# THE INCOME ELASTICITY OF HEALTHCARE SPENDING IN TURKEY

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# THE INCOME ELASTICITY OF HEALTHCARE SPENDING IN TURKEY

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# DECLARATION OF ORIGINALITY

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Abstract

The Income Elasticity of Healthcare Spending in Turkey

In this paper, we present the income elasticity of spending on healthcare services in Turkey, and analyze the effect of healthcare reforms and 2008 global financial crisis on the elasticities. We estimate the elasticities by using data from households' out-of-pocket health expenditures between 2006 and 2019 and by utilizing two-part models and the quantile regression model. The elasticity results show that health is a highly elastic good in Turkey. In addition, the effect of the crisis remains significant through different quantiles of health expenditure. We also notice that after the crisis was over and the income of households started growing, due to increases in expenses of patient care services, the ratio of expenditure spent on pharmaceutical products shrunk too much and left its place to other categories, primarily outpatient care.

## Özet

### Türkiye'de Sağlık Servislerinde Yapılan Harcamaların Gelir Esnekliği

Bu tezde Türkiye'de sağlık servislerinde yapılan harcamaların gelir esnekliğini takdim ettik, ve sağlık reformlarının ve 2008 küresel mali krizinin esneklikler üzerindeki etkisini analiz ettik. Hanehalklarının 2006 ve 2019 arasındaki cepten sağlık harcamaları verisini kullanarak, ve iki-kısım modellerden ve kantil regresyon modelinden faydalanarak esneklikleri tahmin ettik. Esneklik sonuçları gösteriyor ki Türkiye'de sağlık oldukça elastik bir ürün. Ek olarak, krizin etkisi sağlık harcamasının farklı kantilleri boyunca anlamlı kalıyor. Ayrıca, kriz bittikten ve hanehalklarının gelirleri büyümeye başladıktan sonra, hasta bakım hizmetleri giderlerindeki artış nedeniyle, harcamaların farmakolojik ürünlere harcanan oranı çok fazla küçüldü, ve ayakta tedavi başta olmak üzere yerini diğer kategorilere bıraktı.

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# CHAPTER 1

# INTRODUCTION

Access to healthcare is a fundamental human right and an essential component of the development and prosperity of a country. From a macroeconomic perspective, access to healthcare can help to promote economic growth by improving labor productivity and increasing participation in the labor force. On the other side, it can also contribute to reducing poverty by decreasing household healthcare costs and preventing catastrophic health expenditures in the long run. Furthermore, providing access to healthcare for households can ensure socio-economic and demographic equity and diminish regional disparities. Overall, setting up and maintaining a well-functioning healthcare system is crucial for a country's development and good health outcomes.

In recent years, like many other developing countries, Turkey has made significant efforts to improve healthcare access and quality of services. As Turkey's health sector has developed and drastically changed over the last two decades, several policies have been implemented since the beginning of the Health Transformation Program (HTP), which was introduced in 2003 and completed in 2013. HTP aimed to improve the accessibility and quality of healthcare services in Turkey by expanding public health insurance coverage, implementing new incentive schemes for providers constructing new public hospitals and other healthcare facilities, and introducing a family medicine system that provides easy access to general practitioners.

Even though HTP brought about significant improvements to healthcare services in Turkey, including a reduction in infant mortality rates and an increase in life expectancy, certain problems and inefficiencies were noted regarding drug prices, reimbursement rates, and hospital payments. (Ökem & Çakar, 2015) Critics focused on uncertainty faced by the providers in the health sector through irregular and unexpected discounts on drug prices and reimbursement rates, changing prescription rules, delays in hospital payments and the introduction of user fees.

In addition, as a significant part of the program, HTP promoted the privatization of healthcare services. According to Health Statistics Yearbooks published by The Ministry of Health of Turkey, before HTP, the number of private hospitals was 271 in 2002. It increased to 331 in 2006, 489 in 2010 and 550 in 2013. Also, the share of the private sector in hospital numbers was 23.44 in 2002, whereas it was 27.51 in 2006, 33.98 in 2010 and 36.25 in 2013. Thus, this new system might have increased healthcare costs because of the new co-payment scheme during outpatient care and the extra payments that private healthcare facilities charge.

Research on the determinants of out-of-pocket health expenditures is vital in assessing the accessibility of households to healthcare services. Studies show that one of the most influential determinants in these decision-making processes is income. Whether health services are a necessity or luxury may indicate how accessible these services are and whether households are deprived of necessary healthcare services. For these reasons, the relationship between income and healthcare spending is a much-discussed subject in the literature. (Baltagi & Moscone, 2010; Di Matteo, 2003; Farag et al., 2012; Freeman, 2003; Lépine, 2015). Income elasticity is widely used to allow a non-linear relationship between income and out-of-pocket (OOP) health expenditures. (Bustamante & Shimoga, 2018; Jeetoo & Jaunky, 2022; Zare, Trujillo, Leidman, & Buttorff, 2013)

While discussing the effect of household income on healthcare spending, understanding the relationship between income and healthcare spending is crucial for policymakers as it provides insights into the ability of households to pay for healthcare services. The research on the income elasticity of health expenditures has policy implications for healthcare financing. It indicates whether there exists an inequality between families with different income levels. In other words, it is crucial to distinguish for whom health care is a necessity or luxury good and to what extent the citizens need public or private healthcare. Thus, it is important to design an effective and well-functioning healthcare system. When the current healthcare system

does not function well, a low-income household may have difficulties accessing healthcare.

Also, examining this relationship is essential for households. As it can give intuitions about financial decisions and budgeting, it can help households to avoid financial instability. More precisely, knowing how much to allocate for healthcare services can prevent households from overspending and lower the probability of facing catastrophic healthcare expenses. Likewise, households can benefit from income elasticity results for good health outcomes. They can be prepared for unexpected health issues by knowing how much to put some money aside for urgent health situations can allow them, especially low-income ones, to afford preventative measures.

In this research, I will estimate the income elasticity of households' OOP health expenditures between 2006 and 2019 by utilizing two-part models, with GLM and OLS and the quantile regression model. The focus will be on the effect of the 2008 crisis on income elasticity by comparing the rates before, during and after crisis periods. Also, I will remark on the changes in the household's healthcare spending structure.

Results briefly demonstrate that healthcare, in general, is a luxury good in Turkey. From 2006 to 2019, the relationship between a household's income and its spending on healthcare services fluctuate. A 10% increase in total income is associated with 11.5% to 13.3%, for GLM, and 8.7% to 10.5%, for OLS, a positive change in total healthcare expenditure for a family. Quantile regression results suggest that elasticities are greater than one for all quantiles, meaning healthcare could be a luxury good. Furthermore, when I split the data into two depending on the income level of households, results show that elasticities tend to increase as income level rises and fluctuate around the unit elasticity. However, low-income households are more vulnerable to income changes for small spending, i.e., for quantiles of 0.5 and 0.6.

A negative income shock, such as the 2008 financial crisis, significantly decreases the likelihood of positive healthcare spending. Also, compared to other periods, households' income elasticities were the lowest in the first post-crisis period (2010-2013). However, values stay above unity regardless of the level of spending. Furthermore, low-income households prefer to lower their healthcare spending by utilizing public healthcare facilities more often in recession times. While their income dependence increases for the lowest expenses, i.e., 0.5th quantile, their consumption for higher quantiles becomes less income dependent. Conversely, high-income households do not hesitate to spend on high-quality care during the crisis period. Even though elasticity significantly decreased during the crisis, it remained steady after the crisis. That might indicate that they do not adjust their budgets on health depending on the economic environment.

First, I will briefly present some findings in the literature and mention the importance of income elasticity studies. Then, some background and historical changes in Turkey will be given. Next, I will introduce the data, variables and fundamental issues in measuring OOP health expenditures and the model selection process. After developing the proper empirical models for the data, I will move to the results, and the conclusion will follow.

# CHAPTER 2

# LITERATURE REVIEW

Studies about the income elasticity of healthcare expenditures in Turkey are scarce compared to studies in high-income countries. Outstanding research primarily focuses on total health expenditure, including government expenditures using GDP per capita and per capita health expenditure data. Even though studies do not directly focus on the effect of income on out-of-pocket healthcare spending, extensive literature about the determinants of healthcare expenditure in Turkey and the impact of HTP reforms on OOP expenditure exists.

Di Matteo (2003) used state-level data from the US, province-level data from Canada and national-level data from 16 other OECD countries. He compared the results of parametric and non-parametric approaches to the income elasticity of healthcare expenditure. The author focused on the differences between different income groups and stated that elasticities are lower at higher income levels and higher at lower income levels. Also, he remarked that income elasticity could vary depending on the data type used in a study.

Farag et al. (2012) used the country-level panel data set for 173 countries for the period from 1995 to 2006. They found that middle-income countries have the highest elasticity values compared to low and high-income countries. Also, the healthcare expenditures in Europe and South America are the most responsive to changes in income. The authors found the elasticity at 0.817 to 0.844 by dynamic OLS cointegrating regressions and the US state-level data from 1966 to 1998.

Bustamante and Shimoga (2018) compared the elasticities of healthcare spending in middle-income and high-income countries. The panel data set included national accounts data from 1995-2014. They stated that the elasticity was 0.51 for middle-income and 0.50 for high-income countries.

Literature on the income elasticity of healthcare expenditures in Turkey mainly concentrated on macro-level variables such as GDP per capita and per capita health expenditure.

Sülkü and Caner (2011) adopted the data from 1984 to 2006 to evaluate the income elasticity of health expenditures in Turkey using Johansen's multivariate co-integration technique. They found that a 10% increase in GDP per capita leads to an 8.7% rise in per capita health expenditure, implying income elasticity of less than unity.

Kiymaz, Akbulut, and Demir (2006) utilized the same technique to interpret the long-run relationship between GDP per capita and per capita health expenditure. They concluded that a 10% increase in GDP per capita induces a 22% rise in per capita health expenditure. So, this more considerable income elasticity indicates that healthcare expenditure in Turkey is a luxury good.

Yavuz, Yilanci, and Ozturk (2013) took advantage of a more extensive data set from 1975 to 2007. Unlike the other two papers, they developed an ARDL equation and ran an ARDL bounds test for co-integration. They stated that there is no significant effect in the long run, but in the short run, a 10% increase in GDP per capita induces a 7.5% rise in per capita health expenditure.

Even though literature in Turkey is limited to macro variables, there are other studies using micro-level data conducted in other countries to examine the income elasticity of health expenditure.

Kyriopoulos, Nikoloski, and Mossialos (2019) used the data set from the Greek Household Budget Surveys over 2008–2015. They employed two-part, single equation, quantile regression models and instrumental variable approach. They remarked the elasticities from 0.54 to 0.77 depending on the model. Nevertheless, all are well below one, implying that healthcare is a necessity good.

Zare, Trujillo, Leidman, and Buttorff (2013) investigated the relationship between income and healthcare expenditure in urban and rural areas in Iran using data from 1984 to 2008. They implemented spline and quantile regression techniques and noted that the income elasticity is lowest for the poorest Iranians in urban and rural areas. Also, households with lower medical expenses have less elastic health expenditures.

In Turkey, although the emphasis is on macro-level variables, studies about the behavior of the health expenditure of Turkish households exist in the literature.

Sozmen and Unal (2013) and Demir, Alkan, Bilgiç, Florkowski, and Karaaslan (2022) examined what influences the likelihood of positive out-of-pocket health expenditure in Turkey. The former article ran multivariate logistic regression using data from Household Budget Survey in 2008 with 8549 participants. They stated that high-income, green card-type insurance (public health insurance for low-income households) and the presence of elderly or disabled family members significantly increased the risk of incurring any OOP and catastrophic healthcare expenditure (CHE) in the household. Likewise, the latter study applied the multivariate probit model using the Household Budget Survey data in 2018. They found that household disposable annual income, household type and size, age category, and having private health insurance have the largest impact on the incidence of OOP spending. Also, gender and marital status are the other driving forces contributing to the probabilities.

Moreover, the effect of the healthcare reforms implemented under the HTP on households' OOP expenditure is a much-argued subject in the literature. One of the most significant reforms was expanding The Green Card scheme, a non-contributory health insurance scheme for people earning less than one-third of the minimum wage. After 2003, The Green Card program coverage was extended, and the government started funding outpatient care and drug spending of the program's beneficiaries. From 2008 on, Green Card holders can benefit from the same services as those with public health insurance. Hence, the effects of these expansions were analyzed in several studies.

Tirgil, Dickens, and Atun (2019) argued that the expansion of benefits coverage leads to significant reductions in OOP health expenditures. They showed, by using a difference-in-differences study design, that spending of Green Card beneficiaries declined by about 33%. More than that, the scheme became more effective for those with a larger healthcare expenditure. Quantile analysis displayed

that the scheme reduces the incidence of catastrophic spending by nearly 50% among those with the largest annual out-of-pocket expenditures.

As another analysis, Giovanis and Ozdamar (2017) utilized a detailed micro-data level survey from 2002-2011 and employed a difference-in-difference approach using a pseudo-panel based on propensity score matching. They concluded that individuals who have public insurance coverage are less likely to face out-of-pocket health expenditures compared to those without health insurance and Green Card holders. However, the difference in the OOP expenditures between the public health insurees and green card holders is narrowed after the policy change.

Erus and Aktakke (2012) analyzed the effect of healthcare reforms on the size of OOP health expenditures for premium-based public insurees. The study used Household Budget Surveys in 2003 and 2006 to observe the difference in OOP expenditure. The results supported that the ratio of households with non-zero OOP expenditure has increased, but the share and level of OOP expenditures have decreased. Also, the decrease in OOP expenditures gets more remarkable as the income level of individuals rises.

The effect of the global financial crisis on both households' health decisions and changes in the healthcare system took their place in the literature. Habibov, Auchynnikava, Luo, and Fan (2019) found that the 2008 global financial crisis made households in post-communist countries more vulnerable by limiting their utilization of healthcare services and reducing staple food consumption. Sarti, Terraneo, and Bordogna (2017) analyzed the impact of the crisis on Italian households. They stated that during the crisis, households' private healthcare consumption decreased. Furthermore, poor families have significantly cut down on health spending compared to not poor households. Kyriopoulos et al. (2019) emphasized the outcomes of the economic adjustment program that is to address the economic downturn after the 2008 crisis in Greece. Even though the recovery in the health sector through a wide range of healthcare reforms was targeted, the program resulted in decreased

availability and capacity of the public health system, increased user charges, and a lower ability to pay for health care.

# CHAPTER 3

# BACKGROUND

While researching households' out-of-pocket health expenditures and their income dependence, there are two crucial aspects to consider: (i) the structural changes in the health sector and out-of-pocket payment schemes in healthcare services and (ii) the fluctuations in the households' income and thus their ability to pay.

First, the structural changes in the health sector and out-of-pocket payment schemes in healthcare facilities are crucial to observe the possible shifts of patients and increased use of public or private healthcare providers. Hence, the difference in their charging policies might create disparities in expenses.

The improvements in public healthcare, making providers more accessible, might lead households to utilize more public services. On the other hand, also easing access to private providers, as was the case in Turkey, might push households to choose private facilities over public ones and thus, households might face higher expenditures. The balance between public and private healthcare providers may affect the households' access to healthcare, and if it favors the private ones, catastrophic healthcare spending could occur more often.

Out-of-pocket contribution schemes in health insurance programs, especially those considering private facilities, may be another reason for the occurrence of these significant payments. Patients who search for easier access and better treatment conditions may encounter these problems.

Second, since a household's income determines the household's ability to pay in a way, the fluctuations in the economic situation might result in either lack of access or increased use of healthcare services. A drop in income may result for households in a struggle to afford healthcare services. In contrast, higher incomes may result in better access to healthcare services and better health outcomes, though with also higher OOP health expenditures. In addition to variations in health expenditures, income fluctuations could result in fluctuations in households' health status.

Governmental decisions and reforms in the healthcare sector, such as Health Transformation Program in Turkey, are mostly the primary reasons for structural changes in the health sector and out-of-pocket payment schemes in healthcare services. On the other hand, the fluctuations in the households' income are generally due to economic downturns such as financial crises. The following two sections examine the structural changes in Turkey's healthcare sector and economic environment between 2006 and 2019.

### 3.1 Health transformation program

Turkey has implemented a number of significant health reforms in the period leading up to 2008. The establishment of the Health Transformation Program (HTP) in 2003 was the key reform for this period because all other reforms were implemented within the scope of this program. This program involved significant investments in healthcare infrastructure, including the construction of new hospitals and the introduction of new medical technologies. HTP aimed to improve the quality and efficiency of healthcare services.

Specifically, the main objectives of HTP were (i) strengthening the regulatory and monitoring functions of the Ministry of Health and other relevant institutions, (ii) establishing an extensive, accessible and efficient healthcare system, (iii) enhancing the use of technology and information systems in healthcare, such as electronic health records and telemedicine. While doing so, the introduction of The Family Medicine Practice in 2005, and the General Health Insurance System, in 2006, were the milestones. Other reforms included developing a national health information system and establishing a health technology assessment agency to evaluate the effectiveness of new medical treatments and technologies. Also, the coverage of the Green Card program, public health insurance for low-income households, was extended gradually on the path to universal health insurance.

In 2006, Social Insurance and General Health Insurance Act was published in the official journal. The main objective of the act was to introduce a universal health

insurance scheme. The new insurance system replaced the previous fragmented system of social security and private health insurance, and it included a range of benefits such as outpatient care, hospitalization, and prescription drugs. The general health insurance system was officially put into practice in 2008, and the coverage was extended by then. Before the full implementation, by 2005, public employees and members of the government pension fund, who were limited to public healthcare providers until then, began to benefit from private health institutions. In addition, the Green Card program coverage was extended, and beneficiaries started taking advantage of outpatient treatment and drug purchases, while until 2003, they could only benefit from inpatient care.

In September 2005, in order to aim to increase access to primary healthcare services and reduce the burden on hospital-based care, the Family Medicine Practice was introduced as a part of the HTP, although the practice was started throughout the country as of the end of 2010. Under the Family Medicine System, each household is assigned a family physician who is responsible for providing primary healthcare services to all members of the household. The family physician provides a wide range of services, including preventive care, diagnosis and treatment of common illnesses, and referrals to specialized healthcare providers when necessary. The co-payment for family medicine visits was set at 2 Turkish Liras at the beginning.

Along with the introduction of a new health insurance system, a new co-payment scheme for healthcare services was initiated. One of the most important was the introduction of co-payments for certain healthcare services provided in public hospitals. These payments require patients to pay a percentage of the cost of healthcare services, which can add up quickly, especially for those who require frequent medical attention. The co-payment amounts varied depending on the type of facility, the type of service, and the patient's income level.

The healthcare system in Turkey has a highly complex structure. The Ministry of Health (MOH), universities and the private sector are the main health service providers. The healthcare system comprises primary, secondary, and tertiary-level

healthcare institutions. Family Health Centers are classified as primary healthcare institutions. State hospitals and private hospitals are classified as secondary healthcare institutions. Research and training hospitals, public and private university hospitals and special branch hospitals are classified as tertiary healthcare institutions. In those facilities, co-payments in (i) medical doctor and dentist examination for outpatient treatment, (ii) orthesis, prosthesis, treatment tools and equipment, and (iii) medication provided for outpatient treatment started to be charged with the introduction of a new insurance scheme.

Certain groups of individuals are exempt from co-payments under the GHI system. These include children under 18, pregnant women, and individuals with chronic illnesses such as cancer, renal failure, or HIV. In addition, some preventive services, such as mammograms and colonoscopies, are also exempt from co-payments.

According to the first social security institution communiqué on healthcare practices that was published in 2007, the co-payment scheme was described depending on the type of facility and the service. The fee was around 1 Turkish Liras (TL) in outpatient care and for pharmaceutical products and medical equipment, the institution could have charged with a rate of 10% to 20% depending on the income.

However, since the implementation of general health insurance was started in 2008, in that manner, the second communiqué in 2008 was more meaningful. From 2008 to 2010, for outpatient care in medical doctor and dentist examinations, there were not any co-payments in primary healthcare institutions. However, the co-payment was 3 TL in secondary healthcare institutions, 4 TL in the research and training hospitals, 6 TL in the university hospitals and 10 TL in private healthcare organizations and institutions. Nevertheless, the rate of co-payments for pharmaceutical products and medical equipment stayed the same at 10% to 20%.

In 2010, the second communiqué on healthcare practices was published. The co-payment scheme was regulated, and the amounts were updated. From 2010 to 2013, for outpatient care in medical doctor and dentist examination, a payment of 2

TL was charged in primary healthcare institutions. The co-payments in secondary and tertiary healthcare institutions were 8 TL and 15 TL in private healthcare institutions.

In 2013, with the introduction of the third communiqué, the co-payments for outpatient care in medical doctor and dentist examinations were reduced. From 2013 to 2018, in primary healthcare institutions, payment of 2 TL was abolished, and there were no co-payments, just as until 2010. Also, the co-payments in secondary and tertiary healthcare institutions were updated as 5 TL. Patients started to pay 12 TL in private healthcare institutions rather than 15 TL.

In 2018, the law was regulated once more. There was still no payment in primary healthcare institutions, but for other institutions, charges were shifted upwards. The co-payment was updated as 6 TL in secondary public healthcare institutions, 7 TL in the research and training hospitals, 8 TL in medical schools of both state and foundation universities and 15 TL in private healthcare institutions.

In summary, the co-payment scheme in Turkey has evolved over time, with changes introduced as part of the Health Transformation Program and subsequent healthcare reforms. While co-payments are still required for many healthcare services, exemptions have been introduced for certain groups of individuals and some preventive services. The aim of the co-payment scheme was to ensure that patients share in the cost of healthcare services and finance public institutions while also providing some protection against financial hardship.

Since the beginning of the HTP, privatization in the healthcare sector has been promoted. The government encouraged the investor to make their investments in private healthcare institutions. As a result, in Turkey, there became a significant number of private institutions as well as the increased share of private facilities among all. Figure 1 shows the number of hospitals in Turkey by year and sector, whereas Figure 2 shows the shares of public and private hospitals in Turkey. From 2002 to 2006, there were significant increases in both the number of public and private institutions as well as the share of private ones. However, after that, while the

number of public institutions remained almost the same, private providers increased in number. Also, the share of the private sector in hospital numbers was 23% in 2002, whereas it was 28% in 2006, 34% in 2010 and 36% in 2013.

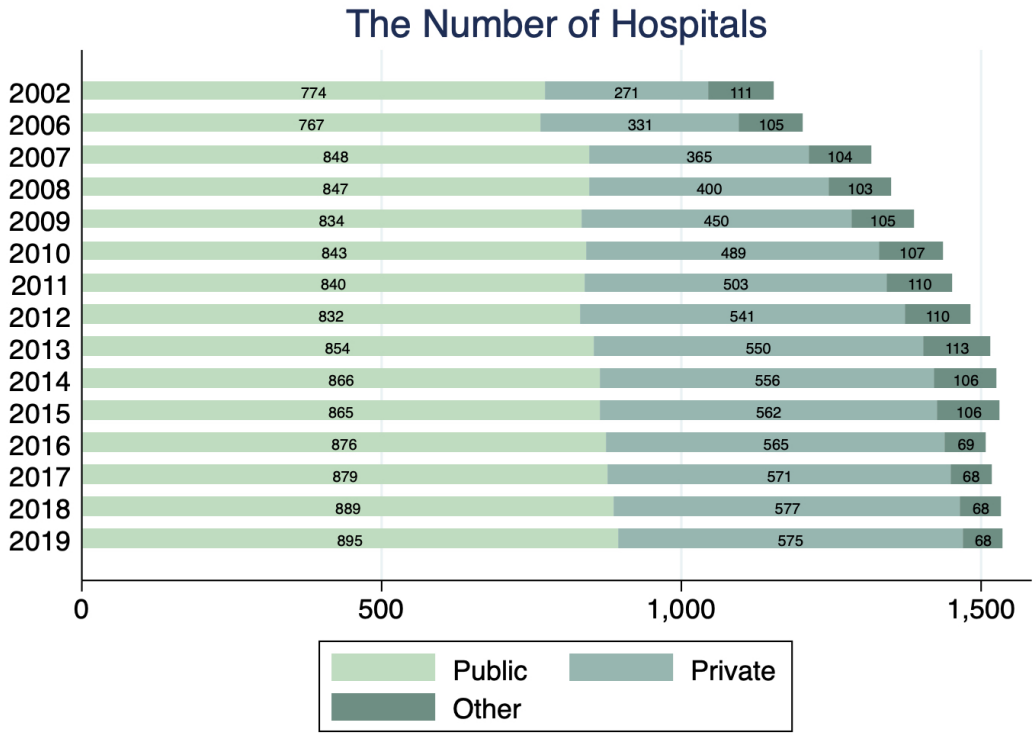


Figure 1. Number of hospitals by year

Furthermore, starting from 2006, private hospitals started to charge additional fees. Although additional fees charged by private healthcare providers were regulated throughout the Health Transformation Program (HTP) in Turkey, amounts never followed a decreasing path.

In 2006, the Ministry of Health introduced a regulation to limit the additional fees that private healthcare providers could charge patients. Prior to 2010, private providers could not charge more than 30% of the fees charged by public hospitals for the same service.

In 2010, the regulation took place, and the upper limit for additional fees that can be charged in private healthcare providers was determined as one fold of expenses in public institutions. So, the cap was increased to 100%. With this change, private hospitals could charge 30% to 100% depending on the hospital.

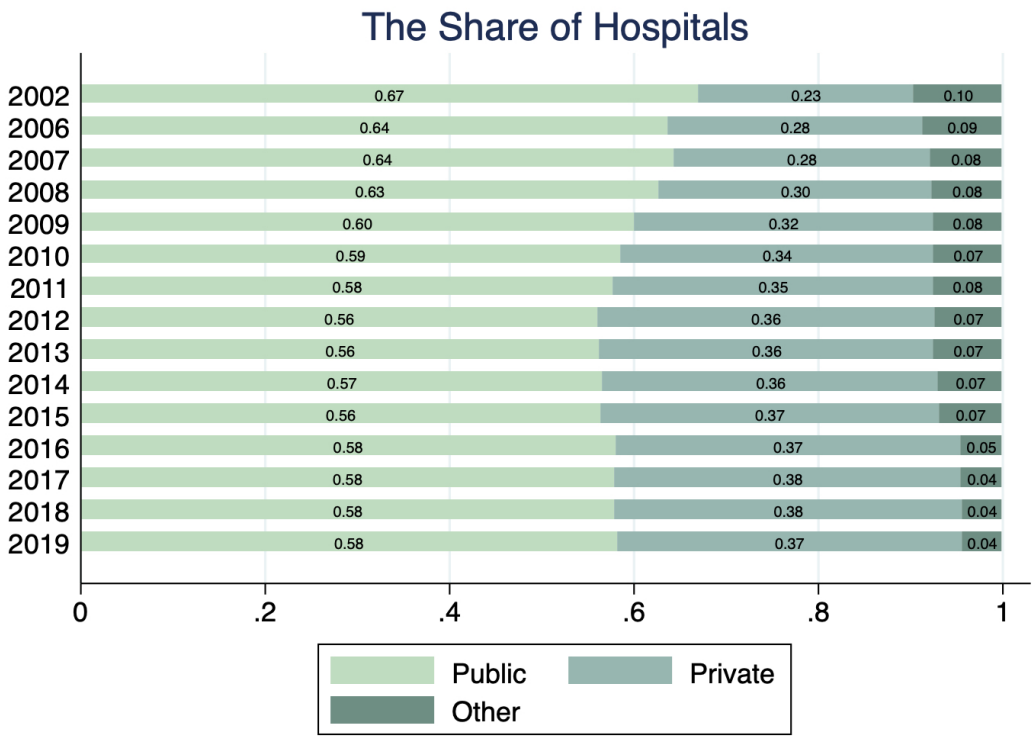


Figure 2. Share of hospitals by year

However, in 2013, the upper limit was changed again, and it was decided as twofold of expenses. This means that if the SSI paid 100 TL for a service, the private provider could have charged up to an additional 30 TL from 2006 to 2010, 100 TL from 2010 to 2013 and 200 TL until 2013 from the patient.

These payments can create a significant financial burden for lower-income households, potentially causing them to delay or abstain from necessary healthcare services. Furthermore, these payments can deepen existing inequalities in access to healthcare, as those with higher incomes can better afford the cost of medical treatment. On the other hand, the lack of these kinds of regulations can lead to price gouging and exploitation of patients, as private healthcare providers may charge excessive amounts for certain treatments.

It's worth noting that the HTP was a comprehensive and ongoing program of reforms that aimed to transform the Turkish healthcare system. As such, reforms were introduced gradually over time and continued to evolve and expand over the years. The aim of the HTP was to improve the accessibility and quality of healthcare

services for the Turkish population while also reducing the financial burden on households. While some reforms may have increased out-of-pocket expenditures in the short term, the overall goal was to improve healthcare access and affordability in the long run.

### 3.2 Financial crisis

During HTP, a worldwide financial crisis arose, and Turkey also suffered from it. The crisis had rapid negative impacts on the Turkish economy, including a negative GDP growth rate, increases in the unemployment rate, a severe initial downturn in industrial production, and decreases in private investment and savings. GDP per capita in real values increased gradually until 2008 and reached 10,802 US dollars, which decreased to 8,990 in 2009, right after the financial crisis. Until 2013, GDP per capita kept growing and peaked in 2013 at 12,507 US dollars, but after then, it rolled down and returned to its previous crisis level of 9,103 US dollars in 2019. Besides, due to the crisis, the unemployment rate in Turkey raised to 12.55% in 2009, which was 8.87% in 2007 and 9.71% in 2008. Fluctuations in the growth rate of GDP per capita and unemployment rate during the period are shown in Figure 3.

Further, the 2008 global financial crisis also significantly impacted the income sensitivity of household healthcare spending. The economic downturn led to increased unemployment rates and reduced household incomes, making it more difficult for many families to afford the cost of medical treatment. As a result, households may have had to reduce their healthcare spending, potentially ignoring health problems and leading to increased healthcare costs in the long run. This was particularly true for low-income households, which were hit hardest by the crisis and had the least ability to absorb the financial shock. The health reforms were designed to address these issues by improving access to healthcare services and reducing the financial burden on households. However, the crisis underscored the need for continued efforts to ensure that healthcare is affordable and accessible for all.

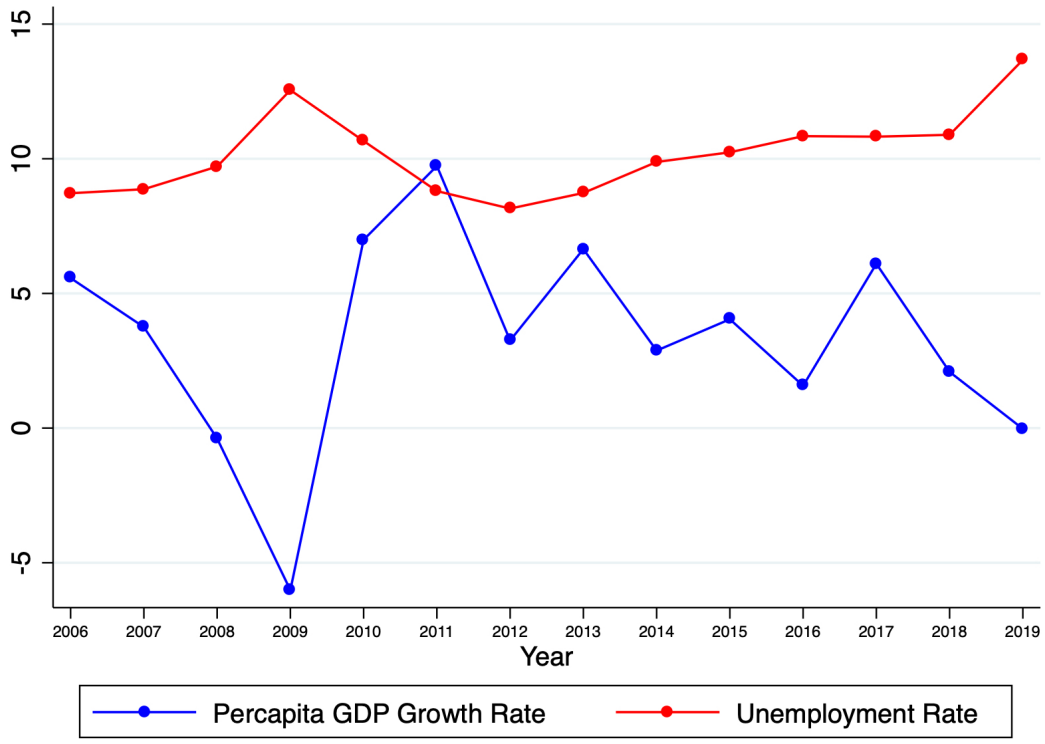


Figure 3. Percapita GDP growth rate and unemployment rate by year

In order to overcome the impacts of the crisis, the government took monetary and fiscal measures such as controlling public spending and budget deficit, regulations on the banking sector, counter-cyclical monetary policy, export-oriented growth models and inflation targeting. Obviously, since the most affected sector was the financial sector, predominantly reforms were focused on that part. Besides, several measures were taken in overwhelmed sectors such as health. Mainly, the focus was to prevent reductions in private and total health expenditures. Hence, the government increased its budget on healthcare to improve healthcare facilities and training professionals. In addition, universal health coverage was implemented aftermath of the crisis to ensure the accessibility to healthcare facilities by all citizens. Furthermore, family medicine practice was introduced to provide access to primary healthcare services. These reforms helped Turkey to cope with the damaging effects of the crisis and to sustain economic and social development.

# CHAPTER 4

# DATA AND VARIABLES

## 4.1 Data structure

The data source is the household budget survey conducted by the Turkish Statistical Institute (TSI) between 2006 and 2019, excluding 2014 and 2018 for which data were not available. The data includes information about the households and household member characteristics, as well as household consumption. TSI records for individuals include gender, age, insurance type, working status and conditions, educational attainment, income status, and resources. Household type, detailed info on residence and assets owned by the household are also included. A household's consumption in a given month is collected and includes details under 12 categories (food, drinks, clothing, home expenses, assets, health, transportation, leisure, education, and insurance).

For this study, data from 2006 to 2019, the latest year available, are used, but data from 2014 and 2018 do not exist. Summary statistics are shown in Table 1. Statistics of variables for the years 2006 to 2019 are represented in columns 3 to 14, and for total sample in column 15. Also, the statistics of expenditure variables are from only positive expenditures.

| Year | | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2015 | | 2016 | | 2017 | | 2019 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables | Definition | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) |
| Health Exp. | Total positive health expenditure | 4500 | 257.87 (707.85) | 4375 | 131.06 (456.09) | 4625 | 119.14 (520.75) | 5956 | 117.79 (389.17) | 6423 | 134.52 (327.06) | 6366 | 139.70 (327.56) | 6358 | 151.66 (426.03) | 7112 | 152.73 (326.13) | 6801 | 162.74 (440.48) | 7159 | 160.55 (396.23) | 8001 | 159.47 (337.97) | 6506 | 187.63 (598.50) | 74182 | 156.69 (440.30) |
| Non-Zero Exp. | Ratio of non-zero total health expenditure | 0.53 | | 0.51 | | 0.54 | | 0.59 | | 0.64 | | 0.64 | | 0.64 | | 0.71 | | 0.59 | | 0.59 | | 0.66 | | 0.56 | | 0.60 | |
| Pharmacy Exp. | Total positive pharmacy expenditure | 3964 | 185.96 (488.72) | 3826 | 46.57 (99.24) | 4082 | 40.52 (79.78) | 5356 | 40.82 (90.73) | 5406 | 41.38 (97.30) | 5325 | 44.33 (83.30) | 5253 | 43.42 (95.95) | 6038 | 46.28 (102.79) | 5218 | 49.18 (118.94) | 5535 | 49.80 (116.70) | 6618 | 49.93 (90.08) | 5125 | 54.95 (298.19) | 61746 | 55.24 (179.37) |
| Outpatient Exp. | Total positive outpatient expenditure | 1310 | 279.27 (739.84) | 1201 | 225.34 (484.70) | 1206 | 209.44 (375.82) | 2062 | 157.51 (411.78) | 3567 | 119.97 (294.11) | 3218 | 136.58 (342.21) | 3523 | 135.52 (427.23) | 5115 | 104.34 (276.17) | 4275 | 121.22 (347.60) | 4554 | 123.16 (375.02) | 4688 | 116.70 (288.95) | 2212 | 238.96 (769.43) | 36931 | 142.08 (408.70) |
| Hospital Exp. | Total positive hospital expenditure | 74 | 1084.73 (1592.92) | 79 | 1124.34 (2294.02) | 93 | 965.50 (3038.51) | 145 | 714.75 (1212.92) | 722 | 199.52 (461.14) | 685 | 189.80 (372.39) | 709 | 245.41 (603.07) | 935 | 178.06 (356.30) | 1008 | 213.30 (481.79) | 979 | 188.45 (341.66) | 2014 | 124.43 (260.67) | 2959 | 90.35 (297.90) | 10402 | 182.13 (562.66) |
| Other Health Exp. | Total positive other expenditure | 591 | 98.40 (493.48) | 549 | 65.14 (194.34) | 632 | 68.45 (193.19) | 827 | 65.88 (167.93) | 826 | 82.77 (268.80) | 945 | 88.69 (225.16) | 923 | 91.79 (213.94) | 1051 | 101.43 (224.64) | 939 | 124.56 (591.93) | 1102 | 116.58 (344.28) | 1162 | 127.25 (393.85) | 1124 | 127.38 (280.26) | 10671 | 100.42 (327.81) |
| Income | Total positive consumption | 8556 | 3990.36 (3189.87) | 8548 | 3930.32 (3004.31) | 8549 | 4245.73 (3177.27) | 10046 | 4216.12 (3210.03) | 10082 | 4341.23 (3266.84) | 9918 | 4553.53 (3657.55) | 9987 | 4861.64 (4010.93) | 10060 | 4817.53 (3837.83) | 11491 | 4705.46 (4443.45) | 12096 | 4790.67 (3897.06) | 12166 | 4782.61 (3975.89) | 11521 | 4683.35 (3881.64) | 123020 | 4523.64 (3707.80) |
| Household Size | Household size | 8556 | 4.08 (1.89) | 8548 | 4.05 (2) | 8549 | 3.89 (1.84) | 10046 | 3.83 (1.93) | 10082 | 3.79 (1.90) | 9918 | 3.74 (1.94) | 9987 | 3.64 (1.86) | 10060 | 3.66 (1.84) | 11491 | 3.56 (1.90) | 12096 | 3.52 (1.88) | 12166 | 3.47 (1.79) | 11521 | 3.36 (1.76) | 123020 | 3.69 (1.89) |
| Gender | Gender of household head | 8556 | 0.90 (0.30) | 8543 | 0.89 (0.31) | 8549 | 0.89 (0.32) | 10046 | 0.86 (0.35) | 10082 | 0.85 (0.35) | 9918 | 0.87 (0.34) | 9987 | 0.87 (0.34) | 10060 | 0.87 (0.34) | 11491 | 0.86 (0.35) | 12096 | 0.87 (0.34) | 12166 | 0.85 (0.35) | 11521 | 0.77 (0.42) | 123015 | 0.86 (0.35) |
| Age | Age of the household head | 8556 | 46.96 (13.49) | 8543 | 47.25 (13.63) | 8549 | 47.83 (13.70) | 10046 | 48.27 (14.13) | 10082 | 48.45 (13.94) | 9918 | 48.45 (14.38) | 9987 | 48.96 (14.31) | 10060 | 48.69 (14.26) | 11491 | 50.28 (14.60) | 12096 | 50.49 (14.84) | 12166 | 50.83 (14.82) | 11521 | 51.73 (15.13) | 123015 | 49.18 (14.40) |
| Number of Children | Number of individuals younger than 5 | 8556 | 0.41 (0.70) | 8543 | 0.40 (0.70) | 8549 | 0.38 (0.67) | 10046 | 0.37 (0.68) | 10082 | 0.36 (0.66) | 9918 | 0.29 (0.59) | 9987 | 0.26 (0.55) | 10060 | 0.28 (0.56) | 11491 | 0.26 (0.56) | 12096 | 0.25 (0.55) | 12166 | 0.25 (0.54) | 11521 | 0.25 (0.55) | 123015 | 0.31 (0.61) |
| Number of Elder | Number of individuals older than 65 | 8556 | 0.24 (0.55) | 8543 | 0.25 (0.55) | 8549 | 0.27 (0.57) | 10046 | 0.28 (0.58) | 10082 | 0.28 (0.57) | 9918 | 0.25 (0.55) | 9987 | 0.25 (0.55) | 10060 | 0.26 (0.56) | 11491 | 0.29 (0.59) | 12096 | 0.31 (0.60) | 12166 | 0.32 (0.61) | 11521 | 0.33 (0.62) | 123015 | 0.28 (0.58) |
| Insurance | =1, if household head has a health insurance | 8556 | 0.86 (0.35) | 8543 | 0.89 (0.32) | 8549 | 1.00 (0.07) | 10046 | 0.90 (0.30) | 10082 | 0.90 (0.29) | 9918 | 0.93 (0.26) | 9987 | 0.94 (0.24) | 10060 | 0.94 (0.23) | 11491 | 0.96 (0.21) | 12096 | 0.95 (0.21) | 12166 | 0.96 (0.20) | 11521 | 1.00 (0.05) | 123015 | 0.94 (0.24) |
| Private Insurance | =1, if household head has a private health insurance | 8556 | 0.01 (0.08) | 8543 | 0.01 (0.09) | 8549 | 0.17 (0.38) | 10046 | 0.01 (0.12) | 10082 | 0.01 (0.11) | 9918 | 0.01 (0.11) | 9987 | 0.02 (0.15) | 10060 | 0.01 (0.10) | 11491 | 0.00 (0.07) | 12096 | 0.00 (0.06) | 12166 | 0.00 (0.06) | 11521 | 0.11 (0.31) | 123015 | 0.03 (0.17) |
| Educ0 | =1, if degree is ISCED 0 | 8556 | 0.12 (0.32) | 8543 | 0.13 (0.33) | 8549 | 0.12 (0.32) | 10046 | 0.15 (0.36) | 10082 | 0.14 (0.34) | 9918 | 0.13 (0.33) | 9987 | 0.13 (0.33) | 10060 | 0.13 (0.33) | 11491 | 0.13 (0.34) | 12096 | 0.13 (0.33) | 12166 | 0.11 (0.31) | 11521 | 0.13 (0.34) | 123015 | 0.13 (0.33) |
| Educ1 | =1, if degree is ISCED 1-2 | 8556 | 0.62 (0.49) | 8543 | 0.61 (0.49) | 8549 | 0.58 (0.49) | 10046 | 0.58 (0.49) | 10082 | 0.58 (0.49) | 9918 | 0.56 (0.50) | 9987 | 0.55 (0.50) | 10060 | 0.55 (0.50) | 11491 | 0.56 (0.50) | 12096 | 0.55 (0.50) | 12166 | 0.56 (0.50) | 11521 | 0.53 (0.50) | 123015 | 0.57 (0.50) |
| Educ2 | =1, if degree is ISCED 3-4 | 8556 | 0.16 (0.37) | 8543 | 0.17 (0.38) | 8549 | 0.18 (0.39) | 10046 | 0.16 (0.37) | 10082 | 0.17 (0.37) | 9918 | 0.17 (0.38) | 9987 | 0.18 (0.38) | 10060 | 0.17 (0.38) | 11491 | 0.16 (0.37) | 12096 | 0.16 (0.37) | 12166 | 0.17 (0.38) | 11521 | 0.16 (0.37) | 123015 | 0.17 (0.37) |
| Educ3 | =1, if degree is ISCED 5 or higher | 8556 | 0.10 (0.30) | 8543 | 0.10 (0.29) | 8549 | 0.12 (0.32) | 10046 | 0.11 (0.32) | 10082 | 0.12 (0.33) | 9918 | 0.06 (0.23) | 9987 | 0.15 (0.36) | 10060 | 0.15 (0.36) | 11491 | 0.14 (0.35) | 12096 | 0.16 (0.37) | 12166 | 0.15 (0.36) | 11521 | 0.17 (0.38) | 123015 | 0.13 (0.34) |

Table 1. Descriptive Statistics

## 4.2 Variables

As the main dependent variable of this research, the total healthcare expenditure of households is used. The variable covers all healthcare expenditures, including health services provided by school and university health centers but excluding health insurance premiums. As other dependent variables of the models, households' expenditures by categories, i.e., pharmacy, outpatients and hospital, are examined to capture differences in responsiveness of health expenditures across different types of health services. Pharmacy expenditure includes medicinal preparations, medicinal drugs, patent medicines, serums and vaccines, vitamins and minerals, cod liver oil and halibut liver oil, and oral contraceptives. The outpatient expenditure group covers medical, dental and paramedical services delivered to outpatients by medical, dental and paramedical practitioners and auxiliaries. Hospital expenditure is spending in general and specialist hospitals as well as medical and maternity centers and nursing and convalescent homes, which chiefly provide in-patient services. It also covers the services of institutions serving old people in which medical monitoring is an essential component and rehabilitation centers providing in-patient health care and rehabilitative therapy where the objective is to cure the patient rather than to provide long-term support. Since the survey consists of consumption in a given month, all these expenditures of three categories are made during a month as well.

Expenditure values obtained from the surveys are adjusted using inflation figures for the relevant expenditure type, namely pharmaceuticals, outpatient, inpatient and other categories, and in the amounts used in the research are in 2019's Turkish Lira. For the total health expenditure, converting values into real ones by using the relevant consumer price index of health as the main group is problematic. Since index indicators for sub-main groups exist and for each household composition of health expenditure differs, it is more appropriate to use each index indicator for the relevant sub-main group and then to obtain the sum of the adjusted sub-group figures to obtain the total health expenditure.

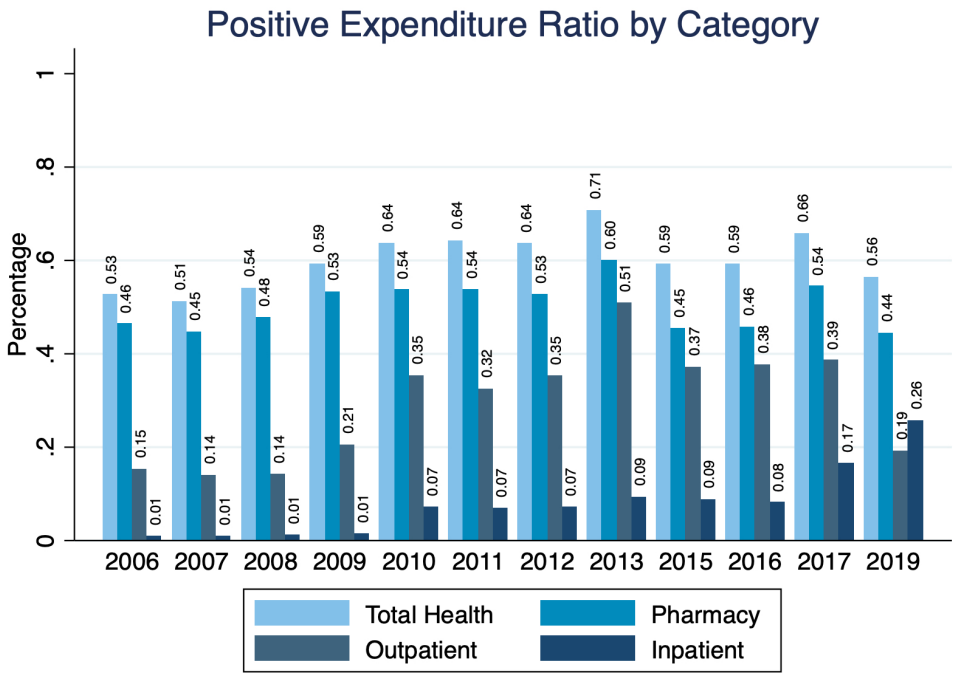


Figure 4. Positive expenditure ratio by category

Figure 4 shows the ratios for positive expenditures by expenditure category and year. The presence of healthcare expenditure increased until 2013 and reached the highest figure in that year with 71% of the sample. Likewise, occurrences of positive expenditures in pharmacy and outpatient care were the highest in 2013. The sudden jump in the ratio of positive expenditures for outpatient care can catch one's eye, considering it increased from 35% to 51% from 2012 to 2013. Rises in income can explain this, as well as increased extra payments in private hospitals. Exceptionally, households had to spend for inpatient care in 2019, as 26% of the sample consists of positive expenditure, while the share of inpatient care was 0.01 from 2006 to 2009 and around 0.08 from 2010 to 2016. That may also be a peculiarity of the data as the methodology for data collection may have changed.

Figure 5 exhibits how the positive health expenditure ratios of households with different income levels change over the period. Where the households with higher income have a greater positive expenditure ratio, a nearly 10% gap between the groups exists over time, narrowing a little in well-heeled times, i.e., in 2013.

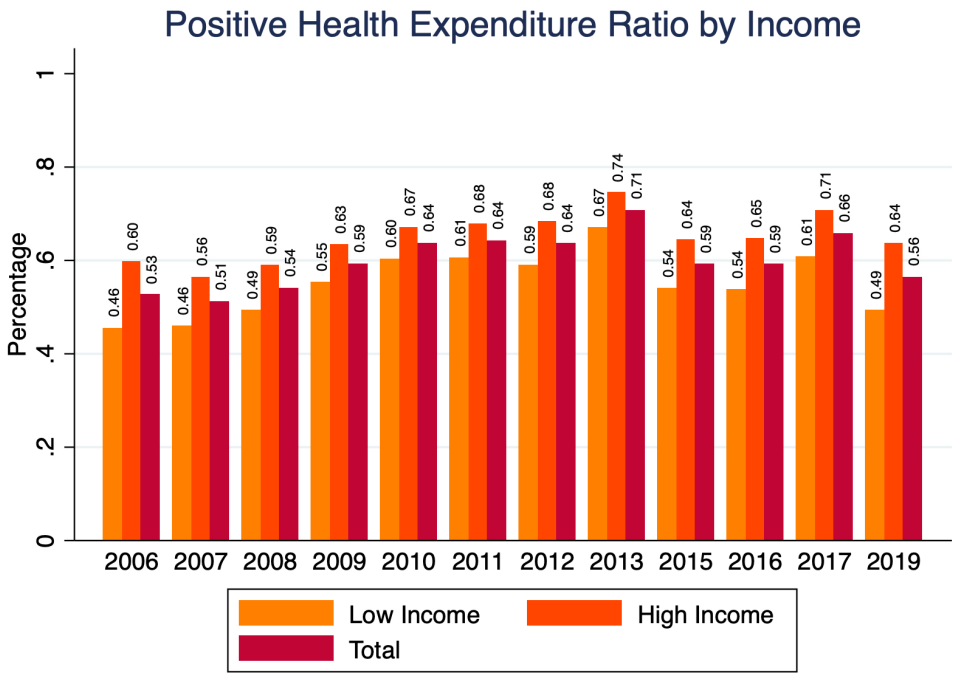


Figure 5. Positive health expenditure ratio by income

Further, the increasing tendency until 2013 vanishes after that for both income groups.

As can be seen in Table 1, total health expenditure has a mean of 156.69 with a standard deviation of 440.30 over the 13-year period. Mean values were lower in the crisis period, with the means of 119.14 in 2008 and 117.79 in 2009, but then it continuously increased towards 2019. Also, the number of observations tells us that nearly 60 percent of the total sample has positive healthcare spending during the period.

Pharmacy expenditure has a mean of 55.24 with a standard deviation of 179.37. This expenditure group followed a similar path with the total health expenditure by decreasing in the crisis period; it had a mean of 40.52 in 2008 and 40.82 in 2009 and accelerated after 2009. Pharmacy expenditure is positive for roughly 50 percent of the total sample.

Outpatient and inpatient (hospital) expenditures have the means of 142.08 and 182.13 with standard deviations of 408.70 and 562.66, respectively. The number of non-zero observations gets smaller in these expenditure categories. Outpatient

expenditures are positive for 30% of the sample, whereas inpatient expenditures rarely occurred for only 8% of observations.

To estimate the income elasticity of health expenditures, I used the total consumption of households as a proxy for income. Consumption might be a better indicator than income for a household since the survey focuses on expenditures rather than income, and a household's spending depends on not only current income but also external money resources such as savings. These variables are used in logarithm form because log transformation can de-scale the large numbers and ease handling the outliers and skewness problems of the distribution. Furthermore, the logarithmic form is more suitable for elasticity calculation. Thus, the main objective of this study is to interpret the response of percentage changes in health expenditure to percentage changes in an individual's income. Total household income, in logarithm, is the leading independent variable; it includes all the household's spending in a month. It seems quite high considering other expenditure categories. The total income of households has a mean of 4523.64 with a standard deviation of 3707.80 which is a good sign of a household's ability to pay. Unsurprisingly, it grasps 4861.64 in 2012 as the highest, where mean income was 3990.36 in 2006 as the lowest.

Other independent variables are household size, gender and age. Household size may affect household healthcare needs and individuals' access to healthcare. It constantly dwindles throughout the era. The mean household size was 4.08 in 2006, whereas 3.66 in 2019. Gender is coded as a dummy variable that takes the value 1 if the relevant household head is male and takes the value 0 otherwise. 86% of the sample consists of households with a male head. However, the gender gap is closed up as 23% of households had a female head in 2019, where the proportion was 10% in 2006. Age is also measured for the household head, and it has a mean of 49.18.

Data includes health insurance types, such as public or private and supplementary insurance types. Thus, we can control both having insurance and private insurance at the same time. Presence of insurance may alleviate expenditures depending on health insurance type, its coverage ratio or the amount in every

subgroup of health care services. It is included as two different variables. The first one, insurance, shows whether the person is insured or not. Thus, it will be a dummy variable that takes the value 1 if the household head is insured and takes the value 0 otherwise. The second variable, private insurance, will be in the model if the individual has private insurance. The mean of the insurance variable indicates that a great majority of the sample has health insurance, whereas only a small percentage of those have private one.

The number of children and elders are other critical control variables. They show the number of individuals younger than 5 and older than 65, respectively. Since children are more prone to illnesses and frequently need health services such as vaccines and regular check-ups, although the immunizations and regular check-ups for young children are often covered by health insurance, more expensive situations such as emergency care and need for specialized services are more likely to be encountered for this group compared to adults. For elderly individuals, since they are more likely to get sick, they can increase the healthcare expenditure of a household. Besides, healthcare services may be covered often by the universal healthcare system but as private healthcare services may offer more specialized or personalized care, they could be preferred over public institutions. However, potential catastrophic expenditures could occur. Hence, the number of children and elders are other critical control variables for this study. They show the number of individuals younger than 5 and older than 65, respectively. These age groups tend to have higher health expenditures because their treatments often require special care.

Education is an important variable to account for. An individual's education level might affect his or her attitude to illnesses and health care services. Households with higher levels of education are more likely to purchase private health insurance. On the other hand, households headed by individuals with lower levels of education may have limited knowledge about healthcare and may be less likely to seek medical care when needed. Increased education level may help to be aware of the best choice available. Thus, higher education may lower income elasticity. In the study, four

dummy variables are created to indicate education level based on the International Standard Classification of Education (ISCED-11). The first variable is Educ0 and is equal to 1 if the individual has no formal education, including illiterate people, and equal to 0 otherwise (ISCED level 0). The second variable is Educ1 and is equal to 1 if the individual has primary or lower secondary education and equal to 0 otherwise (ISCED level 1 or 2). The third variable is Educ2 and is equal to 1 if the individual has upper secondary or post-secondary non-tertiary education and 0 otherwise (ISCED level 3 or 4). The fourth variable is Educ3 and is equal to 1 if the individual has short-cycle tertiary education or a bachelor's degree or higher and 0 otherwise (ISCED level 5 or higher).

# CHAPTER 5

# DATA ISSUES AND MODEL SELECTION PROCESS

Household health expenditure data is subject to certain issues. Most importantly, it includes an excessive number of zeros. This type of data is called semi-continuous data, composed of a significant number of zero outcomes and positive continuous outcome parts. In medical care cost data, there are two distinct processes. First, a patient decides whether to seek healthcare or not, then how much to spend if he chooses to consume in the first process. Both processes can generate zero expenditures. There may be more than one reason for zero expenditures: household members might not have needed health services, not have gone to a hospital even if needed or have gone to a hospital, but they might have received the treatment without any payment. Analyzing zeros and non-zero expenditures separately is reasonable in such cases. Thus, the model should guide us to comprehend how these zeros can be used properly.

There are a few ways to handle the excess zero problems in the literature. Tobit and Hurdle models or Zero-inflated processes can be used as a solution. However, these methods are not appropriate in our case.

Firstly, The Tobit model is a generalization of the standard linear regression model that is generally used for censored data outcomes. Censored data is a type of data such that the true value of the variable is partially or entirely hidden from observation. In other words, the Tobit model is useful when the data is left-censored, in which some zero observations can be obtained by limiting and modifying negative outcomes. However, this does not fit the data in this study.

The Tobit model considers both the observed and unobserved data and estimates the parameters of interest. The model assumes that the observed data is generated by a latent variable linearly associated with the explanatory variables, and a threshold value censors the observed data. The Tobit model estimates both the coefficients of the explanatory variables and the threshold value. Also, Tobit can be utilized when the data comes from a single data-generating process in which only one

process can produce a zero outcome. So, one can eliminate this approach for these reasons.

Similarly, the Hurdle models are used to analyze data with excess zeros. They have two parts: a binary process and a count process. The binary process is modeled using a probabilistic regression model such as logistic or probit regression models and calculates the likelihood of occurrence of a zero or a positive outcome. Count process models only positive outcomes using a Poisson or a negative binomial regression model. The hurdle models combine the two models to estimate the parameters of interest and can provide more accurate estimates. Hurdle models assume that there is a single process by which a zero can be produced. Particularly, Hurdle models support that there are two types of individuals: those who never experience the outcome, zero values, and those who always experience the outcome at least once, positive values. Hence, in our data, there should not be a person who goes to a hospital and receives treatment without any payment, but this is not the case. Even though they are used when the zero and non-zero values occur from different processes, they are more applicable for count data cases.

Differently, zero-inflated models can be the solution for the excess zero problems. Those models consist of a binary process and count process like Hurdle models. They simply divide the sample into two such that a group that is more likely to have a zero value and another group that has a distribution of non-zero values. Nonetheless, they are helpful for the count data cases such as doctor visits even if they assume both processes can generate a zero outcome.

Since the use of the models above can be inaccurate for our case, one of the most prevalent solutions is employing a two-part model. It is a common approach in excessive zero cases. Two-part models examine discrete and continuous parts of data separately. The model works in two stages; in the first stage, a logit function differentiates whether a zero is true or always zero. Then, it gives a probability of positive outcomes given explanatory variables. In the second stage, using the given probability, the model continues with a regression. Regression can be a standard

linear model with or without log-transformation, generalized linear model (GLM) with again any option of transformation, poisson, negative binomial or any appropriate model, depending on the data.

For the health expenditure data which is semi-continuous as mentioned above, OLS and GLM fit the data. Another way to deal with excessive zeros is to remove them and treat the data as if it only has positive numbers. In our case, one should assume that a household's healthcare consumption is always positive. However, it is not only an information and data loss, but it also is misleading while interpreting the coefficients, especially considering that there are different proportions of households with zero OOP health expenditures in different years.

Two-part models handle zero and non-zero expenditures separately. The quantile regression analysis, however, models all of the data together. Hence it requires taking log of all the data, which is impossible for observations with zero OOP health expenditures. Eliminating the zero outcomes by dropping these households, on the other hand, would shift the relevant quantile since there are different proportions of zero-expenditure households in different years.

Basically, quantile regression tries to estimate a specific quantile of the positive expenditures, and the ratio of positive expenditures is unstable and changes every year. Interpreting the estimation results of the quantile regression model can be problematic in that manner. For example, assume that the proportion of non-zero expenditures in 2006 is 50% and in 2007 is 70%. The median quantile analysis for these sub-samples estimates for the .75 and .85 quantiles of the sub-samples with zeros. Thus, the elasticity comparison of these two would need to be more accurate.

In order to overcome this issue and keep zero expenditure households in the data, I added a minimal number, i.e., 0.01, to zero values when running quantile regression. Since the focus of the study is on quantiles at and above the median, this change did not affect the values at relevant quantiles. In this way, one can compare two similar households from different years.

# CHAPTER 6

# EMPIRICAL MODELS

The models of this paper are GLM with log-link function using gamma distribution and the quantile regression model. As an alternative to GLM, I also used another two-part model which is OLS with a log-dependent variable for comparison and robustness checks. Similar methodology was followed by Kyriopoulos, Nikoloski, and Mossialos (2019) and Zare, Trujillo, Leidman, and Buttorff (2013).

The explicit regression formula in the models, including logistic regression, are as follows:

$$\begin{aligned} Y_i = \beta_0 &+ \beta_1 Income_i \times Year_{2006} + ... + \beta_{12} Income_i \times Year_{2019} \\ &+ \beta_{13} Year_{2006} + ... + \beta_{23} Year_{2019} \\ &+ \sum_{k=24}^{k=33} \beta_k X_i + \epsilon_i \end{aligned} \tag{1}$$

where the product variables capture the interaction between household income and the year. The second row controls year effects, and $X_i$s represent other controls: age, gender, household size, number of children, number of elders, health insurance, private health insurance, educ0, educ1, educ2 and educ3. Note that 2014 and 2018 are excluded because the data was unavailable. Also, note that in logistic regression, the coefficients are specified as $\alpha$'s rather than $\beta$'s.

## 6.1 Two-part models

Two-part models decompose $E[Y|X]$ by specifying a parametric model for part one such that $Pr(Y > 0|X) = \pi(X;\alpha)$ and second part such that $E(Y|Y > 0, X) = \mu(X;\beta)$ (Mullahy, 1998).

### 6.1.1 Part one: logistic regression

In the first part, logistic regression calculates the probability of having non-zero outcomes by using the regression equation in (1). The coefficient matrix, the hurdle component of the model, is as follows:

$$Pr(Y > 0|X) = \pi(X;\alpha) = F(X\alpha) = \frac{exp(X\alpha)}{1 + exp(X\alpha)} \tag{2}$$

where $X$ is the vector of independent variables and $\alpha$ is the corresponding vector of parameters to be estimated, and $F$ is the cumulative distribution function of error terms.

### 6.1.2 Part two: generalized linear model and ordinary least square

In the second part, GLM with log-link function and gamma distribution and as alternative OLS are employed for comparison and robustness checks. The formulation is the same for both models but in the second part, one needs to assume that the error terms of log-transformed OLS regression is normally distributed with a constant variance, i.e. homoskedastic, $\sigma^2$. Then we can have the following formulation for the second part, the level component of the models, for GLM (3) and for OLS (4):

$$E(Y|Y > 0, X) = \mu(X;\beta) = g(X\beta) = exp(X\beta) \tag{3}$$

$$E(Y|Y > 0) = \mu(X;\beta) = g(X\beta) = exp(X\beta + \frac{\sigma^2}{2}) \tag{4}$$

where $\beta$ is the corresponding vector of parameters to be estimated, and $g$ is a density function for $y|y > 0$. Some basic probability algebra then permits one, in principle, to recover $E(Y|X)$ as

$$
\begin{aligned}
E(Y|X) &= Pr(Y > 0|X) \times E(Y|Y > 0, X) \\
&= \pi(X;\alpha) \times \mu(X;\beta) \\
&= \frac{exp(X(\alpha+\beta))}{1+exp(X\alpha)}
\end{aligned} \tag{5}
$$

by utilizing the likelihood estimation for an observation as

$$
L = [1 - F(X\alpha)]^{i(i=0)} * [F(X\alpha)g(X\beta)]^{i(y>0)} \tag{6}
$$

where $i(.)$ denotes the indicator function, and the log-likelihood contribution as

$$
lnL = i(i=0) * ln[1 - F(X\alpha)] + i(y>0) * ln[F(X\alpha)g(X\beta)] \tag{7}
$$

After getting the results of the regressions, to calculate the elasticities in two-part models, one need to estimate the semielasticities ($d(lny)/d(x)$) because the dependent variables are the levels of expenditures of the households whereas the independent variables are used in logarithms. The $j$-th conditional semielasticity can be found as:

$$
\begin{aligned}
\frac{\partial lnE(Y|X)}{\partial x_j} &= \frac{\partial \pi(X)}{\partial x_j} + \frac{\partial \mu(X)}{\partial x_j} \\
&= \frac{\partial ln(\frac{exp(X\alpha)}{1+exp(X\alpha)})}{\partial x_j} + \frac{\partial ln(exp(X\beta)}{\partial x_j} \\
&= \frac{\partial x_j \alpha_j}{\partial x_j} + \frac{\partial x_j \beta_j}{\partial x_j} \\
&= \alpha_j - \frac{exp(X\alpha)}{1+exp(X\alpha)}\alpha_j + \beta_j \\
&= \alpha_j(1 - \pi(X)) + \beta_j
\end{aligned} \tag{8}
$$

## 6.2 Quantile regression

Quantile regression examines the effect of income for different expenditure groups. The explicit regression formula for this model is as follows

$$\begin{aligned} Y_i = \gamma_0 &+ \gamma_1 Income_i \times Year_{2006} + ... + \gamma_{12} Income_i \times Year_{2019} \\ &+ \gamma_{13} Year_{2006} + ... + \gamma_{23} Year_{2019} \\ &+ \sum_{k=24}^{k=33} \gamma_k X_i + u_i \end{aligned} \tag{9}$$

Quantile regression model for $\tau$th quantile as follows

$$Q_\tau(y_i) = \omega_0(\tau) + \omega_1(\tau)x_{i1} + ... + \omega_k(\tau)x_{ik} \qquad i = 1, 2, ..., n \tag{10}$$

where omega coefficients are functions of the selected quantiles, and they can be derived from the following equation

$$\hat{\omega}(\tau) = argmin_b \frac{1}{N} \sum_{n=1}^{N} |(y_i - x_i b)|\rho_\tau \tag{11}$$

where $\rho_\tau$ comes from a piecewise function that gives weights to deviation from median depending on both the quantile and sign of error. Thus, it looks like as following

$$\rho_\tau = \begin{cases} \tau & \text{if } y_i > x_i b \\ 1 - \tau & \text{if } y_i \leq x_i b \end{cases} \tag{12}$$

The $j$-th conditional elasticity for quantile regression is straightforward. It is basically the regression coefficient, $\gamma_j$, since both dependent and independent variables are in logarithm forms.

# CHAPTER 7

# RESULTS

This chapter obtains results from three different models using the sample data. I get the regression tables and elasticity numbers by using Stata programming. The *twopm* package in Stata allows to fit the two-part models with logit and probit specifications for the first part and OLS [on y and on ln(y)] and GLM regression for the second part (Belotti, Deb, Manning, & Norton, 2015). I used the same regressors in both parts, as one can specify different regressors. After running the regression, I calculated the semi-elasticities in TPMs and elasticities in QR by *margins* command. Then, the interpretation of the specific elasticities followed by utilizing (Deb, Norton, & Manning, 2017).

## 7.1 Probability of having positive expenditure

Column 1 in Table 2 stands for the results of logistic regression. It reflects the parameters for the likelihood of having non-zero health expenditure. However, the direct interpretation of these values is misleading since the results are in exponential forms. Hence, Table A1 presents the effect of regressors on the change in the probability of having positive expenditure for a household.

Interaction variables of household income and years have significant and positive effects on the probability of having positive health expenditures throughout the period. However, the effect fluctuates over time. While a percentage increase in income raised the probability by 0.15% in 2006, the effect of income dropped to 0.12% in 2009. After a slight bounce in 2010, the smallest effect of income on the probability was 0.11% in 2011. Between 2011 and 2019, the effect of income on the probability was more stable than in previous years. On the other hand, the effect of income increased from 0.14% to 0.17% probability and peaked in 2019.

The coefficients for the years in column 1 of Table A1 tell how the effect of the year changed compared to 2006. In general, there was always a significant difference from 2007 to 2017. The year 2007 significantly raises the probability of

having positive health expenditure, yet the significance level is negligible. From 2008 to 2011, the effect of the years was hiking, and the year effect increased the probability by 0.38% in 2011. Then, from 2012 to 2017, the effect was comparatively smaller, but it was still positive and significant. The variation in the values continued until the end of the period. However, unlike other years, there is no significant effect on the probability in 2019.

Some of the other control variables had a significant effect on the probability as well. An additional child and elderly individual increases the probability by about 0.06% while the effect of health insurance is 0.04%. Nevertheless, the age and gender of the household head, household size and private health insurance coverage are the non-influential controls on the probability. In addition, education dummies show how having additional education compared to having no formal education alters the probability of positive expenditure. Although there is no significant difference between completing primary or lower secondary education, having a high school diploma decreases the probability by 0.03%. Having a college degree decreases the probability by 0.03%.

## 7.2 Regression results

Table 2 shows regression results for models. Columns 2 and 3 are the results from the second part of the two-part models. Since they are conducted only for positive expenditures, they only represent the impacts of regressors on these expenditures. Columns 4 to 8 in Table 2 present the regression results of quantile regressions. Due to the excessive number of zeros in the data, examining the values for lower quantiles below 0.5 would be non-sense. Hence, the starting quantile is the median, 0.5, for quantile regressions. Moreover, the income elasticities of the expenditures are examined in the next section because one needs to combine the results of the two-part models with logistic regression outcomes. So, in this section, the effect of the year controls and household characteristics are interpreted.

| | TPM | | | QR | | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Total Health Expenditure | Logit | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income x 2006 | 0.693*** | 0.880*** | 0.764*** | 3.458*** | 2.433*** | 1.735*** | 1.437*** | 1.218*** |
| | (0.036) | (0.041) | (0.034) | (0.149) | (0.065) | (0.050) | (0.046) | (0.045) |
| Income x 2007 | 0.586*** | 1.132*** | 0.825*** | 3.221*** | 1.988*** | 1.462*** | 1.333*** | 1.311*** |
| | (0.037) | (0.040) | (0.035) | (0.156) | (0.068) | (0.052) | (0.048) | (0.047) |
| Income x 2008 | 0.554*** | 1.028*** | 0.742*** | 2.815*** | 1.541*** | 1.232*** | 1.139*** | 1.143*** |
| | (0.036) | (0.038) | (0.034) | (0.152) | (0.066) | (0.051) | (0.047) | (0.046) |
| Income x 2009 | 0.527*** | 0.998*** | 0.670*** | 1.844*** | 1.208*** | 1.019*** | 1.006*** | 1.092*** |
| | (0.033) | (0.033) | (0.030) | (0.137) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2010 | 0.566*** | 1.000*** | 0.769*** | 1.526*** | 1.240*** | 1.137*** | 1.133*** | 1.160*** |
| | (0.034) | (0.033) | (0.028) | (0.140) | (0.061) | (0.047) | (0.044) | (0.042) |
| Income x 2011 | 0.523*** | 0.972*** | 0.734*** | 1.345*** | 1.143*** | 1.079*** | 1.127*** | 1.090*** |
| | (0.034) | (0.034) | (0.028) | (0.140) | (0.061) | (0.046) | (0.043) | (0.042) |
| Income x 2012 | 0.602*** | 0.980*** | 0.713*** | 1.426*** | 1.150*** | 1.084*** | 1.078*** | 1.063*** |
| | (0.033) | (0.032) | (0.027) | (0.136) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2013 | 0.608*** | 0.928*** | 0.678*** | 1.121*** | 1.009*** | 1.013*** | 1.017*** | 1.080*** |
| | (0.035) | (0.031) | (0.027) | (0.136) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2015 | 0.582*** | 1.015*** | 0.750*** | 1.861*** | 1.276*** | 1.149*** | 1.156*** | 1.163*** |
| | (0.030) | (0.031) | (0.026) | (0.123) | (0.054) | (0.041) | (0.038) | (0.037) |
| Income x 2016 | 0.604*** | 0.956*** | 0.696*** | 1.934*** | 1.275*** | 1.204*** | 1.175*** | 1.136*** |
| | (0.030) | (0.030) | (0.026) | (0.122) | (0.053) | (0.041) | (0.038) | (0.037) |
| Income x 2017 | 0.615*** | 0.947*** | 0.689*** | 1.300*** | 1.065*** | 1.070*** | 1.107*** | 1.143*** |
| | (0.031) | (0.029) | (0.024) | (0.122) | (0.053) | (0.041) | (0.038) | (0.037) |
| Income x 2019 | 0.762*** | 1.035*** | 0.726*** | 3.057*** | 1.586*** | 1.360*** | 1.313*** | 1.299*** |
| | (0.032) | (0.033) | (0.027) | (0.129) | (0.056) | (0.043) | (0.040) | (0.039) |
| year=2007 | 0.804* | -2.905*** | -1.073*** | 1.344 | 3.229*** | 1.604*** | 0.039 | -1.574*** |
| | (0.413) | (0.465) | (0.399) | (1.729) | (0.749) | (0.575) | (0.536) | (0.521) |
| year=2008 | 1.121*** | -2.186*** | -0.475 | 5.315*** | 7.023*** | 3.511*** | 1.579*** | -0.390 |
| | (0.410) | (0.455) | (0.391) | (1.718) | (0.745) | (0.571) | (0.533) | (0.518) |
| year=2009 | 1.578*** | -1.921*** | 0.170 | 14.426*** | 10.190*** | 5.523*** | 2.806*** | 0.145 |
| | (0.390) | (0.429) | (0.366) | (1.624) | (0.704) | (0.540) | (0.504) | (0.490) |
| year=2010 | 1.435*** | -1.822*** | -0.367 | 17.788*** | 10.432*** | 4.986*** | 2.164*** | -0.153 |
| | (0.399) | (0.430) | (0.360) | (1.648) | (0.715) | (0.548) | (0.511) | (0.497) |
| year=2011 | 1.801*** | -1.573*** | -0.059 | 19.360*** | 11.290*** | 5.523*** | 2.238*** | 0.449 |
| | (0.402) | (0.435) | (0.360) | (1.658) | (0.719) | (0.551) | (0.514) | (0.500) |
| year=2012 | 1.115*** | -1.650*** | 0.121 | 18.678*** | 11.172*** | 5.435*** | 2.603*** | 0.623 |
| | (0.397) | (0.425) | (0.356) | (1.632) | (0.707) | (0.542) | (0.506) | (0.492) |
| year=2013 | 1.396*** | -1.139*** | 0.581* | 21.787*** | 12.752*** | 6.322*** | 3.340*** | 0.677 |
| | (0.405) | (0.423) | (0.352) | (1.633) | (0.708) | (0.543) | (0.507) | (0.492) |
| year=2015 | 1.095*** | -1.845*** | -0.062 | 14.785*** | 10.077*** | 4.877*** | 1.999*** | -0.139 |
| | (0.377) | (0.418) | (0.350) | (1.561) | (0.677) | (0.519) | (0.484) | (0.470) |
| year=2016 | 0.896** | -1.390*** | 0.320 | 13.984*** | 9.984*** | 4.361*** | 1.788*** | 0.046 |
| | (0.376) | (0.417) | (0.348) | (1.556) | (0.675) | (0.517) | (0.483) | (0.469) |
| year=2017 | 1.095*** | -1.268*** | 0.464 | 19.948*** | 12.049*** | 5.702*** | 2.538*** | 0.148 |
| | (0.381) | (0.412) | (0.341) | (1.558) | (0.675) | (0.518) | (0.483) | (0.469) |
| year=2019 | -0.526 | -1.935*** | 0.143 | 3.869** | 7.247*** | 3.005*** | 0.652 | -1.228** |
| | (0.388) | (0.434) | (0.358) | (1.596) | (0.692) | (0.531) | (0.495) | (0.481) |
| Age | 0.004*** | 0.002*** | -0.001* | 0.003 | 0.000 | 0.000 | 0.001 | 0.003*** |
| | (0.001) | (0.001) | (0.001) | (0.003) | (0.001) | (0.001) | (0.001) | (0.001) |
| Gender | -0.006 | -0.038* | -0.005 | 0.087 | 0.044 | 0.021 | 0.002 | -0.029 |
| | (0.019) | (0.020) | (0.017) | (0.080) | (0.035) | (0.027) | (0.025) | (0.024) |
| Household size | -0.003 | -0.071*** | -0.049*** | -0.042** | -0.037*** | -0.051*** | -0.061*** | -0.071*** |
| | (0.004) | (0.004) | (0.003) | (0.016) | (0.007) | (0.005) | (0.005) | (0.005) |
| Number of children | 0.254*** | 0.128*** | 0.162*** | 0.633*** | 0.407*** | 0.338*** | 0.293*** | 0.211*** |
| | (0.012) | (0.012) | (0.010) | (0.050) | (0.022) | (0.017) | (0.016) | (0.015) |
| Number of elder | 0.282*** | 0.183*** | 0.187*** | 0.655*** | 0.441*** | 0.386*** | 0.355*** | 0.302*** |
| | (0.013) | (0.013) | (0.011) | (0.056) | (0.024) | (0.018) | (0.017) | (0.017) |
| Health insurance | 0.178*** | -0.212*** | -0.128*** | 0.632*** | 0.274*** | 0.052 | -0.092*** | -0.144*** |
| | (0.025) | (0.028) | (0.023) | (0.108) | (0.047) | (0.036) | (0.034) | (0.033) |
| Private health insurance | 0.006 | -0.054 | -0.034 | -0.184 | -0.045 | -0.042 | -0.026 | -0.032 |
| | (0.037) | (0.040) | (0.033) | (0.157) | (0.068) | (0.052) | (0.049) | (0.047) |
| Educ1 | -0.032 | -0.109*** | -0.119*** | -0.099 | -0.135*** | -0.160*** | -0.144*** | -0.123*** |
| | (0.020) | (0.021) | (0.018) | (0.087) | (0.038) | (0.029) | (0.027) | (0.026) |
| Educ2 | -0.134*** | -0.137*** | -0.099*** | -0.203* | -0.218*** | -0.219*** | -0.175*** | -0.176*** |
| | (0.026) | (0.027) | (0.022) | (0.109) | (0.047) | (0.036) | (0.034) | (0.033) |
| Educ3 | -0.155*** | -0.109*** | 0.020 | -0.194 | -0.110** | -0.084** | -0.064* | -0.097*** |
| | (0.029) | (0.030) | (0.024) | (0.120) | (0.052) | (0.040) | (0.037) | (0.036) |
| Constant | -5.905*** | -1.319*** | -1.788*** | -28.666*** | -17.536*** | -10.329*** | -6.753*** | -3.925*** |
| | (0.292) | (0.336) | (0.278) | (1.205) | (0.522) | (0.401) | (0.374) | (0.363) |
| Observations | 123015 | 74179 | 74179 | 123015 | 123015 | 123015 | 123015 | 123015 |

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table 2. Regression Results for Total Healthcare Spending 2006-2019

While the year dummies significantly decrease the level of positive expenditures in the GLM model compared to 2006, in OLS results, there was no significant difference between years. Also, the results of quantile regressions indicate that the effect of the years increased gradually until 2013, but then it decreased from 2013 to 2017. Although there were spikes in the effects in 2017, the effect shrank in 2019 and reverted to the level of 2008. In addition to the changes in the effects from year to year, the effect varies depending on the specification of the quantile. Moving from column 4 to column 8 in the same row shows that the effect of the year gets smaller for the larger expenditures. One can interpret this outcome as the larger expenditures are necessary, like surgeries, and the yearly changes in the conditions do not have an impact.

The household characteristics have similar impacts on the positive expenditures in GLM and OLS models. While household size and health insurance coverage lower positive expenditures, the number of children and elders in a home increase spending significantly. Nevertheless, the age and gender of the household head and private health insurance have no significant impact on these expenditures. Additively, having at least a primary school degree drops the level of positive expenditure. While the gap widens for high school level in GLM and the highest difference occurs in primary school compared to having no formal education, OLS results support that having a high school diploma matters more. In quantile regression analysis, we concluded with similar outcomes. The age and gender of the household head and private health insurance still have no impacts, regardless of the specified quantile. While the level of expenditure is smaller for larger households, the number of children and elders increases expenditures significantly, but the effects of these variables diminish over quantiles. Despite the fact that having health insurance increases the level of positive expenditures for lower quantiles, it decreases the level for higher quantiles. Also, having a school diploma significantly lowers these expenditures, and a high school education seems the most effective.

### 7.3 Income elasticities

Table 3 displays income elasticities obtained from relevant regressions presented in Table 2. When columns 1 and 2 of Table 3 display the elasticities obtained from two-part models, columns 3 to 7 the results from quantile regressions.

According to the GLM model, column 1, a 10% increase in total income is associated with 11.5% to 13.3% positive changes in total healthcare expenditure for a family, yet elasticity values hardly go below the unity. The income elasticity of healthcare expenditure was 1.154 in 2006, but it increased to 1.364 in 2007. After the sudden pike, it decreased to 1.180 in 2011. From 2011 to 2017, there was no observable difference in the values, but then it increased to 1.337 in 2019. OLS results followed a similar conclusion but more moderate changes in the elasticities, implying that there might be no significant difference in numbers. While the highest elasticity was 1.057 in 2007, the lowest value was 0.879 in 2009.

| | TPM | | QR | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Total Health Expenditure | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income x 2006 | 1.154*** | 1.039*** | 3.458*** | 2.433*** | 1.735*** | 1.437*** | 1.218*** |
| | (0.043) | (0.037) | (0.149) | (0.065) | (0.050) | (0.046) | (0.045) |
| Income x 2007 | 1.364*** | 1.057*** | 3.221*** | 1.988*** | 1.462*** | 1.333*** | 1.311*** |
| | (0.042) | (0.038) | (0.156) | (0.068) | (0.052) | (0.048) | (0.047) |
| Income x 2008 | 1.247*** | 0.962*** | 2.815*** | 1.541*** | 1.232*** | 1.139*** | 1.143*** |
| | (0.040) | (0.037) | (0.152) | (0.066) | (0.051) | (0.047) | (0.046) |
| Income x 2009 | 1.207*** | 0.879*** | 1.844*** | 1.208*** | 1.019*** | 1.006*** | 1.092*** |
| | (0.035) | (0.032) | (0.137) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2010 | 1.224*** | 0.993*** | 1.526*** | 1.240*** | 1.137*** | 1.133*** | 1.160*** |
| | (0.036) | (0.031) | (0.140) | (0.061) | (0.047) | (0.044) | (0.042) |
| Income x 2011 | 1.180*** | 0.942*** | 1.345*** | 1.143*** | 1.079*** | 1.127*** | 1.090*** |
| | (0.036) | (0.031) | (0.140) | (0.061) | (0.046) | (0.043) | (0.042) |
| Income x 2012 | 1.219*** | 0.953*** | 1.426*** | 1.150*** | 1.084*** | 1.078*** | 1.063*** |
| | (0.034) | (0.030) | (0.136) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2013 | 1.270*** | 0.919*** | 1.121*** | 1.009*** | 1.013*** | 1.017*** | 1.080*** |
| | (0.034) | (0.030) | (0.136) | (0.059) | (0.045) | (0.042) | (0.041) |
| Income x 2015 | 1.246*** | 0.981*** | 1.861*** | 1.276*** | 1.149*** | 1.156*** | 1.163*** |
| | (0.032) | (0.029) | (0.123) | (0.054) | (0.041) | (0.038) | (0.037) |
| Income x 2016 | 1.196*** | 0.936*** | 1.934*** | 1.275*** | 1.204*** | 1.175*** | 1.136*** |
| | (0.032) | (0.028) | (0.122) | (0.053) | (0.041) | (0.038) | (0.037) |
| Income x 2017 | 1.191*** | 0.933*** | 1.300*** | 1.065*** | 1.070*** | 1.107*** | 1.143*** |
| | (0.031) | (0.027) | (0.122) | (0.053) | (0.041) | (0.038) | (0.037) |
| Income x 2019 | 1.337*** | 1.029*** | 3.057*** | 1.586*** | 1.360*** | 1.313*** | 1.299*** |
| | (0.035) | (0.030) | (0.129) | (0.056) | (0.043) | (0.040) | (0.039) |

Table 3. Income Elasticities 2006-2019

Columns 3 to 7 of Table 3 reflect the income elasticities for quantile regression analysis with ascending quantiles starting from the median. Those results have similar conclusions with two-part models. For the median quantile, the elasticity values tended to get lower from 2006 to 2013, in which values decreased from 3.458 to 1.121; they increased after then and peaked in 2019 at 3.057. As we move to the elasticity estimation results for higher quantiles of health expenditure, this pattern can also be seen for those quantiles. In addition, the elasticities get smaller as the specified quantile gets bigger. However, the elasticities never went under the unity supporting that OOP healthcare is a highly elastic good.

Improved living conditions due to the increase in GDP per capita in 2013 seem to be an influential determinant for lower-income dependence on healthcare spending. Households may benefit from healthcare services without any delay. The lack of insurance coverage in 2006 and 2007 and the economic environment in 2019 might explain the behavior for those years.

### 7.3.1 Income elasticities by income level

A household's income is an influential factor to consider when exploring the healthcare spending behavior of households because it determines a household's capacity to access and pay for healthcare services. Households with higher incomes may be able to afford more expensive healthcare services and treatments. In comparison, those with lower incomes may only be able to afford primary healthcare services or may abstain from healthcare due to cost. These might generate a gap between the elasticities of households with different income levels.

From 2006 to 2019, many laws and legislation regarding healthcare pricing and payment scheme were initiated. These amendments often address low-income households not covered by other health insurance programs. Especially the extending coverage of the green card program supported these households. Nevertheless, regulations about pricing in the Social Insurance and General Health Insurance Act might have contrarily affected those families.

Examining income elasticity depending on income level is essential because it guides us to understand how changes in income affect household behavior differently across different income groups. In order to evaluate the disparities between families with different income levels, I split the data into two depending on whether a family's income is below or above the median. The results are shown in Table 4.

Columns 1 to 2 and 8 to 9 are low-income and high-income households' income elasticities obtained in GLM and OLS models, respectively. GLM and OLS values tend to increase as income rises and fluctuates around the unit elasticity. In contrast, the quantile regression elasticities are larger than the ones with the two-part models.

For the lower income group, the elasticity from the GLM model was 1.091 in 2006 and increased suddenly in 2007 with a value of 1.160, the impact did not last very long, and elasticity decreased to 1.080 in 2008. Until the end of 2016, it went up and down year by year, and we ended up with a value of 0.962, the lowest value in 2016. It started to increase after then, and the highest elasticity was obtained in 2019 with 1.159.

Findings in the OLS model for the lower income group are different this time. The elasticity was 1.061 in 2006, and that was the highest value. Further, for the lower income group, elasticity never exceeded the unity again throughout the period. From 2006 to 2007 and 2007 to 2008, there were observable drops in values considering the elasticity was 0.877 in 2007 and 0.795 in 2008. However, the fluctuations in other years were modest.

Quantile regression estimation for the median quantile shows that elasticities were much higher between 2008 and 2019 than in the previous two years. While the value was 1.532 in 2006 and 1.043 in 2007, it increased to 3.340 in 2008. Although it decreased after 2008 and reached 1.886 in 2013, the income effect for the smallest expenditures stayed as very high for the rest of the period. For the other quantiles, the pattern was the opposite. The highest elasticities were obtained in 2006 and 2007.

However, for the remaining period, between 2008 and 2019, the lowest elasticity was received in 2013 for all quantiles.

For the higher income group, GLM suggests that the sudden increase in 2007 and decrease after then exist as well. Elasticity increased from 1.117 in 2006 to 1.563 in 2007. Differently, the gradual decreases in the values lasted until the end of 2013, and the elasticity reached its lowest at 1.141 in 2013. The values were similar for the rest of the period, varying between 1.155 and 1.285. OLS resulted in a similar trend in elasticities. The elasticity increased from 0.837 in 2006 to 1.042 in 2007. Since then, the values decreased slowly until 2013 and reached the elasticity of 0.868 in 2013. Even though it increased on average, the highest value was 0.936 in 2019 for the rest of the period.

Quantile regression elasticities in column 10 show that the elasticity in 2006 was 1.487, very similar to the value for the lower-income group. However, in 2007, it increased to 1.708, which was a different movement. After then, the sudden decreases in 2009 and 2013 were also observable for the higher income group. Elasticity dropped from 1.246 to 0.986 in 2009 and 1.026 to 0.862 in 2013. Ups and downs were also apparent until 2019, as there was a notable increase in 2019 as the elasticity rose from 1.022 to 1.409. Although the elasticities were not moving in order across other quantiles, the direction of the values within a quantile remained the same.

Overall, for the lower income group compared to the higher one, the elasticities were higher for the lower quantiles of health spending and lower for the higher quantiles. Since each quantile includes specific kinds of healthcare services, i.e., while lower quantiles are generally composed of doctor visits, higher quantiles reflect the expenditure for surgeries, households in the lower income group might not go to a private healthcare provider for serious healthcare problems since they cannot afford a higher level of service. On the other hand, high-income households can afford more expensive treatments as odds for higher quantiles support.

| | Low Income | | | | | | | High Income | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TPM | | QR | | | | | TPM | | QR | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| Total Health Expenditure | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income x 2006 | 1.091*** | 1.061*** | 1.532*** | 3.923*** | 2.550*** | 1.855*** | 1.264*** | 1.117*** | 0.837*** | 1.487*** | 1.319*** | 1.151*** | 0.972*** | 1.071*** |
| | (0.084) | (0.075) | (0.502) | (0.180) | (0.104) | (0.089) | (0.089) | (0.084) | (0.066) | (0.156) | (0.098) | (0.091) | (0.088) | (0.090) |
| Income x 2007 | 1.160*** | 0.877*** | 1.043** | 2.844*** | 1.397*** | 1.203*** | 1.266*** | 1.563*** | 1.042*** | 1.708*** | 1.271*** | 1.391*** | 1.382*** | 1.319*** |
| | (0.086) | (0.078) | (0.520) | (0.186) | (0.108) | (0.092) | (0.092) | (0.082) | (0.069) | (0.162) | (0.102) | (0.094) | (0.092) | (0.094) |
| Income x 2008 | 1.080*** | 0.795*** | 3.340*** | 2.244*** | 1.083*** | 0.864*** | 0.970*** | 1.365*** | 0.948*** | 1.246*** | 1.052*** | 1.170*** | 1.202*** | 1.268*** |
| | (0.076) | (0.070) | (0.482) | (0.173) | (0.100) | (0.086) | (0.086) | (0.081) | (0.069) | (0.165) | (0.104) | (0.096) | (0.094) | (0.095) |
| Income x 2009 | 1.019*** | 0.808*** | 3.152*** | 1.709*** | 1.035*** | 0.884*** | 0.915*** | 1.294*** | 0.901*** | 0.986*** | 0.876*** | 0.987*** | 1.094*** | 1.323*** |
| | (0.063) | (0.059) | (0.422) | (0.151) | (0.088) | (0.075) | (0.075) | (0.075) | (0.063) | (0.152) | (0.096) | (0.089) | (0.086) | (0.088) |
| Income x 2010 | 1.024*** | 0.903*** | 2.277*** | 1.464*** | 1.081*** | 0.961*** | 0.930*** | 1.345*** | 1.036*** | 1.180*** | 1.173*** | 1.227*** | 1.299*** | 1.315*** |
| | (0.067) | (0.059) | (0.446) | (0.160) | (0.092) | (0.079) | (0.079) | (0.073) | (0.059) | (0.147) | (0.093) | (0.086) | (0.083) | (0.085) |
| Income x 2011 | 1.085*** | 0.917*** | 2.082*** | 1.335*** | 1.042*** | 0.966*** | 0.960*** | 1.177*** | 0.894*** | 1.057*** | 1.049*** | 1.074*** | 1.166*** | 1.096*** |
| | (0.067) | (0.060) | (0.465) | (0.167) | (0.097) | (0.083) | (0.083) | (0.070) | (0.058) | (0.144) | (0.091) | (0.084) | (0.082) | (0.083) |
| Income x 2012 | 1.055*** | 0.929*** | 2.553*** | 1.372*** | 1.036*** | 0.944*** | 0.909*** | 1.242*** | 0.940*** | 1.026*** | 0.973*** | 1.050*** | 1.106*** | 1.090*** |
| | (0.065) | (0.058) | (0.446) | (0.160) | (0.093) | (0.079) | (0.079) | (0.066) | (0.056) | (0.141) | (0.089) | (0.082) | (0.080) | (0.081) |
| Income x 2013 | 1.069*** | 0.937*** | 1.886*** | 1.171*** | 0.979*** | 0.898*** | 0.901*** | 1.141*** | 0.868*** | 0.862*** | 0.896*** | 0.945*** | 1.030*** | 1.096*** |
| | (0.062) | (0.057) | (0.441) | (0.158) | (0.092) | (0.078) | (0.078) | (0.069) | (0.056) | (0.142) | (0.090) | (0.083) | (0.081) | (0.082) |
| Income x 2015 | 1.053*** | 0.895*** | 3.478*** | 1.606*** | 1.148*** | 1.048*** | 0.949*** | 1.285*** | 0.936*** | 1.116*** | 1.048*** | 1.061*** | 1.087*** | 1.248*** |
| | (0.060) | (0.055) | (0.401) | (0.144) | (0.083) | (0.071) | (0.071) | (0.066) | (0.052) | (0.127) | (0.080) | (0.074) | (0.072) | (0.074) |
| Income x 2016 | 0.962*** | 0.850*** | 3.657*** | 1.609*** | 1.156*** | 1.024*** | 1.020*** | 1.169*** | 0.860*** | 1.056*** | 1.031*** | 1.098*** | 1.116*** | 1.130*** |
| | (0.062) | (0.056) | (0.407) | (0.146) | (0.084) | (0.072) | (0.072) | (0.063) | (0.052) | (0.126) | (0.079) | (0.073) | (0.072) | (0.073) |
| Income x 2017 | 1.030*** | 0.858*** | 2.116*** | 1.207*** | 0.963*** | 0.987*** | 0.951*** | 1.155*** | 0.889*** | 1.022*** | 1.016*** | 0.993*** | 1.011*** | 1.108*** |
| | (0.059) | (0.053) | (0.410) | (0.147) | (0.085) | (0.073) | (0.073) | (0.064) | (0.050) | (0.125) | (0.079) | (0.073) | (0.071) | (0.073) |
| Income x 2019 | 1.159*** | 0.926*** | 4.184*** | 2.164*** | 1.301*** | 1.126*** | 1.177*** | 1.270*** | 0.915*** | 1.409*** | 1.265*** | 1.173*** | 1.157*** | 1.145*** |
| | (0.068) | (0.060) | (0.431) | (0.154) | (0.089) | (0.076) | (0.076) | (0.066) | (0.054) | (0.131) | (0.083) | (0.076) | (0.075) | (0.076) |

Table 4. Income Elasticities for Low and High Income Levels 2006-2019

## 7.4 The effect of the 2008 financial crisis

Given the significant impact that health reforms and the 2008 crisis have had on households' healthcare spending and financial well-being, it is crucial to understand the long-term income effects of these events. While the initial reforms and crisis response measures may have provided some relief for households in the short term, it is crucial to investigate whether these changes have had a lasting impact on healthcare affordability and access. A complete understanding of the income effects of health reforms and the crisis enables policymakers to identify and manage the ongoing financial challenges faced by households in accessing healthcare services.

| | TPM | | | | QR | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Total Health Expenditure | Logit (Exp) | Logit (Pr) | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income (2006-2019) | 0.641*** | 0.254*** | 1.264*** | 1.048*** | 3.331*** | 2.195*** | 1.593*** | 1.380*** | 1.260*** |
| | (0.026) | (0.010) | (0.030) | (0.027) | (0.110) | (0.046) | (0.036) | (0.034) | (0.033) |
| Crisis Income (2008-2009) | -0.102*** | -0.040*** | -0.038 | -0.132*** | -1.025*** | -0.843*** | -0.499*** | -0.310*** | -0.157*** |
| | (0.035) | (0.014) | (0.040) | (0.035) | (0.147) | (0.062) | (0.048) | (0.045) | (0.045) |
| Post Crisis Income I (2010-2013) | -0.066** | -0.026** | -0.066* | -0.097*** | -1.977*** | -1.080*** | -0.521*** | -0.291*** | -0.165*** |
| | (0.031) | (0.012) | (0.034) | (0.030) | (0.127) | (0.053) | (0.042) | (0.039) | (0.039) |
| Post Crisis Income II (2015-2019) | -0.003 | -0.001 | -0.025 | -0.080*** | -1.463*** | -0.919*** | -0.407*** | -0.197*** | -0.079** |
| | (0.030) | (0.011) | (0.034) | (0.030) | (0.124) | (0.052) | (0.040) | (0.038) | (0.038) |
| Observations | 123015 | 123015 | 74179 | 74179 | 123015 | 123015 | 123015 | 123015 | 123015 |

Table 5. Total Healthcare Spending Elasticities for Crisis

Table 5 illustrates the income elasticity in different periods, including the crisis period (2008-2009), the post-crisis period with increasing GDP per capita (2010-2013) and the post-crisis period with decreasing GDP per capita (2015-2019).

Columns 1 and 2 of Table 5 refer to the participation equation for the two-part models. The income during the crisis period significantly decreases the probability of positive healthcare expenditures. While there is a significant difference at the 5% level in the first post-crisis period, there is no difference compared to the pre-crisis period in the second post-crisis period, as logistic regression coefficients suggest. In the crisis period, the probability of having positive expenditure decreased by 4%, whereas in the following period, the difference was 2%.

In columns 3 and 4, the GLM model exhibits negligible differences between periods. In contrast, OLS supports that there are significant drops in positive

healthcare expenditures in every post-crisis period compared to the pre-crisis period. Nevertheless, in columns 5 to 9, quantile regression values show that the income effect got smaller during the crisis. For the median quantile, the elasticity decreased by 1.025. The effect outperformed during the first post-crisis income period implying the decrease in dependence on income even went further. However, as household incomes shrank after 2013, the effect returned to the reverse, and elasticity increased. Furthermore, although the income effect diminishes, the difference between periods stays steady for the higher quantiles of expenditure.

### 7.4.1 The effect of the 2008 financial crisis by income level

Tables 6 and 7 present the same regression outcomes with different household income levels.

| | TPM | | | | QR | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Total Health Expenditure | Logit (Exp) | Logit (Pr) | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income (2006-2019) | 0.752*** | 0.336*** | 1.124*** | 0.972*** | 1.350*** | 3.485*** | 1.931*** | 1.558*** | 1.273*** |
| | (0.051) | (0.230) | (0.061) | (0.055) | (0.318) | (0.125) | (0.076) | (0.066) | (0.064) |
| Crisis Income (2008-2009) | -0.067 | -0.030 | -0.081 | -0.170** | 1.856*** | -1.597*** | -0.866*** | -0.684*** | -0.324*** |
| | (0.066) | (0.029) | (0.076) | (0.069) | (0.411) | (0.161) | (0.098) | (0.086) | (0.083) |
| Post Crisis Income I (2010-2013) | -0.033 | -0.015 | -0.067 | -0.051 | 0.837** | -2.153*** | -0.889*** | -0.620*** | -0.353*** |
| | (0.059) | (0.026) | (0.067) | (0.060) | (0.364) | (0.143) | (0.087) | (0.076) | (0.073) |
| Post Crisis Income II (2015-2019) | -0.041 | -0.018 | -0.077 | -0.092 | 2.110*** | -1.955*** | -0.794*** | -0.511*** | -0.246*** |
| | (0.057) | (0.025) | (0.067) | (0.060) | (0.356) | (0.140) | (0.085) | (0.074) | (0.072) |
| Observations | 61505 | 61505 | 34038 | 34038 | 61505 | 61505 | 61505 | 61505 | 61505 |

Table 6. Total Healthcare Spending Elasticities of Low Income Households for Crisis

| | TPM | | | | QR | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Total Health Expenditure | Logit (Exp) | Logit (Pr) | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income (2006-2019) | 0.365*** | 0.126*** | 1.352*** | 0.933*** | 1.603*** | 1.294*** | 1.263*** | 1.166*** | 1.147*** |
| | (0.049) | (0.017) | (0.059) | (0.048) | (0.111) | (0.073) | (0.066) | (0.067) | (0.065) |
| Crisis Income (2008-2009) | -0.069 | -0.024 | -0.024 | -0.011 | -0.510*** | -0.325*** | -0.201** | -0.018 | 0.153* |
| | (0.067) | (0.023) | (0.079) | (0.065) | (0.153) | (0.101) | (0.090) | (0.092) | (0.090) |
| Post Crisis Income I (2010-2013) | 0.097* | 0.033* | -0.127* | -0.000 | -0.578*** | -0.282*** | -0.190** | -0.018 | -0.004 |
| | (0.058) | (0.020) | (0.067) | (0.055) | (0.128) | (0.085) | (0.076) | (0.078) | (0.075) |
| Post Crisis Income II (2015-2019) | 0.097* | 0.033* | -0.135* | -0.034 | -0.460*** | -0.218*** | -0.188** | -0.076 | 0.012 |
| | (0.056) | (0.019) | (0.066) | (0.053) | (0.124) | (0.082) | (0.073) | (0.075) | (0.073) |
| Observations | 61510 | 61510 | 40141 | 40141 | 61510 | 61510 | 61510 | 61510 | 61510 |

Table 7. Total Healthcare Spending Elasticities of High Income Households for Crisis

As columns 2 in Tables 6 and 7 show, lower-income households were more likely to have positive health expenditures in the pre-crisis period. Furthermore, while the probability did not vary in the crisis and post-crisis periods for the lower income group, a slight increase in the probabilities, by 0.03%, in post-crisis periods took place for the higher income group.

In columns 3 and 4 of the tables, GLM and OLS models suggest no significant difference in elasticities of positive healthcare expenditures, excluding 0.170 decreases in the crisis period for the lower income group.

As median quantile regression results propose, while low-income households need more money to compensate for their spending, high-income ones need less during crisis periods. However, for the higher quantiles of health expenditure, income elasticities for both groups decrease compared to the pre-crisis period. This might be explained by the fact that during a crisis, low-income households choose to go to public hospitals rather than private ones, which costs them less. Thus, the fraction of spending on public facilities might increase. Consequently, they spend and need relatively more money than before they do. Hence, for the lower payments, they started putting more resources.

Similarly, they cut their spending on higher expenses, i.e., private hospitals. However, since high-income households are less exposed to these income shocks, the differences in the values in Table 7 are negative. Other than the effect of the crisis, the improving healthcare sector after 2008 could be the driving effect of these negative values. Also, the law regarding the extra payments to private hospitals might have led families to public ones regardless of income level. That could be the reason for the unchanging income dependence level for higher quantiles of healthcare spending in Table 7.

### 7.5 Income elasticity of subcategories

Healthcare expenditure is measured under three subcategories, i.e., expenditure on medical products, outpatient and inpatient expenditures. So, the evaluation of

responses to income change from these expenditure categories may guide us in understanding the values of total healthcare expenditure tables in a better way.

Pharmaceutical products are the first subcategory's most considerable and crucial portion. Elasticity results for this category are shown in Table A2.

According to the results from the two-part models, one can conclude that the income sensitivity of pharmaceutical products varies year by year. For the GLM model, it reached the lowest in 2009 and the highest in 2019, with elasticities of 0.599 and 0.910, respectively. Meanwhile, OLS has similar results for pharmacy expenditures apart from showing 2006 has the most elastic value with 0.760. The same conclusion can be made for the higher levels of quantile regression. While the elasticity was around 0.4 in 2009, it became about 0.7 in 2019. Nevertheless, the value for 0.5th quantile supports that pharmaceutical products were relatively more expensive in 2009 as the estimated elasticity was 2.044, which is very high considering it was 0.617 in 2008.

Table A3 exhibits the results of regressions of outpatient and inpatient expenditures. Since nearly 70% of outpatient and 92% of inpatient expenditures are zero outcomes, and as a result, the quantile regression model is applicable for only very high quantiles. However, this could not lead to any conclusion about the changes between quantiles. Hence, I only run TPMs with positive expenditures.

Columns 1 and 2 of Table A3 demonstrate the income elasticity results of outpatient services. The values are higher than those for pharmaceutical products and quite above the unit. While the estimated elasticity numbers by GLM vary between 1.328 and 1.607, OLS results point to lower values considering the elasticity was 0.983 in 2013 and the value became 1.408 in 2019. So, we can conclude that households reduce their outpatient visits when their income gets lower or prefer public healthcare services rather than private ones, as the elasticity values were the lowest in 2013 for both models.

Elasticity results of inpatient care expenditure are shown in columns 3 and 4 in Table A3. The dependence on income decreases gradually after 2007. Whereas the

elasticity was 2.837 in 2007, the number was 1.375 in 2019 for TPM with GLM. OLS results also indicate a gentle decline in elasticities towards the end of the period. Either the payment changes in private hospitals under the Social Insurance and General Health Insurance Act could play a massive role in these drops, and rising costs for these institutions might push households to public providers, or the excluded zero expenditures could lead to these outcomes.

### 7.6 Expenditure shares of subcategories in total healthcare spending

Changes in payment scheme of healthcare services and household income during the period might change the payment share of subcategories of healthcare spending. Especially, raising co-payment amount in outpatient care in 2010 and doubling additional fees in private healthcare providers in 2013 might be important break points.

In order to measure these effects, first I divided the sample into 5 income groups. Then, I calculated the 45th and 55th percentiles of total healthcare expenditure for each income group to see the effect around the median. After that I measured the ratio of subcategories, i.e. pharmacy, outpatient, inpatient and other health, for these sub-groups of households. Figure 6 demonstrates the mean ratios of subcategories of healthcare spending to total healthcare spending depending on income level of households. There are some findings regarding the fractional changes throughout the period.

At first, for the lowest group of income, prior to 2009, healthcare expenditure was zero but for higher quantiles, healthcare expenditure exist for all years. Primary reason could be that these low-income households might benefited from the green card coverage or any other protection programs. Or they did not use healthcare services since they could not afford them. Although positive expenditures mainly consist of expenditures on pharmaceutical products, outpatient care has a significant portion in 2013.

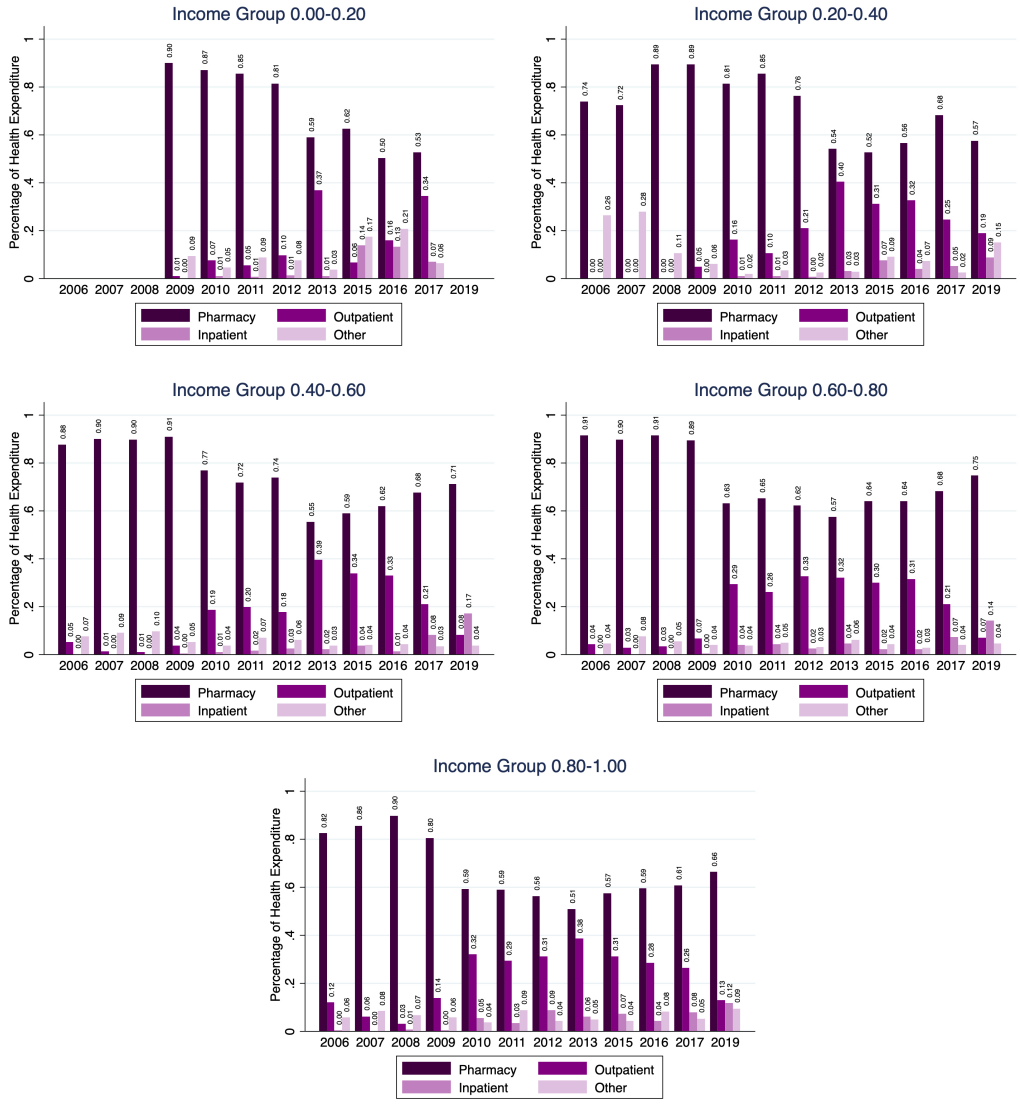


Figure 6. Shares of subcategories by year and income level

As the second finding, there were significant jumps in the share of spending on outpatient care services in 2010 and 2013 for the lower three groups of income. The share of outpatient care at least tripled in 2010 and doubled in 2013 with respect to the previous year. However, there were a single sudden increase in outpatient care share in 2010 for higher two groups of income. Drop in the share of pharmacy spending and increase in the share of outpatient care in 2010 were more considerable for the higher quantiles of income.

Moreover, introduction of new additional fee cap in private institutions might explain these differences. While the cap increases for additional fees in 2010 affected all sample, the next increase in 2013 affected only for the lower income groups. So,

after crisis period, along with the increasing incomes and developing private healthcare facilities, lower-income households might apply private institutions more often whereas higher income households have paid attention to their health status all the time and been less affected by the fee changes.

# CHAPTER 8

# CONCLUSION

In this research, I evaluate Turkey's income elasticity of healthcare services. My sample data consists of household budget survey data from 2006 to 2019. I interpreted the income elasticities of total health, pharmacy, outpatient and hospital care expenditures using the merged data formed by appending the available for years. While studying the effect of income, I use two-part models and quantile regression analysis. As control variables, age and gender of household head, household size, child and elder number in the households, insurance coverage and education level of household head.

The elasticity results show that health is a highly elastic good in Turkey. Total healthcare spending is extremely income-dependent, and for a very large part of the sample, it can be considered luxury spending. While spending on pharmaceutical products does not require big resources, other subcategories remarkably demand more income than total healthcare spending does.

During the 2008 financial crisis, the effect of income on the households' likelihood of having positive expenditure decreased significantly. Furthermore, if we presume that private facilities are more costly than public ones, on average, and the income of a low-income household declines, they prefer utilizing the public institutions more frequently as they need more resource to their low-type expenditure. On the other hand, this behaviour was not observed for high-income households.

After the crisis was over and the income of households started growing, due to increases in expenses of patient care services, the ratio of expenditure spent on pharmaceutical products shrunk too much and left its place to other categories, primarily outpatient care. Also, the share spent in outpatient services rises as income increases.

Authorities and policymakers should consider some implications that could be used to reduce the impact of income on healthcare expenditure, especially for low-income households. These implications could be expanding health insurance

coverage, increasing the level of reimbursement for essential health services and providing financial assistance to low-income households. These are the most effective ways to protect people from financial hardship due to high healthcare costs. All people should have access to affordable health insurance, regardless of their income or employment status. Promoting preventive care and encouraging healthy lifestyles also could help to reduce the need for expensive medical treatment later on and the risk of chronic diseases, which are a major source of healthcare costs. Furthermore, implementing a lower cap on out-of-pocket spending in private healthcare providers could prevent significant out-of-pocket healthcare expenditures and reduce income dependence, which was observed primarily in outpatient services.

# APPENDIX A

# EFFECTS ON PROBABILITIES AND ANALYSIS OF SUBCATEGORIES

| Variables | Logit Probability |
|---|---|
| Income x 2006 | 0.157*** |
| | (0.008) |
| Income x 2007 | 0.133*** |
| | (0.008) |
| Income x 2008 | 0.126*** |
| | (0.008) |
| Income x 2009 | 0.120*** |
| | (0.007) |
| Income x 2010 | 0.129*** |
| | (0.007) |
| Income x 2011 | 0.119*** |
| | (0.007) |
| Income x 2012 | 0.137*** |
| | (0.007) |
| Income x 2013 | 0.138*** |
| | (0.008) |
| Income x 2015 | 0.132*** |
| | (0.006) |
| Income x 2016 | 0.137*** |
| | (0.006) |
| Income x 2017 | 0.140*** |
| | (0.007) |
| Income x 2019 | 0.173*** |
| | (0.007) |
| year=2007 | 0.179** |
| | (0.089) |
| year=2008 | 0.249*** |
| | (0.086) |
| year=2009 | 0.341*** |
| | (0.076) |
| year=2010 | 0.314*** |
| | (0.080) |
| year=2011 | 0.382*** |
| | (0.075) |
| year=2012 | 0.248*** |
| | (0.084) |
| year=2013 | 0.306*** |
| | (0.083) |
| year=2015 | 0.243*** |
| | (0.079) |
| year=2016 | 0.199** |
| | (0.080) |
| year=2017 | 0.243*** |
| | (0.080) |
| year=2019 | -0.103 |
| | (0.076) |
| Age | 0.000*** |
| | (0.000) |
| Gender | -0.001 |
| | (0.004) |
| Household size | -0.000 |
| | (0.000) |
| Number of children | 0.057*** |
| | (0.002) |
| Number of elder | 0.064*** |
| | (0.003) |
| Health insurance | 0.040*** |
| | (0.005) |
| Private health insurance | 0.001 |
| | (0.008) |
| Educ1 | -0.007 |
| | (0.004) |
| Educ2 | -0.030*** |
| | (0.005) |
| Educ3 | -0.035*** |
| | (0.006) |

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table A1. Probability of Having Positive Expenditure

| | TPM | | QR | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Total Pharmacy Expenditure | GLM | OLS | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
| Income x 2006 | 0.827*** | 0.760*** | 1.851*** | 2.546*** | 1.424*** | 1.034*** | 0.822*** |
| | (0.055) | (0.035) | (0.310) | (0.150) | (0.051) | (0.040) | (0.041) |
| Income x 2007 | 0.770*** | 0.666*** | 0.145 | 1.802*** | 0.912*** | 0.777*** | 0.714*** |
| | (0.056) | (0.036) | (0.324) | (0.157) | (0.054) | (0.042) | (0.043) |
| Income x 2008 | 0.630*** | 0.551*** | 0.617* | 1.209*** | 0.695*** | 0.558*** | 0.533*** |
| | (0.053) | (0.034) | (0.316) | (0.153) | (0.052) | (0.041) | (0.042) |
| Income x 2009 | 0.599*** | 0.486*** | 2.044*** | 0.848*** | 0.609*** | 0.483*** | 0.464*** |
| | (0.044) | (0.030) | (0.284) | (0.138) | (0.047) | (0.037) | (0.038) |
| Income x 2010 | 0.698*** | 0.537*** | 1.844*** | 0.782*** | 0.592*** | 0.545*** | 0.551*** |
| | (0.044) | (0.030) | (0.292) | (0.141) | (0.048) | (0.038) | (0.039) |
| Income x 2011 | 0.647*** | 0.518*** | 1.687*** | 0.702*** | 0.585*** | 0.549*** | 0.545*** |
| | (0.044) | (0.030) | (0.290) | (0.140) | (0.048) | (0.038) | (0.039) |
| Income x 2012 | 0.644*** | 0.535*** | 2.363*** | 0.856*** | 0.635*** | 0.561*** | 0.500*** |
| | (0.044) | (0.029) | (0.282) | (0.137) | (0.047) | (0.037) | (0.038) |
| Income x 2013 | 0.678*** | 0.537*** | 1.247*** | 0.716*** | 0.579*** | 0.516*** | 0.545*** |
| | (0.042) | (0.029) | (0.282) | (0.137) | (0.047) | (0.037) | (0.038) |
| Income x 2015 | 0.734*** | 0.588*** | 0.173 | 1.470*** | 0.835*** | 0.653*** | 0.586*** |
| | (0.043) | (0.028) | (0.256) | (0.124) | (0.042) | (0.033) | (0.034) |
| Income x 2016 | 0.730*** | 0.575*** | 0.254 | 1.506*** | 0.812*** | 0.679*** | 0.612*** |
| | (0.042) | (0.028) | (0.254) | (0.123) | (0.042) | (0.033) | (0.034) |
| Income x 2017 | 0.647*** | 0.519*** | 1.877*** | 0.727*** | 0.585*** | 0.558*** | 0.567*** |
| | (0.039) | (0.026) | (0.254) | (0.123) | (0.042) | (0.033) | (0.034) |
| Income x 2019 | 0.910*** | 0.657*** | 0.436 | 2.349*** | 0.952*** | 0.789*** | 0.719*** |
| | (0.043) | (0.030) | (0.268) | (0.130) | (0.044) | (0.035) | (0.036) |

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table A2. Income Elasticities for Pharmaceutical Products 2006-2019

| | Outpatient | | Inpatient | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | GLM | OLS | GLM | OLS |
| Income x 2006 | 1.525*** | 1.222*** | 1.935*** | 1.809*** |
| | (0.091) | (0.072) | (0.407) | (0.367) |
| Income x 2007 | 1.442*** | 1.185*** | 2.837*** | 3.079*** |
| | (0.090) | (0.075) | (0.374) | (0.326) |
| Income x 2008 | 1.390*** | 1.245*** | 2.207*** | 1.847*** |
| | (0.089) | (0.075) | (0.296) | (0.300) |
| Income x 2009 | 1.467*** | 1.226*** | 1.946*** | 1.790*** |
| | (0.069) | (0.058) | (0.288) | (0.240) |
| Income x 2010 | 1.397*** | 1.217*** | 1.505*** | 1.132*** |
| | (0.053) | (0.045) | (0.136) | (0.114) |
| Income x 2011 | 1.433*** | 1.183*** | 1.354*** | 1.178*** |
| | (0.055) | (0.046) | (0.136) | (0.112) |
| Income x 2012 | 1.440*** | 1.170*** | 1.540*** | 1.365*** |
| | (0.051) | (0.043) | (0.126) | (0.107) |
| Income x 2013 | 1.328*** | 0.983*** | 1.466*** | 1.588*** |
| | (0.045) | (0.038) | (0.111) | (0.096) |
| Income x 2015 | 1.439*** | 1.160*** | 1.410*** | 1.384*** |
| | (0.045) | (0.038) | (0.104) | (0.089) |
| Income x 2016 | 1.364*** | 1.115*** | 1.391*** | 1.449*** |
| | (0.044) | (0.037) | (0.110) | (0.092) |
| Income x 2017 | 1.401*** | 1.111*** | 1.365*** | 1.209*** |
| | (0.045) | (0.036) | (0.083) | (0.066) |
| Income x 2019 | 1.607*** | 1.408*** | 1.375*** | 0.950*** |
| | (0.067) | (0.054) | (0.069) | (0.058) |

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Table A3. Income Elasticities for Inpatient and Outpatient Expenditures 2006-2019

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