

Mathematical model analysis of mandatory state health insurance : Revisiting risks and opportunities for private health

Edmond Muhaxheri [§]

Kamal Shahrabi [†]

Debabrata Samanta ^{*}

Department of Computing and Information Technologies

Rochester Institute of Technology

Kosovo

Europe

Abstract

This article aims to determine a feasible entrance brink constant for secluded healthiness indemnification corporations to access the newest purchaser excess for Kosovo's planned compulsory wellbeing indemnification fund, as well as to evaluate the reasoning behind it and measure the surplus. We begin with a succinct overview of the current status of the private insurance sector. Despite experiencing a substantial growth spurt in recent years, its share in the overall financial sector has, in fact, decreased. Following this, we delve into an intuitive approach for calculating the threshold coefficient. Due to the unavailability of similar contingent valuation survey data, we adopt a method based on adjusting prices using the consumer price index. These adjusted prices are then used to estimate the most recent data. Our findings reveal the presence of a consumer surplus, signifying an opportunity for original sequestered guarantors to enter the marketplace or for prevailing companies to offer additional services at an additional cost. However, it's important to note that the 2021 surplus is notably lower compared to the estimate for the year 2015.

Subject Classification: 00A69, 00A64.

Keywords: Health insurance, Potential entry threshold, Median, Sample size, Contribution rates, SER.

[§] E-mail: emuhaxheri@auk.org

[†] E-mail: kshahrabi@auk.org

^{*} E-mail: debabrata.samanta369@gmail.com (Corresponding Author)

Orcid Id: 0000-0003-4118-2480

1. Introduction

This paper provides an extension to the idea that what happens to the fragile private health insurance market in Kosovo, given a new and increased push towards final enactment of a binding healthiness indemnification fund voted in by the legislature. At its core HIF will provide a set of basic services, that those insured will be able to utilize (with or without co-payment). These services currently can be acquired through normal voluntary private health insurance providers, but once HIF becomes fully functioning, the law on health insurance prohibits private health insurance to offer the same services as HIF (assumption being that those covered are already paying for those services), but instead can accommodate additional services, such as single rooms upon hospitalizations, personalized home visits, etc [6][9][10]. Therefore, the idea presented here is a possible market segment for isolated health insurance companies; which in turns means minimizing risks or optimizing opportunities for private companies that would emanate once HIF starts. It is worth noting that HIF already functions in a limited capacity, such as providing services for patients that require treatments outside Kosovo, and has already established procedures that pave the way for expanding services, transparency, and accountability through introduction of Kosovo wide management information system.

A starting point is presuming that contribution frequency set by Kosovo's legislature, and develop a technique for producing a coefficient that evaluates the possible number of private health insurance providers. The Law on HIF provisions for a generic premium rate, and includes ways for those that are exempt, or on different provisions, so everyone is covered. Kosovo Agency of Statistics (KAS) has grown in its capacity and offerings, and does provide a wealth of demographic data that are essential for this study. This paper seeks to rectify the results of previous research [5][13], which restates the fundamentals of the analysis. Additionally, survey data from a willingness-to-pay (WTP) database [7][11] is presented, offering extensive data on demographic indicators in Kosovo. Of greater significance is the information on the people's readiness to pay for healthiness indemnification, which was collected from a survey using the Dual-Bounded twofold option contingent valuation model [4][12], which boosts statistical efficiency. The average maximum WTP per family member using this method was 3.53 euros per month.

A. Aim/purpose

To analyze issues related to private health insurance market once Kosovo's Mandatory Health Insurance fund is fully operational.

B. Background

Kosovo's lawmakers passed the law on health insurance in 2014, thus paving the way for a new direction in the country's healthcare system financing. These reforms raise concerns about their impact on the existing (non-mandatory) private health insurance market, as individuals may have to opt out private health insurance purely for economic reasons.

C. Methodology

Methodology employed uses Surplus-to-Exploitation Ratio (SER), to assess the excess amount of people's willingness to pay over what they are mandated to pay, and Potential Entry Threshold (PET) analysis. Results are obtained by applying a consumer price index (CPI) adjustment, to estimate Kosovo's consumer surplus (CS) on individuals' willingness to pay for a mandatory health insurance, and then calculate SER and PET.

D. Contribution

This paper adds to scientific contribution, by addressing an important factor that is a result of direct outcome of governments' reform of healthcare financing, namely the impact on private health insurers. Results show that despite Kosovo's health reform, private insurers can play an active role, albeit in providing supplemental coverage.

E. Recommendation for Researchers

Researchers should be able to apply same methodology to other countries ex post to test the rigidity of techniques applied and establish comparative analysis.

The rest of the paper continues by first providing a brief introduction to the current structure of Kosovo's indemnification marketplace. The following section develops a concept underlying the reasoning and assessment of customer left-overs followed by the derivation of the marketplace likely admission verge and its ramifications. The final portion contains deductions.

2. Kosovo's Current Private Insurance Market

Although assurance industries have expanded since UNMIK Pillar II established it in 2000, when five inanimate insurance firms were granted licenses providing third-party responsibility auto insurance, the sector is still relatively young. After the Banking and Payments Authority of Kosovo (BPK) was established in 2008, the Chief Bank of the Nation of Kosovo (CBK) took over as the entity responsible for overseeing the insurance market. The insurance sector witnessed notable changes in 2008. CBK permitted a controlled liberalization of the market, granting licenses to an extra businesses, bringing the total to ten. Additionally, this procedure made it possible for other goods, like life insurance, to expand. Although there were now 14 insurance businesses in the financial industry by 2014, their 3.1% market share was still quite tiny. Even though there were a lot more businesses selling “life” products, life assets only accounted for 10.1% of all assets—a slight rise over the prior year. The entire assets owned by insurance companies by the year 2021, as illustrated by Figure 1 below, amounted to 238.8 million Euros (an annual increase of 9.3%); the non-life insurance market accounted for 91.3% of the total assets, while the life market accounted for only 8.7%. In Kosovo, the private insurance market made up a small portion (2.7%) of the country's financial industry by the end of 2020, despite remarkable annual growth since 2019 [2][13].

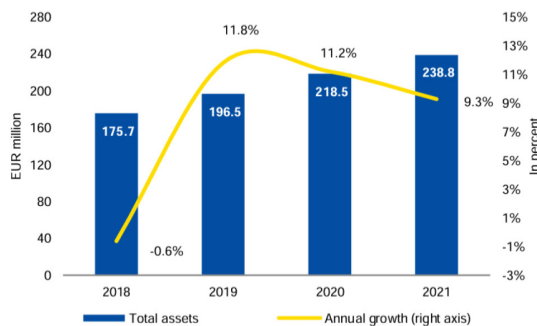


Figure 1

Insurance businesses' resources overall millions of euros. (Source: CBK2022)

3. What Risks or Opportunities Are There for Private Insurers

Article 15, paragraph 1, sections 1.1 -1.4 of Kosovo Law on Health Insurance detail the rate of contribution (p)s, which stands at 7% (3.5%

employee contribution (q) + 3.5% employer contribution(v)). The set of definitions and assumptions [5][14], that are used throughout this paper:

Therefore, $p = q + v = 3.5\% + 3.5\% = 7\%$

[1][15] defines the economic theory of consumer surplus as the difference between the price a consumer pays for an item and the price he would be willing to pay rather than go without it. The difference between the greatest amount that an employee is willing to pay and the actual amount that they are compelled to pay, as covered by employment, is known as consumer surplus (CS) in this context.

- The following definitions and/or presumptions are then introduced:
- m_i = is the median monthly income range for that particular household.
- h_i =corresponding size of the home
- x_{WTPi}^{MAX} = is the utmost amount (MAX) that each person in each individual home (i) is willing to pay (WTP) each month.
- N = is the total number of individuals covered by the mandated program.
- n = is the sample size (which determines the maximum WTP).
- P_{life} = is the total premiums paid to private health insurance companies for a given time frame before the introduction of HIF.

4. Consumer Surplus (CS)

By adopting its definition, we estimate CS by computing the mean-variance among max WTP and the real rate of contribution as established by regulations on HIF, using the following annualized formula:

$$CS = 12N \frac{\sum \left(x_{WTPi}^{MAX} - \frac{qm_i}{h_i} \right)}{n} \quad (1)$$

Coefficient of 12 is used to annual data in a discrete setting as survey data were monthly in nature.

5. Surplus-to-Exploitation Ratio - SER

Surplus-to-Exploitation Ratio (SER) which is obtained by dividing CS by P_{life} to get:

$$SER = \frac{12N \frac{\sum \left(x_{WTP_i}^{MAX} - \frac{qm_i}{h_i} \right)}{n}}{P_{life}} = \frac{CS}{P_{life}} \quad (2)$$

SER functions as a two-pronged signal:

(i) it calculates the proportion of customer extras to the entire perks that privately owned medical protection companies have received over given time frames; and it helps individual insurers to potential market possibilities by determining an entrance criteria. The degree in SER is influenced by a number of elements that are inherently present in CS.

6. Range Values of SER and Their Implications

The first obvious conclusion drawn from (2) is that $SER > 0$, which presupposes the existence of the private health insurance market and admits which CS remains optimistic (such as the rule about requests prevails). [3]. The following information regarding the ratio's level is provided by the SER's meaning and resultant ranges, and is visually shown in Figure 2 below:

$SER \leq 1$ - This level of SER indicates that the current CS has been fully exploited by the private health insurers. This occurs when $P_{life} \geq CS$. In other words, if the total amount of premiums received by insurance companies is equal to or greater than the consumer surplus, then consumers are no longer willing to pay above that price, hence CS has been fully exploited.

$SER > 1$ - Values of SER at this level indicate that the current CS has not been fully exploited. This occurs when $P_{life} < CS$. This means that total

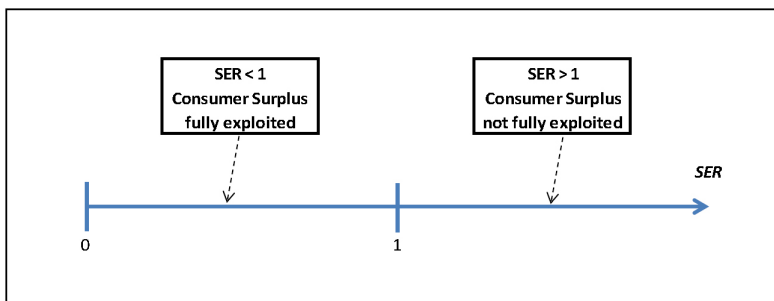


Figure 2

Consumer SER (Source: Muhaxheri and Szkudlarek (2016))

amount of premiums received by insurance companies is less than the consumer surplus, so consumers are willing to pay more to ensure that they get private health insurance, hence CS has not been fully exploited.

7. Probable Entry Threshold and Market Possibilities

Let's start by defining SER and analyzing its implications for market opportunities on the quantity of privately owned medical coverage carriers. First, there's the presumption that the existing health insurance providers account for 100% (or 1, if decimal representation is preferred) of the industry's overall share. Furthermore, let y be the total the amount of independent healthcare insurers. Suppose that each provider would use consumer surplus equitably, has a corresponding $(1/y)$ share of the current marketplace and maintains a share of it. Next, let express PET such that:

$$PET = 1 + \frac{1}{k} \quad (3)$$

Where '1' is the entire contemporary share and '1/k' is average share of potential entries (ASPE), that is $ASPE = PET - 1$

K rises when more players enter the marketplace, suggesting that the ASPE falls and the pool of possible new entrants rises. And in the limit:

$$\lim_{k \rightarrow \infty} (1 + 1/k) = 1$$

That is, $PET = 1$ is a natural (asymptotic) inferior edge. So, PET exists in the interval $(1, SER)$, labelled 'Market Possibilities Region'. Graphically, this is statistics presented in Figure 3 below:

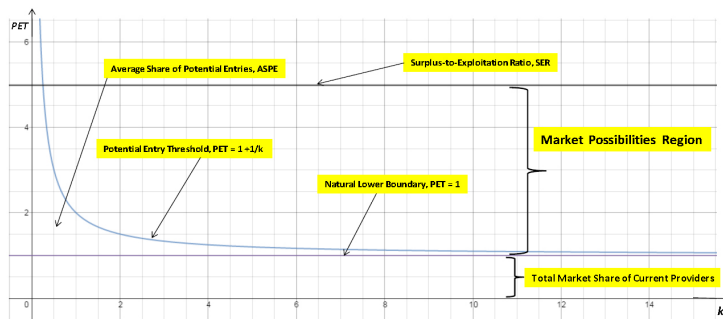


Figure 3

PET Analysis (Ratio (Source: Muhaxheri and Szkudlarek (2016))

- In light of the prospective entrance threshold also marketplace opportunities, the following conclusion is drawn: $1 < SER \leq PET$ – The market is oversaturated, meaning there isn't any space for new suppliers to break into the marketplace or for present carriers to deliver additional offerings for a higher price. $1 < PET < SER$ – The market is not yet saturated, meaning there is potential for new providers to enter it or for current suppliers to offer more services for a higher price.
- A closer look at (ii) reveals the following:
- Market opportunities are limited to the area enclosed by SER and $PET=1$.
- The ratio of SER to $ASPE$ represents the whole quantity of prospective novel applicants (N_t), ceteris paribus, also supercilious that CS stands fully exploited. N_t is not restricted to existing "life" suppliers who wish to charge more for new services, and it must constantly be adjusted to guarantee the final company to join the marketplace stays in an area of potential trade opportunities. as

$$N_t = \frac{SER}{ASPE} \quad (4)$$

8. Estimating SER for Kosovo

[5] estimated CS at 11.96 million Euros. According to World Bank economic indicators [8], Consumer Price Index (CPI) for Kosovo in 2015 was at 111.8, and by 2021 was at 122.3, an increase of 9.39%. Therefore, next comes price-adjustment to 2015 CS to obtain an estimate for 2021:

$$CS_{2021} = \frac{CPI_{2021}}{CPI_{2015}} CS_{2015} = \frac{122.3}{111.8} \cdot 11.96 = 13.08$$

So, for 2021 CS is estimated at 13.08 million Euros. Furthermore, CBK Yearly Statement 2021 differentiates solely among lifeless and life assurance; from an overall of 117,400,000 € on total premiums written by assurance firms, 112,600,000 € were written for non-life insurance products and 4.9 million euros were generated through premiums from life insurance products, P_{life} . So,

$$SER = \frac{CS}{P_{life}} = \frac{13.08}{4.9} = 2.67$$

In 2015, CS and P_{life} were at 11.96 and 2.4 million Euros respectively, giving a SER value of 4.98. The Insurance Association of Kosova reports

$k=9$ privately-owned medical coverage suppliers, resulting in an achievable entrance verge of $PET=1.111$. Therefore, there's an instance of $SER>PET$, which means that there are several alternatives:

- Provides a straightforward mathematical assessment of unfulfilled earnings possibility to corporations outside the Kosovo market.
- Allows lifeless insurance firms will join the 'life' part of the marketplace.
- Allows present life-offering coverage businesses to offer extra amenities at additional expenses.

Furthermore, this leads to $ASPE=1/9$, so each provider would get $1/9$ of CS.

$$N_t = \frac{SER}{ASPE} = \frac{2.67}{\frac{1}{9}} = 24.03 \cong 24$$

Put another way, CS is mostly underutilized, and there is a significant difference among the entire sum of the real (life) charges collected by privately-owned assurance firms plus the amount that individuals are prepared to pay for health insurance. However, N_t for 2015 stood at 44, thus indicating that CS has shrunk in the period 2015 – 2021, and hence private insurers will need to be more creative in offering services in a shrinking market.

9. Conclusion

The functionalization of Kosovo's Mandatory Health Insurance system presents a formidable challenge to the existing health insurance providers in the country. With both employers and employees mandated to contribute to the state scheme, there is a significant shift of financial resources from the private sector to the public sector. Nevertheless, an intriguing finding emerges: there is evidence of a consumer surplus (CS) within this context, which opens up a new realm of possibilities for further exploration in terms of the roles and opportunities for private health insurance providers. To delve into this aspect, we revisit an intuitive approach that delves into the intricate details of how the CS is determined. Additionally, we introduce two novel indicators, the extra-to-abuse ratio plus the potential access edge, to enhance our understanding of this complex landscape. While the availability of more recent data would be ideal, the lack thereof presents an opportunity to employ a price-

adjustment methodology. This involves utilizing Kosovo's consumer price index to estimate the consumer surplus for the year 2021. The results of this analysis reveal that an important customer excess still exists within the present obligatory medical cover influence amount. This surplus offers room for remaining isolated well-being assurance businesses to consider providing supplementary facilities or new entrants by exploring opportunities in the market.

10. Limitations with Future Scope

One significant limitation lies in the mathematical approach employed to evaluate the average segment of potential entries. This approach becomes impractical when we consider that amount of novel entrants cannot be infinite. In such a scenario, it would fail to incentivize further participation in the market, as the theoretical share of profit would diminish or even vanish entirely, while still incurring associated costs. Therefore, a crucial area for future development in this study is to introduce upper limits on the number of new entrants to the market. By doing so, we can gain a more precise understanding of the potential consumer surplus that a company might attain. Furthermore, employing a vector approach could significantly enhance the analysis. In this approach, different new entrants would have distinct allocations of potential share, depending on their market capitalization. This addition could further refine our analysis and offer deeper insights.

While the analysis in this paper is rooted in the context of Kosovo, it holds the promise of broader applicability. Extending this research to other countries with varying income rankings offers a rich opportunity for in-depth multinational analysis. Such an expansion can provide insights that benefit a wider global community and facilitate a more comprehensive understanding of the dynamics at play across different regions and economies.

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Received June, 2023