Private Health Insurance under Universal Health Care: Unintended Consequences

Manuel Hoffmann[1]
(Texas A&M University)

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Abstract
Universal healthcare is associated with desirable health and equity outcomes and often allows individuals to purchase supplementary private health insurance. While the purchase of private health insurance is clearly beneficial in the absence of public insurance, it is more difficult to evaluate individual costs and benefits when baseline coverage exists for everyone. The perceived benefits of insurance and the increase in health costs due to premium payments can lead to hidden costs and unintended consequences of supplementary health insurance. To study those costs, I use a regression kink design in conjunction with a policy implemented in Australia in 2000 to overcome selection. The policy punishes agents for delaying the purchase of private health until later in life. Following the policy-guided instrumentation of insurance purchase, it appears that private health insurance does not cause moral hazard. There is a zero effect on medical expenditures despite evidence of adverse selection. Supplementary insurance does not change mortality or work expenses but it changes the budget. We observe an increase in student debt which is consistent with premium payments crowding out debt repayments. Surprisingly, there is a loss of gross income from private health insurance which can partially be explained by income misreporting.

JEL Classification: C26; D12; I31; H12; J22; L82

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[1] Economics Department, Texas A&M University, 4228 TAMU, College Station, TX 77843, Manuel Hoffmann. E-Mail: manuelhoffmann@tamu.edu.

Universal health care allows every citizen to have equal access to health care that is not financially punitive. It is generally seen as beneficial to society: universal health care is associated with lower infant mortality, longer life-expectancy as well as positive labor and income effects (Morena-Serra and Smith, 2012; Dizioli and Pinheiro, 2016; Finkelstein et al., 2012). However, more than fifty percent of the world's population does not live in a universal health care system. The World Health Organization has declared health a basic human right and stated its mission to achieve universal health coverage world-wide by 2030 (Prince, 2017). Institutions like the Organisation for Economic Co-operation and Development and the United Nations support such a mission. While support of universal health care has increased over time (Pew Research Center, 2017), what might comprise the most efficient and equitable system requires a better understanding of the underlying economic considerations such as the cost-benefit trade-off.

Under universal health care, supplementary private insurance often provides added individual benefits, such as faster and personalized health services through additional purchases of benefits that include reduced wait times, the choice of doctors, and private hospital rooms. It also provides spill-over social benefits by reducing demand and cost on the public health sector. While universal health care systems in the developed world are correlated with reduced access cost and lower overall health costs, they are associated with longer wait-times, which generally leads to systems that offer both public insurance as well as private insurance due to the tradeoff between equity and efficiency of health care provision.[2] Currently, the exact welfare implications of universal health care with supplementary private insurance remain obscure. While the benefits of being privately insured over being uninsured have been studied extensively (see e.g. McWilliams et al., 2004; Wilper et al., 2009), there is a gap in knowledge for systems implementing public and private and insurance simultaneously. Existing research

[2] See Figure A1, A2, A3.

does not address whether the existence and coverage of private health insurance under universal health care increases individual and societal welfare. There also remains scant overall evidence on the long-run consequences of private health insurance coverage. This study initiates to fill in these gaps.

A common problem with studies of insurance is adverse or advantageous selection, i.e. individuals with specific characteristics select into insurance. We solve this problem by employing data from the health care system of Australia. By international standards, Australia represents a low-cost system marked by good health outcomes (Schneider et al., 2017). Administrative tax data spanning multiple years across a large ten-percent panel sample of individuals in Australia allows us to identify the potential benefits and hidden costs arising from private health insurance under universal health care using a policy that creates an unconventional natural experiment.

The Australian policy that introduces price-discrimination by age called the Lifetime Health Cover (LTHC) is exploited for this study. It rewards (punishes) early (delayed) purchase of private health insurance. A regression kink design (Card et al. 2016) is utilized to investigate demand responses of private health insurance where high-quality public insurance is the baseline. With this large administrative sample of observations, precise estimates can be obtained and heterogeneity and implications for policies are explored. The empirical effect of private health insurance on health expenditures, mortality, work expenses, gross salary, and student debt is evaluated via a reduced-form regression kink approach to obtain local average treatment effects at the policy threshold.

This study contributes to numerous strains of literature. First, the studies which investigated three major Australian policies incentivizing private health insurance coverage either used highly aggregated time-series (Butler, 2001; Frech et al., 2003; Ellis and Savage 2008) or cross-sectional data (Palangkaraya and Yong, 2005, 2007; Stavrunova and Yerokhin, 2014). With a few exceptions (Kettlewell et al., 2018), these studies were based on self-reporting from surveys (Cameron et al., 1988, Buchmueller et al., 2013; Cheng 2014), which have potential reporting problems due to social desirability and memory issues. Those problems can be reduced with tax data due to government sanctions from misreporting. While previous investigations mainly focus on explaining one historic jump in private health insurance coverage around the millennium, the coverage is investigated more broadly in the current study. Since the data spans more than a decade, an examination of responses is possible for the same individual directly after an event of interest, thus allowing for a direct look at the effectiveness of the policies in the short- and long-run.

Second, impact evaluation is at the core of health economics and has been done in domains such as incentivized exercises (Charness and Gneezy, 2009), wearables (Handel and Kolstad, 2018), and TV consumption (Chadi and Hoffmann, 2018). Yet, impact studies of private health insurance under universal health care have thus far been neglected. The current study provides the first large-scale investigation of unbiased private health insurance estimates on mortality and income while also assessing long-run moral hazard via health expenditures. Hall (2004) provides one of the few studies on mortality in a universal health care system, finding that private health insurance is negatively associated with three-year mortality for prostate cancer patients from Western Australia. The robustness of this finding is unclear since both, sorting based on low risk health characteristics (advantageous selection) and high risk health characteristics (adverse selection) was reported in Australia (Buchmueller et al., 2013; Kettlewell 2018), and the direction of the true bias is unknown. The present study can account for sorting and provide unbiased estimates by exploiting the exogenous policy variation.

While adverse selection can be observed here, no evidence for moral hazard based on the administrative tax health expenditure measure is found. No effect of private health insurance on mortality is detected either, likely due to the relatively young age of individuals in the study sample. This study contributes to the scarce literature of health insurance coverage on financial obligations such as debt and work expenditures as well. We investigate whether there are any potential unintended consequences when obtaining health insurance. Surprisingly, gross salary is reduced for individuals that are more likely to be covered privately. One likely partial mechanism is ex post income manipulation of the reported gross income since expenses are higher for the insured. Also, paying the premiums could change the repayment rates of student debt and reduce other expenditures. No evidence of a reduction in work-expenditures reported to the Australian Taxation Office in detected, yet an increase in student debt for those covered by private health insurance is apparent, indicating delay of repayments.

This paper is organized as follows. In the next section, the background of Australian health policies as well as the specific policy used for identification is introduced. Section 2 briefly discusses the underlying theoretical framework. Section 3 describes the data and Section 4 presents the empirical strategy. Section 5 tests the identification assumption. Section 6 presents the impact of the exogenous penalty policy on private health insurance coverage in Australia. Section 7 discusses adverse and advantageous selection and shows the results for the long-run consequences of private health insurance. Section 8 concludes.

1. Background

Universal health care was first introduced in Australia in 1975 and has existed in its current form since 1984. While private health insurance (PHI) did not disappear, it experienced a decline until approximately 1999. Figure 1 illustrates the drop in PHI through the proxy called hospital cover which covers insurance benefits for stays in the hospital.[3] The reduction in coverage raised the concern that healthy low-cost individuals would drop out over

[3] Another part of insurance is called extras cover which covers services such as dental, physiotherapy or chiropractic treatment which are commonly not covered by the hospital cover.

time while unhealthy high cost individuals would remain in the insurance market (known as adverse selection death spiral; Cutler and Zeckhauser, 1998; Einav and Finkelstein, 2011) making insurance increasingly unprofitable and leading to the collapse of the private health insurance system. Subsequently, Australia established three tax-related health policies to increase insurance coverage: the Medicare Levy Surcharge, the Private Health Insurance Rebate and the Lifetime Health Cover loading.[4] After the introduction of the three policies at the turn of the millennium, coverage indeed stabilized.

--- FIGURE 1 about here ---

The Medicare Levy Surcharge was an additional 1% tax on taxable income on affluent singles (families) with taxable income above \$50,000 (\$100,000) who failed to purchase PHI. Both, the income threshold as well as the tax penalty increased over time. The Private Health Insurance Rebate initially covered 30% of the private health insurance premiums. Age-related thresholds were introduced over time, yet benefits were also reduced to phase out this costly policy. Neither of these two policies interfere with the third policy of interest: the Lifetime Health Cover.

With the introduction of the Lifetime Health Cover (LTHC) on 1 July 2000, individuals who delay initial sign-up for PHI are penalized with a higher premium than those that purchased PHI while younger. The policy is completely independent of income and applies to every Australian.

[4] A question raised in the Australian private health insurance literature is by how much private health insurance take-up was increased by each individual policy as well as an advertisement campaign by the government promoting private health insurance take-up at the time. Due to the relatively close introduction of the policies, it is difficult to disentangle the effects. This paper will not try to answer this question. It will specifically focus on the Lifetime Health cover that introduces mandatory discrimination by age to evaluate demand responses and the consequences of private health insurance when public insurance is the baseline.

--- FIGURE 2 about here ---

The introduction of the LTHC policy did not result in any increase in premiums for those individuals below the age of 31. Figure 2 illustrates that premiums increase by 2% with each additional year after age 30 for which an agent decided to delay sign-up. An individual purchasing private health insurance for the first time at age 40 has to pay 20% more than what he would have paid, had he signed up at age 30. This price surge based on initial purchase – called a loading – increases up to 70% for individuals signing up for the first time at age 65. At the time of the policy introduction, the loading was locked in at an infinite horizon. The law was changed on April 2007, requiring the loading to be dropped for agents that were continuously covered through private health insurance over ten years.[5] Until 2007, the National Health Act from 1953 prohibited premium discrimination based on age, health-status, or other circumstances which effectively establishes a community rating for private health insurance. Crucially, the Lifetime Health Cover (LTHC) was the exception to the community rating rule which requires uniform pricing within the same territory. Those rules changed with the introduction of the Private Health Insurance Act in 2007 which specifically prohibits discrimination by age (except for the LTHC), health status, gender, sexuality, race, religious beliefs, and claims history. While price variation by state of residence was explicitly allowed, it is difficult for companies to price discriminate by state to offset the mandatory price penalty.[6]

[5] The Lifetime Health cover policy is also known as an unfunded lifetime community rating. Gale and Brown (2003) claim that the policy is actuarial fair, i.e. the premium is equal to the expected claims.

[6] In a binary way, firms could reduce premiums minimally by 2% for states with individuals that are on average above 30 while they could increase prices by 2% in states where individuals are on average below 30. This would not off-set the whole mandatory price schedule but just a tiny fraction. Increasing the difference beyond 2% will introduce adverse selection given that old individuals have higher health risks. It further seems infeasible since no state has tax-payers that are on average below 30 over our period of interest. The overall average age is 42.

2. Theoretical Framework

The Lifetime Health Cover policy introduces price discrimination by age. It changes the price of private health insurance each year that purchase is delayed past the age of thirty, leading to an increase in private health insurance premiums when initial sign-up happens later rather than earlier in life. Given that the policy asks health funds to price-discriminate by age but price discrimination by age is not feasible in any other way, it seems impossible for firms to respond to this price change to offset the law optimally to attract higher revenue. Therefore, the theoretical framework and analysis focuses on the consumer side.

Imagine an agent i that maximizes utility with respect to health consumption x_s and non-health, residual consumption y_s over a finite time horizon until $s = t, t+1, \dots, T$ until death (T) subject to the available budget w_s.

$$\max_{\{x,y\}} U^s(u_s, u_{s+1} \dots, u_T) = \sum_{s=t}^{T} \delta^s u_s(x_s, y_s) \qquad (1)$$

s.t.

$$\forall s\colon p_s x_s + q_s y_s = w_s \qquad (2)$$

In this simple model, the premium change represents an impact on the price of health services p_s, where insurance is a subset of health services. The Lifetime Health Cover changes the price for health services from the vector $p_s = p_t, p_{t+1} \dots, p_T$ to $p'_s = p'_t, p'_{t+1} \dots, p'_T$ with an exogenous price increase for individuals above the age of 30, s.t. $p_s > p'_s$.

--- FIGURE 3 about here ---

Figure 3 displays that change in price for a 35-year-old person who suddenly must pay a higher price for insurance given that the agent is relatively myopic. It implies that the agent did not sign up for cover before the introduction of the policy but is only considering to sign-up after the introduction of the policy which leaves the agent to face the price change at that point in time. The price increase leads to a reduction in demand in the health good x_s and an increase in demand in the residual good y_s. Given this framework where health is an investment good, demand for the health good is expected to be downward sloping.

3. Data

A novel data set called A-Life was provided by the Australian Taxation Offic. It consists of a panel of ten percent of Australian taxpayers from 1999 to 2012 and is utilized for this study. These data will be used to estimate the causal effects of private health insurance within the universal health care system of Australia. The country has a population of 24.21 million citizens (World Bank, 2018), 1.8 million of which are available in the panel, which implies a tax base of 18 million individuals. I restrict the set of included individuals to those between 18 and 60 years of age to avoid any potential confounding effect of retirement. The main sample includes 243,298 unique taxpayers which are followed throughout a decade to investigate the effect of the policy on the following outcomes: medical expenses, mortality, gross salary, work expenses, and outstanding student debt.

--- TABLE 1 about here ---

Table 1 shows descriptive statistics of the tax data. The average Australian taxpayer is 41 years old, has a dependent child, a partner, is an Australian resident, and lives in a densely populated area. The average gross salary over the full period of interest is $32,651 with 44% of individuals having private health insurance as measured by hospital cover. The main sample includes individuals above and below the age of 30 with a bandwidth of H=6. The average age of the main sample is 30 by construction with otherwise relatively similar characteristics to the full dataset.

4. Empirical Strategy

Ideally, we would like to randomly assign agents to have private health insurance vs. not to obtain the average treatment effect on health, labor, and budget outcomes, which would be identified via the following clean ordinary least square regression for agent i at time t:

$$Y_{it} = \beta_0 + \beta_1 PHI_{it} + \varepsilon_{it} \tag{3}$$

Such an approach, however, is ethically and practically infeasible. Alternatively, imagine a world where one randomly assigns different prices of private health insurance contracts in a field experiment to the general population or a subset thereof. This would allow us to use an instrumental variable approach where individual compliance is expected to decrease with increasing exogenous premiums. By instrumenting private health insurance coverage through the price, one would obtain the effect of insurance on the outcomes for the set of compliers. This can be achieved by scaling up the reduced form (5) by the first stage (4), as shown in the two equations below.

$$PHI_{it} = \gamma_0 + \gamma_1 price_{it} + \varepsilon_{it} \tag{4}$$
$$Y_{it} = \delta_0 + \delta_1 price_{it} + \varepsilon_{it} \tag{5}$$

Closely related, the instrument employed in this setting is using a kink in the policy and with it the regression kink design. While random assignment is not used in its purest form, the quasi-random assignment of individuals to the policy schedule is sufficient to identify effects from differences in slopes generated through the premium increase at the threshold. The following first stage and reduced form equations are used to identify the local causal estimate from the policy kink at the age of thirty.

$$PHI_{it} = \alpha_0 + \sum_{k=1}^{2} \alpha_k age_{i2000}^{k} + \alpha_3 age_{i2000} \mathbb{1}(age_{i2000} \leq 30) + \varepsilon_{it} \quad (6)$$

$$Y_{it} = \rho_0 + \sum_{k=1}^{2} \rho_k age_{i2000}^{k} + \rho_3 age_{i2000} \mathbb{1}(age_{i2000} \leq 30) + \varepsilon_{it} \quad (7)$$

The regressions are shown in a bandwidth $|age_{i2000}| < H$ with the $H = 6$ as the main bandwidth. Robustness of the results is tested with respect to the bandwidth. The reduced form (6) can be scaled up by the first stage to obtain the regression kink estimator:

$$\tau_{SS} = \frac{\lim_{v\downarrow 30} \frac{E(Y_{it}|R=age_{i2000})}{dage_{i2000}} - \lim_{v\uparrow 30} \frac{E(Y_{it}|R=age_{i2000})}{dage_{i2000}}}{\lim_{v\downarrow 30} \frac{E(PHI_{i2000}|R=age_{i2000})}{dage_{i2000}} - \lim_{v\uparrow 30} \frac{E(PHI_{i2000}|R=age_{i2000})}{dage_{i2000}}} \quad (8)$$

The most powerful first stage is a version of percentage changes using $Log(PHI_{it})$ and $Log(Price_{it})$. However, such a first stage can only be used when aggregating by age which results in a substantial loss of power since age is only available at a yearly level. Therefore, intent-to-treat (reduced form) estimates for the impact of private health insurance are shown instead. To demonstrate that the first stage is reasonable and that intent-to-treat effects are based on the mechanism of the loading policy, the identification is employed without the logarithm for a conservative estimate. The Lifetime Health cover policy can be translated into the following policy function $B = b(age)$ such that:

$$\frac{\partial b(age)}{\partial age} = \begin{cases} 0 & if\ age \leq 30 \\ 0.02 & if\ age > 30 \end{cases}. \quad (9)$$

Intent to treat percentage premium increases are employed based on the policy-schedule, i.e. the loading of the Lifetime Health Cover and we can observe the change in the growth rate of insurance coverage due to a change in the growth rate of the price.

$$\tau_{FS} = \frac{\lim_{v\downarrow 30}\frac{E(PHI_{i2000}|R=age_{i2000})}{dage_{i2000}} - \lim_{v\uparrow 30}\frac{E(PHI_{i2000}|R=age_{i2000})}{dage_{i2000}}}{\lim_{v\downarrow 30}\frac{db(age)}{dage} - \lim_{v\uparrow 30}\frac{db(age)}{dage}} \quad (10)$$

Since the loading increases by 2 pp. every year past age 30, the most conservative first stage slope change is 0.02 and can be fixed by construction.

5. Testing the Identification Assumption

For a regression kink design to provide unbiased estimates, it is necessary that only the growth-rate of the outcome changes due to the policy, i.e. there is no other factor that induces the change in the growth-rate. I test this identifying assumption in three ways: I check for manipulation of the running variable, smoothness of covariates and I run placebo-tests.

5.1 Manipulation of the Running Variable

A necessary first check regards any possible manipulation of the reported running variable age. Based on the policy incentives one might suspect that agents could systematically report being below the age of 31 to receive no price punishment. However, such manipulation is extremely difficult since age must be reported the first time a person enters the taxpayer database and for every tax filing thereafter to a powerful government agency, Australian Taxation Office (ATO). The ATO can and does cross validate information per individual over time. It is further possible for the ATO to cross-check the stated age with official birth certificates. In recent years, the ATO alleviated the tax-filling procedure by receiving information directly from the employers to pre-fill tax forms for submission which are another source to cross-check to ensure consistency in tax filing statements. It implies that any misreporting would have to be done in at least two official registries and with the employer. Beyond those large hurdles, the ATO is able to punish individuals not only in monetary terms but also with criminal charges when individuals do not comply with the agency.[7]

--- FIGURE 4 about here ---

Figure 4 shows the probability density distribution over age. It is relatively smooth across the cut-off. However, there is a minor mass peak right before the kink. The related McCray test shows a significant relationship at the five percent level. Now, if one would not know the institutional setting, this peak might be worrisome. However, the peak can be traced back to an increase in birth rates in the 1970s (Figure A4). Unless the parents of those individuals systematically decided to give birth more often while forecasting a policy that is implemented thirty years later and was only debated in 1997, manipulation seems impossible. One might still worry that pure statistical association could confound the estimates. Yet, it can be demonstrated that the coefficient of private health insurance coverage obtained is not an outlier in the distribution of estimates, but rather the mean of the distribution. This was accomplished through 10,000 jackknife Monte Carlo simulation cycles wherein 1% of the population at the left hand-side of the cutoff was randomly dropped at each iteration (Figure A5). Therefore, neither manipulation is detected nor do any potential associations of the unlucky birth-peak coinciding with the policy influence the estimates.

5.2 Smoothness of Covariates

Table 2 shows the effect of the slope-change on the covariates. Almost all variables are statistically insignificant which means that the covariates cannot explain the underlying treatment. It is reasonable to conclude that private health insurance demand only changes through the policy; therefore, any intent-to-treat effects of insurance on health, labor, and budget outcomes can only be induced due to the change in the growth-rate of the price

[7] The Australian Taxation Office has three types of penalties: i) failure to lodge penalty up to $10,502, ii) After years a default assessment based on income is conducted and iii) a maximum penalty $8,500 or imprisonment for up to 12months is the most extreme type.

from the left to the right hand side at the age of 30 in the year 2000.

--- TABLE 2 about here ---

5.3 Placebo-Tests across Age and Time

Finally, we carry out two placebo checks to make sure that the assignment of the kink happens at the correct age and time. Placebo-kinks are placed at different values of the age distribution with subsequent checks on whether the regression kink design retains predictive power to change private health insurance demand at these kinks. The adjusted R^2 values for the age-based placebo-test is very high at the policy-kink and lower at the placebo kinks (not shown). It means the predictive power of the kink is large and we conclude the age of 30 is the correct kink.

The time-period prior to the introduction of the LHC policy was examined for any potential issues since the policy was initially publicly discussed in 1997. Gale and Brown (2003b) have previously implied that responses to price increase may have started one month prior to policy implementation. Due to data limitation, no year prior to 1999 is available. However, there is no significant change in the slope during the year 1999. The main demand responses occurred during the year 2000 and is driven – as expected – by new purchases. No kink is observed in the demand of private health insurance for individuals that already had coverage in 1999; however, a kink is apparent at the year of policy implementation for those that were not covered in 1999 and incentivized by the policy (not shown).

6. Private Health Insurance Coverage

Given the change in the growth-rate of the premiums for initial purchase (see Figure 2), a change in the growth-rate of private health insurance coverage is expected, i.e. the quantity demand.

--- FIGURE 5 about here ---

Figure 5 shows the private health insurance coverage propensities over the distribution of age. Below the age of 30, the growth rate of private health insurance coverage is relatively steep and it drops after the kink point. This is consistent with a reduction in the quantity demanded due to an increase in the price of health goods, i.e. in particular private health insurance. This change in slope is used as a conservative first stage to estimate the impact of private health insurance. To estimate the change in coverage, the loadings assigned to each age-cohort are utilized to obtain a first stage estimate of 0.02 with a very high F-value of 713,247 for the main bandwidth (H=6).

--- TABLE 3 about here ---

Table 3 displays the reduced form and second stage estimates. All reduced form estimates have F-values beyond 10 which means that there is a strong first stage. However, a different first stage could theoretically be obtained using the logarithm of insurance coverage. Since this is not possible without aggregation and loss of power, only the intent-to-treat estimates for the later consequences of private health insurance are shown. For the main bandwidth of individuals between the ages of 25 and 36 (H=6), the private health insurance growth rate drops by 2.1 pp. when moving from below (and including) the age of 30 to above the age of 30 using the main specification without controls. The reduced form probit estimate is slightly larger but within the confidence interval of the ordinary least square coefficient while the coefficient with controls is smaller and remains within the confidence interval. The coefficients are marginally larger when we increase the bandwidth up to 3.1 (3.6) pp. reductions of the growth rate for OLS (Probit) but, overall, the results are robust. The second stage results for ages between 25 and 36 show that an increase in the price by 1 pp. reduces demand by more than 1 pp. The coefficient with controls is within the confidence interval of the main specification. Coverage is negatively affected by the change in price: demand is downward sloping. We conclude that there is a robust first stage of the penalty policy on coverage which allows us to proceed to estimate the intent-to-treat estimates of being insured.

7. Effects of Private Health Insurance

Several questions regarding the purchase of private health insurance are discussed in this section. What is the role of information asymmetries for Australian insurance contracts? Does the Australian insurance market exhibit adverse selection, advantageous selection, or moral hazard? What are the impacts of being privately insured on health, labor market outcomes, and personal budgets? If there would be no behavioral response after being exogenously insured, the benefits of private health insurance can manifest themselves in reduced health expenditures, lower mortality, an increase in gross salary, and no budget responses. However, moral hazard might lead to an increase in health expenditures. Given longer stays in hospitals due to more convenient amenities, private health insurance can also lead to reduction in salaries. From a budget perspective, individuals who are exogenously pushed into private health insurance coverage might experience increased budget constraints resulting in reduced work expenses and an increase in outstanding student debt due. Agents might also be inclined to manipulate their reported gross salary to compensate for their premium expenses. The results are displayed in Table 4 and they are discussed in the next two sections.

--- TABLE 4 about here ---

7.1 Adverse Selection, Advantageous Selection and Moral Hazard

Acting upon information asymmetries is a commonly observed human behavior for health insurance, either in the form of adverse (advantageous) selection, i.e. the attraction of high (low) risk health types, or in the form of moral hazard, i.e. the change in risk behavior after obtaining insurance. A crucial question is whether the Lifetime Health Cover policy which discriminates by age (as well as the other policies at the time) was necessary to reduce adverse selection. Are unhealthy individuals more likely to select into private health insurance? Standard selection tests for insurance markets compare expected costs of the insured vs. expected costs of the uninsured. If the expected costs are larger for the insured than the uninsured, one might conclude that adverse selection exists. However, as Einav and Finkelstein (2011) point out, the positive correlation test is a joint test of moral hazard and adverse or advantageous selection, at least in the absence of differentiating the two problems of information asymmetry through any other means. Fortunately, the exogenous variation in PHI data provided through the current design allows for a differentiation.

The first row in Table 4 shows the correlations of private health insurance with the outcomes of interest. There is evidence of positive selection on medical expenses, mortality, gross salary and work expenses and student debt due. Medical expenditure and private health insurance are positively correlated by $AUD 38.45 for those individuals between 25 and 36 that grew older by 13 years in the time-horizon of interest. The reduced form estimation reveals that there is no moral hazard in the classical sense since having private health insurance does not visibly increase medical expenditures. It implies that all the variation from the OLS correlation with medical expenditure can be attributed to adverse selection. While it is a small amount in absolute terms, the relative impact is a large 170% increase in comparison to not being privately insured. A simple back of the envelope calculation reveals a total adverse selection cost of AU$ 9,354,808 for this young sub-group.[8] This finding also confirms the intuition that exogenous variation of private health insurance coverage is crucial to obtain

[8] We take the average correlation and multiply the number of individuals that are the main bandwidth, i.e. $AUD 38.45*243,298 = AU$ 9,354,808.

unbiased estimate of the effects.

7.2 Health, Labor, and Budget Considerations

From Table 4 it is evident that private health insurance does not lead to changes in health in the reduced form (intent-to-treat). This strongly implies that relatively young individuals do not obtain any health benefits over the long horizon of 13 years when purchasing insurance, at least for the medical expenditure and mortality measures inspected in this study.

The main labor market outcome is gross salary from the Australian tax data. Intent-to-treat reductions of gross salaries around AU$1,000, or 3% of the baseline, are observed. While, one might expect increases in salary due to a faster return to the labor force when privately insured, it appears the opposite is the case. The private health insurance industry states the benefits of having coverage in addition to public insurance are the free choice of doctors, private rooms, and reduced wait-times for health services. Potentially, the convenience of a private room over a shared room might induce individuals to stay longer in the hospital when they are sick. This results in them foregoing the next best alternative, i.e. working and obtaining a higher residual income. Hence, those individuals with private health insurance forgo opportunity costs from the variable pay component of their income. Unfortunately, no direct tests of this hypothesis are currently possible with the data at hand, as individual-level data on the length of hospital stay is lacking. However, it appears that the effect is driven by a sub-group of individuals with the highest residual income: the self-employed. Self-employed individuals forgo AU$1,500 of residual income when insured. This finding is robust (not shown).[9] External aggregate data from the Australian Health and Welfare Institute shows a positive correlation of the length in the hospital and being privately insured (AIHW, 2017).[10]

[9] All results are robust. Among others, robustness checks for my intent-to-treat results entail going beyond a polynomial of degree 2, checking for potentially spurious life-cycle effects by adding age and quadratic age or year fixed effects as well as adding the covariate set displayed in Table 1.

[10] Private patients stay 3.5 (2.2) days on average vs 3.1 (1.9) days for publicly insured patients in public (private) hospitals.

Those two pieces of evidence together reinforce the idea that individuals forgo income by staying in the hospital for a longer period of time. However, since there is no effect on medical expenditures, this explanation is unlikely. Another explanation is ex post income manipulation. Agents who get privately insured, have higher expenses but the same income. To optimize, they will report a lower income which leads to a lower tax burden if the ATO does not detect misreporting. The explanation of income manipulation is consistent with the observation that the self-employed drive the gross salary effect. However, since there is also an effect from the employed – albeit at a lower level. Therefore, ex post income manipulation can only partially explain the results.

Finally, the availability of budget restriction measures, such as work-related expenses and outstanding student debt, allowed us to test the effect of private health insurance on personal budgets. While suffering the consequences of having to pay the premium, individuals may substitute away from non-health expenditures. There are no effects of private health insurance coverage on work-related expenses. However, there is some evidence for the substitution hypothesis which displays the unintended consequence of policies that push people into private health insurance. Private health insurance increases the intent-to-treat amount of student debt due by AU$ 8.90. This is a 12% increase with respect to the baseline. It indicates that individuals with private health insurance delay their student debt repayments that they owe the government. If everyone would have student debt and coverage in this sample, it would imply a burden of AU$ 2,165,352.[11] According to the Australian Taxation Office, the number of people with outstanding student debt was 1,188,000 in 2006 and it is steadily increasing. A back of the envelope calculation implies that extending coverage to those individuals could result in a delay of student debt payments of an amount of AU$ 10,573,200.[12]

[11] AU$ 8.90*243,298 = AU$ 2,165,352.

[12] AU$ 8.90*1,188,000 = AU$ 10,573,200.

8. Conclusion

We document that the change in the growth rate of the price, changes the growth rate of insurance coverage. The Australian market seem to exhibit adverse selection which implies that the concern of an adverse selection death spiral that motivated the government interventions incentivizing private health insurance take-up at the millennium was justified. We do not find positive effects of private health insurance but some unintended consequences. In particular, we do not find any effects of private health insurance on the measures of health and even negative effects on gross salary which are likely driven by ex post income manipulation to reduce the premium burden from private health insurance. We also find evidence for substitution due to increased student debt indicating repayments slowing down for those being insured. For the relatively young individuals of the ages between 25 and 48 private health insurance coverage does not seem to pay off. However, the largest benefits might not be observable yet in this study. For example, non-emergency surgery wait-times for privately insured individuals are significantly lower than for publicly insured individuals and the likelihood to have non-emergency surgery increases with age. This study underlines that we must understand health insurance more holistically to be aware not only of the benefits but also of the costs that can arise from increasing supplementary insurance in a universal health care system.

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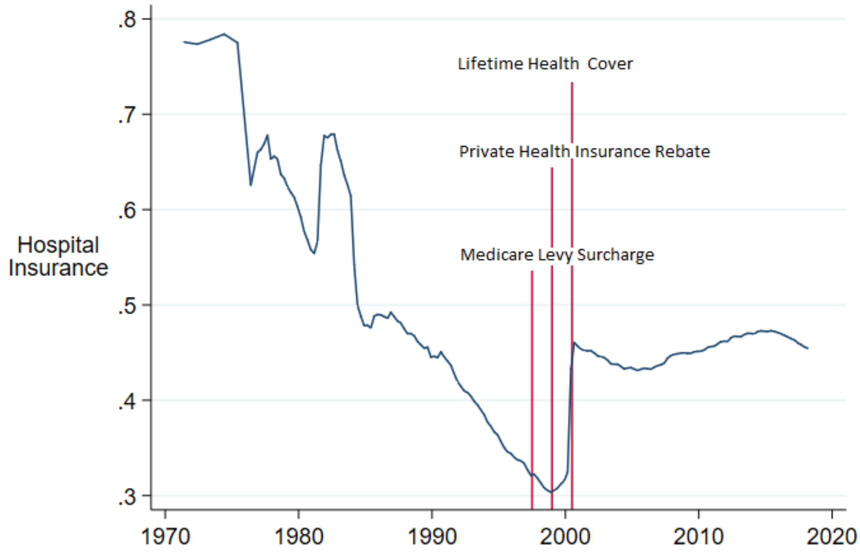
Figure 1 Australian Private Health Insurance Coverage

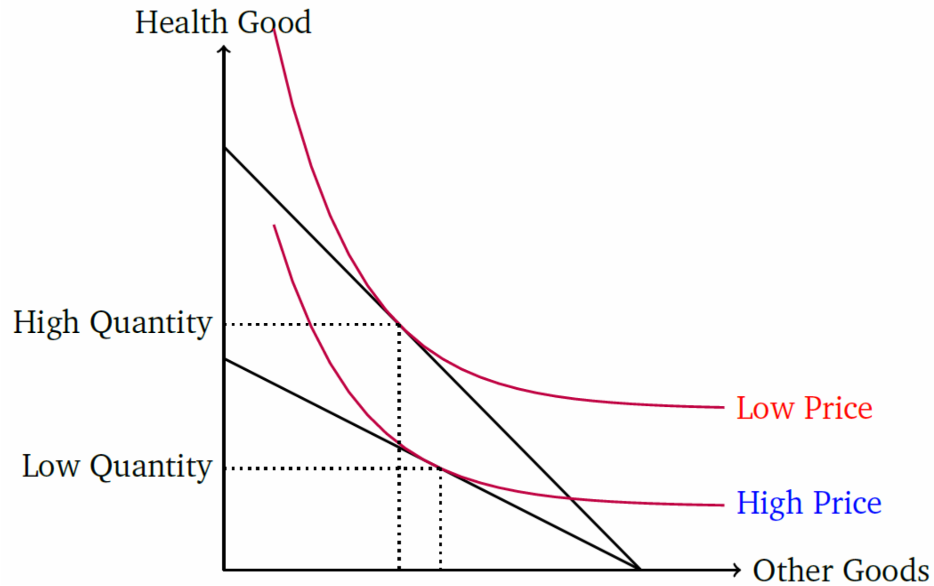


Notes: The figure displays Australian private health insurance (hospital insurance) coverage over time. The percentage of individuals which are privately insured drastically decreased until the change of the millennium when the Australian government introduced three private health insurance policies, among others the Lifetime Health Cover.

Figure 2 Lifetime Health Cover – Policy Schedule

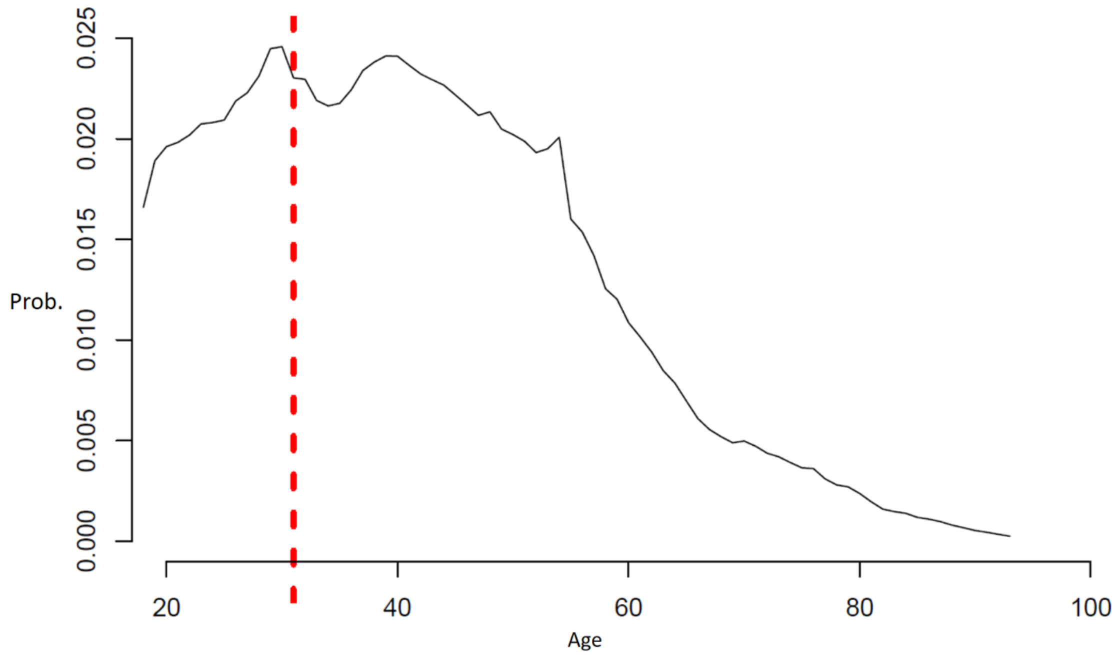
Notes: The exogenous policy leads to a price increase of a certain percentage (called Loading) on top of the premium costs based on the age of first sign-up of private health insurance purchase and a growth-rate difference from the left to the right hand side of the threshold of 2 percentage points.

Figure 3 Lifetime Health Cover – Price Change



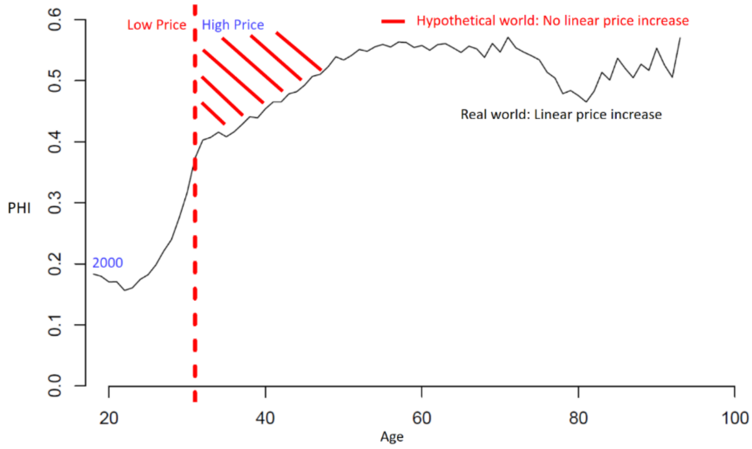
Notes: The exogenous Lifetime Health Cover policy leads to a price change on health for agents above the age of 31 and reduces health demand and increases the demand for residual consumption (i.e. the other goods).

Figure 4 Probability Density Distribution of Private Health Insurance over Age



Notes: The figure shows the likelihood of having private health insurance coverage as a probability density function for each age group in the year 2000, i.e. at the time of the introduction of the policy.

Figure 5 Private Health Insurance Coverage at Time of the Policy Introduction



Notes: The figure shows mean private health insurance coverage for each age group in the year 2000, i.e. at the time of the introduction of the policy. In a hypothetical scenario without the linear price increase schedule, private health insurance growth would be higher than in the current scenario where private health insurance is suppressed by schedule that yearly increases the price of private health insurance. The growth rate difference of the left and right hand side is between 2 and 4 pp.

Table 1 Descriptive Statistics

	1999-2012			2000			2000, H=6		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Running Variable									
Age	42	16	17,246,604	41	16	1,095,225	30	2.8	243,298
Characteristics									
𝟙(Male)	0.52	0.50	17,246,604	0.53	0.50	1,095,225	0.54	0.50	243,298
𝟙(Children)	0.94	0.24	17,246,604	0.98	0.14	1,095,225	0.98	0.14	243,298
𝟙(Partner)	0.99	0.11	17,246,604	0.99	0.10	1,095,225	0.98	0.13	243,298
𝟙(Self-Employed)	0.09	0.29	17,246,604	0.08	0.27	1,095,225	0.09	0.28	243,298
𝟙(Resident)	0.99	0.08	17,246,604	0.99	0.08	1,095,225	0.99	0.08	243,298
Remoteness Index	0.42	0.75	17,083,568	0.43	0.76	1,088,860	0.39	0.76	241,927
𝟙(Occupation 1)	0.00	0.04	13,047,808	0.00	0.00	810,380	0.00	0.00	195,785
𝟙(Occupation 2)	0.11	0.31	13,047,808	0.11	0.31	810,380	0.11	0.31	195,785
𝟙(Occupation 3)	0.19	0.39	13,047,808	0.14	0.35	810,380	0.17	0.38	195,785
𝟙(Occupation 4)	0.09	0.29	13,047,808	0.06	0.24	810,380	0.07	0.25	195,785
𝟙(Occupation 5)	0.10	0.30	13,047,808	0.10	0.31	810,380	0.12	0.33	195,785
𝟙(Occupation 6)	0.10	0.30	13,047,808	0.13	0.34	810,380	0.14	0.34	195,785
𝟙(Occupation 7)	0.13	0.34	13,047,808	0.13	0.34	810,380	0.14	0.35	195,785
𝟙(Occupation 8)	0.06	0.24	13,047,808	0.04	0.21	810,380	0.05	0.21	195,785
𝟙(Occupation 9)	0.11	0.31	13,047,808	0.13	0.33	810,380	0.13	0.34	195,785
𝟙(Occupation 10)									
Outcomes									
𝟙(PHI)	0.44	0.50	17,246,604	0.41	0.49	1,095,225	0.33	0.47	243,298
Medical Expenses	30	281	17,246,604	16	188	1,095,225	7.9	125	243,298
𝟙(Mortality)	0.00	0.05	17,246,604	0.00	0.05	1,095,225	0.00	0.02	243,298
Gross Salary	32,651	45,373	17,246,604	25,031	30,162	1,095,225	30,440	26,454	243,298
Work Expenses	1,183	3,008	17,246,604	850	2,232	1,095,225	1,130	2,458	243,298
Student Debt Due	80	551	17,246,604	55	340	1,095,225	132	539	243,298

Note: H is the bandwidth of age. The remoteness index has values from 0 to 4.

Table 2 Smoothness of Covariates

	Coefficient	Standard Error	p-value	Mean at Kink	Standard Deviation
Characteristics					
𝟙(Male)	0.01	0.01	0.37	0.54	0.50
𝟙(Children)	0.00	0.00	0.36	0.98	0.14
𝟙(Partner)	-0.00	0.00	0.64	0.98	0.13
𝟙(Self-Employed)	-0.00	0.00	0.21	0.09	0.28
𝟙(Resident)	0.00	0.00	0.85	0.99	0.08
Remoteness Index	0.01	0.01	0.38	0.39	0.76
𝟙(Occupation 1)	0.00	0.00	1.00	0.00	0.00
𝟙(Occupation 2)	0.00	0.00	0.76	0.11	0.31
𝟙(Occupation 3)	0.01	0.01	0.02	0.17	0.38
𝟙(Occupation 4)	0.00	0.00	0.30	0.07	0.25
𝟙(Occupation 5)	0.00	0.00	0.57	0.12	0.33
𝟙(Occupation 6)	-0.01	0.00	0.02	0.14	0.34
𝟙(Occupation 7)	0.00	0.01	0.84	0.14	0.35
𝟙(Occupation 8)	0.00	0.00	0.84	0.05	0.21
𝟙(Occupation 9)	0.00	0.00	0.84	0.13	0.34
𝟙(Occupation 10)	0.00	0.00	0.68	0.08	0.27

Note: The bandwidth H=6. The remoteness index has values from 0 to 4.

Table 3 Policy-Induced Demand for Private Health Insurance

	$Age \in [25,36]$		$Age \in [24,37]$		$Age \in [23,38]$	
First Stage						
Beta			-0.020			
SE			(0.000)			
F			713,247			
Reduced Form						
OLS	0.021***	0.016***	0.029***	0.026***	0.031***	0.030***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)
Probit	0.026***	0.021***	0.034***	0.031***	0.036***	0.034***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)
Second Stage						
2SLS	-1.06***	-0.80***	-1.45***	-1.29***	-1.57***	-1.50***
	(0.21)	(0.23)	(0.16)	(0.18)	(0.13)	(0.14)
IV Probit	-3.38***	-2.70***	-4.54***	-4.11***	-4.85***	-4.63
	(0.60)	(0.68)	(0.47)	(0.54)	(0.38)	(0.44)
Controls		x		x		x
F	27.56	10.24	93.44	42.25	141.37	107.95
N	243,298	231,466	336,892	268,362	384,518	305,506

Note: In parenthesis are heteroskedastic standard-errors, generated via the delta method. All estimates are calculated for the year 2000, the year of the policy introduction. The first stage is the intent-to-treat loading schedule applied resulting in a first stage of 0.020*** with an F-value of 713,247 for H=6; A polynomial of degree P=2 was used for the running variable age.

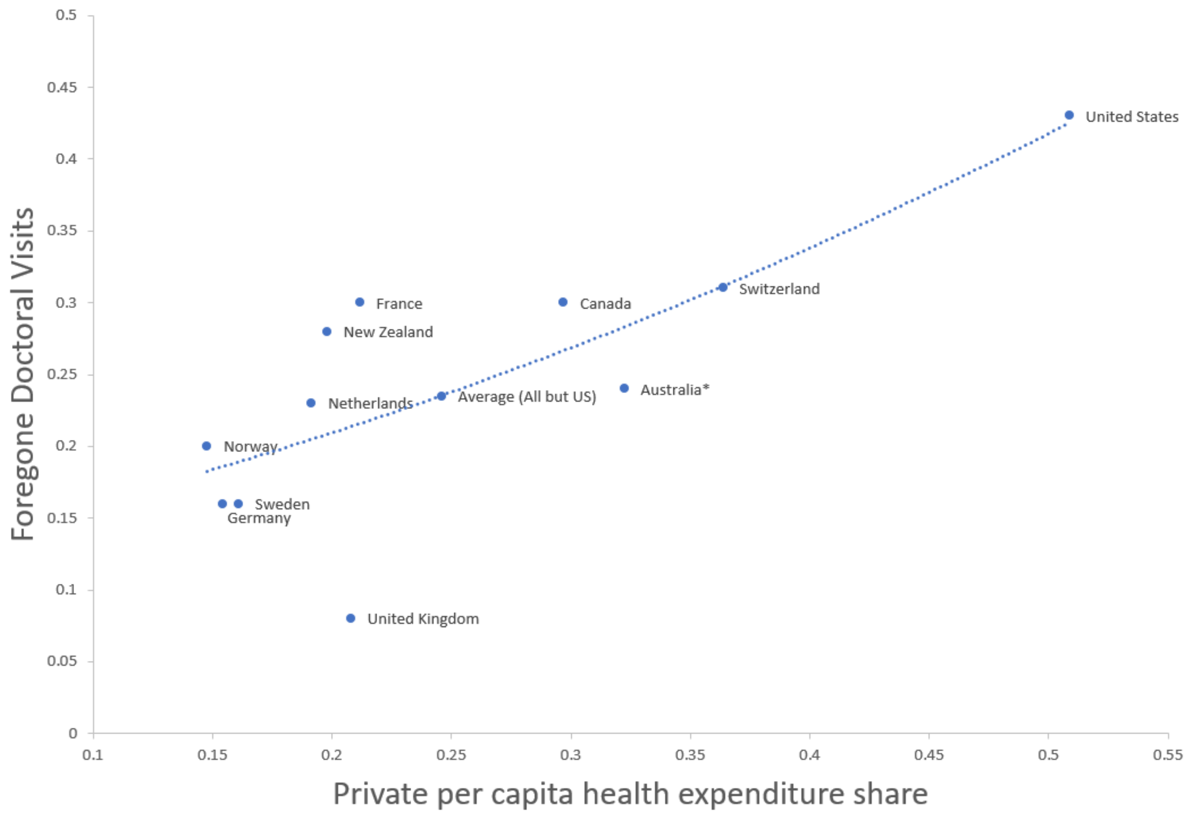
Table 4 From Correlation to Causality – Health, Labor, and Budget Considerations

	Medical Expenses	Mortality	Gross Salary	Work Expenses	Student Debt Due
OLS					
Coeff.	38.45***	-0.00***	23,175.35***	570.72***	4.90***
(SE)	(0.142)	(0.000)	(56.427)	(4.061)	(0.582)
Baseline	14.15	0.00	32,778.34	1,353.56	82.92
(%)	170%	-49.23%	170%	142%	4%
Reduced Form					
Coeff.	-0.44	0.00	-1,084.76***	10.69	8.90***
(SE)	(0.66)	(0.00)	(139.62)	(9.23)	(1.42)
Baseline	28.01	0.00	43,149.49	1,631.71	76.32
(%)	-2%	18%	-3%	1%	12%

Note: In parenthesis are heteroskedastic standard-errors, generated via the delta method. All estimates are calculated for the years 2000-2012. A polynomial of degree P=2 was used for the running variable age based on the year 2000 and a bandwidth H=6. The mortality coefficients are very small (low incidence), percentage changes are based on mean comparisons of those with and without private health insurance using the fourth digit after the coma (not shown).

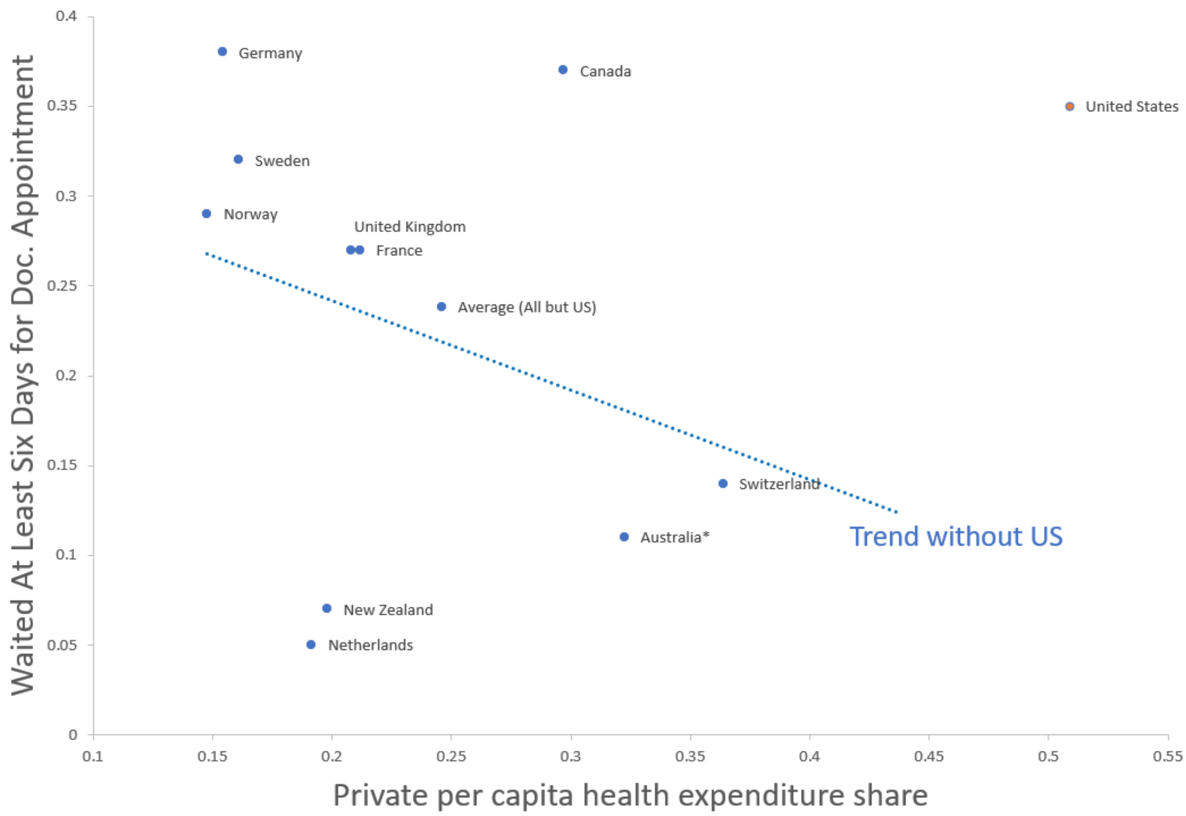
APPENDIX

Figure A1 Foregone Doctoral Visits and Private Provision of Health Care



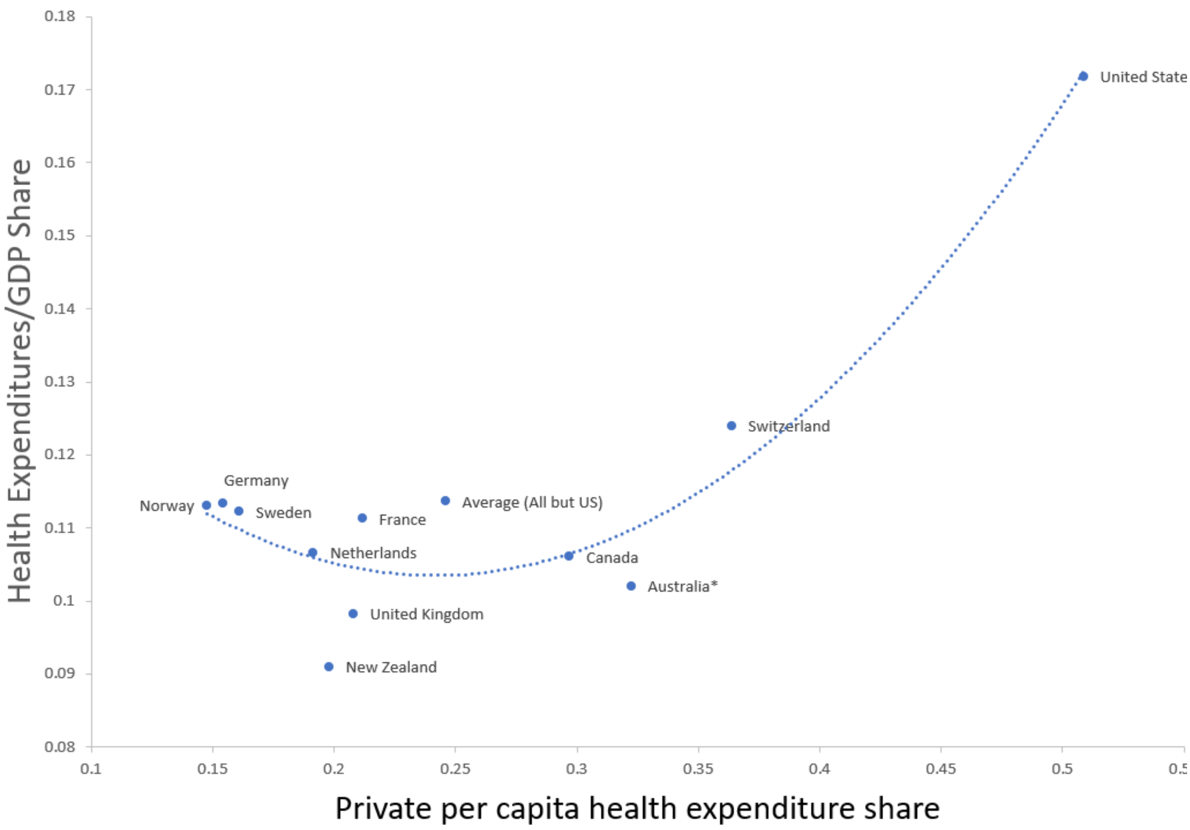
Notes: All countries aside from the United States have systems of universal health care. Overall foregone doctoral visits increase with the share of private health expenditure. Australia has a share of foregone doctoral visits that is below the level that is expected given private expenditures. Source: OECD, WHO, The Commonwealth Fund, 2016.

Figure A2 Wait Time for Doctoral Appointments and Private Provision of Health Care



Notes: Wait-times are generally higher with lower private provision of health goods but this trend reverses when private expenditures are too high, as in the case for the United States. Australia has lower wait-times than expected given its share of private expenditures. Source: OECD, WHO, The Commonwealth Fund, 2016.

Figure A3 Health Expenditures and Private Provision of Health Care

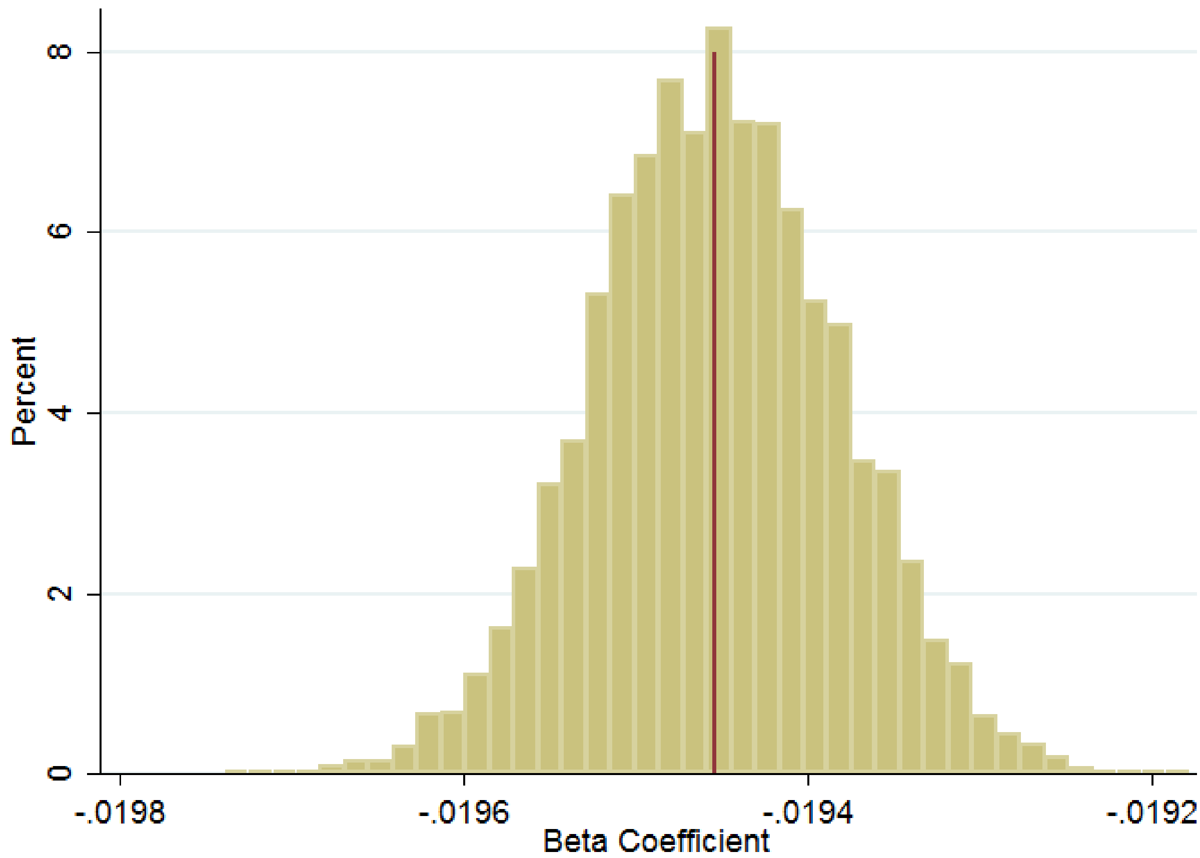


Notes: Health expenditures are relatively high for the only developed nation without universal health care, i.e. the United States. There seems to be an optimal balance between private and public provision of health goods. Australia performs better than predicted. Source: OECD, WHO, The Commonwealth Fund, 2016.

Figure A4 Australian Birth Rates over Time

Notes: This figure shows an increasing trend of official birth registered from 1901 to 2017 in Australia. The peak in births around 1970 coincides with the peak visible in the frequency distribution of the Australian Taxation Office. Source: Australian Bureau of Statistics, 2016.

Figure A5 Monte Carlo Simulation of Private Health Insurance Beta Coefficients



Notes: This figure displays 10,000 coefficients from jack-knife Monte Carlo simulation where 1% of individuals below the age of 30 are dropped for each run. The coefficient obtained without the simulation is identical to the average coefficient of the distribution which implies that the minor peak in the frequency distribution does not create any association issue for the treatment effects.