctor visits or out-of-pocket health care payments. The utilization of health care services is very essential as both the quantity and the quality of health care services utilized reflects the capability for producing improved health outcomes. Accessing to health care services provides opportunities for people to heal illnesses and rectify health problems, to diagnose and to make preventions for health risks, to mitigate pains, or simply to know health status. As a consequence, health care utilization in some extent is strongly and appropriately regarded as a crucial input for an individual's health production in addition to other crucial ingradients such as nutrition, exercise, diet and lifestyles.

Moreover, the assessment of health care utilization is significantly recognized as an crucial indicator for evaluating the functioning performance of a health care system in terms of the quantity and quality of health care facilities, or financing issues of heath care services (Kruk & Freedman, 2008; Murray & Frenk, 2000; World Health Organization, 2011). Boosting health care utilization towards universalization is therefore very impactful for any country especially poor countries in order to generate a healthier population and advance a national stock of health human capital as well (United Nations, 2015). This study probes the functioning of Vietnam's health care system in particular how Vietnamese people make their choices of health care utilization

and provides first empirical evidence on the causal impacts of schooling on health care utilization in this developing country.

This paper importantly scrutinizes a supposition that education plays a very important role for making decisions on the choice of medical service types inasmuch as people with various schooling level probably have different health-related information or health knowledge that in turn determines health care utilization outcomes. This hypothesis is generally congruous with the idea that the more educated tends to more acquire and better handle health information or knowledge from Grossman's demand-for-health model (Grossman 1972, 1976, 2000). In other words, people with higher schooling can enhance abilities to efficiently allocate given resources for health production, and better allocations of resources for health production successively produce more desirable health outcomes in general.

Momentously, a substantial obstacle to ameliorate the precise comprehension of the connection between education and health-related outcomes is the endogeneity problem in which both education is rised in a manner that is linked to other elements that are likely to simultaneously determine health-related outcomes. To surmount this major problem, using compulsory schooling laws as natural experiments to instrument for exogenous alterations in schooling and estimate its causal effects on health-related consequences has been increasingly applied as a fashionable estimation method over recent years (Dickson et al., 2016). For example, Li and Powdthavee (2015) take advantage of a regulation of the extension of minimum age for leaving schools from 14 to 15 years after World War II to instrument for exogenous variations in education and find that more schooling results in increased diets, more frequent exercise, and reduced drinking in Australia. In another case, Grépina and Bharadwaj (2015) utilize the 1980 compulsory secondary schooling law to find that maternal education makes beneficial impacts on the probability of child survival in Zimbabwe. Recently, Leuven et al. (2016) exploit a compulsory educational expansion during the 1960s in Norway as an instrument for educational attainment to substantiate the protective effects of

education on health outcomes with lower risks of lung and prostate cancers among Norwegian men.

This study employs the Law on Universal Primary Education (LUPE) which was introduced in 1991 in Vietnam to instrument for exogeneous shifts in schooling year to estimate the causal impacts of schooling year on health care utilization in this transition economy. Before 1991, opportunities to access to education were not applied for all Vietnamese people, especially those from rural and remote areas because of the existence of widespread poverty and resource deficiencies. The LUPE following the *Doimoi* (Renovation) in 1986 that the government of Vietnam implemented to transform its economy from a penurious situation into economic growth significantly provides more chances for Vietnamese children to engage in schooling at least primary education because LUPE regulates that all Vietnamese children who age 14 or less than 14 have to complete primary education since 1991. This educational reform has been regarded as a important policy to improve schooling level for Vietnamese people.[1]

Almost previous studies on the determinants of health care utilization mainly focuses the role of health insurance. The existing literature seemingly ignores attention to the effects of schooling on the demand for health care services not only in Vietnam but also in other countries. This study significantly aims to fulfill this indispensable research gap.

In terms of the finding, this study finds robust evidence that education does influence the choice of health care treatment types including inpatient and outpatient medical treatments. The more educated tends to utilize more inpatient and less outpatient services for both public and private health sectors. On average an additional schooling year increases inpatient utilization outcomes, including the likelihood of doctor visits by 9.1–9.3% and 18.9–19.6%, the number of doctor visits by about 0.18 visits and 0.59–0.66 visits, and out-of-pocket payments by nearly Vietnamese dong (VND) 579 thousand and VND 2632–2737 thousand for public and private sectors,

[1] Dang (2017) uses LUPE as an instrument for exogenous changes in education to estimate the causal effects of education on political outcomes in Vietnam.

respectively. In contrast, the adverse impacts of one year of schooling are reductions in the probability, the number and the per visit out-of-pocket spending of outpatient health care services by about 11.8–12.9% and 10.7–12.1%, 0.15–0.18 visits and 0.16–0.19 visits, and VND 136–150 thousand and VND 91–102 thousand for public and private health sectors respectively.[2]

Furthermore, the paper inspects potential pathways that might account for the link between education and health care utilization in Vietnam. Education is much more likely to improve health-related outcomes by ways of the efficient allocation of resources directly or improving other benefits that also lead to better health-related outcomes (Grossman, 2006). This study focuses on two main factors which include health insurance status and income as primary mediators for the establishment of the causal relationship between education and health care utilization.

This paper contributes to the existing literature in some ways. First, the paper provides empirical evidence on the causal impact of education on health care utilization in the world. Moreover, this study is specially more significant when it is conducted in a developing country context like Vietnam where there is an increasing demand for evidence-based information on health care utilization. Second, the paper provides new insights into the causal link between schooling and health care utilization that education makes influence on utilization however the direction of the impact relies on the type of health care service utilized. Dominant previous findings are consistently conclusive of the positive effect of education on health care utilization in general. However, this study evidently indicates that there are different impacts of education between inpatient and outpatient health care services. Third, this study gives more evidence on the impact of compulsory schooling reform in the world that has been increasingly concerned over last few years.

The remainder of this paper is arranged as follows. Section 2 provides a concise description of the context of development that is closely related to the research

[2] Exchange rate: VND/USD = 22.8 thousand at the time of the study.

problem investigated in this study including information about the 1991 compulsory schooling reform and health care system and utilization in Vietnam. Next, section 3 discusses estimation methods with a regression discontinuity design and section 4 presents data source and the descriptive statistics of the sample. Meanwhile, the baseline estimates of the causal impacts of schooling on health care utilization outcomes are reported in section 5 while the robustness checks of the baseline results using various windows to creating subsamples are demonstrated in section 6. Section 7 provides potential mechanisms used to explain possible pathways through which education generates impacts on health care utilization. Finally, this paper is concluded in section 8.

2 Context of the Study

The 1991 Compulsory Schooling Reform in Vietnam

Vietnam launched an economic reform (called *Doimoi*) in 1986 through which a central planning economy was proposed to be transitioned towards a market-oriented economy. Parallel with modifications from its economic institutions, Vietnam also made alterations in its education system. One of the most important education policies is the policy of compulsory primary education that formally implemented in 1991 under the Law on Universal Primary Education (LUPE). According to LUPE, all Vietnamese children aged 6 must go to the first grade (grade 1) and complete the last grade (grade 5) of primary education at the maximum age of 14. Prior to the reform, there was no compulsory education policy in Vietnam and Vietnamese children were not forced to go to school for any level. An individuals' educational attainment depended on his or her family's own choice. Hence, LUPE has made changes on the number of compulsory schooling year from 0 to 5 years in Vietnam. The annual date of 5^{th} of September has become the "the day for bringing children to schools" that was stemmed from LUPE to promote education enrollment for all Vietnamese children, especially primary education in Vietnam.

Under this legal framework, the public budget for education system and primary education in particular has increased in Vietnam. In addition, the government of Vietnam also attracted financial supports from private agencies and civil organizations in the society for the implementation of universal primary education. In addition, the reform in education system occured with the transformation of academic curriculum. LUPE regulated that the academic curriculum should emphasize the provision of academic foundations for pupils's early understanding of people, nature and the society arround them in addition to the core skills including speaking, reading, writing, and basic mathamatics. Therefore, the pedagogical content of primary education meaningfully showed its supports for pupils' further studies after completing primary education. In other words, the reform of academic curriculum was more likely to promote educational attainment for succeeding levels of post primary education.

It is important to note that one of leading targeting groups for LUPE is Vietnamese children from rural, isolated and remote areas where children traditionally had diminutive opportunities to go to schools. The implement of LUPE generated some highlighting achievements for education in Vietnam. The statistics from World Bank (2017) shows that the numbers of primary educational attainment increased overtime in Vietnam. For example, the numbers of Vietnamese children who enrolled primary schooling were about 8.1 million and 8.7 million in 1986 and 1989 respectively while the corresponding figures were approximately 9.1 million and 10 million in 1992 and 1995 respectively. Moreover, as of the year of 2000 almost 14-year-old children completed the primary education and since 2000 almost children aged 14 completed their primary education by the right age. Apparently, LUPE in 1991 is worth to be used as a remarking point to make discontinuous changes in schooling for Vietnamese people whose ages in 1991 were around the age of 14. This discontiuity is used to create the treatment and control groups for examining the causal effect of education on health care utilization in this study.

Health care system and utilization in Vietnam

After the 1975 unification of the nation, Vietnam undertook its strategy of development based on a centrally planned economy. In this context, Vietnam maitained a fully stated-based health care system in which the government delivered and financed almost medical care services until 1989. As a result, numerous health practices of physicians, or pharmacists and health care facilities were functioned under the control of the state (Ladinsky & Levine, 1985). However, the government-based health system did not worked well as initial expectations with insufficient quality and quantity of health services because of lack of investment resources facing this low-income country (Matsuda, 1997).

When Vietnam carried out its economic reform in 1986 under the name of *Doimoi* (renovation), there were changes in the functioning structure of health care system. Some key public policies were implemented to inaugurate a new plan of action to govern Vietnam's health care system that was so-called "socialization of health care," for examples the application of user fee for public health providers in 1989, the introduction of health insurance in 1992, and the financial autonomy for selected public health care facilities in 2002 (Thanh et al., 2014). These policies increased the mobilization of resources for health care practices within the economy. Moreover, the capability of health care service provision was therefore expanded considerably in both the quantity, i.e. many health care providers and facilities from both public and private sectors were established and functioned to deliver sufficiently Vietnamese people's increasing demand for medical treatments and services (Ministry of Health of Vietnam & Health Partnership Group, 2008) and the quality of medical services, i.e more investments in medical technologies and better services in order to attract more patients (Ministry of Health of Vietnam & Health Partnership Group, 2012).

More importantly, private health care practices have been accepted in parallel with the public health sector since 1989 (Lönnroth et al., 1998). The market-based or non-state health care practices have been more impetuously functioned and increasingly utilized as chosen approaches to medical treaments in Vietnam as an apparent consequence of the partial privatization of health care system (Hoai & Dang,

2017; Ladinsky et al., 2000; Wolffers, 1995). The development of private health care sector has been treated as a very neccessary complementary part to the public health sector to sufficiently provide health care services in terms of both the volume and the quality of services, especially in low- and middle-income countries (Uplekar, 2000).

Vietnam has so far retained a two-sector health care system in which both public and private health sectors has worked together in providing medical care treaments for Vietnamese people (Tat & Barr, 2006; Thanh et al., 2014). Therefore, it is essential to emphasize the separation of health care utilization outcomes between public and private sectors when investigating health care utilization in Vietnam. In this study, I provides the estimates of the health care utilization impacts of education for both public and private health sectors.

Increasing the capability of health care provision both in the volume and the quality is important for Vietnam's health care system. However, promoting health care untilization for Vietnamese citizens is an equally important function for the health care system in this transition economy. Enhancing the utilization of health care services is currently one of the most essential health policies in Vietnam over the last decades. The government of Vietnam has implemented some key policies with the expectation of making considerable advancement in the utilization of health care services from both public and private health sectors among citizens, especially the poors. For example, the policy of universal health insurance for children aged five and less than five lunched in 2005 allows more children to access to health care services especially for those from disadvantaged families (Nguyen, 2016; Palmer, 2015). This study in a different pespective contribute to the understanding of health care ulitization in Vietnam by investigating the role of education.

3 Estimation Methods

To examine the association between schooling year and health care utilization, one in principle estimates the following regression equation:

$$U_i = \varphi_1 + \varphi_2 S_i + \varphi_3 \boldsymbol{X}_i' + \tau_t + \varpi_c + \varepsilon_i \quad (1)$$

where U_i indicate an utilization outcome for health care service for individual i, in year survey t and from birth cohort c; S_i is the number of schooling year for the corresponding respondent; $\boldsymbol{X}_i'$ is a vector of characteristics of the respondent such as male, urban, majority, and dummies for six geographical regions; τ_t indexes for survey year fixed effects; ϖ_c presents cohort fixed effects; and ε_i is the corresponding error term. The coefficient of interest from equation (1) is φ_2 that indicates the impact of schooling year on health care utilization. However, OLS estimate using equation (1) likely yields an biased estimate of φ_2 due to the endogeneity problem of the association beween education and health care utilization. The problem is potentially originated from the existence of unobserved characteristics that affects both one's education and health care utilization.

To overcome the problem of endogeneity between schooling and health care utilization the paper uses the 1991 compulsory schooling reform as a reliable exogenous change in education in Vietnam. In particular, the paper use a RDD to establish the causal impact of compulsory education reform on health care utilization using a two-stage least square (2SLS) estimation. RDD is arguably an appropriate approach in this case (Imbens & Lemiux, 2008; Lee & Lemieux, 2010).

In the first stage, the paper estimates the following regression equation:

$$S_i = \alpha_1 + \alpha_2 R_i + \alpha_3 \boldsymbol{X}_i' + \tau_t + \varpi_c + \varsigma_i \quad (2)$$

where R_i is schooling reform exposure, or a dummy variable for whether the age of respondent in 1991 was equal to 14 or less than 14, mathematically $R_i = \begin{cases} 1 \text{ if } \text{age}_{1991} \leq 14 \\ 0 \text{ if } \text{age}_{1991} > 14 \end{cases}$. Equation (2) is used to obtain predicted values for S_i that are then used for the second stage of the estimation procedure.

In the second stage, the paper estimates the following regression function:

$$U_i = \beta_1 + \beta_2 S_i + \beta_3 \boldsymbol{X}_i' + \tau_t + \varpi_c + \zeta_i \quad (3)$$

where the coefficient of interest (β_2) is infered as the causal impact of education on health care utilization. This coefficient apparently indicates the local average treatment effect (LATE) of the impacts of schooling in health care utilization.

In addition using the instrumental variable (IV) approach for a RDD as an identification strategy to produce the baseline estimates, the study also estimates intent-to-treat (ITT) models as reduced form regressions using the following regression form:

$$U_i = \gamma_1 + \gamma_2 R_i + \gamma_3 \boldsymbol{X}_i' + \tau_t + \varpi_c + \xi_i \quad (4)$$

where γ_2 represents the effect of the 1991 schooling reform in Vietnam on health care utilization, or the intent-to-treat effect.

It is crucial to discuss the choice of econometric models used to estimate the causal effect of schooling on health care utilization corresponding to data type of the dependent variable. First, in the case that a dependent variable is measured by a binary variable (the probability of doctor visits) the paper employs an IV-Probit model. Second, an IV-Poisson is employed when a dependent variable is measured by a count data variable (the frequency of doctor visits). Third, the paper uses an IV-Tobit model to estimate the causal impact of schooling year on out-of-pocket health care expenditure because there is a fact that the rate of Vietnamese citizens who did not visit health care providers is roughly large and zero values of out-of-pocket health care expenditure thus have a dominant proportion in the sample.

4 Data and the Sample

The paper uses three waves of Vietnam Household Living Standards Survey (VHLSS) including the 2010, 2012 and 2014 VHLSS. VHLSS is a nationally representative survey in Vietnam that has conducted biannually to elicit Vietnamese households' socio-economic, demographic and information about multiple aspects of living conditions. VHLSS is very highly common source of data that has been used for numerous published studies on the realms of economics, sociology, public health and development in Vietnam. Using VHLSS, this paper is therefore strongly confident about the high quality of data.

In terms of sampling criteria for this study, according to LUPE all Vietnamese children aged 14 or less than 14 have to go to primary schools in order to obtain the corresponding degree. Therefore, the paper uses respondents' age in 1991 to create a dummy variable for schooling reform exposure, that take 1 if age in 1991 equals or under 14 years and take 0 otherwise. This study limits the sample to individuals whose age in 1991 between 6 and 23 corresponding the age at the time of survey between 25 and 46. This is equivalent to using a baseline window of ± 9. In particular, the sample of analysis consists of the birth cohorts between 1968 and 1985. As a consequence, the total observations of the sample is 27,271 individuals. Among them, there are 12,909 individuals for the treatment group while there are 14,362 respondents for the control group. Equivalently, about 47.3% of observations in the sample are influenced by the 1991 schooling reform. We can see there is a highly balanced ratio between the treatment and control groups in this study. The descriptive statistics of the sample is specifically presented in Table 1.[3]

Importantly, VHLSS contains both information about completed schooling year (between 0 and 12 years) and the highest educational level of a respondent that allow this study to create a variable of full schooling year that is more suitable to capture the whole duration of the formal education one spends in Vietnam rather than completed schooling year. Full schooling year for the whole sample ranges from 0 to 22 years with a mean value of about 8.4. Meanwhile, average full schooling years for the treatment

[3] The definitions of all variables are specifically presented in Appendix 1.

and control groups are respectively 9.3 and 7.7. Intuitively, it is clear that the treatment group whose individuals are fully exposed to the 1991 compulsory schooling reform has higher full schooling year compared to the control group.

5 Baseline Results

This section reports the result of baseline estimates. In particular, the estimates of the first stage in which the impacts of the 1991 compulsory schooling reform on educational outcome are presented. For the causal impacts of education on health care utilization in the second stage, the paper presents the estimates for three utilization measures including (i) the probability of doctor visits using an IV-Probit model, (ii) the frequency of doctor visits using an IV-Poisson model, and (iii) out-of-pocket health care expenditure using an IV-Tobit model. The estimates are achieved for both public and private health sectors. Using three various outcomes of health care utilization for both public and private health sectors allows this paper to disentangle in detail the causal impacts in Vietnam.

5.1 The effects of the 1991 compulsory schooling reform on education

Table 2 presents the impacts of the 1991 complusory schooling reform on one's educational outcome that is measured by full schooling year using two estimation models (i) simple model that excludes control variables, and (ii) full model that includes control variables. Both models include survey year and birth corhort fixed effects. The results indicate that the 1991 compulsory schooling reform has considerable positive impacts on full schooling year for both simple and full models. The estimated coefficients are all statistically significant at 1%.

The impact magnitudes are nearly similar for both models. In particular, the respondent with being exposed to the 1991 compulsory schooling reform tends to have

higher schooling year on average by 2.4 years using a simple model (column 1) or 2.5 years using a full model (column 2) compared to an individual from the control group whose age in 1991 was over 14. This finding even shows the larger impacts compared to other studies for Vietnam. For example, Dang (2017) discovers that the 1991 compulsory educational reform in Vietnam only creates increases of 1.12–1.27 schooling years. However, it is helful to note that Dang (2017) uses a comparatively small sample from World Values Survey that only consists of about 1000–1500 observations. This study takes an advantage of a large and nationally representative sample from VHLSS with 27,271 observations to examine the impacts of the 1991 compulsory schooling reform on educational outcome as shown in Table 2.

Also, the impact of the 1991 compulsory schooling reform on educational outcome is graphically domonstrated in Figure 1. There is accordingly a substantial jump on full schooling year from the control group whose individuals aged over 14 to the treatment group whose observations aged 14 or less than 14 in 1991. Intuitively, the 1991 compulsory schooling reform in Vietnam provides a discontinuity on the trend of educational outcome that is feasibly employed as an instrument for exogenous changes in education using a sample in this study.

More importantly, F-stat values for two models are all larger than 10 as a conventional rule of thumb for testing the validity of avoiding weak instruments in a 2SLS estimation procedure. Specifically, F-stat values equal 25.1 and 40.0 respectively for simple and full models. The estimated coefficients from the first-stage are used to predict values of schooling year that are used in the second-stage estimation.

5.2 The causal effects of education on health care utilization outcomes

Table 3 represents the baseline coefficients of the causal impacts of education on the probability of doctor visits using a IV-Probit regression equation. The findings indicate that full schooling year has causal links with the probability of doctor visits for

both inpatient and outpatient services from both public and private health sectors. The estimated coefficients are all statistically significant at 1% or 5%.

However, the directions of the impacts are apparently reverse for two distinct types of health care services ulitized by observations. In particular, on average the more educated tends to have higher probabilities of inpatient visits by 9.1% using a simple (column 1) or 9.3% using a full model (column 2) for the public sector (Panel A), and 19.6% using a simple (column 1) or 18.9% using a simple (column 2) for the private sector (Panel B) compared to one from the counterpart group. It is also suggestive of being that private health providers are apparently more attractive to inpatient visits than state health care facilities in Vietnam.

In contrast, education reduces the probability of outpatient visits. On average, one year of schooling results in decreases in the probability by 12.9% using a simple model (column 1) or 11.8% using a full model (column 2) for the public health sector (Panel A), and 12.1% using a simple model (column 1) or 10.7% using a full model (column 2) for the private health sector (Panel B). We can see that there are insignificant differences between the impact magnitudes for the likelihood of outpatient visits from public and private health providers whereas there are obvious dissimilarities with inpatient services as mentioned above.

Next, Table 4 shows the estimated coefficients on the causal impacts of full schooling year on the number of doctor visits using a IV-Poisson regression form. In the same way as the effect on the probablity of doctor visits, the paper recognizes the causal association between education and the frequency of health care visits. All estimated coefficients are statistically significant at 1% and 5%.

Accordingly, an additional year of schooling rises the average number of inpatient visits by about 0.18 times using both simple and full models (column 1 and 2) for the public health sector (Panel A), and approximately 0.66 times using a simple model (column 1) or 0.59 times using a full model (column 2) for the private health sector (Panel B). We also see that there are significant gaps between public and private health

sectors for the impacts of education on the frequency of inpatient visits. This implies that the more educated utilizes more inpatient services from private health providers than from suppliers from the public health sector.

In a different manner, schooling year is negatively linked to the frequency of outpatient visits. In particular, one more schooling year on average reduces the number of outpatient visits by nearly 0.18 times using a simple model (column 1) or 0.15 times using a full model (column 2) for the public health sector (Panel A), and 0.19 times using a simple model (column 1) or 0.16 times using a simple model (column 2) for the private health sector (Panel B). Once again, there is almost no differences between the impacts of education on the number of outpatient visits from private and public health providers.

Turning to the health care expenditure impacts of education, the findings presented in Table 5 show that education leads to considerable increases in health care spending. For instance, an additional year of schooling causes an increase in health spending from the public health sector by about VND 579 thousand for both simple and full models (columns 1 and 2 in Panel A). The estimated coefficients are statistically significant at 5%. Especially, the degree of the impact is considerably larger than for the private health sector as shown in Panel B of Table 5. In this case, increases in out-of-pocket expenditure for private health care services due to a more year of schooling are approximately VND 2,737 thousand using a simple model (column 1) or VND 2,632 thousand using a full model (column 2).

In the opposite direction, education leads to decreases in out-of-pocket health care spending for outpatient services from both public and private health sectors. In particular, one more year of schooling yields reductions in out-of-pocket payments by nearly VND 150 thousand using a simple model (column 1) or VND 136 thousand using a full model (column 2) from the public health sector (Panel A), and VND 102 thousand using a simple model (column 1) or VND 91 thousand using a full model (column 2) from the private health sector (Panel B). The effect magnitudes are nearly comparable for both sectors and all estimated coefficients are statistically significant at 1%.

In addition to the estimates from 2SLS estimation, the paper also finds statistically significant impacts of the 1991 compulsory schooling reform on health care utilization in Vietnam using a reduced-form regression form. The estimated coefficients for the impacts on the probability of doctor visits, the number of doctor visists, and out-of-pocket health care payments are respectively reported in Table A1, Table A2, and Table A3 of Appendices.

6 Robustness Checks

Next, the results of robustness checks for the baseline estimates using various subsamples established by the use of different windows are presented in Tables 6–8 corresponding to IV-Probit, IV-Poisson and IV-Tobit regression forms for the impacts of schooling year on the probability of doctor visits, the frequency of doctor visits and out-of-pocket health care expenditure. The paper employs four bandwidths of the range of age in 1991 including (i) 7–22 with 24,131 observations, (ii) 8–21 with 21,107 observations, (iii) 9–20 with 17,798 observations, and (iv) 10–19 with 14,598 observations.[4]

Table 6 provides the robustness checks for the probability of doctor visits. First, when outcome is the probability of inpatient visit, the estimated coefficients are strong robust to baseline estimates only for the public health sector as demonstrated in Panel A of Table 3. In particular, one more year of schooling causes increases in the probability of inpatient visits by between 7.5–8.9% using a simple model (column 1) or 7.8–12.6% using a full model (column 2). These estimated coefficients are statistically significant at the conventional levels. Although the directions of the impacts are consistently retained compared to the baseline estimates, its amplitudes are almost smaller. However, the situation changes with the probability of inpatient visits for the private health sector as

[4] When using various sub-samples, the paper also finds statistically significant impacts of the 1991 compulsory primary schooling reform on full schooling year although the magnitudes of the impacts are relatively smaller than the estimates using baseline samples. The results of first-stage estimates using various sub-samples are specifically presented in Table A4 of Appendices.

shown in Panel B of Table 6. The signs of the impacts are all negative and more importantly the estimated coefficients lose its statistical significance at traditional levels.

Second, the impacts of schooling year on the probability of outpatient visits are strongly robust to the baseline estimates in terms of both the signs and the magnitudes for both public and private health sectors. All coefficients are statistically significant at 1% or 5% for almost subsamples with the exception of a subsample using a range of age in 1991 of 10–19 for the private health sector (Panel B). Generally, education has negative effects on the probability of outpatient visits. In particular, an additional year of schooling is causally related to decreases in the probability of outpatient visits by about 8.1–10.8% using a simple model (column 1) or 8.8–12.7% using a full model (column 2) for the public health sector (Panel A), and 9–11.7% using a simple model (column 1) or 10.3–11.9% using a full model (column 2) for the private health sector (Panel B).

Subsequently, the results of robustness checks for the frequency of doctor visits are illustrated in Table 7. In terms of the number of inpatient visits to the public health care facilities, almost estimated coefficients lose its statistical significance at conventional levels as shown in Panel A. Exceptionally, the paper finds the statistically significant impacts for a subsample of 8–21 age in 1991. In particular, the postive impacts as consequences of having an additional schooling year are increases of 0.15 visits using a simple model (column 1) or 0.16 visits using a full model (column 2).

Meanwhile, the paper strinking finds the adverse impacts of education on the frequency of inpatient visits to the private health care providers at 5% level of statistical significance for subsamples of 9–20 and 10–19 windows of age in 1991 as indicated in Panel B of Table 7. Specifically, one more year of schooling is causally associated with average decreases by about 0.78–0.94 visits using a simple model (column 1) or 0.81–1.02 visits using a full model (column 2). Other estimates are statistically insignificant even though it shows negative signs of the impacts.

As usual, this paper also obtains the negative impacts of full schooling year on both the frequency of public and private outpatient visits for all available subsamples with levels of statistical significance at 1% or 5%. In particular, one year of schooling is causally connected to decreases of about 0.19–0.20 visits with a simple model (column 1) or 0.19–0.22 visits with a full model (column 2) in the number of doctor visits for the public health sector (Panel A). The corresponding figures for the private health sector are falls of about 0.23–0.35 using a simple model (column 1) or 0.21–0.31 using a full model (column 2) as shown in Panel B.

Finally, Table 8 presents the robustness checks for per visit out-of-pocket payments. Almost estimated coefficients are highly robust to the baseline estimates excluding the impacts on per inpatient visit expenditure for the private health sector (Panel B of Table 8). In particular, almost impacts have negative signs that are opposite to the baseline estimates as in Table 5. However, the estimates lose its statistical significance. In contrast, the estimates for public inpatient visit expenditure maintain its consistency with increases of roughly VND 604–825 thousand using a simple model (column 1) or VND 604–1109 thousand using a full model (column 2) for an increasing year of schooling.

Meanwhile, education reduces per outpatient visit expenditure by about VND 107–147 thousand using a simple model (column 1) or VND 113–166 thousand using a full model (column 2) for the public health sector (Panel A), and approximately VND 88–93 thousand uisng a simple model (column 1) or VND 85–108 thousand using a full model (column 2) for the private health sector (Panel B).

7 Potential Mechanisms

Having recognized the causal effects of education on various outcomes of health care utilization in Vietnam, in this section the paper provides some highlighting potential pathways through which increased education is probably linked to changes in health

care utilization outcomes. In paricular, two main mediators used to explain the causal effects include the probability of health insurance and income. The estimation results are meticulously presented in Table 9. Essentially, the paper finds statistically significant associations between schooling year and the probability of health insurance and income. The estimated coefficients all are strongly significant with 1%.

First, the results from Panel A of Table 9 show that education does cause favourable impacts on a respondent's probability of being insured with employing a IV-Probit model form for the estimations. One year of schooling on average increases the probability of health insurance by about 8.2% using a simple model (column 1) or 7.4% using a full model (column 2). Moreover, using reduced form regressions the paper also finds the positive and statistically significant effects of the 1991 compulsory schooling reform on the probability of health insurance as demonstrated in Panel A of Table A5. Specifically, the 1991 compulsory schooling reform rises the probability of health insurance by 19.8% using a simple model (column 1) or 18.7% using a full model (column 2). Moreover, Figure A1 geographically demonstrates that the 1991 compulsory schooling reform creates a major leap in the probability of health insurance for a respondent from the treatment group in comparison with one from the control group.

Previous studies evidently confirm that health insurance has considerable impacts on increases in health care utilitiztion outcomes, for example Card et al. (2008) in the United States, or Kondo and Shigeoka (2013) in Japan. Moreover, the existing literature on health economics and public health as well emphasize the positive role of education for improving health-related outcomes because the more educated people tend to care more about their health status than the less educated ones (Cutler & Lleras-Muney, 2008). Therefore, education promotes the probability of health insurance that in turn increases utilization of health care services with superior quality.

Admittedly, the affirmative impacts of health insurance on health care utilization in Vietnam are previously well-documented. For instance, Sepehri et al. (2006) find that health insurance increases the likelihood of hospital admission and prolongs patients' treament duration and this type of hospital-based treatment is completely inferred as

an inpatient medical service. Moreover, Thanh et al. (2014) emphasize that patients with health insurance are more likely to to be hospitalized and treated with inpatient services than patients without health insurance in Vietnam. With a recognization of an inpatient health care service as a better quality service type compared to an outpatient service, the finding in this study that citizens with health insurance because of higher schooling utilize more inpatient services is logically understandable. Generally, the probability of health insurance may play a role as a potential mediator for explaining the causal link between education and health care utilization in Vietnam.

Second, income is another potential mediator used to account for the causal impact of education on health care utilization. The impacts of schooling year on income using an IV regression form are presented in Panel B of Table 9. The paper finds that education produces apparent increases in a respondent's monthly income, and the estimated efficients are statistically significant at 1%. One schooling year is in detail linked to increments in monthly income by VND 178 thousand using a simple model (column 1) or VND 172 thousand using a full model (column 2). Furthermore, employing a reduced form regression equation, the paper also finds favorable impacts of the 1991 compulsory schooling reform on monthly income with corresponding rises of nearly VND 427 thousand using a simple model (column 1) or VND 436 thousand using a full model (column 2) as depicted in Panel B of Table A4. Graphically, Figure A2 reveals a considerable shift of monthly income for a respondent from the treatment group compared to one from the control group.

It is academically undoubted that income plays an essential role for improving health-related outcomes (Ettner, 1996; Frijters et al., 2005; Marmot, 2002). Richer people have more financial conditions to access more health care services and treatments, for examples regular diagnoses, protective services, or meticulous medical treaments than poor people. Moreover, people with higher income also care more about the quality of medical services and they have higher willingness to pay for more desirable health care services. Ministry of Health of Vietnam (2007) concludes that poor citizens have considerably lower health care ulitization and pay less for medical services

than rich ones over last decades in Vietnam and the gap in health care utilization between poor and rich Vietnamese people tends to increase from year to year. This study specifically provides a more specific insight in the choice of health care utilization based on schooling level in Vietnam that the more educated people who have higher income will utilize more inpatient services with higher quality of medical practices while they use less outpatient services with lower quality of services.

8 Conclusion

The relationship between schooling and health care utilization is very important as health care utilization plays a very significant role as a leading preventable approach to illnesses and thus the magnification of health care utilization is significantly acknowledged as a primary strategy for mastering the stock of health human capital of any country. This study provides an empirical investigation into the causal effects of schooling on health care utilization in Vietnam by exploiting a compulsory schooling law to plausibly instrument for exogenous changes in year of schooling. The paper robustly finds the significant impacts of education on health care utilization in Vietnam. However, the signs of the impacts importantly rely on the specific type of health care services. Acorrdingly, education increases inpatient health care services whereas it reduces outpatient services. Furthermore, the favourable impact of schooling on inpatient service utilization is exceptionally larger for the private health sector than the public health sector. Meanwhile, the reverse effect of education on outpatient service utilization is roughly similar for both public and private health providers.

In Vietnam, inpatient health care services are commonly classified as high quality services compared to outpatient health care services. Inpatient health care services are defined as medical treatments in which patients stay in hospitals or health care facilities during their treament durations and they are medically treated under physicians' daily close supervisions and other significant supports for making improved resilient progresses. The results in this study suggest that education is an important determinant

for Vietnamese people to make the choice of health care service type towards being favourble to inpatient services with higher quality of treatments in Vietnam.

Also, tt is essential to inspect the question of what potentially motivates the impacts of education on health care utilization in Vietnam. The paper finds that the probability of health insurance and income are significant mediators of the association between schooling and health care utilization. Health insurance plays a very important role in mastering health care utilization because it works as a source of financing health care services. In Vietnam, health insurance has been regarded as a major channel of health care payments not only from the public health sector but also from the private health sector (Wagstaff et al., 2016). The rate of Vietnamese people privately insured increases twice between 2004–2006 (World Bank, 2007).

In addition, income vastly affects the pattern of health care utilization. In an income-restricted country like Vietnam the poor has low likelihoods to access to high quality health care services. Therefore, almost poor people select outpatient health services that cost them payable bugets rather than inpatient health services with relatively high spending (O'Donnell et al., 2008; Thoa *et al.,* 2013). Expanded education apparently leads to increases in income. Therefore, citizens with higher education tend to choice inpatient health services rather than outpatient utilization as found in this study. Notably, schooling can result in an increasing gap in health care utilization based on the quality of service between the rich and the poor.

The various findings on the impacts of schooling on utilizations of inpatient and outpatient health care services in this study is very interesting because it provides a more insightful understanding of socio-economic determinants of the demand for health care treatments in Vietnam. Vietnam's health care system has changed over last decades, and the development of private sectors provides a wider range for citizens' choice of health care services. The more educated people make their choices towards increasing higher quality health care services reflect an increasing demand for better health care services among Vietnamese citizens as a consequence of improved education.

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Table 1. Descriptive statistics of the sample

Variable	Full sample		Treatment		Control	
	Mean	SD	Mean	SD	Mean	SD
Health care utilization outcomes						
Public health care services						
Probability of inpatient visit	0.066	0.248	0.075	0.263	0.057	0.232
Probability of outpatient visit	0.208	0.406	0.188	0.391	0.225	0.418
Frequency of inpatient visit	0.086	0.397	0.094	0.399	0.079	0.396
Frequency of outpatient visit	0.561	1.742	0.490	1.566	0.624	1.883
Per inpatient visit expenditure	184.877	1461.102	200.078	1408.507	171.213	1506.728
Per outpatient visit expenditure	76.442	408.809	62.429	365.140	89.038	444.050
Private health care services						
Probability of inpatient visit	0.005	0.068	0.005	0.068	0.005	0.067
Probability of outpatient visit	0.143	0.350	0.128	0.334	0.157	0.363
Frequency of inpatient visit	0.007	0.167	0.005	0.084	0.009	0.216
Frequency of outpatient visit	0.441	1.726	0.366	1.431	0.509	1.951
Per inpatient visit expenditure	17.610	395.900	19.822	405.258	15.621	387.301
Per outpatient visit expenditure	38.100	223.924	28.975	178.727	46.301	257.606
Main control variables						
Male	0.495	0.500	0.501	0.500	0.490	0.500
Urban	0.308	0.462	0.319	0.466	0.299	0.458
Majority	0.836	0.370	0.842	0.365	0.831	0.375
Red river delta	0.192	0.394	0.199	0.400	0.186	0.389
Midlands and northern mountainous areas	0.177	0.382	0.170	0.375	0.184	0.388
Northern and coastal central region	0.216	0.411	0.207	0.405	0.223	0.417
Central highlands	0.072	0.258	0.069	0.254	0.074	0.261
Southeast area	0.126	0.332	0.134	0.341	0.118	0.323
Mekong river delta	0.217	0.412	0.220	0.415	0.214	0.410

Survey 2010	0.341	0.474	0.345	0.475	0.338	0.473
Survey 2012	0.333	0.471	0.329	0.470	0.336	0.472
Survey 2014	0.326	0.469	0.326	0.469	0.326	0.469
Potential mechanisms						
Health insurance	0.478	0.500	0.504	0.500	0.456	0.498
Income	1191.557	2033.040	1422.818	2164.166	983.692	1883.500
Schooling variables						
Reform exposure	0.473	0.499	1.000	0.000	0.000	0.000
Schooling year	8.449	3.948	9.337	3.703	7.652	3.991
N	27,271		12,909		14,362	

Table 2. First-stage: The impacts of the 1991 compulsory schooling reform on full schooling year

	Dependent variable: Full schooling year	
	(1)	(2)
Reform exposure	2.400*** (0.206)	2.533*** (0.186)
Male		0.488*** (0.056)
Urban		2.231*** (0.164)
Majority		2.740*** (0.256)
Red river delta		2.732*** (0.337)
Midlands and northern mountainous areas		1.930*** (0.237)
Northern and coastal central region		1.504*** (0.305)
Central highlands		1.276*** (0.220)
Southeast area		0.987*** (0.317)
Mekong river delta		Omitted
Survey year fixed effects	Yes	Yes
Birth cohort fixed effects	Yes	Yes
Constant	7.338*** (0.219)	2.740*** (0.327)
F-stat	25.13	40.00
R-squared	0.056	0.258
N	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Ordinary least squares are used. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 3. Baseline estimates: IV-Probit regressions of the impacts of schooling year on the probability of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Probability of inpatient visit	0.091*** (0.032)	0.093*** (0.030)	0.196** (0.091)	0.189** (0.087)
Probability of outpatient visit	–0.129*** (0.027)	–0.118*** (0.026)	–0.121*** (0.025)	–0.107*** (0.026)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
N	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 4. Baseline estimates: IV-Poisson regressions of the impacts of schooling year on the frequency of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Frequency of inpatient visit	0.177*** (0.066)	0.179*** (0.063)	0.657** (0.283)	0.585** (0.266)
Frequency of outpatient visit	–0.177*** (0.051)	–0.151*** (0.049)	–0.191*** (0.051)	–0.156*** (0.050)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
N	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 5. Baseline estimates: IV-Tobit regressions of the impacts of schooling year on out-of-pocket health care expenditures

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Per inpatient visit expenditure	578.611** (264.267)	578.916** (255.357)	2736.949** (1283.959)	2631.666** (1217.269)
Per outpatient visit expenditure	–149.615*** (37.764)	–135.754*** (35.700)	–102.022*** (18.876)	–90.572*** (18.859)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
N	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 6. Robustness, various windows: IV-Probit regressions of the impacts of schooling year on the probability of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Probability of inpatient visit				
age in 1991: 7–22 (N=24,131)	0.075** (0.032)	0.079** (0.037)	–0.013 (0.089)	–0.015 (0.102)
age in 1991: 8–21 (N=21,107)	0.089*** (0.030)	0.092*** (0.033)	–0.106 (0.076)	–0.116 (0.079)
age in 1991: 9–20 (N=17,798)	0.088** (0.043)	0.096** (0.043)	–0.059 (0.088)	–0.057 (0.091)
age in 1991: 10–19 (N=14,598)	0.087* (0.052)	0.126** (0.058)	–0.082 (0.113)	–0.082 (0.137)
Probability of outpatient visit				
age in 1991: 7–22 (N=24,131)	–0.108*** (0.027)	–0.127*** (0.030)	–0.100*** (0.033)	–0.119*** (0.035)
age in 1991: 8–21 (N=21,107)	–0.088*** (0.023)	–0.094*** (0.024)	–0.117*** (0.028)	–0.113*** (0.030)
age in 1991: 9–20 (N=17,798)	–0.081** (0.038)	–0.088** (0.040)	–0.090*** (0.037)	–0.103*** (0.038)
age in 1991: 10–19 (N=14,598)	–0.094*** (0.035)	–0.090** (0.039)	–0.039 (0.039)	–0.039 (0.042)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 7. Robustness, various windows: IV-Poisson regressions of the impacts of schooling year on the frequency of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Frequency of inpatient visit				
age in 1991: 7–22 (N=24,131)	0.067 (0.071)	0.081 (0.082)	–0.049 (0.270)	–0.043 (0.304)
age in 1991: 8–21 (N=21,107)	0.149* (0.084)	0.161* (0.089)	–0.317 (0.231)	–0.324 (0.233)
age in 1991: 9–20 (N=17,798)	0.130 (0.107)	0.150 (0.105)	–0.782** (0.324)	–0.807** (0.350)
age in 1991: 10–19 (N=14,598)	0.119 (0.113)	0.174 (0.127)	–0.944** (0.434)	–1.015** (0.488)
Frequency of outpatient visit				
age in 1991: 7–22 (N=24,131)	–0.195*** (0.056)	–0.216*** (0.063)	–0.242*** (0.077)	–0.271*** (0.078)
age in 1991: 8–21 (N=21,107)	–0.199*** (0.043)	–0.197*** (0.044)	–0.229*** (0.055)	–0.207*** (0.055)
age in 1991: 9–20 (N=17,798)	–0.191** (0.081)	–0.204** (0.083)	–0.348*** (0.093)	–0.379*** (0.095)
age in 1991: 10–19 (N=14,598)	–0.190** (0.078)	–0.190** (0.085)	–0.280*** (0.103)	–0.313*** (0.107)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 8. Robustness, various windows: IV-Tobit regressions of the impacts of schooling year on out-of-pocket health care expenditures

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Per inpatient visit expenditure				
age in 1991: 7–22 (N=24,131)	641.841** (257.463)	641.020** (298.625)	–993.807 (1627.693)	–1165.676 (1838.347)
age in 1991: 8–21 (N=21,107)	604.206** (271.727)	603.512** (292.621)	–1248.346 (1080.249)	–1372.602 (1103.281)
age in 1991: 9–20 (N=17,798)	679.252* (369.410)	713.719* (368.959)	286.939 (1491.327)	572.297 (1509.166)
age in 1991: 10–19 (N=14,598)	825.468* (453.812)	1108.580** (520.689)	–1708.526 (1664.941)	–1910.462 (1957.477)
Per outpatient visit expenditure				
age in 1991: 7–22 (N=24,131)	–140.637*** (32.388)	–166.222*** (36.131)	–92.769*** (24.375)	–107.774*** (26.061)
age in 1991: 8–21 (N=21,107)	–120.505*** (28.940)	–123.789*** (30.297)	–88.002*** (19.592)	–85.350*** (20.733)
age in 1991: 9–20 (N=17,798)	–106.911** (45.287)	–113.220** (46.370)	–90.361*** (29.474)	–96.857*** (28.994)
age in 1991: 10–19 (N=14,598)	–146.626*** (38.462)	–159.770*** (42.687)	–34.558 (25.919)	–35.354 (27.345)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table 9. Potential mechanisms: The impacts of schooling year on the probability of health insurance and monthly income

	Panel A. Health insurance		Panel B. Income	
	(1)	(2)	(1)	(2)
Schooling year	0.082*** (0.024)	0.074*** (0.025)	178.0908*** (43.447)	172.220*** (33.035)
Model	IV-Probit	IV-Probit	IV	IV
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Observations	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

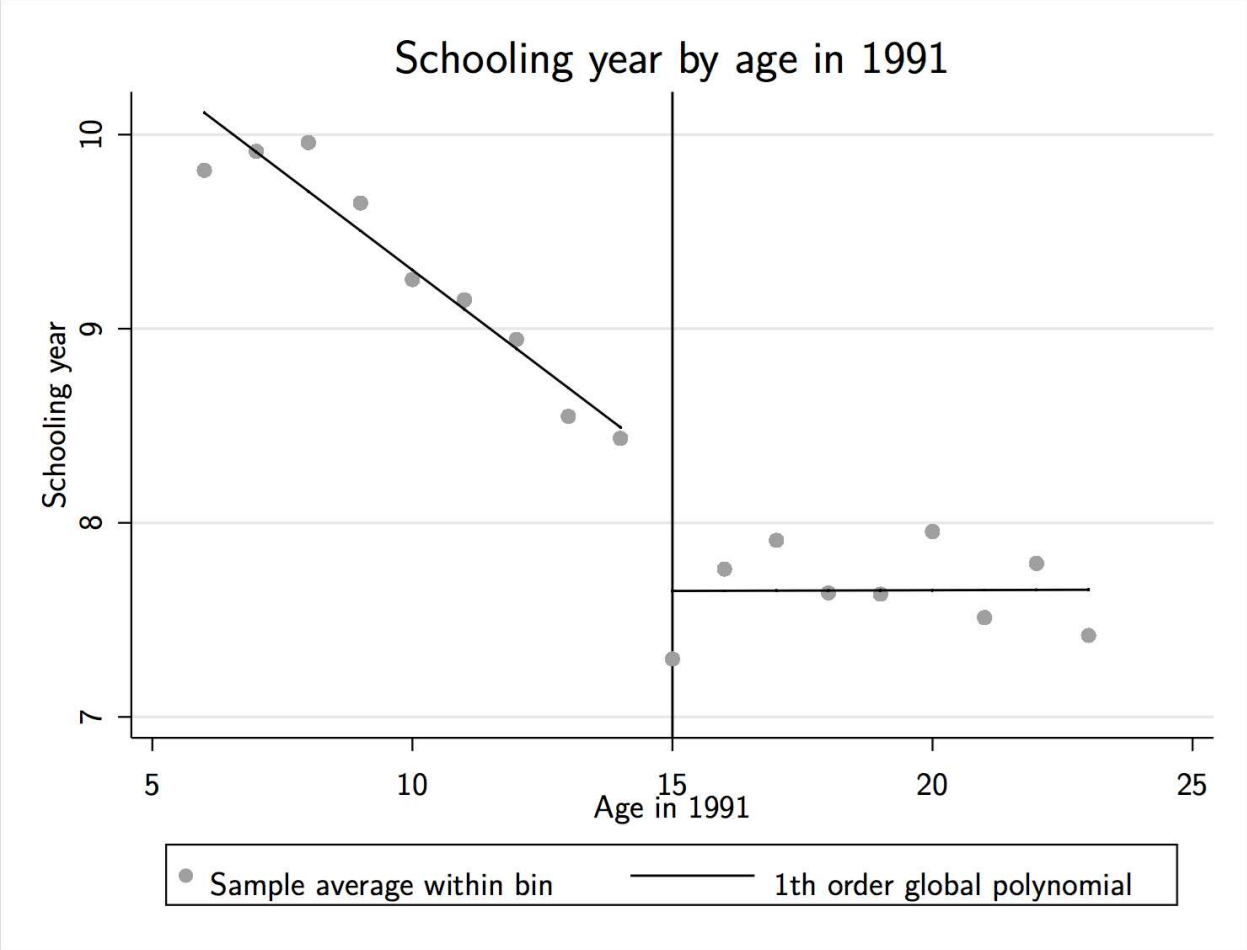

Figure 1. The impact of the 1991 schooling reform on schooling year

Appendices

Appendix 1: Definition of variables

Health care utilization outcomes

Public health care services

Probability of inpatient visit. Probability of any inpatient visit to public health care services during the last 12 months (=1 if yes, =0 otherwise).

Probability of outpatient visit. Probability of any outpatient visit to public health care services during the last 12 months (=1 if yes, =0 otherwise).

Frequency of inpatient visit. The number of inpatient visits to public health care services over the last 12 months (times).

Frequency of outpatient visit. The number of outpatient visits to public health care services over the last 12 months (times).

Per inpatient visit expenditure. The expenditure per inpatient visit to public health care services (VND 1,000, 2010 price).

Per outpatient visit expenditure. The expenditure per outpatient visit to public health care services (VND 1,000, 2010 price).

Private health care services

Probability of inpatient visit. Probability of any inpatient visit to private health care services during the last 12 months (=1 if yes, =0 otherwise).

Probability of outpatient visit. Probability of any outpatient visit to private health care services during the last 12 months (=1 if yes, =0 otherwise).

Frequency of inpatient visit. The number of inpatient visits to private health care services over the last 12 months (times).

Frequency of outpatient visit. The number of outpatient visits to private health care services over the last 12 months (times).

Per inpatient visit expenditure. Expenditure per inpatient visit to private health care services (VND 1,000, 2010 price).

Per outpatient visit expenditure. Expenditure per outpatient visit to private health care services (VND 1,000, 2010 price).

Main control variables

Male. Respondent's gender is male (=1 if yes, =0 otherwise).

Urban. Respondent's household is in an urban area (=1 if yes, =0 otherwise).

Majority. Respondent's ethnic is majority, Kinh or Hoa (=1 if yes, =0 otherwise).

Red river delta. The geographical region is Red river delta (=1 if yes, =0 otherwise).

Midlands and northern mountainous areas. The geographical region is Midlands and northern mountainous areas (=1 if yes, =0 otherwise).

Northern and coastal central region. The geographical region is Northern and coastal central region (=1 if yes, =0 otherwise).

Central highlands. The geographical region is Central highlands (=1 if yes, =0 otherwise).

Southeastern area. The geographical region is Southeastern area (=1 if yes, =0 otherwise).

Mekong river delta. The geographical region is Mekong river delta (=1 if yes, =0 otherwise).

Survey 2010. The year of survey is 2010 (=1 if yes, =0 otherwise).

Survey 2012. The year of survey is 2012 (=1 if yes, =0 otherwise).

Survey 2014. The year of survey is 2014 (=1 if yes, =0 otherwise).

Potential mechanisms

Health insurance. The probability of being insured with public or private health insurance (=1 if yes, =0 otherwise).

Income. Respondent's monthly income (1,000 VND, 2010 price).

Other variables

Reform exposure. Respondent's probability of being exposed to the 1991 schooling reform that her or his age equals 14 or less than 14 in 1991 (=1 if yes, =0 otherwise).

Schooling year. Respondent's full schooling year at the year of survey (years).

Table A1. Reduced form (intent-to-treat) regressions: The impacts of the 1991 compulsory schooling reform on the probability of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Probability of inpatient visit	0.219*** (0.076)	0.234*** (0.077)	0.470** (0.217)	0.479** (0.222)
Probability of outpatient visit	–0.309*** (0.064)	–0.299*** (0.065)	–0.291*** (0.061)	–0.270*** (0.066)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
Observations	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table A2. Reduced form (intent-to-treat) regressions: The impacts of the 1991 compulsory schooling reform on the frequency of doctor visit

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Frequency of inpatient visit	0.424*** (0.158)	0.453*** (0.160)	1.577** (0.679)	1.482** (0.673)
Frequency of outpatient visit	–0.425*** (0.123)	–0.382*** (0.123)	–0.458*** (0.123)	–0.395*** (0.127)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
Observations	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table A3. Reduced form (intent-to-treat) regressions: The impacts of the 1991 compulsory schooling reform on out-of-pocket health care expenditures

Dependent variable	Panel A. Public health sector		Panel B. Private health sector	
	(1)	(2)	(1)	(2)
Per inpatient visit expenditure	1388.751** (634.279)	1466.211** (646.738)	6569.080** (3081.692)	6665.175** (3082.956)
Per outpatient visit expenditure	–359.098*** (90.639)	–343.837*** (90.422)	–244.869*** (45.304)	–229.391*** (47.764)
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes
Observations	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table A4. Robustness, various windows, first-stage: The impacts of the 1991 compulsory schooling reform on schooling year

	Dependent variable: Schooling year							
	Age in 1991: 7–22		Age in 1991: 8–21		Age in 1991: 9–20		Age in 1991: 10–19	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Reform exposure	2.124*** (0.244)	1.905*** (0.172)	2.447*** (0.210)	2.287*** (0.183)	1.695*** (0.197)	1.667*** (0.163)	1.620*** (0.197)	1.408*** (0.167)
Male		0.477*** (0.060)		0.485*** (0.061)		0.489*** (0.065)		0.535*** (0.069)
Urban		2.301*** (0.169)		2.314*** (0.176)		2.419*** (0.191)		2.506*** (0.189)
Majority		2.753*** (0.260)		2.808*** (0.268)		2.781*** (0.263)		2.746*** (0.259)
Red river delta		2.732*** (0.357)		2.742*** (0.369)		2.726*** (0.390)		2.730*** (0.380)
Midlands and northern mountainous areas		1.903*** (0.249)		1.923*** (0.253)		1.876*** (0.266)		1.791*** (0.268)
Northern and coastal central region		1.487*** (0.307)		1.453*** (0.305)		1.398*** (0.326)		1.360*** (0.317)
Central highlands		1.295*** (0.237)		1.256*** (0.227)		1.242*** (0.213)		1.125*** (0.223)
Southeastern area		1.020*** (0.317)		1.006*** (0.301)		1.029*** (0.299)		1.041*** (0.264)
Mekong river delta		Omitted		Omitted		Omitted		Omitted
Survey year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.718*** (0.241)	3.201*** (0.347)	7.440*** (0.265)	2.877*** (0.358)	7.914*** (0.266)	3.115*** (0.330)	7.609*** (0.276)	2.997*** (0.348)
F-stat	25.02	40.57	19.57	43.62	16.92	37.11	15.80	42.60
R-squared	0.051	0.258	0.046	0.256	0.035	0.251	0.028	0.252
Observations	24,131	24,131	21,107	21,107	17,798	17,798	14,598	14,598

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Ordinary least squares are used. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

Table A5. Reduced form (intent-to-treat) mechanisms: The impacts of the 1991 complusory schooling reform on probability of health insurance and monthly income

	Panel A. Health insurance		Panel B. Income	
	(1)	(2)	(1)	(2)
Reform exposure	0.198***	0.187***	427.444***	436.178***
	(0.058)	(0.064)	(104.278)	(83.666)
Model	IV-Probit	IV-Probit	IV	IV
Controls	No	Yes	No	Yes
Survey year fixed effects	Yes	Yes	Yes	Yes
Cohort fixed effects	Yes	Yes	Yes	Yes
Observations	27,271	27,271	27,271	27,271

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Robust standard errors are clustered at the provincial level and reported in parenthesis. Controls consist of male, urban, majority, and dummies for six geographical regions.

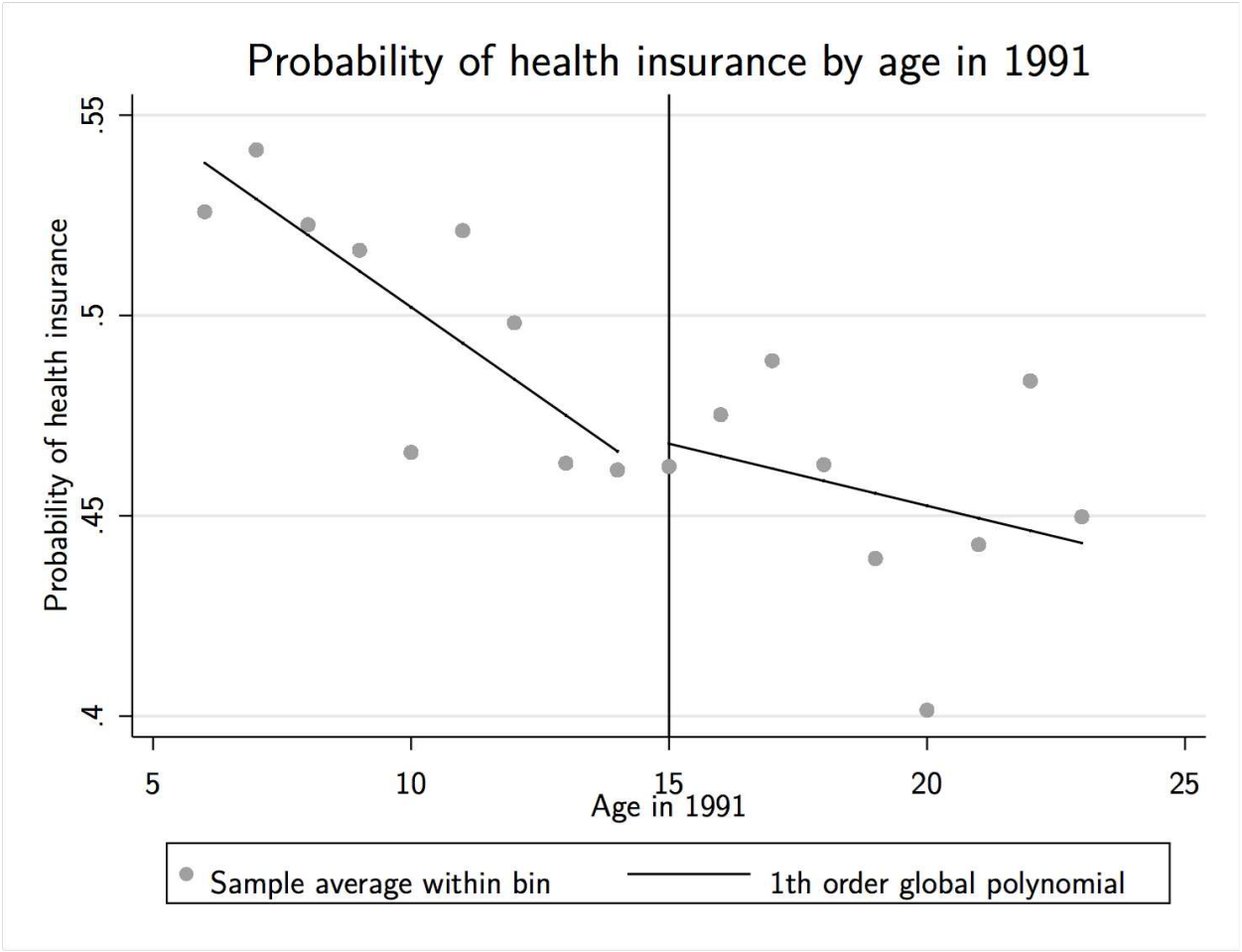

Figure A1. The impact of the 1991 schooling reform on probability of health insurance

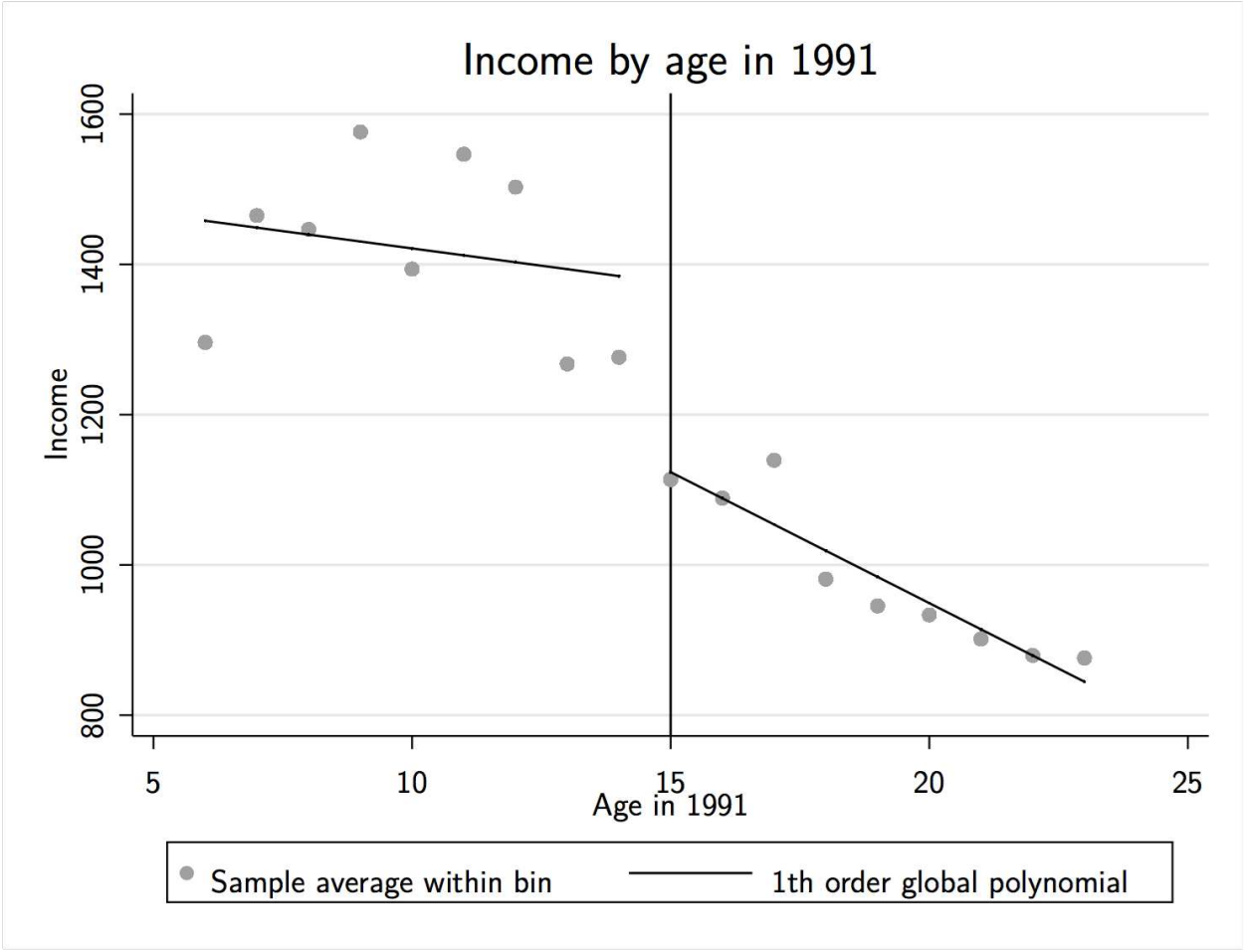

Figure A2. The impact of the 1991 schooling reform on income