THE UNIVERSITY OF CHICAGO

THE IMPACT OF PUBLIC HEALTHCARE PROGRAM ON HOSPITAL HOSPITALITY: EVIDENCE FROM INDONESIA HEALTHCARE PROGRAM

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE DIVISION OF THE SOCIAL SCIENCES

IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

KENNETH C. GRIFFIN DEPARTMENT OF ECONOMICS

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CHICAGO, ILLINOIS

JUNE 2018

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Acknowledgments

I am indebted to my advisors, Ali Hortacsu, Pietro Tebaldi, and Rena Conti for their patience, support, and guidance. I also want to thank Kathryn Dominguez for giving me the experience and guidance I needed to enter the PhD program in economics.

I thank my parents, Kee Chai and Siew Kwee for their love, care and support throughout my life. Without them, I would not be here today.

I thank my dear friend and fellow classmate, Howard Riady for his notes in the first year and for securing the data for my research.

I thank my girlfriend, Mint for helping me to get through the toughest time in my life.

Lastly, I would like to thank the University of Chicago Department of Economics for giving me the chance and financial support to grow in such an outstanding scholarly environment.

Abstract

Hospitals worldwide are increasingly competing for patients by providing hotel-like services. This focus on hospital accommodations increases healthcare expenditures, with inconclusive benefits for real health outcomes. To examine how public health insurance expansion affects both welfare and the cost-effectiveness of healthcare delivery related to hospital accommodations, we perform a case study on selection in terms of tastes, prices, and health benefits of hospital accommodations using a natural experiment of two hospitals in Indonesia, one providing high-quality, hotel-like services and the other utilitarian services. We use an implementation of a universal healthcare insurance program in Indonesia that has expanded health insurance coverage but limits patients to lower-quality hospital accommodations. We find that on the intensive margin, patients who continue visiting the high-quality hospital have higher tastes for accommodations. Due to the imperfect-competition market structure, high-quality hospitals can raise prices and price discriminate better against these patients. On the extensive margin, some patients switch from the high-quality to utilitarian hospitals, lowering expenses on hospital accommodations. Hence, we conclude that patient tastes for hospital accommodations have introduced income redistribution in addition to that of the standard taxation mechanism. We also find that conditional on the high quality hospital, spending on amenities leads to only a minimal improvement in health outcomes, and expenditures on amenities are reduced by 7.27%. Thus, in our case study, public health insurance expansion has improved the cost effectiveness of healthcare delivery related to hospital accommodations. These results warrant future research on hospital amenities with more comprehensive data to establish broader policy consequences.

Chapter 1

The Impact of Public Healthcare Program on Hospital Hospitality: Evidence from Indonesia Healthcare Program

1.1 Introduction

Many studies have analyzed how expanding public health insurance programs would affect the welfare of the parties involved and the cost effectiveness of delivering healthcare. When examining the welfare of the parties involved and the cost effectiveness of delivering healthcare, these studies generally perform analyses on common aspects of healthcare, such as drugs and physician-recommended treatments, and investments in new healthcare-related technologies. However, these studies overlook healthcare accommodations when performing analyses. The reasons these studies overlook healthcare accommodation are: (1) historically, costs of accommodations are minimum fixed costs for healthcare delivery, and thus public policies have little impact on it; and (2) the costs of healthcare accommodations are buried with other healthcare administrative costs under the miscellaneous healthcare-service-costs category, making accommodation costs difficult to measure. Because hospitals incur costs by providing hotel-like services, and patients are likely to consider such accommodations when choosing a hospital, the expansion of public healthcare programs will inevitably impact both the welfare of the parties involved and the cost effectiveness of healthcare delivery related

to hospital accommodations. The impacts of public health insurance programs expansion through the hospital accommodations channel are likely to be significant because hospitals are increasingly focusing on the patient experience to compete for patients by providing hotel-like services. Such a focus raises the costs of hospital accommodations beyond what is necessary for hospitals to deliver healthcare, but does not necessarily improve health outcomes[1]. Simultaneously, patients value these amenities.Goldman and Romley (2008) show that patients choose a hospital based on amenities. To explore the impacts of expansion of public healthcare programs, we perform a case study based on two hospitals in Indonesia. The reasons we choose Indonesia are: (1) Indonesia recently expanded its public health insurance program; (2) private hospitals in Indonesia are increasingly focus on hospital accommodations; and (3) comprehensive administrative data of two hospitals supplied by the largest Indonesia healthcare provider enable us to perform our analysis.

Based on our case study, we show that expanding public health insurance programs in Indonesia has improved the cost effectiveness of healthcare delivery related to healthcare accommodations. In addition, we demonstrate that the welfare of patients who are poorer and have lower tastes for hospital accommodations has improved but the welfare of patients who are richer and have higher tastes for hospital accommodations has decreased. We also show that private firms that own hospitals could experience either an increase or decrease in revenue from hospital accommodations, depending on the distribution of patients, the market structure, and the types of hospitals they own.

To elaborate, the expansion of the public health insurance program in Indonesia has changed the distribution of patients who choose high-quality[2] hospitals and utilitarian hospitals. The impact of the change in the distribution of patients can be analyzed along two margins: the intensive margin and extensive margin. On the intensive margin, we find that patients who opt to pay privately and choose high-quality hospitals despite the availability of public healthcare programs are richer and have higher tastes for hospital accommodations. Due to the imperfect competition structure of the healthcare market, the high-quality hospitals can raise prices and also price discriminate better against these patients along the dimension of hospital accommodations. This reaction of high-quality hospitals decreases

1. The Patient Experience and Health Outcomes, NEJM

2. Note that throughout the paper, high-quality implies high-quality services but not care.

the cost effectiveness of healthcare delivery. At the same time, these patients experience a decrease in welfare because they not only have to pay taxes to fund the expansion of the government healthcare program, but also face higher accommodation prices. On the extensive margin, we find some patients switch to public healthcare programs and hence are constrained to lower-quality accommodation. This improves the cost effectiveness of healthcare delivery because the costs of hospital accommodations incurred by these patients at utilitarian hospitals are lower, and we find that spending on hospital accommodations has a minimal impact on health outcomes. Hence, the welfare of these patients improves.

Based on our case study, we conclude that the impact of the expansion of the government program on private firms depends on what types of hospital they own. Private firms that own only high-quality hospitals would experience a reduction in revenue from hospital accommodations even though they are able to raise the prices of hospital accommodations, because these private firms now face a reduction in patient visits and would have raised prices prior to the policy if doing so had been profitable to them. However, private firms that own both types of hospitals could capture the patients who switch to the utilitarian hospitals, hence possibly increasing their revenue from hospital accommodations.

Overall, we conclude that the observed redistribution of patient types across hospital types introduces additional income redistribution on top of the redistribution introduced by taxes funding the public health expansion. Absent the aspect of patient tastes for hospital accommodations, the public healthcare expansion program receives more funding in the form of higher taxes from wealthy patients than from poor patients. In the presence of patient tastes for hospital accommodation, patients who are richer and have higher tastes for hospital accommodations have to pay more for hospital accommodations, whereas patients who are poorer and have lower tastes switch from high-quality hospitals to utilitarian hospitals, and thus pay less for accommodations. This mechanism introduces additional redistribution of income from the rich to the poor. In addition, we observe no significant improvement in health outcomes from spending on healthcare accommodations, and see a reduction of 7.27% in expenditures on accommodations. Thus, we find public health insurance expansion has improved the cost effectiveness of healthcare delivery in our case study.

Findings from this paper inform the Indonesian government on the potential impacts of its healthcare expansion policies. Future research with comprehensive nationwide hospital administration data is warranted to confirm that our results hold on at the national level. Beyond the implications for the Indonesian government, this paper shows the impor-

tance of focusing on hospital accommodations to both researchers and policy makers because accommodations represent a substantial component of inpatient hospital bills, and policy designs could affect spending on hospital accommodations, and hence the cost effectiveness of healthcare delivery as well as the welfare of the affected parties.

To perform our research, we examine the Indonesian implementation of a universal healthcare insurance program, using the unique context of two private Indonesian hospitals. Indonesia, a lower-middle-income country with the fourth largest population in the world (249.9 million), implemented a universal healthcare reform in 2014 managed by Indonesia's Social Security Organizing Body (BPJS). This reform aims to reach 100% health insurance coverage by 2019. All Indonesian citizens and residents must register for the BPJS insurance by the end of 2018. BPJS is a single-payer national health insurance program that is financed mainly through social insurance and general tax revenues. When it comes to financing the BPJS insurance, Indonesians pay a flat rate of their earnings based on their occupation except for those who are self-employed and are very poor. Those who are self-employed pay a fix amount while those who are very poor do not pay. The difference between the amount of received from individuals and the amount reimbursed is paid by the Indonesian government through general tax revenues. All Indonesians receive the same coverage from BPJS. BPJS insurance covers essential care at zero copayment but limits patients to utilitarian facilities, which include all government hospitals and a limited number of private hospitals. Despite broad coverage and compulsory participation in BPJS insurance, out of pocket health expenditures still constituted 46.9% of total health expenditures in 2014, suggesting that there are some patients who are willing to pay for additional services in non-utilitarian facilities. For our experiment, we use the unique private hospital setting of two private hospitals of Indonesia's largest private healthcare provider. This provider, eager to capture potential increases in demand for healthcare due to BPJS insurance, constructed a hospital similar in quality to that of public hospitals in order to cater to BPJS-insured patients. The low-quality hospital is located adjacent to one of the hospital provider's preexisting hospitals, which represents a typical high-quality-service private hospital. Comprehensive data from the two branches of hospitals allowed us to implement our empirical strategy.

This paper relates to hospital-choice literature, which focuses on how patients choose hospitals. A variety of studies in this literature maintain the assumption that patients make choices between hospitals to maximize their utility instead of physicians choosing hospitals for the patients(Luft et al. (1987), Kessler and McClellan (2000), Kessler and McClellan (2002),

Gaynor and Vogt (2003), Ho (2006), Goldman and Romley (2008), Romley and Goldman (2011),Chandra et al. (2016)). Similar to studies in this literature, our study maintains the assumption that patients are the ones making the choices. However, instead of patients making choices between hospitals, our study focuses on how patients choose accommodation levels within a hospital and shows that patients do actively choose accommodation levels within a hospital. It is true that there are some studies in this literature that show physicians play a role in the how patients choose of hospitals (Burns and R. (1992), Ho and Pakes (2014)). However, in our paper, physicians are unlikely to play a role in how patients choose amenities because patients are choosing amenities within the same hospital. In addition, our results show that after adjusting for mortality risks and diagnosis types, physicians do not induce inpatients to stay longer in the hospital despite reduction in the number of patients.

In addition, the findings of our paper are consistent with some of the studies in the subset of the hospital-choice literature which look into the relationship of hospital amenities and hospital-choice (Goldman and Romley (2008), Romley and Goldman (2011)). Specifically, Goldman and Romley (2008) show that amenities play a larger role than clinical quality in pneumonia patients' choices of hospitals. Our paper demonstrates that within the same hospital, patients actively choose amenities quality. Additionally, Romley and Goldman (2011) show that the improving hospital amenities is more costly than improving health outcomes. Our paper shows that high quality amenities are expensive but have minimal impact on health outcomes. Beyond consistency with the findings of studies in the hospital amenities and hospital-choice literature, we show that patient tastes for hospital amenities could potentially affect welfare and cost-effectiveness of healthcare delivery when there's a change in government health insurance program.

The findings of our paper support the studies that show that patient experience is independent of health outcomes. In the patient experience and health outcomes literature, there are studies that show that better patient experiences are associated with better outcomes (Glickman et al. (2010),Boulding et al. (2011)). Conversely, there are also studies that show patient-experience measures at best have no relation to the quality of delivered care and at worst are associated with poorer patient outcomes (Rao et al. (2006),Lee et al. (2008)). Our paper not only shows that health amenities have minimal impact on health outcomes, but also shows that patients actively seek experiences on non-health related amenities, thus supporting studies that show that patient experience measures are not associated with patient outcomes.

Additionally, the findings of our paper is consistent with the findings in the luxury versus necessity health-demand literature (Yavuz et al. (2013), Khan and Mahumud (2015), Farag et al. (2012), Getzen (2000)). Studies in this literature show that in markets where both public and private hospitals exist, the income elasticity of healthcare demand in private hospitals is above one. We find that the income elasticity of amenities expenditure in the private high quality hospital is above one.

Finally, this paper deviates from the adverse selection in the health insurance market literature. Several studies in the adverse selection in the health insurance market literature use individuals' plan choices and risk realizations to identify how individuals self-select into insurance plans based on their risk preferences and risk expectations (Cardon and Hendel (2001), Bundorf et al. (2012), Einav et al. (2010), Handel et al. (2015)). These studies find that individuals with higher risks choose plans with better coverage. One of these studies shows introducing risk-adjustment premiums, essentially price discriminating individuals based on their risk ratings, can improve market efficiency (Handel et al. (2015)). In contrast, this paper studies how individuals self-select into various levels of hospital accommodations and find that individuals choose accommodations based on their income levels and elasticities. Due to individuals self-selecting into various accommodation levels, hospitals would be able to make additional revenue by providing various accommodation levels to segregate the patients.

We study how patients self-select within hospital accommodations for two reasons. First, the comprehensive hospital billing data broken down to the service items level and a definitive ranking of the hospital rooms quality allow us to analyze demand for hospital accommodations. In contrast, the data used in the adverse selection literature do not provide specific details on hospital accommodations. Second, analyzing the impacts of the BPJS insurance from the adverse selection perspective is inappropriate given the structure of the BPJS insurance. This is because all Indonesian are required to sign up for the insurance regardless of their health risk. In addition, there is a separation between claims and premiums because the Indonesian government subsidize any difference between claims and payments. Hence, the relationship between the health risks of the insureds and the insurance premiums analyzed in the adverse selection literature does not appear in the BPJS insurance.

1.2 Indonesian Health System

		Delivery	
		Public	Private
Financing	Public	Insurance and service delivery are handled by a single public agency (e.g. Norway, Sweden, Denmark).	The public pays for services through taxes or social security and are provided by private agencies (e.g. Canada, Japan, Germany, France, United Kingdom).
	Private	The cost is charged directly to users (through insurance or out of pocket payments), but services are provided in public facilities.	Healthcare is funded by private insurance or paid for directly by the patient, and is provided in private facilities.

Table 1.1: Public- and Private-Sector Involvement in Healthcare

Based on the framework that distinguishes between public and private roles in both the financing and provision of healthcare (Table 1.1) by Bloom (1998), Indonesia uses a mix of financing and delivery options from both the public and private sectors. Historically, the public sector has played the dominant role in the delivery of healthcare. The public sector provides healthcare through over 9,000 government-financed Puskemas (i.e., Health Community Centers) and 900 government hospitals. The Puskesmas provide primary care and vaccinations for the population at the subdistrict level[3]. However in recent years, the private sector has increased its role in providing care. According to a survey from the Ministry of Health of Indonesia, Indonesia had 2,228 hospitals as of January 1, 2014, of which 1,323 were privately owned and 905 publicly owned.

3. These statistics are based on a publication from the Ministry of Health of Indonesia, and can be located at http://sirs.buk.depkes.go.id/rsonline/report/report_by_catrs_2013.php

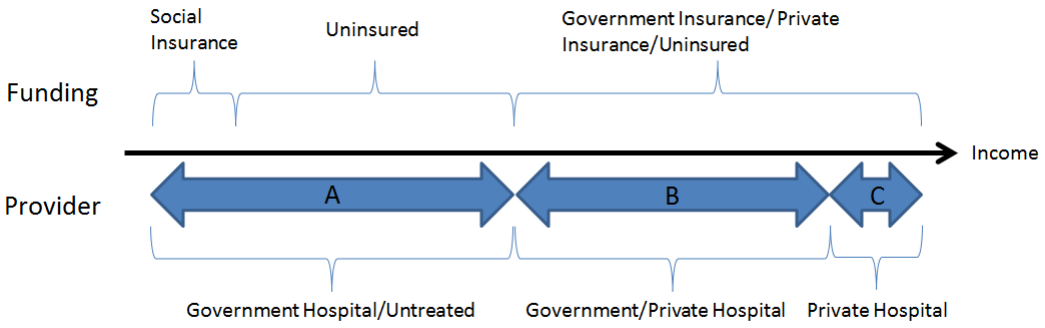


Figure 1.2.1: Funding and Provider Choice by Income Prior to Implementation of BPJS

Prior to the introduction of BPJS insurance, Indonesians financed their healthcare based on income and occupation. Before elaborating on how Indonesians financed their healthcare, note that the public healthcare system generally provided care at lower prices than the private healthcare system. Based on Figure 1.2.1, Indonesians with the lowest income were eligible for social insurance. These people visited government hospitals because only the public healthcare systems accepted social insurance. However, due to a lack of awareness of such insurance, some Indonesians didn't receive treatment. Indonesians with below-average but who were not poor enough to be eligible for social insurance paid out of pocket at public healthcare facilities or remained untreated. Indonesians with above-average income either purchased private insurance or paid out of pocket at private hospitals or government hospitals. People in this income group who worked for the government were usually government officials and hence had access to government insurance. Government insurance differs from social insurance because the former grants access to some private healthcare facilities. Wealthy Indonesians visit only private facilities.

Health-service use is generally low in Indonesia. Analysis of the 2010 SUSENAS survey indicates that about 14% of the population used outpatient care during the month prior to the survey. Approximately 60% of outpatient visits occurred at private facilities (typically clinics/midwives and nurses), and the remainder occurred at public facilities, mostly at the primary-care level. About 2.5% of the population used inpatient services during the year prior to the survey, of which nearly 60% used public hospitals and the rest private care. Public facilities continue to dominate inpatient care, except for the top three deciles, a larger proportion of which used private facilities for inpatient care.

Effective January 1, 2014, the new Mandatory Health Insurance Scheme (JKN), managed

by Badan Penyelenggara Jaminan Sosial (BPJS), Indonesia's Social Security Organizing Body, was introduced. Under JKN, all Indonesians receive coverage for a range of treatments through health services from public providers and from private organizations that opted to join the scheme. The purpose of BPJS is to improve the situation for citizens stuck in the middle of healthcare provision—too poor to afford health insurance but not poor enough for government help (The Guardian, "Indonesia's universal health scheme: one year one, what's the verdict"). The target of BPJS insurance are those uninsured in bracket A of Figure 1.2.1. The scheme is mandatory for all Indonesian citizens and residents, including those covered by other health insurance programs. Since the scheme is mandatory, the premiums for the scheme can be viewed as a form tax. Based on Table 1.2, the majority of Indonesians pay a percentage of their income to the program. Hence, Indonesians with higher incomes pay higher taxes to fund the scheme than those with lower incomes.

Although the scheme is mandatory, not all Indonesians registered for BPJS insurance at its launch. Based on Figure A.4.1, companies whose employees were registered with government healthcare plans previously (Askes and Jamsostek) and members of the Indonesian army, police, civil employees, and assistance recipients (PBI) were due to be registered at the launching of BPJS insurance and pay premiums. The deadline for small, medium, and large state-owned and private enterprises to register employees was January 1, 2015. Registration deadline for micro enterprises was January 1, 2016, and all Indonesian citizens and residents must register by January 1, 2019. Despite the deadlines of the registration for specific groups of Indonesians were set post launch, all Indonesians were able to register for the BPJS insurance before the launch of the program. By December 2013, 111 million of Indonesias had registered for the BPJS insurance[4]. The number of registrations increased to 140 million in January 2014[5]. Hence, although it is possible the impact of the BPJS insurance that we capture in our paper is smaller than the impact of BPJS insurance if every Indonesians have registered, the difference between the impact we capture and full impact is small because any Indonesians who intend to use the BPJS insurance were able to register for the insurance pre-launch. The deadline for the registrations are only binding for Indonesians who do not

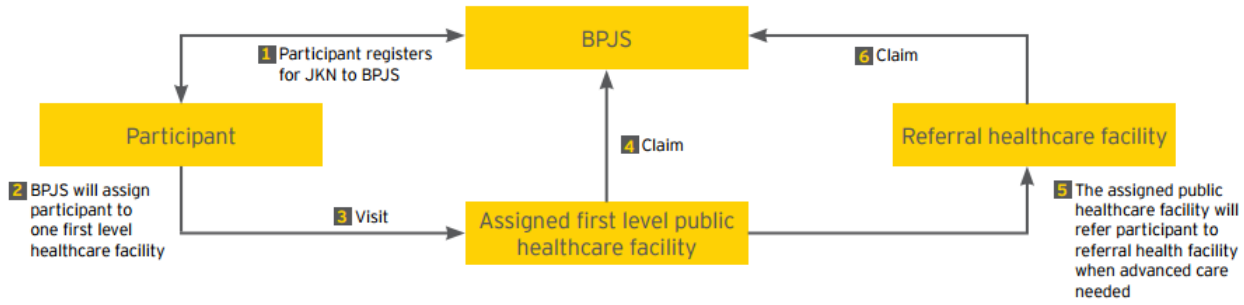
4. Retrieved from http://www.loc.gov/law/foreign-news/article/indonesia-universal-health-care-program-implemented/

5. Retrieved and translated from http://setkab.go.id/mulai-1-januari-2014-pemerintah-beri-jaminan-kesehatan-140-juta-peserta-bpjs/

intend to use the BPJS insurance. Only an additional 15 million Indonesians registered by December 2015 while the total number of employment in the agriculture and manufacturing industry alone is around 54.3 million[67].

Member	Monthly Premium
Assistance Recipient	Premium paid by government
Civil servant/ military/ police/ retirees	2% of salary paid by employee and 3.0% of salary paid by employer
Private business's employees and non-civil servant	1% of salary paid by employee and 4.0% of salary paid by employer.
Informal worker and non-employee	Minimum of Rp25,500 per person

Table 1.2: Contribution levels by member type



(Source: Picture retrieved from February 2015 Newsletter, Ernst & Young Indonesia)

Figure 1.2.2: BPJS Claim Procedures

Figure 1.2.2 demonstrates that the cumbersome BPJS claim procedures may deter Indonesians who have high opportunity costs of time to use BPJS. Members must choose a first-level public healthcare facility from BPJS, usually a public health center. Initial treatment must be done here unless an emergency. Secondary care is by referral from the first-level public healthcare facility, mostly to public hospitals. BPJS pays referral healthcare facilities using bundled payments. Based on the diagnosis of the BPJS-insured patient, referral healthcare facilities are required to provide the recommended treatment, and in return are paid fixed fees specified by the diagnosis. The referral process results in a delay of receiving

6. 155 million Indonesians registered by December 4th, 2015 according to https://www.wartaekonomi.co.id/read83150/desember-2015-peserta-bpjs-kesehatan-jadi-155-juta.html.

7. Retrieved from https://www.indonesia-investments.com/finance/macroeconomic-indicators/unemployment/item255?

secondary care using the BPJS insurance, instead of going to secondary healthcare facilities and paying out of pocket or with private insurance.

	Indonesia	United States
Total Population(millions)	249.9	318.9
Total Health Expenditure per Capita(USD)	101.68	8886.14
Insurance Coverage	• 36% uninsured, 52% public, 12% private	• 13% uninsured, 33% public, 54% private
Health Expenditure	• 37.8% public, 62.2% private	• 48.3% public, 51.7% private
Insurance Role and Coverage	• Out of pocket is the major form of healthcare financing in private healthcare facilities • Having government insurance does not imply usage	• Relies primarily on private insurers for healthcare financing

Table 1.3: Overview of healthcare in Indonesia compared to that of the United States in 2013

Table 1.3 presents two notable differences between United States and Indonesia in healthcare delivery. Based on Table 1.3, health expenditures per capita in United States is more than 80 times that of Indonesia. Hence, our results are likely smaller in magnitude in comparison to the United States. Second, the role of private insurance in Indonesia is not as dominant as that in the United States. The percentage of the population without health insurance remains high in Indonesia at 36% for 2013, in comparison to 14.2% in the United States for 2010. A majority of patients visiting private facilities typically paid out of pocket. Hence, we focus on initially uninsured patients in our study instead of insured patients because uninsured patients face the full price of healthcare. To further elaborate, insured

patients may overuse the hospital amenities because the cost of hospital amenities are partially or fully covered by the health insurance; this phenomenon is known as moral hazard. Incorporating this behavior of insured patients into our analysis would required information on patients' insurance plan but we do not have data on patients' insurance plans.

1.3 Data and Setting

Our analysis focuses on inpatient demand for hospital-room classes. We use hospital-room class because it provides a clear order of patients' demand for service quality, in comparison to other measures of quality, such as attentiveness of hospital staff and indoor hospitals, which are difficult to measure. To perform the analysis, we acquired administrative data from two hospital branches of the largest private hospital operator in Indonesia. Similarities between the two hospitals enabled us to perform the analysis. First, the hospitals are adjacent to one another in the city of Tangerang, which is part of the Banten Province. The hospitals are 16 miles from the capital of Indonesia, Jakarta, with a population of over 10 million. For confidentiality reasons, we call the two hospital branches Hospital A and Hospital B. Data from Hospital A and Hospital B are from January 2012 to December 2015, and May 2014 to December 2015, respectively. Both hospitals offer outpatient, inpatient, and 24-hour emergency care, same specialties, and have 524 beds in total. Occupancy of the beds in the hospitals fluctuates between 70% and 90%. Although both hospitals are private and for-profit and are managed by the same hospital group, Hospital A is different in terms of its patient base and service quality. Similar to typical private healthcare hospitals in Indonesia, Hospital A focuses on middle- to upper-class-income patients. To attract patients, the hospital offers high-quality services, for example private rooms with catering services for inpatients. Hospital B was constructed to cater to BPJS-insured patients. Due to the low reimbursements given by BPJS, Hospital B offers only minimum service quality, and offers beds separated only by curtains in a large communal hall for inpatients.

Data supplied by the hospitals allowed us to perform analysis, because they provided detailed information on patient visits. First, the data allowed us to identify two important subsamples of the population, which were pivotal to the study: (1) patients who chose to visit Hospital A despite the availability of BPJS insurance, and (2) patients who switched from paying out of pocket at Hospital A to paying using BPJS insurance at Hospital B after introduction of BPJS insurance. The data allow identification because they contained the

same identification numbers for patients between the two hospital, and information on how patients paid their medical bills. The data also provided all necessary information on the variable of interest—patient demand for hospital rooms. The data included the types of rooms patients demanded, how many days patients stayed in the rooms, and the amounts patients or their insurers paid for the rooms. The data also included information on patients' characteristics, which allowed estimation of a demand system based on those characteristics. The data included patient diagnoses, doctors involved, the specializations of those doctors, and patient demographics. This information on patients was vital to determining a demand system for hospital-room classes.

To acquire information on patient income, which was unavailable in the hospital administration data, we supplemented the data using the Indonesia - National Socioeconomic Survey (SUSENAS). The primary SUSENAS datasets used were the Indonesian National Socioeconomic Survey from March 2013 and the Indonesian National Socioeconomic Survey from March 2015 for provinces DKI Jakarta and Tangerang. The datasets provided information on income distributions and hospital visits by households, broken down into visit types (i.e., outpatient vs. inpatient), and hospital ownership (i.e., government vs. private). Using the SUSENAS data, we constructed a distribution of household income based on the 504 districts in which the households were located, the type of hospitals the households visited and whether the visit is before or after the policy. We then matched those data with hospital administrative data by district, type of hospital and whether the visit is before or after the policy.

1.4 Descriptive Statistics and Preliminary Regression

1.4.1 Patient-Related Statistics

	Pre-2014	Post-2014	
	Hospital A	Hospital A	Hospital B
Uninsured	7,117.5(47.9%)	4,305.5(37.1%)	585(10.3%)
Private Insurance	5,388(36.3%)	5,418.5 (46.7%)	10.2(0.2%)
Private Employer Sponsored	2,198.5(14.8%)	1,860.5 (16%)	189(3.3%)
Government Sponsored	97(0.06%)	0	0
BPJS	0	12.5 (0.1%)	4890.6 (86.18%)
Total	14, 801	11,597	5,674.8

Table 1.4: Distribution of Annual Inpatient Visits by Hospital and Payment Type

Our unit of analysis is inpatient visit. As shown in Table 1.4, the number of annual inpatient visits across all payment types in Hospital A decreased by 10.6% after implementation of the BPJS insurance. This finding suggests a substantial number of patients who initially chose Hospital A and then switched to the lower-quality hospital to pay using BPJS insurance instead. However, not all switches were voluntary. After implementation of BPJS insurance, government-insured patients at Hospital A stopped visiting that hospital because BPJS insurance consolidated all previous government insurance types, including government insurance provided to government employees. Focusing on the distribution of patient visits within hospitals, Table 1.4 shows that the a substantial proportion of patients who visited Hospital A before and after the policy were uninsured, and the majority of patients who visited Hospital B were BPJS-insured. Note the small number of BPJS patient visits at Hospital A. These visits occurred only in rare circumstances, such as when a patient needed emergency treatment and was sent from Hospital B to Hospital A based on a physician's discretion because of the facility constraints of Hospital B.

Charlson Index	Pre-2014	Post-2014	
	Hospital A	Hospital A	Hospital B
0	11,562.5(78.12%)	8,999.5(77.6%)	3384(59.63%)
1	1637.5(11.06%)	1,272.5(10.97%)	691.2(12.18%)
2	921.5(6.23%)	758(6.53%)	1135.8(20.01%)
3	308(2.08%)	276.5(2.38%)	195(3.44%)
>3	371.5(2.51%)	299.5(2.58%)	268.8(4.74%)
Total	14, 801	11,597	5,674.8

Table 1.5: Distribution of Yearly Inpatient Visits by Hospital and Charlson Index

We then look at inpatient severity before and after the BPJS policy. To measure severity, we use the Charlson index, which is a weighted sum of indicators for the presence of certain conditions, where weights reflect relative increases in one-year mortality risk for a person; the higher the index, the higher a person's mortality risk. To calculate the index, we used ICD-10 diagnosis codes from patients' diagnosis histories to identify the presence of 19 conditions, and then applied the weights described in Charlson et al. (1987). As shown in Table 1.5, after implementation of BPJS insurance, inpatients visiting Hospital A had, on average, greater Charlson severity index. The severity index increase was from a decrease in patients with a low-severity index($\leq$1) and an increase in patients with high severity ($>$ 1). In addition, the severity of inpatients visiting Hospital B are more concentrated towards higher

severity compared to that of Hospital A. This may be due to gatekeeping process of the BPJS insurance at the first level public facilities.

1.4.2 Room-Related Statistics

Hospital-room expenditures represent a significant portion of inpatient hospital bills. On average, they account for 37% of a hospital room's total cost.

Types of Room	Patients	TV	Dining Table/Area	Toilets	Design
Class 1	6	1	0	1	Plain
Class 2	2	1	0	1	Plain
Class 3	2	1	0	1	Plain
Class 4	2	2	0	1	Plain
Class 5	1	1	0	1	Fancy
Class 6	1	1	0	1	Fancy
Class 7	1	1	1	1	Fancy
Class 8	1	1	1	1	Fancy
Class 9	1	2	1	2	Fancy

Table 1.6: Room Characteristics According to Room Classes

To understand how patients choose a room class, we examine how hospital-room characteristics differ across various classes. Table 1.6 shows room characteristics by room classes. Two characteristics that correlate perfectly are whether patients are sharing a room with other patients and room design. For room classes 1 through 4, patients share rooms, and classes 5 and above are single rooms. Classes 1 through 4 have plain designs, and classes 5 and above have fancy designs[8].

Within room classes that have multiple patients and plain designs, class 1 differs from the rest in terms of the number of patients. Room class 1 houses up to six patients, and classes 2 through 4 house up to two patients. Class 4 differs from the rest in terms of TV-sharing. Room class 4 has two TVs for two patients, and classes 3 and below have one TV. Within room classes that have one patient and fancy designs, we divide the classes into two subgroups: classes 5 and 6 in one and 7 through 9 in another. Classes 7 through 9 have dining areas with tables.

8. The Appendix shows examples of plain and fancy designs.

Types of Room	Pre-2014		Post-2014		% Increase
	IDR	USD	IDR	USD	
Class 1	130,000	9.73	170,000	12.72	30.8%
Class 2	350,000	26.21	375,000	28.08	7.1%
Class 3	450,000	33.70	450,000	33.70	0%
Class 4	575,000	43.06	575,000	43.06	0%
Class 5	1,150,000	86.11	1,180,000	88.36	2.6%
Class 6	1,400,000	104.83	1,500,000	112.32	7.1%
Class 7	1,750,000	131.04	1,850,000	138.52	5.7%
Class 8	2,000,000	149.76	2,100,000	157.24	5%
Class 9	3,000,000	224.63	3,000,000	224.63	0%

Table 1.7: Room and rates in Hospital A. For comparison of the amount, the average monthly salary in Indonesia is around USD 283

Among room classes, rates per day rise significantly whenever the number of patients in each room changes. Table 1.7 shows that when a patient switches from a six-person (Class 1) to a two-person (Class 2) room, or switches from a two-person room to a single room, the price per night increases at least one-fold. Table 1.7 shows an increase in room rates after implementation of the policy, the largest of which was for Class 1 (30.8%). The remainder of the rates increased less than 8%.

	Dependent variable:	
	$I\{Died\}$	$I\{Readmit\}$
	(1)	(2)
PricePerDay	0.00001	-0.0004^{**}
	(0.00005)	(0.0002)
Charlindex	0.016^{***}	-0.003
	(0.001)	(0.004)
Age	0.765^{***}	-2.093^{***}
	(0.121)	(0.419)
Age^2	0.965^{***}	1.321^{***}
	(0.108)	(0.395)
Gender	0.002	-0.008
	(0.002)	(0.007)
Income	-0.0001	-0.0001
	(0.00005)	(0.0002)
Constant	0.007^{**}	0.220^{***}
	(0.003)	(0.009)
Observations	14,063	13,917
Log Likelihood	12,516.150	$-6{,}666.491$
Akaike Inf. Crit.	$-25{,}014.290$	13,350.980
Bayesian Inf. Crit.	$-24{,}946.330$	13,418.850
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 1.8: Spending on amenities appears to have a minimal benefit on health outcomes.

For the rest of our analysis, we focus on patients who pay out of pocket in the sample period. We focus on this group of patients because this group of patients face the full price of hospital amenities. To further elaborate, patients with health insurance may overuse the hospital amenities because the cost of hospital amenities are partially or fully covered by the health insurance; this phenomenon is known as moral hazard. We do not have sufficient data on patients' health insurance plans to control for this phenomenon. On the other hand, patients who pay out of pocket face the full prices, and hence allow for straightforward analysis through the hospital amenities prices. To assess whether patients benefit from paying more for hospital rooms in Hospital A, we examine two potential health outcomes: whether patients died and, conditional on not surviving, whether patients are readmitted.

Two logistic models are fitted as follows:

$$I\{Died\} = \begin{cases} 1 & if\ \gamma_0 + \gamma_1 PricePerDay + \gamma_2 CharlsonIndex + \gamma_3 Age + \gamma_4 Age^2 \\ & \quad + \gamma_6 Gender + \epsilon \\ 0 & otherwise; \end{cases}$$

$$I\{Readmission\ \&\ Survive\} = \begin{cases} 1 & if\ \gamma_0 + \gamma_1 PricePerDay + \gamma_2 CharlsonIndex + \gamma_3 Age \\ & \quad + \gamma_4 Age^2 + \gamma_6 Gender + \epsilon \\ 0 & otherwise; \end{cases}$$

Table 1.8 shows that spending on hospital rooms had a minimal impact on health outcomes. Although the coefficient on PricePerDay is negative and significant when we fit the readmission model, the magnitude of the coefficient is very small. When we use death as an independent variable, the coefficient on PricePerDay is positive but non-significant. Hence, the price paid for a hospital room has a minimal effect on health outcomes.

We also examine how patients who continued to pay out of pocket at Hospital A despite the availability of BPJS insurance chose rooms in comparison to those who switched from Hospital A to Hospital B. Figure 1.4.1 shows that the distribution of rooms patients chose shifted to the after the introduction of BPJS insurance. Patients who visited Hospital A were more likely to choose higher room classes after the policy. Based on this observation, we infer that patients who continued to pay out of pocket and visited Hospital A preferred higher-class rooms in comparison to those who switched from Hospital A after the policy.

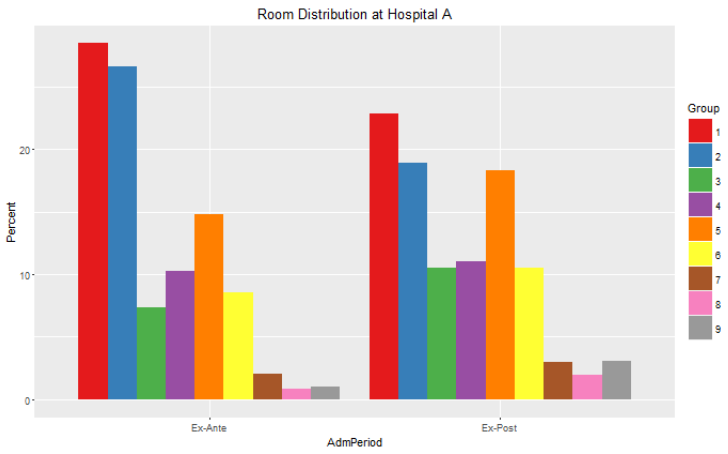


Figure 1.4.1: Room-Usage Distribution at Hospital A Pre and Post-Policy

Finally, we explored the preliminary relationship between amenities expenditure and patient characteristics by fitting the following linear model:

$$\begin{aligned} log(AmenitiesExpenditure) =& \gamma_0 + \gamma_1 Age + \gamma_2 Age^2 + \gamma_3 Gender + \gamma_4 log(Income) + \\ & \gamma_5 Post2014 + \gamma_6 log(Income) \times Post2014 + \epsilon. \end{aligned}$$

Patients in Hospital A appeared to have income elasticity above 1 for spending on amenities based on Table 1.9. This finding demonstrates that these patients treat hospital amenities as luxury goods. Fitting the linear model without the interaction between $Income$ and $Post2014$, the coefficient on $Post2014$ appears to be positive and significant; that is, patients who are in Hospital A post policy are more likely to spend more on hospital amenities on average. Fitting the model with the interaction between $Income$ and $Post2014$, the coefficient on the interaction term appears to be positive. This finding suggests that patients who visit Hospital A post policy are more income elastic and hence have higher tastes for hospital amenities. However, the coefficient on $Post2014$ becomes negative. Further exploration of the term $\beta_{inc} log(Income) + \beta_{post2014} Post2014 + \beta_{post2014,income} Post2014 \times log(Income)$ shows that patients at almost all levels of income choose to spend more on hospital amenities (Figure 1.4.2).

	Dependent variable:	
	$log(AmenitiesExpenditure)$	
	(1)	(2)
Age	-0.005^{***}	-0.005^{***}
	(0.001)	(0.001)
Age^2	0.0001^{***}	0.0001^{***}
	(0.00001)	(0.00001)
Gender	-0.061^{***}	-0.061^{***}
	(0.012)	(0.012)
Post2014	0.142^{***}	-0.910^{***}
	(0.011)	(0.132)
log(Income)	1.490^{***}	1.412^{***}
	(0.012)	(0.016)
Post2014×log(Income)		0.196^{***}
		(0.025)
Constant	6.498^{***}	6.916^{***}
	(0.070)	(0.087)
Observations	14,063	14,063
R^2	0.551	0.553
Adjusted R^2	0.551	0.553
Residual Std. Error	0.664 (df = 14057)	0.662 (df = 14056)
F Statistic	$3{,}449.471^{***}$ (df = 5; 14057)	$2{,}898.013^{***}$ (df = 6; 14056)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 1.9: Room-Expenditure Regression

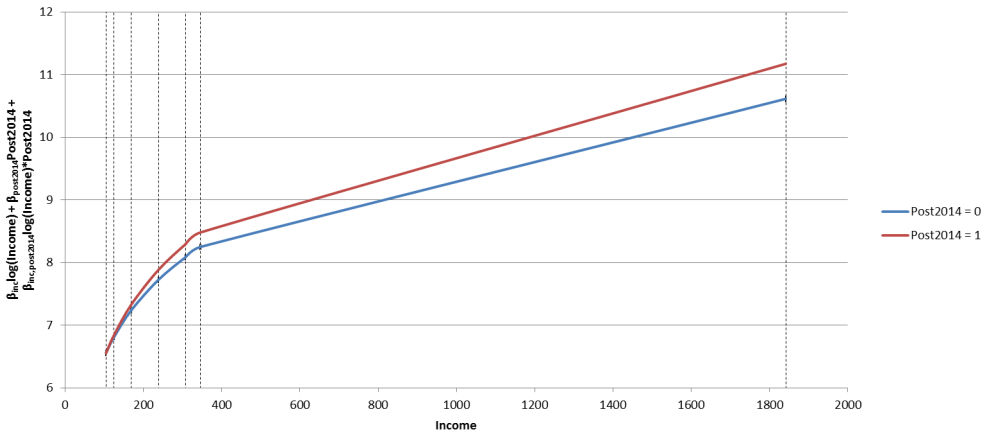


Figure 1.4.2: Line plot of $\beta_{inc}log(Income)+\beta_{post2014}Post2014+\beta_{post2014,income}Post2014\times log(Income)$ across income levels. Starting from the left, the dotted black lines show the min, 10th, 25th, 50th, 75th, 90th, and max income of patients visiting Hospital A.

1.5 Theoretical Model

In order to understand how government policy affects the effectiveness of healthcare delivery through hospital-accommodation channels, we constructed a theoretical model that considers all moving parts of how government policy changes the cost effectiveness of healthcare delivery through patient demand for healthcare and healthcare accommodations. We included only pure healthcare benefits, not the utility patients derive from using extraneous quality of hospital accommodation. Let vector g denote the eligibility and coverage of government policy. A higher g implies greater eligibility and coverage. Two types of patients exist, high income(H) and low income(L) patients, with N_H and N_L denoting their respective numbers. These patients must choose between two types of facilities, A and B, where A is high quality and B is low quality. Type L patients use facility B with probability $G(g)$, $G'(g) > 0$, or do not receive care with probability $1 - G(g)$. Type H patients use facility A with probability $1 - F(g)$ and facility B with probability $F(g)$, where $F'(g) > 0$. These features of the model are based on the Indonesian healthcare context, where poor people had limited access to healthcare prior to the program, and middle-class and wealthy patients chose either government or private facilities. Facility B offers health benefit b_B at price $p_B < b_B$, and facility A offers health benefit $b_B + \alpha(g)$ at price $p_A(g) = p_A^{amenities}(g) + p_A^{care}(g)$. This feature again is based on the Indonesian context, where low-quality public hospitals are cheaper than high-quality hospitals, and patients pay extra for better hospital accommodations. As

a function of g, the benefit received from healthcare delivery system $B(g)$ is

$$B(g) = N_L G(g) b_B + N_H F(g) b_B + N_H (1 - F(g))(b_B + \alpha(g)).$$

The benefits of the healthcare delivery system include the healthcare patient type L receives from using facility B, patient type H receives from facility B, and patient type H from facility A. The cost of healthcare is

$$C(g) = N_L G(g) p_B + N_H F(g) p_B + N_H (1 - F(g)) p_A(g).$$

The cost of healthcare delivery incorporates money paid to hospitals when patients visit those hospitals. We do not consider patients' payment methods to simplify the model interpretations. Taking the first-order condition with respect to g

$$\begin{aligned} B'(g) &= N_L G'(g) b_B + N_H F'(g) b_B - N_H F'(g)(b_B + \alpha(g)) + N_H (1 - F(g))(\alpha'(g)) \\ C'(g) &= N_L G'(g) p_B + N_H F'(g) p_B - N_H F'(g) p_A(g) + N_H (1 - F(g)) p_A^{'}(g). \end{aligned}$$

Taking $B'(g) - C'(g)$,

$$\begin{aligned} B'(g) - C'(g) &= N_L G'(g)(b_B - p_B) + N_H (1 - F(g))(\alpha'(g) - p_A^{'}(g)) \\ &\quad + N_H F'(g)(p_A(g) - p_B + \alpha(g)). \end{aligned}$$

Assume $p_A^{care}(g) = \alpha(g)$ and $p_A^{'care}(g) = \alpha'(g)$. Then

$$\underbrace{N_L G'(g)(b_B - p_B)}_{\text{Increase Utilization}} - \underbrace{N_H (1 - F'(g))(p_A^{'amenities}(g))}_{\text{Intensive Margin}} + \underbrace{N_H F'(g)(p_A^{amenities}(g) - p_B)}_{\text{Extensive Margin}}.$$

For an increase in g, the first term in the equation represents an increase in use among patients who previously did not have access to healthcare. The second term represents how much patients who continue to pay privately and choose high-quality would pay in terms of hospital accommodations due to change in prices for hospital accommodation. The final term represents the reduction in prices patients must pay for hospital accommodations

due to switching to low-quality hospitals. Because the increase in use is always positive, $N_H F'(g)(p_A^{amenities}(g) - p_B) - N_H(1 - F(g))(p_A^{'amenities}(g)) > 0$ implies $B'(g) - C'(g) > 0$; an increase in g improves the cost effectiveness of the healthcare delivery system if the extensive margin is larger than the intensive margin.

We further examine the possible interpretations of the sign on $p_A^{'amenities}(g)$ in a market equilibrium setting under the standard assumptions of a downward-sloping demand curve and an upward-sloping supply curve. Based on Table 1.10[9],when the sign of $p_A^{'amenities}(g)$ is positive, both the surplus of patient type H who did not switch and Hospital A would decrease. When the sign of $p_A^{'amenities}(g)$ is negative, the surplus of patient type H would increase but the surplus of Hospital A would decrease.

Sign of $p_A^{'amenities}(g)$	Possible Market Structure	Surplus of Patient Type H Who Did Not Switch	Surplus of Hospital A
Positive	The market is imperfectly competitive and patients who switch are likely to be those that have the least willingness to pay(least taste for hospital accommodations).	The surplus of patient type H who did not switch decreases because the patient now faces higher prices for amenities.	The surplus of Hospital A decreases because Hospital A would have increased its prices to maximize its profit before the policy expansion if the new higher prices are profit maximizing.
Negative	The market is perfectly competitive.	The surplus of patient type H increases because the patient now faces lower prices for amenities.	The surplus of Hospital A decreases because the hospital has fewer patients.
	The market is imperfectly competitive, but patients who switch are not the ones with the least willingness to pay.	The surplus of patient type H increases because the patient now faces lower prices for amenities.	The surplus of Hospital A decreases because the hospital has fewer patients.

Table 1.10: Implications of sign on $p_A^{'amenities}(g)$

1.6 Empirical Strategy

Our empirical strategy comprised of three steps. First, we estimate a patient's length of stay and room-choice models at Hospital A. From the room-choice model, we can acquire additional information on patients' income elasticities of substitution for hospital rooms. We then estimate the average change in expenditures on amenities for patients at Hospital A

9. The derivation of the results in this table can be found in Appendix A.2.

before and after implementation of BPJS insurance. For the last step, we used the estimate model from steps one and two to calculate the extensive and intensive margins of the theoretical model.

1.6.1 Patient Length-of-Stay and Room-Choice Model

In the patient length-of-stay model, doctors recommended a length of stay to patients who then followed the doctor's recommendations. Doctors' recommendations were based on patients' diagnoses, patients' characteristics, and introduction of BPJS insurance. To estimate the model, we fit a simple linear model:

$$\begin{aligned} ln(LengthStay) &= \alpha_1 CharlsonIndex + \alpha_2 Age + \alpha_3 Age^2 + \alpha_4 Gender + \alpha_5 Post2014 \\ &\quad + \alpha_6 CharlsonIndex \times Post2014 \\ &\quad + \alpha_7 Age \times Post2014 + \alpha_8 Age^2 \times Post2014 + \alpha_9 Gender \times Post2014 \\ &\quad + \sum_a \gamma_a DocSpec + \sum_a \gamma_a DocSpec \times Post2014 + \epsilon \end{aligned}$$

We used the variables $CharlsonIndex$ and $DocSpec$ to control for patients' diagnoses, and $Post2014$ for pre- and post-introduction of BPJS insurance. To estimate how patients chose hospital-room types, we used the random utility maximization (RUM) consistent nested logit model, which we chose from among other discrete-choice models because it complemented our empirical context. The nested logit model allows room characteristics to be entered into the model through coefficients on patient characteristics and room price. Since non-price characteristics of the rooms do not change across patients and time, we are unable to use the full set of room characteristics in a simple logit or probit discrete-choice model, because using the full set would result in complete identification of room choice. A nested logit model allows us to use room characteristics to form the tree structure of room choices. The RUM consistent nested logit model allows for disparate price elasticity of substitution across room groups. We expect patients to have the same elasticity of substitution for similar room types but different elasticities of substitution for very different room types. The nested logit model allowed the elasticity of substitution to be different across room-type groups, and hence solve the independence of irrelevant alternatives (IIA) problem present in some discrete-choice models. The RUM consistent nested logit model also allows for different income elasticities across groups of rooms. This feature of the model is particularly important to the current

analysis because by assessing how patient income elasticity varies across groups of rooms, we are able to disentangle patient tastes for room services across groups of rooms.

We divide rooms into M upper categories, each denominated by m. Each category contained B_m alternative room types, with a total of J types of rooms. In a random utility model (RUM) framework, by selecting alternative j in category M, decision maker i obtains utility

$$U_{imj} \quad = \quad V_{imj} + \epsilon_{imj} = x_{imj}\beta + z_i\gamma_m + \epsilon_{imj},$$

where V_{imj} is the deterministic part of utility and ϵ_{imj} is the random part. x_{imj} is the alternative-specific variables and z_i are individual i-specific variables. Errors ϵ_{imj} follow a generalized T1EV distribution that allows correlation of alternatives within nests of the tree structure. Let ρ_m denote the correlation in nest m, and define the dissimilarity parameter $\tau_m = \sqrt{1-\rho_m}$. The inclusive value for the mth nest corresponds to the expected value of the utility decision maker i obtains by consuming an alternative in nest m. We denote this value by IV_m:

$$IV_m \quad = \quad ln \sum_{j \in B_m} exp(V_k/\tau_m),$$

where B_m denotes the set of alternatives in nest m. Given the inclusive values, we show that the probability of the RUM that decision maker i chooses alternative j is

$$Pr_j \quad = \quad \frac{exp\{V_j/\tau(j)\}}{exp\{IV(j)\}} \frac{exp\{\tau(j)IV(j)\}}{\sum_m exp(\tau_m IV_m)}.$$

Using hospital-room characteristics of the number patients per room and the presence of dining table/area, the nests of the room choices considered are

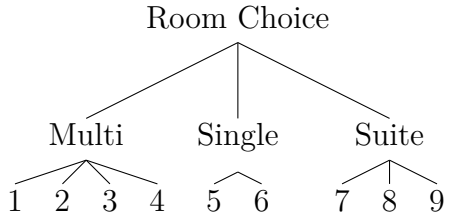


Figure 1.6.1: Nested Logit Tree 1

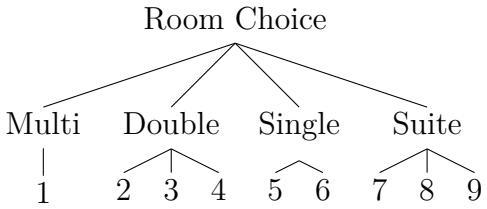


Figure 1.6.2: Nested Logit Tree 2

We estimate patient length-of-stay and room-choice models independently because we can reasonably assume independence of the errors of the two models, and allowing correlation between the errors terms is intractable. The independence assumption is reasonable because decision makers in the two models are different. Regarding length-of-stay, doctors make recommendations and patients follow them. In less than two cases per year were patients forced to leave a hospital because they were unable to pay. For the room-choice model, patients make their room choices, and the length-of-stay only comes in through the total price patients must pay for the rooms. Because doctors make decisions independent of a patients' tastes of room, the unobserved component of the length-of-stay model is unlikely to enter the room-choice model. To fit the demand settings patients face, we model length of stay with normal errors, and model room choice with nested logit errors. No straightforward method allows for correlation of errors between the two models.

Using the results from the nested logit model, we calculate the average income elasticity of substitution for the M upper categories before and after the introduction of the policy as follows

$$\eta_m = \begin{cases} -\frac{1}{N}\sum_{i\in N}\sum_{l\in M}\gamma_{l,inc}Pr_{il} & \text{if } m = base \\ \frac{1}{N}\sum_{i\in N}(\gamma_{l,inc} - (\sum_{l\in M}\gamma_{l,inc}Pr_{il})) & \text{if } m \neq base, \end{cases}$$

where Pr_{il} is the probability of individual i choosing upper class

$$\frac{1}{N}\sum \frac{dPr(C_1 = t)}{dz_i}\frac{z_i}{Pr(C_1 = t)} = \frac{1}{N}\sum z_i(\alpha_{ti} - (\sum_{k\in T}\alpha_k Pr(C_1 = k))).$$

The income elasiticities allow us to measure how patients substitute across the various room categories when the patients' income increases.

1.6.2 Change in Spending on Hospital Accommodation

We estimate the following specification for uninsured patient visits at Hospital A for the whole sample period:

$$AmExp_{ijt} = \beta_0 + \beta_1 Post2014_{ijt} + \epsilon_{it},$$

where

$$\begin{aligned} AmExp_{it} &= LengthStay_{ijt} \cdot Price(RoomClass_{ijt}) \\ Post2014_{ijt} &= \text{Indictor for post implementation of the BPJS policy} \\ \epsilon_{it} &= \text{i.i.d. normal error term.} \end{aligned}$$

The variable of interest is $Post2014_{ijt}$. Whether the sign of β_1 is positive or negative depends on the market structure and the distribution of patients who switch from Hospital A to Hospital B. We opted for a simple model because it is sufficient for the analysis.

1.6.3 Total Change in Spending on Hospital Accommodation

The change in spending for patients who continue to utilize Hospital A is calculated as

$$N_{Ip,A} \quad \hat{\beta_1}^{int},$$

where $N_{Ip,A}$ is the average number of uninsured inpatient visits at Hospital A in a year post implementation of the BPJS policy and $\hat{\beta_1}^{int}$ is the estimated coefficient on $Post2014_{ijt}$ from section 6.2.

For the patients who switched, we calculate $\hat{y_{ijt}}$ as the amount patients would have paid for hospital rooms at Hospital A if they had chosen Hospital A instead of Hospital B. Total change in spending on hospital accommodations for this group of patients is calculated as:

$$\sum \hat{y_{ijt}} - \sum PatientDays_{ijt} * RoomRate_B.$$

For a given patient i at visit t, $\hat{y_{ijt}}$ is calculated as the the price of the counterfactual room that patient i chooses multiply by the patient i's counterfactual length stay. To calculate

the room choice, we plug in patient i characteristics to the estimated discrete choice model, and set $Post2014 = 0$ and prices equal to pre-policy room prices. We use pre-policy room prices because Hospital A is unlikely to raise prices if not for the implementation of the policy. Similarly, to calculate the counterfactual length stay model, we plug $Post2014 = 0$ and calculate patient i length of stay based on patient i's characteristics and diagnosis.

Finally, the total change in spending on hospital accommodation is calculated as

$$Extensive\ Margin - Intensive\ Margin.$$

We re-weight the extensive margin with relative sizes between Hospitals A and B. To construct the confidence interval for the intensive, extensive, and total savings, we used a bootstrap procedure. For a given bootstrap, we perform a draw of 365 days with re-sampling. Based on those sampled dates, we construct a sample of individuals who continued to pay out of pocket and use Hospital A, and a sample of individuals who switched from Hospital A to Hospital B. We then calculate the intensive margin, extensive margin, and total savings for the sample. Using the distribution of bootstrap estimates, we construct the confidence intervals. We draw the sample from days because we believed patients arrived randomly at hospitals each day. The bootstrap procedure is used instead of a structural demand model between Hospital A and Hospital B because we have insufficient data of other quality measures and viable instrument for treatment prices, and the bootstrap procedure is sufficient for our analysis.

1.7 Results and Discussion

	Dependent variable:
	log(lengthstay)
Age	-0.004^{**}
	(0.001)
Age^2	0.0001^{***}
	(0.00001)
Gender	-0.035^{**}
	(0.016)
Charlindex	0.103^{***}
	(0.007)
Post2014	0.125
	(0.334)
Age×Post2014	0.001
	(0.002)
Age^2×Post2014	−0.00003
	(0.00002)
Gender×Post2014	0.021
	(0.022)
Charlindex×Post2014	−0.025
	(0.0158)
Constant	1.643^{***}
	(0.227)
Observations	14,063
R^2	0.154
Adjusted R^2	0.149
Residual Std. Error	0.592 (df = 13982)
F Statistic	31.724^{***} (df = 80; 13982)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 1.11: Summary of regression model for $ln(LengthStay)$. Omitted doctors fixed effects in reporting.

Table 1.11 shows results from estimating the patient length-of-stay model. After controlling for diagnosis types, the increase in severity measured by the Charlson index led to an increase in patients' lengths of stay. We expected this result because doctors are more likely to recommend longer hospital stays for patients with greater severity. The coefficient for Post2014 is non-significant, suggesting that the introduction of BPJS insurance had a minimal impact on physicians' choices of lengths of stay.

Table 1.13 shows similar estimates between the two tree structure of the RUM consistent nested logit models s. Columns (1) and (2) show results from using the tree structure presented in Figures 1.6.1 and 1.6.2, respectively. The signs and the significances of the coefficients are the same across the two models, though the magnitudes of the coefficients vary.

For the remainder of analyses, we focus on the RUM consistent logit model with the tree structure presented in Figure 1.6.2, because the model fit the data best. To accurately compare the two nested logit tree structures, we used the likelihood-ratio test. We first calculate the likelihood of the two models, shown in Table 1.12. Using those likelihoods, we construct the likelihood-ratio tests between the models, and find the model that fit the data best was the RUM-consistent model with the tree structure shown in Figure 1.6.2. Hence, we proceed with analyses using that model.

	Nested Logit Tree 1	Nested Logit Tree 2
Log-likelihood	-15506.9	-15026.2

Table 1.12: The log-likelihood of the models

Based on the results in column (2) of Table 1.13, variables $log(Income)$, $Post2014$, and $log(Income) \times Post2014$ not only summarize, but also provide interesting insights into patients' room choices before and after introduction of the BPJS insurance. The magnitudes of the coefficients for these variables relative to other variables, especially for top-tier rooms, suggest a patient's taste for accommodations is a driver of room choices. Coefficients for $log(Income)$ are significant and increase as the quality of a room increases, suggesting patient room choice is driven by income and that patients infer that higher-quality rooms are more luxurious. Although the coefficient for $Post2014$ is negative, the coefficient for the interaction term between $Post2014$ and $log(Income)$ is positive. This observation suggests polarization of patient room choices after the policy; patients with lower incomes choose lower-quality rooms after the policy, but patients with higher incomes choose better-quality

rooms.

log(RoomPrice)	-30.18***	-30.64***
	(-43.31)	(-44.65)
Double		
log(Income)	4.896***	4.985***
	(34.84)	(35.92)
Age	-0.0258***	-0.0257***
	(-3.70)	(-3.67)
Age^2	0.000174*	0.000173*
	(2.39)	(2.37)
Gender	-0.0378	-0.0372
	(-0.49)	(-0.48)
Post2014	-130.4***	-131.2***
	(-37.70)	(-37.92)
log(Income)×Post2014	23.87***	24.01***
	(35.87)	(36.04)
Age×Post2014	0.0389**	0.0391**
	(2.67)	(2.68)
Age^2×Post2014	-0.000133	-0.000134
	(-0.86)	(-0.87)
Gender×Post2014	0.245	0.246
	(1.44)	(1.45)
Single		
log(Income)	11.98***	12.20***
	(44.16)	(45.40)
Age	-0.0458***	-0.0438***
	(-4.42)	(-4.18)
Age^2	0.000375***	0.000351**
	(3.39)	(3.13)
Gender	-0.252*	-0.228
	(-2.00)	(-1.79)
Post2014	-181.5***	-179.8***
	(-45.25)	(-45.09)
log(Income)×Post2014	33.49***	33.18***
	(44.01)	(43.83)
Age×Post2014	0.0596**	0.0581**
	(3.00)	(2.92)
Age^2×Post2014	-0.000236	-0.000218
	(-1.10)	(-1.02)
Gender×Post2014	0.490*	0.469
	(2.02)	(1.93)
Suite		
log(Income)		13.98***
		(43.08)
Age		-0.0694***
		(-4.52)
Gender		-0.640**
		(-3.25)
Age^2		0.000666***
		(4.13)
Post2014		-269.9***
		(-29.03)
log(Income)×Post2014		46.54***
		(32.06)
Age×Post2014		0.330***
		(7.08)
Age^2×Post2014		-0.00244***
		(-5.58)
Gender×Post2014		1.335**
		(2.92)
Dissimilarity		
Multi	1.000	1.000
	(0.00)	(0.00)
Double	11.32***	11.40***
	(34.58)	(34.95)
Single	5.191***	5.443***
	(37.24)	(30.10)
Suite		6.315***
		(15.71)
N	14063	14063
Log-Likelihood	-15472.3	-14958.1

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.13: Nested-Logit Estimates

The signs of the remainder of the variables in Table 1.13 were what we expected. Room prices drive patient choices toward low-quality rooms. Coefficients for Age and Age^2 suggest patients who are either very young or very old stay in higher-quality rooms than middle-aged

	Multi	Double	Single	Suite
Pre-2014	-6.43	-1.45	5.77	7.54
Post-2014	-29.97	-0.98	15.41	30.55

Table 1.14: Income Elasticities of Substitution

patients.

Using the results for the nested logit model, we construct the income elasticities of substitution. Based on Table 1.14, room classes Multi and Suite have negative income elasticity, implying they are inferior to room classes Single and Double for patients who visit Hospital A. We find a general increase in the magnitude of income elasticities after the introduction of the policy. This result suggests patients who visit Hospital A post-policy are more willing to spend more on expensive hospital rooms when their income increases compared to that of patients who visit Hospital A prior to the policy. This finding is consistent with the results in Table 1.9, where the income elasticity of choices increases after the policy. We can also conclude that in an imperfect competition setting, Hospital A can better discriminate post policy due to higher income elasticities of substitution across the major room groups.

Based on estimation results from the second step of the empirical strategy, we find an increase in patient expenditures on hospital rooms after introduction of BPJS insurance, shown in Table 1.15. This result accords with that in Table 1.13 and Table 1.10. After introduction of BPJS insurance, patients who continue to visit Hospital A pay higher prices for hospital accommodations because the healthcare market is imperfectly competitive, and patients with lower tastes switch from Hospital A to Hospital B, leaving patients with higher tastes for hospital amenities in Hospital A. Hence, Hospital A is able to charge higher prices and price discriminate better on hospital accommodations. This interpretation of Hospital A's response is based on the assumption that Hospital A has perfect information on patient distribution and other competitors, and based on those information, choose prices to maximizes profit. It is possible that Hospital A do not have perfect information, and thus cannot setting the profit-maximizing prices.

	Dependent variable:
	AmExp
Post2014	48.025***
	(6.285)
Constant	259.357***
	(4.513)
Observations	14,063
R^2	0.004
Adjusted R^2	0.004
Residual Std. Error	372.462 (df = 14061)
F Statistic	58.393*** (df = 1; 14061)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 1.15: Amenities Upgrade Results. Patients pay higher prices for amenities on average at Hospital A.

From the implied shift in the distribution of patient tastes for hospital accommodation across Hospital A and Hospital B due to the implementation of the government policy, we would like to examine potential outcomes on the supply side. We assume the underlying market competition is imperfectly-competitive but not monopolistic; we previously showed the the market cannot be perfectly competitive. We argued that Hospital A is not a monopoly, because in the market we examined, other private hospitals exist whose quality is similar to that of Hospital A. Under this assumption, the private firm that owns Hospital A is constrained in how much it can raise prices or shift prices, because patients would choose its competitors if prices are too high. Following implementation of the policy, patients with low tastes are absorbed by Hospital B, which is owned by the same private firm. In turn, the private firm has more flexibility to raise and shift prices in Hospital A. Hence, the private firm that owns Hospitals A and B can potentially increase its revenue from hospital accommodations. However, if the private firm owns only Hospital A, it would experience reductions in revenue from hospital accommodations even if the private firm made more revenue per patient on accommodations. The logic is that if raising prices in Hospital A to the post-policy levels would have increased revenue prior to the policy, the private firm would have raised the prices of accommodations in Hospital A.

From the social planner's perspective, both the observed changes in prices and the redistribution of the patient types across Hospital A and B due to the expansion of the government healthcare program can be welfare improving. The observed changes in prices draw similarity to the price discrimination aspect of the Ramsey pricing rule (Ramsey (1927)) where prices in different market segments should be set such that the mark-up over marginal cost in each segment is inversely proportional to the price sensitivity of demand with the intention to maximize social welfare. Due to the imperfectly competitive structure of the market, patients who are richer and have higher tastes, hence less price sensitive for hospital accommodations, have to pay higher prices in addition to the taxes they pay to fund the expansion of government policy. Those patients with lower incomes and lower tastes for hospital accommodations shift to utilitarian hospitals and pay less for hospital accommodations. In other words, the market mechanism induces patients with the higher incomes and higher tastes patients to voluntarily subsidize the patients with lower incomes and lower tastes.

Finally, we examine whether the government policy improves the cost effectiveness of healthcare delivery from the hospital accommodations aspect. Based on the empirical strategy described in section 1.6.3, we combined the results from steps (1) and (2) to calculate the extensive margin, the intensive margin, and their differences. Table 1.16 shows both the extensive and intensive margins were significant at the 95% confidence interval, suggesting the validity of the mechanisms identified in the theoretical model. The mean savings was USD $138,345.80, and was significant at the 95% confidence interval. Results suggest the introduction of universal healthcare insurance in Indonesia, which is a form of public healthcare program expansion, affects healthcare spending through hospital-accommodation channels. Using 2013 expenditures on hospital rooms as a base, total savings were 7.27%.

	Extensive Margin	Intensive Margin	Extensive Margin - Intensive Margin
Estimate	277543.4	160575.2	116968.2
	(279537.5, 275549.2,)	(160012.7, 161137.6)	(115050.2, 118886.3)

Table 1.16: Estimates of annual intensive margin, extensive margin, and difference

There are some caveats with our empirical strategy. First, we may not be able to capture all patients who would've use Hospital A if not for the BPJS insurance because some new patients in Hospital B would have visit Hospital A if not for the BPJS insurance and some patients are treated by first level BPJS healthcare facilities. This would lead to underestimation of the extensive margin, and hence the total savings through hospital accommodations.

Nevertheless, the ordinality of our empirical results is still consistent with the prediction of our theoretical model because total savings remain positive. To deal with both of the issues, accurate models of selection based on care and how primary health care facilities filter patients are required. The former requires credible instrumental variable on prices of care in Hospital A while the latter requires data on how different primary healthcare facilities operate, both of which are not available to us. Future research with those data are warranted.

Second, patients who initially visit Hospital A but switch to using BPJS insurance at Hospital B may not visit Hospital A even if the BPJS insurance is not in place. This would lead to overestimation of total savings through hospital accommodations. To deal with this issue, we would need a model of choice between Hospital A and other hospitals of similar quality in the market. This model requires hospital visits data from other facilities, which we do not have.

Lastly, not all Indonesians are required to register for the BPJS insurance in the sample period. Hence, it is possible that our empirical strategy do not capture the full of impact of the BPJS insurance. However, the possibility is minimal because Indonesians who intend to use BPJS insurance are able to register for the insurance before the program start date. According to Figure A.4.4, the monthly number of BPJS inpatient visits in Hospital B do not show any trend or jump that coincides with the BPJS registration deadlines despite Hospital B not operating at full capacity.

1.8 Conclusion

Based on the case study in Indonesia, we show that public programs can potentially alter the welfare of the parties involved, resulting in additional income redistribution on top of that caused by standard taxation mechanism, and improve the cost effectiveness of healthcare delivery through the hospital-accommodation channels. In addition, based on our case study, we have shown that expanding public health insurance programs while limiting patient choices of hospital accommodation choices, (1) introduces additional income redistribution from the rich to the poor through the market mechanism and (2) reduces spending on hospital rooms by 7.27%. This reduction is significant because, on average, expenditures on hospital accommodations represent at least one-third of inpatient bills. Most importantly, the reduction of healthcare costs comes at a minimal expense to patients' health outcomes.

These results are contingent on the magnitudes of two countervailing mechanisms. For the first mechanism, that is, the intensive margin, hospitals can easily raise prices for patients who continue to pay privately because these patients have higher tastes for hospital accommodations. For the second mechanism, that is, the extensive margin, patients who use public insurance are constrained in terms of their choices of hospital accommodations. Hence, these patients see a reduction in hospital-accommodation expenditures. The magnitudes of the two mechanisms depend on patients' tastes for hospital accommodations and patients' choices of hospitals.

Given the statistical significance and the magnitudes of the results in our case study, research with comprehensive nationwide hospital administration data in Indonesia is warranted to confirm that our results hold at the national level. In addition, research with a longer timeline is warranted. In our paper, we focus on short term impacts of expanding government insurance such as patient tastes and prices because other aspects of hospitals are fixed. In a longer timeline, we would expect entry or exit of hospitals and incumbent hospitals may modify their facilities or specialties. Furthermore, since the expansion of public insurance programs and the focus of hospitals on providing hotel-like services are not unique to Indonesia, more research outside of Indonesia should be conducted to assess how public-policy design interacts with patient demand for hospital accommodation. The results of our case study support public-healthcare-policy designs that involve hospital accommodations. Hospital accommodations are a growing portion of patients' bills worldwide, and public-policy design is capable of affecting expenditures on hospital accommodations and the welfare of the parties involved. However, public-policy makers should be wary of introducing policies that are similar to the one implemented in Indonesia, because the distribution of patient tastes for accommodations and the competitive structure of the market affects the intensive and extensive margins to disparate magnitudes, and hence the overall cost effectiveness and welfare impact of the policy. Lastly, future research that include patient demand for hospitals should incorporate patient demand for hospital accommodations. Many studies examine patient demand for hospitals, but such studies assume uniformity within a hospital. We show that hospital accommodations introduce product differentiation in a hospital, where patients demand different qualities of hospital accommodations. Future research should consider the aspect of hospital accommodations in order to acquire more accurate representations of patient demand for hospitals.

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Appendix A

The Impact of Public Healthcare Program on Hospital Hospitality: Evidence from Indonesia Healthcare Program

A.1 Data Definition

Data came from the administrative data of Hospital A and Hospital B. The data can be divided into two parts: (1) physician characteristics, and (2) patient admission and billing. Physician-characteristics data contain a physician's ID, gender, tenure, specialization, employment type, date of birth, and spouse's name. Patient data contain: patient ID, admission ID, bill number, admission type, dates of admission and discharge, service item and the corresponding prescribed and performing physician, payment type, ICD-10 diagnosis code, age, gender, marital status, address, and religion.

For the purpose of our study, we defined a single inpatient visits as a group of hospital defined admissions between the admission date and discharge date of the same inpatient visits. All measures of health risk were calculated at the visit level. To calculate health risk, we use the Charlson Index. The Charlson Index predicts 10-year mortality for patients presenting one or more conditions in the model. Patients' ICD codes were mapped to a condition in the Charlson defined groups, and each group had a different digit score. We then summed the score to create the Charlson index. All billing amounts were converted

from Indonesian Rupiah to USD at 13,165 Rupiah/USD.

A.2 Derivation of Table 1.10

To analyze Hospital A pricing decisions, we look at two extreme market competition settings: perfectly competitive and monopoly. Although we lack the data to pinpoint accurately the competition structure of the market, by looking at the two extremes, we are able to pinpoint whether Hospital A has market power and the expected change in patients' price elasticity of demand. Based on Tirole (1988), the monopoly pricing decision is given by

$$P = \frac{1}{1 - \frac{1}{\epsilon}} MC(Q)$$

where

$$\begin{aligned} P &= \text{Price} \\ \epsilon &= \text{Absolute value of price elasticity of demand} \\ MC &= \text{Marginal cost} \end{aligned}$$

Assuming increasing marginal cost and $0 \leq \frac{1}{\epsilon} < 1$, the first order conditions are given by:

$$\begin{aligned} \frac{dP}{dQ} &= \frac{1}{1 - \frac{1}{\epsilon}} MC'(Q) > 0 \\ \frac{dP}{d\epsilon} &= -\frac{1}{(\epsilon - 1)^2} MC(Q) < 0 \end{aligned}$$

By definition, in a perfectly competitive market, the price elasticity demand is ∞. Hence, we have

$$P = MC(Q)$$

The first order conditions are given by:

$$\frac{dP}{dQ} = MC'(Q) < 0$$

In the context of the Hospital A pricing decision, Hospital A faces a decrease in the number of patients, Q and a change in patients' elasticity of demand for hospital rooms. Hence, it is optimal for Hospital A to raise prices if the market is not perfectly competitive and patients' price elasticity of demand decreases.

However, three possible scenarios would lead Hospital A to reduce prices. In the first scenario, Hospital A has market power and the effects of reduction in quantity outweighs the effects of decrease in patients' price elasticity of demand. In the second scenario, Hospital A has market power and patients' price elasticity of demand increases. In the last scenario, Hospital A is in a perfectly competitive market.

In this exercise, we assume Hospital A is setting prices for a single product. Although in reality Hospital A offers different prices for different amenities level, the results in this exercise still hold. This is because Hospital A is still facing the same demand curve but discriminates on the quality dimension to extract different levels of revenues based on patients' willingness to pay.

Note that throughout this exercise, we assume that Hospital A is setting the optimal prices. It is possible that Hospital A is in the process of learning about the market and is not setting the optimal prices. However, without information on the patients' demand for accommodations and the room pricing decision of other hospitals in the market, we are unable to determine whether Hospital A is not setting the optimal prices. Even with patients' demand for accommodations and the room pricing decision of other hospitals in the market, we may not be able to pin down exactly the optimal prices for Hospital A. Previous studies in the competitive market segmentation literature only characterize the market equilibrium in a two firms and two products setting because of computational complexity (Verboven (1999), Ellison and Glenn (2005),Sticher (2013)).

A.3 Income Elasticity of Choices Calculations

Based on the nested logit model, the probability of choosing upper-level $m \in M$ where m is not the base class is given by

$$Pr_i(C_1 = m) = \frac{exp(z_i\gamma_m + \tau_m I_m)}{\sum_{l \in M} exp(z_l\gamma_l + \tau_l I_l)},$$

where $I_m = log(\sum_{j \in B_m} exp(\frac{x_{imj}\beta}{\tau_m}))$. Differentiating the above probability w.r.t. to $z_{inc,i}$, we have

$$\begin{aligned}\frac{dPr_i(C_1 = m)}{dz_{inc,i}} &= \gamma_{inc,l}\frac{exp(z_i\gamma_m + \tau_m I_m)}{\sum_{l \in M} exp(z_l\gamma_l + \tau_l I_l)} - \frac{exp(z_i\gamma_m + \tau_m I_m)\sum_{l \in M}\gamma_{inc,l}exp(z_l\gamma_l + \tau_l I_l)}{[\sum_{l \in M} exp(z_l\gamma_l + \tau_l I_l)]^2} \\ &= \gamma_{inc,l}Pr(C_1 = m) - Pr(C_1 = m)(\sum_{l \in M}\gamma_{inc,l}Pr(C_1 = m)).\end{aligned}$$

For the base class, we have

$$Pr_i(C_1 = m) = \frac{1}{\sum_{l \in M} exp(z_l\gamma_l + \tau_l I_l).}$$

Differentiating the above probability would result in

$$\begin{aligned}\frac{dPr_i(C_1 = m)}{dz_{inc,i}} &= -\frac{\sum_{l \in M}\gamma_{inc,l}exp(z_l\gamma_l + \tau_l I_l)}{[\sum_{l \in M} exp(z_l\gamma_l + \tau_l I_l)]^2} \\ &= Pr(C_1 = m)(\sum_{l \in M}\gamma_{inc,l}Pr(C_1 = m)).\end{aligned}$$

In the model, $z_{inc,m}$ is equal to $log(Income)$. The income elasticity for individual i is given by

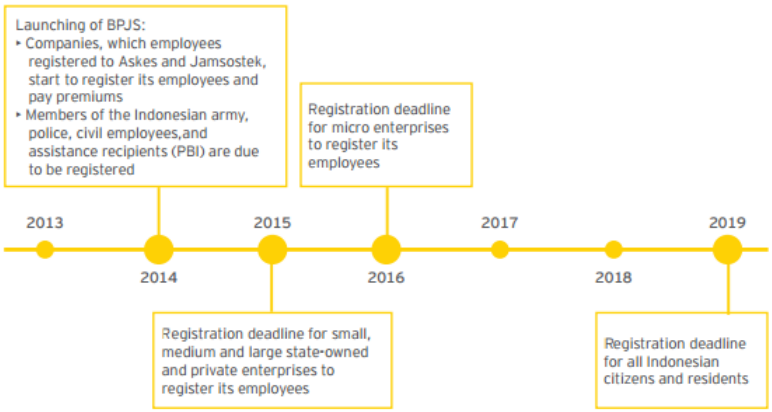
$$\begin{aligned}\frac{dPr_i(C_1 = m)}{dIncome}\frac{Income}{Pr_i(C_1 = m)} &= \frac{dPr_i(C_1 = m)}{dz_{inc,m}}\frac{dz_{inc,m}}{dIncome}\frac{Income}{Pr_i(C_1 = m)} \\ &= \frac{dPr_i(C_1 = m)}{dz_{inc,m}}\frac{1}{Pr_i(C_1 = m)} \\ &= \begin{cases} -(\sum_{l \in M}\gamma_{inc,l}Pr(C_1 = m)) & \text{if } m = base \\ \gamma_{inc,l} - (\sum_{l \in M}\gamma_{inc,l}Pr(C_1 = m)) & \text{if } m \neq base. \end{cases}\end{aligned}$$

Average across individuals, we have

$$\eta_m = \begin{cases} -\frac{1}{N}\sum_{i \in N}\sum_{l \in M}\gamma_{l,inc}Pr_{il} & \text{if } m = base \\ \frac{1}{N}\sum_{i \in N}(\gamma_{l,inc} - (\sum_{l \in M}\gamma_{l,inc}Pr_{il})) & \text{if } m \neq base. \end{cases}$$

A.4 Figures

A.4.1 BPJS Insurance Information



(Source: Picture retrieved from February 2015 Newsletter, Ernst & Young Indonesia)

Figure A.4.1: Timeline of the Mandatory Health Insurance Scheme (JKN)

A.4.2 Cost Shifting

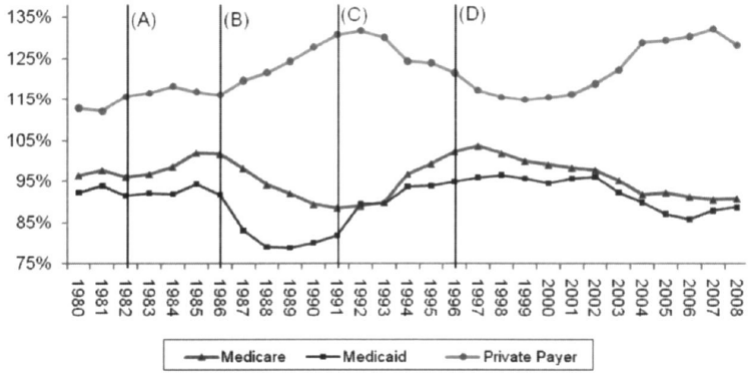


Figure A.4.2: Aggregate Hospital Payment-to-Cost Ratios for Private Payers, Medicare, Medicaid, 1980-2008

- (A) = Beginning of Medicare Hospital Prospective Payment System (PPS) phase-in; (B) = PPS fully phased in; (C) = Era of commercial market managed-care ascendance; (D) = Balanced Budget Act(BBA) passage and managed-care backlash

A.4.3 Room Design

Figure A.4.3: Plain Vs Fancy Design

A.4.4 Patient Across Time

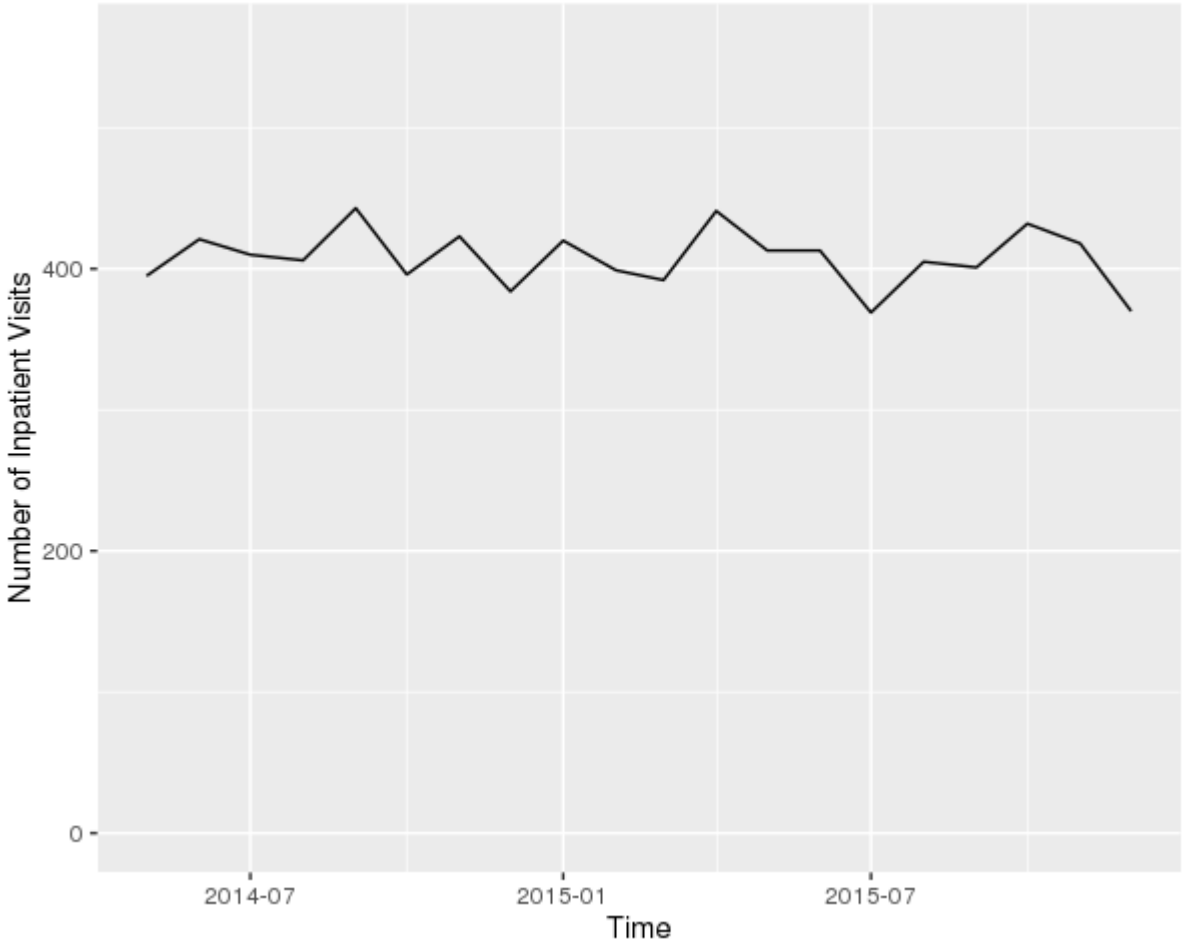


Figure A.4.4: Monthly number of BPJS inpatient visits in Hospital B

A.5 Tables

	Indonesia	United States
Total Population(millions)	249.9	318.9
GDP Per Capital(thousand USD)	3.475	53.041
Total Health Expenditure(billions USD)	25.41	2,833.79
Total Health Expenditure Per Capita(USD)	101.68	8886.14

Table A.1: Overview of healthcare in Indonesia compared to that of the United States in year 2013(unless stated otherwise)

	Indonesia	United States
Provision of healthcare	• Both private and public facilities provide healthcare to the general population • Majority of publicly and privately funded facilities user are low-income and middle to high-income respectively • Privately funded facilities can deny services to those unable to pay	• Public facilities are limited to military and veteran families and to certain Native American tribe • Private facilities provide healthcare to general public • EMATALA requires hospitals emergency departments to accept patient regardless of citizenship, legal status or ability to pay
Insurance Coverage	• 36% uninsured, 52% public, 12% private	• 13% uninsured, 33% public, 54% private
Insurance Role and Coverage	• Out-of-pocket is the major form of health care financing in private healthcare facilities • Having government insurance does not imply usage	• Relies primarily on private insurers for health care financing

Table A.2: Overview of health care in Indonesia compared to that of the United States in 2014(unless stated otherwise)