Price Discrimination in the Swiss Car Insurance Market

[redacted] **RAUH, Samuel**[4]

[redacted]

[4] **B.A. Sociology (Major); People-Oriented Computing (Minor) UZH**

ABSTRACT

Price discrimination is a pricing strategy that creates variation in the prices charged to customers. This has normative implications, as soon as the purchase of a product or service is not voluntary, but required by law, as is often the case in the car insurance market. Our paper was aimed to explore price discrimination in the Swiss car insurance market by using a novel data set of unstructured data. Using automated data extraction of web data from the insurance comparison website ”comparis.ch” we were able to gather a data-set according to our pre-selected strata of characteristics. The novel data set features 145 requests with 2007 price offerings across 4 demographic traits holding everything else constant. The data-set allowed an exploratory study into the discriminatory character of insurance pricing across various demographic traits including preliminary analyses with a simple regression model. We found evidence that price discrimination is present in the specification of our data. We review the presented evidence with regards to its explanatory power and conclude by discussing the consequences of price discrimination and policy suggestions.

Keywords: price discrimination, swiss car insurance market, webscraping

INTRODUCTION

In 2011, Ricardo Lumengo, a Swiss Member of the Parliament, submitted a *Postulat* to the Swiss Government, which should examine whether price differences between nationalities of mandatory car insurance had discriminatory character (Lumengo, 2011). This parliamentary motion was not granted. Price discrimination is arguably even more prevalent now, as it is strongly connected to the development of the internet and the use of big data to refine market strategies. Through more granular data collection and analysis companies can provide several pricing strategies based on location and other traits that are either voluntarily provide by individuals or through cookies. Charging different prices can be justified in markets where costumers can decide whether they want to buy the good or service. However, there are many examples in modern economies where this is not the case due to government regulations. Especially the insurance market is highly regulated and for certain services such as health insurance or car insurance, where individuals and car owners, respectively, are required by law to buy an insurance. This means different prices then have a normative dimension. Insurance also often has a solidarity character that is undermined by different prices. This means price discrimination must be justified. It is, however, often the case that customers do not even know that their demographic traits are used to offer them a different price even if it is risk-adjusted. The Swiss car insurance market is an especially interesting case to study, as it features mandatory insurance and free tariffing. The goal of this analysis is to inquire whether there is price discrimination in the Swiss car insurance market.

Assessing the variation in prices of a given product is not an easy feat. The statistical models that insurers use to price their products are confidential information because risk assessment is at the heart of their business model in the hope of giving them an edge over competitors. However, with the development of the internet, insurers increasingly opted for online requests for offering quotes for their respective products. This can be exploited through web scraping, which is what this paper aims to achieve. We will use an online comparison website to get quotes from different insurers. The quotes are stratified for different demographic traits and then analyzed. The nature of our inquiry is exploratory. This means it comes with certain limitations with regards to sample size and generalizability. Our analysis is mainly descriptive and includes a basic regression model to demonstrate the differences in pricing and their significance. We found very strong evidence of price discrimination for a variety of variables. Nationality was the biggest factor for price variation.

LITERATURE REVIEW

Definition of price discrimination and its categorizations

Price discrimination is a common pricing strategy among sellers looking for price optimization. In its essence it ”refers to the practice of a seller charging different prices to different customers, either for exactly the same good or for slightly different versions of the same good. [...] It also includes charging different prices for combinations of products than for individual products sold separately” (Phillips, 2021, p. 120). Other terms used for the practice include ”price differentiation”, ”dynamic pricing” and other expressions that avoid the negative connotations of the word discrimination. However, as Phillips (ibid.) mentions, dynamic pricing is not the same as price discrimination: “Price differentiation usually (but not always) means that different prices are in play for the same (or very similar products) at the same time. Dynamic pricing, on the other hand, refers to changing the price of a product over time. Dynamic pricing is often employed to balance supply and demand [...]”. We can speak of pure price discrimination when “the seller charges each customer the maximum price they will pay” (Twin, 2022). In reality however, pure price discrimination is usually not possible. More common forms are “group pricing” where the seller charges groups of buyers different prices for the same product, “but also the less controversial strategies of product versioning, regional pricing, channel pricing, and nonlinear pricing” (Phillips, 2021, p. 120). Whether pure or not, price discrimination will always split a market into two at the very least. This benefits the seller when “the profit that is earned as a result of separating the markets is greater than the profit that is earned as a result of keeping the markets combined” (Twin, 2022). The potential increase in profit when not selling at a single price comes from two market segments as illustrated in Figure 1. The buyers that are only willing to pay less than a potential single price but more than production price (C) and the buyers willing to pay even more than a potential single price (B).

One of the founding fathers of the theory of price discrimination was Arthur Cecil Pigou. He originally discussed price discrimination in the context of the transferability of a good and as a phenomenon appearing in monopolies: “When a degree of non-transfer-ability, of commodity units on the one hand or of demand units on the other hand, sufficient to make discrimination profitable, is present, the relation between the monopolistic seller and each buyer is, strictly, one of bilateral monopoly. The terms of the contract that will emerge between them is, therefore, theoretically indeterminate and subject to [...] “bargaining” [...] (Pigou, 2002, p. 278). Pigou categorised price discrimination according to three degrees: First-degree discrimination refers to

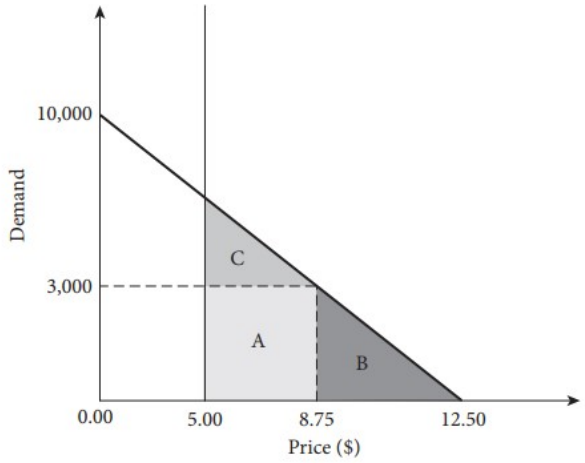

Figure 1. Source: Phillips 2021, p. 122

what we called pure price discrimination above: Charging every buyer exactly what he or she is willing to pay "and no consumers' surplus was left to the buyers" (Pigou, 2002, p. 279). Second-degree discrimination according to Pigou means bundling different units of a good into different price categories. Later scholars have labelled this "volume discounting" and included other forms of self-selective discrimination such as "versioning" (developing slightly different products for different price demands) (Phillips, 2021, ps. 128, 150). Third-degree discrimination means group pricing, separating customers into serviceable groups and charging each group differently. According to Pigou , "though all theoretically possible, [. . .]in real life the third degree only is found" (Pigou, 2002, p. 279). Today, Pigou's categorisation is still being referenced, however usually not talked about in the context of monopolies. The term price discrimination itself has been extended. This paper assumes that price discrimination in its market of interest is neither based on willingness to pay nor on the quantity of the purchased good. Instead, price discrimination is understood as defined above, a pricing strategy that creates variation in the prices charged to customers.

PD in insurance markets: methods, policies and public discussion

While the discussion above was mostly focused on the seller, we now briefly look at the market of interest from the point of view of the buyer. When we look at institutions like insurances or private as well as public retirement planners that offer to insure individuals against certain risks, we find that there are two opposing principles that can serve as the base of their design: The solidarity principle and the risk-based principle.

The solidarity principle can be found in public institutions such as the AHV (Alters- und Hinterlassenenversicherung), the most important pillar of old age and survivors' benefits

in Switzerland. This insurance is mandatory and everybody pays a small percentage of their wage into the pot. After retiring (or in the case of death of someone's provider), everyone receives a rent that is somewhat, but not entirely proportional to what they paid in. Since there is both a minimum and maximum amount, high-income individuals subsidise low-income individuals. Also, the rents being paid now to retired people are being supported by the current workforce. Hence there is both solidarity between income classes and generations involved.

In the private sector however, we often find the risk-based approach. Here, individuals can both profit as well as suffer from price discrimination. Ideally, multiple companies compete for customers and are thus forced to offer attractive prices. Additionally, each company can create different versions of its base product (insurance) and thus tap into different demand price segments of the market. On top of that, insurance companies create risk profiles for potential clients which allows them to offer each potential client individual prices. This is not pure price discrimination according to Pigou, since it is not possible to determine the exact maximum price each customer is willing to pay). Generally, a customer can benefit from that in different ways. First, the subsidy principle is reduced, allowing for better individual utility maximisation. Secondly, thanks to versioning the customer can choose a product close to his or her demand price. New technology even allows insured persons to reduce their rate by tracking risk-mitigating behaviour, such as working out with an app provided by the insurer. However, as we will see in this paper, there are also aspects of individual pricing that effect the insurance buyers utility negatively. This is the case, when the price function includes factors that the buyer cannot (or can hardly) influence. These factors can be characteristics such as nationality, a genetic predisposition to a certain condition, age or sex. Such methods of price discrimination naturally provoke public debate which may even lead to policy adaptations. In 2012 the European Union ruled that car insurance companies may no longer discriminate on the basis of gender. Previously men used to pay higher premiums than women and it was expected that this new legislation would even out these differences. Surprisingly however, the gap has widened even further, according to an article by The Guardian (Collinson, 2017). While insurance companies no longer use sex or gender as a variable in their price function, they still use all other available data. And since men tend to work riskier jobs, drive more expensive cars in a more dangerous fashion and are generally known to live a riskier lifestyle, these factors now apparently weigh even more. So ironically, removing sex as a variable seems to emphasise difference in gender (in its original sense: the social construct stuck to sex) even more. Or as The Guardian author Patrick Collinson put it: "Car insurance may have become less equal. But it is

more fair" (Collinson, 2017).

Germany knows even stricter anti-discrimination laws. Price discrimination based on nationality for example is not permitted (Heim, 2019). In Switzerland, which is not part of the EU, such legislation has not been introduced yet. In 2011, Ricardo Lumengo, then member of the federal parliament put forward a parliamentary motion to the Federal Council to look into countermeasures to price discrimination in the car insurance market based on ethnicity or country of origin. The federal council advised legislature to reject the postulate. Before it could pass to vote however it was abandoned because Lumengo had not been re-elected (Lumengo, 2011). The debate is ongoing, but so far, Switzerland's liberal tendencies have kept the upper hand. In an interview with "Handelszeitung", Prof. Dr. Martin Erling, insurance expert at Hochschule St. Gallen explained that while nationality based price discrimination made him feel uncomfortable, it is ultimately in an insurance's nature to discriminate. Further restrictions would imply that risk-averse people subsidised the risk taking of others. This would mean that mostly individuals with a higher risk acceptance would be drawn to buying insurance and thus raise the prices for everybody. Alternatively, insurers could also look to exclude high risk customers (Heim, 2019).

Swiss Car Insurance Market

In Switzerland, car owners are required to own insurance, but they are free to choose the cover level. Legal requirements are based on the Verkehrsversicherungsverordnung vom 20. November 1959 (SR741.31, 2022).

Insurance Level	Description
Motor Vehicle 3rd party liab. (mandatory)	Covers property damage and personal injury to third parties. The benefits of mandatory motor vehicle liability are defined by law and hardly differ from one insurance company to the next. Nevertheless, the premiums can vary greatly.
Partial cover (voluntary)	Covers damage to own vehicle caused by natural hazards, animals, theft, and vandalism (not including scratches).
Comprehensive cover (voluntary)	Covers damage to own vehicle as a result of collision.
Add-on components (mandatory)	Including: Damage to the parked vehicle, passenger accident insurance, gross negligence protection, bonus protection.

Table 1. The Swiss car insurance market. Sources: comparis.ch, axa.ch, SR741.31 (2022)

RESEARCH DESIGN

Data & Operationalization

Data Source: Comparis.ch

The data for our empirical research is based on the most popular Swiss online comparison site for insurances: comparis.ch. It aggregates data from any different insurance providers and lets users easily compare them by inserting their personal data returning many different offers. Comparis.ch is the biggest player in online comparison services in Switzerland. They provide comparison services in different markets ranging from insurances till internet access pricing. The website comparis.ch is provided by the Comparis.ch AG founded in 1996 by Richard Eisler. As of 2022, comparis.ch has about 80 million clicks, this makes is one of the most clicked on websites in Switzerland. Comparis' business model is built on four profit sources. These are advertising certain deals, royalties, agency fees and advertising on their platform. Comparis itself claims that their goal is neutral comparison of different players in the market. They aim to achieve this by not being related to the government nor being owned by another company. This can be doubted since they state themselves that they do have contracts with big players in the respective market and make profit by receiving a royalty on certain deals.

Data Collection

To gather this data our initial idea was to automatically simulate searches on comparis.ch with different input parameters to test if the comparison site would give us different prices according to the input values. With an automated method it would have been possible to gather a large amount of data and look into multiple different variables and their effect on the prices. But like many other online services, comparis.ch has a protection against such automated calls by blocking an IP address after suspicious search behaviour. There would be a way around this by using alternating proxy-server, but such a procedure would exceed the scope of this project. The alternative approach was to restrict the number of variable parameters and thus reduce the amount of searches to a scope which was possible for us to conduct manually by putting in the parameters by hand. We restricted our self to 4 parameters with a limited number of expressions visible in Table 2.

We then automatically created all possible permutations of the expressions while for the age and time since the drivers license always choosing a random date in the time frame. This method ensures that we have younger as well as older people for every combination of the other variables which lets us calculate regression based on this data-set. As mentioned, we only varied those four variables. For all the other possible input factors

Parameter	Expressions				
Gender	female		male		
Date of birth	18-29	30-39	40-49	50-59	60-90
T since D-License	1 year or less	1 to 3 years	3 years or more		
Nationality	Switzerland	France	Portugal	Kosovo	

Table 2. Search Parameters and their expressions.

like the car model or for what it is used we chose a ”base-person” which could reference an average person. All the base-parameters are visible in appendix 1. After inserting all the parameters the comparis.ch website displays all the possible offers matching the inserted variables. To transform the data in its unstructured form as a website, we downloaded it as a HTML-file, which then was further processed with a script, reading out the relevant data of the insurance offers and its prices. The final result is a data-set with all the insurance offers, their prices and the input variables. This lets us easily analyze the data and detect possible price discrimination.

The final data-set consists of 145 different searches. The number is lower than the possible permutations because some of the people are too young to be in a category where they already have had their drivers license for multiple years. For all the 145 different searches we got a total amount of 2007 insurance offers from 11 different companies and 19 different models. Larger insurance companies have multiple models with different services but all the models match the input data of the hypothetical person. The data was collected in the period from December 2022 until January 2023.

Method

Since the data for this research is not based on a conventional research subject it is also not possible to apply the conventional methods. The data we fetched from comparis.ch is based on the statistical models that insurance companies employ to define prices according demographic traits of their customers. Analyzing these models is basically a rough attempt to re-engineer the models of the insurance companies.

In a first step we conduct a mostly descriptive analysis of the collected data to describe the discrimination in the selected parameters we varied. For such an exploratory approach we will also rely heavily on visualizations. This is especially convenient, since with such a subject there is no such thing as ”significance”. Our data is based on a price for certain input parameters, these prices are fixed and there is no ”random” component in them. So this takes the sense out of a significance test, since if there is a difference in the data, there is a difference in the price you pay for an insurance.

In a second step we will also focus on different insurance models themselves. We select the four models which are represented the most often in our data-set. These models are not surprisingly from four large insurance companies: The FLEX model from AXA, the nice model from ELVIA by Allianz, the BaloiseDirect M model from Baloise and the OPTIMUM model from Zurich. The models are not exactly the same, but they are selected to have more or less similar prices and most of them are the cheaper version. AXA for example also has a FLEX Plus model with a higher coverage. We then want to compare these different models and find out, if they all have a similar model for price discrimination or if some of them focus on different variables or rely more on a model in which prices are distributed among all the customers. We cannot forget that the models of the insurances are partly based on their own customer base. This means that a different customer base can lead to different models.

RESULTS

Descriptive Statistics

Our analysis comprises a set of descriptive statistics and a basic regression model to demonstrate the significance of the graphically described variation. We grouped the data by age, time passed since obtaining the driver's licence, gender and nationality.

Table 3. Regression Analysis

	Dependent variable:
	Price
Age	-58.325^{***}
Age squared	0.594^{***}
Gender: Male (ref. Female)	35.398^{**}
Nationality: France (ref. Switzerland)	44.858^{*}
Nationality: Italy	197.516^{***}
Nationality: Kosovo	719.202^{***}
Nationality: Portugal	180.153^{***}
Time since Drivers License	-7.023^{***}
Constant	$2{,}341.718^{***}$
Observations	2,007
R^2	0.460
Note:	*p<0.1; **p<0.05; ***p<0.01

Figure 2 shows the annual car insurance price plotted against different age levels, holding

everything else equal. It shows that there is horizontal and vertical price variation with younger drivers having to pay higher premiums. The premiums decrease until around the age of 55 and then slowly increase again. Figure 3 shows the car insurance price plotted against different years in which the driver's licences have been issued. We omitted values beyond 2000 to demonstrate the correlation better graphically. The diagramm clearly shows that drivers who had their license issued earlier pay lower premiums that recently licensed drivers. Figure 4 plots again the annual price of the premium against gender. The differences are very small, however as we will see in the regression model later on they are statistically significant when controlling for the other variables.

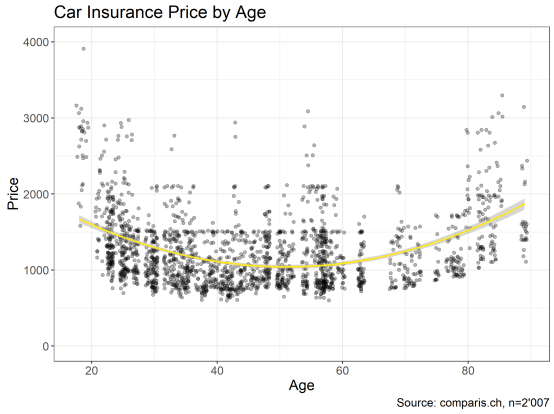

Figure 2. Age

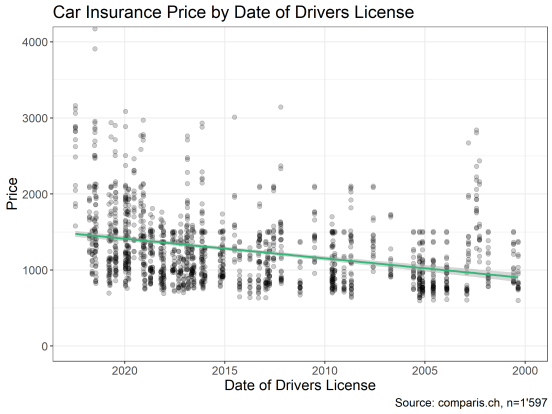

Figure 3. Time since Drivers License

Table 2 shows our regression model. Our dependent variable is the annual insurance premium price and our independent variables are time since driver's license, age, gender and nationality. We also used age squared to account for the parabolic correlation of age and price. The regression model features a basic OLS-Regression. All of our variables are statistically significant on the 99% level, excluding the nationality-level France compared to Switzerland and gender, which is only significant on the 90% level. Nationality had the largest effect.

Figure 5 shows the differences of the 5 tested nationalities. While Switzerland and France have nearly no difference in pricing, one can see that Italian and Portuguese drivers have slightly lower prices for their respective insurance model. The most striking difference lies between the Kosovars and the other nationalities. The median price for Kosovo, all things held equal, is 1590 CHF. That is a difference of 653 CHF compared to the median price for Swiss. Additionally, it is worth mentioning that the statistical outliers are higher and more common for Italy, Portugal and Kosovo. Again Kosovo

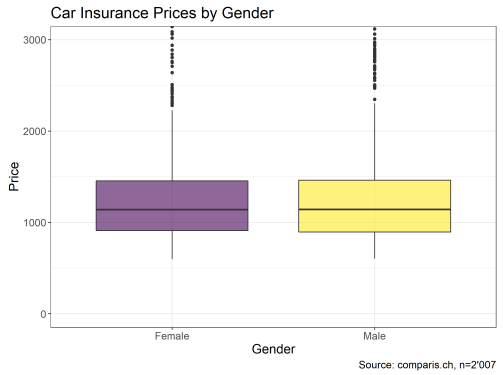

Figure 4. Gender

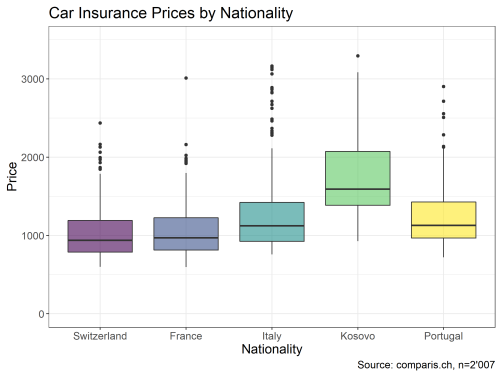

Figure 5. Nationality

appears to have the highest maximum prices. France and Switzerland show mostly similarities, although the maximum price for France is higher.

Different Companies, different statistical models?

In this part we focus on the selected insurance models and look into their specific models to review if there are differences in the way they discriminate for the selected parameters. We again rely on visualizations to present our findings.

Figure 6 shows the distribution of Insurance prices throughout different ages of individuals for different insurance pricing models. Again only the age factor is varied. Generally speaking one can see a downwards bent curve which peaks at the lower and higher end of age. 3 of the 4 shown models will have its peak at old age, prices here are slightly above the prices for young drivers. Only Zurich OPTIMUM prices peak for young drivers. Lowest prices appear to be given to the range of 40-60 year old drivers. Looking at the statistical outliers they appear to peak for prices given to drivers of young age. Figure 7 shows the statistical influence of the year which one takes their drivers license. There appears to be different trends among the four insurance models. While Zurich and ELVIA peak their prices in the present and seem to nearly parallel move down their prices the further back one goes in time, AXA has lower prices for drivers which took their drivers test recently. Moving back in time their prices rise and appear to nearly meet Baloise around 1990. Baloise shows a slight downward trend from 2020 back to 1990 but appears to be less influenced by this factor than any of the other models.

To be able to compare how the different companies treat gender and nationality we can look at figure 8 and 9. The different models have different prices, the OPTIMUM model by Zurich for example is always a little bit more expensive than the other ones. So to compensate for the price differences, there is a need for normalization. To achieve

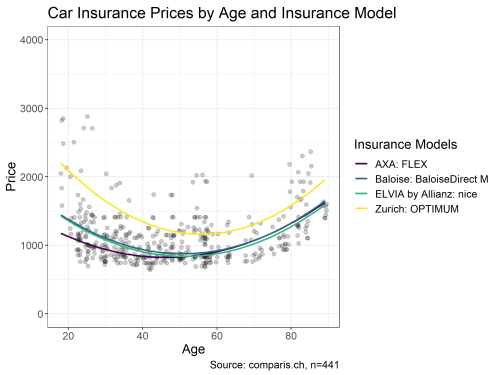

Figure 6. Age

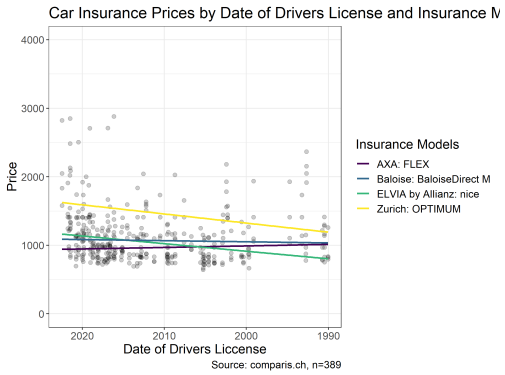

Figure 7. Time since Drivers License

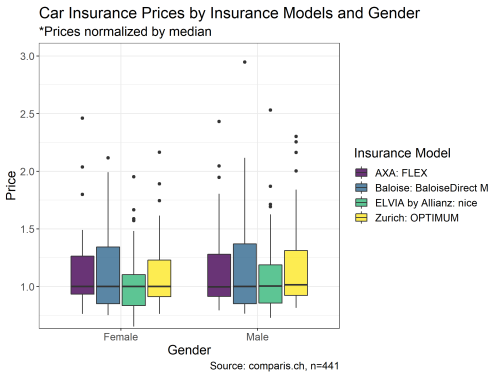

Figure 8. Gender

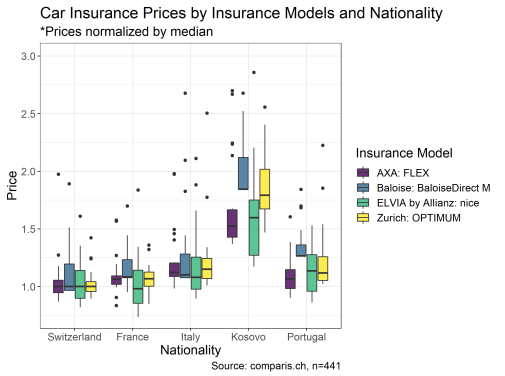

Figure 9. Nationality

this, the prices for each model are divided by the corresponding median price of the reference category in our case ”Female” for gender and ”Switzerland” for nationality. In figure 9 this is easily visible as all of the Swiss median prices are at level 1. This means that if the models would discriminate in similar ways all the other values would be on the same level for a specific nationality.

In figure 4 we saw that there is almost no difference in overall gender discrimination. Figure 8 now shows that this holds for all the insurance models. All of the box plots have the median value on the same level, none of them discriminates notably more for gender then the other ones.

This cannot be said about the discrimination against nationality. Figure 9 shows, that for most countries, not all insurance models are on the same level which means they don’t discriminate similarly against nationality. The differences are very visible for the nationality Kosovo. The figure shows that for the Kosovo case, Baloise and Zurich discriminate a lot more in comparison to AXA and ELIVA by Allinaz. For Baloise the higher price discrimination rate also holds for the nationalities Portuguese and French.

But overall, a clear statement concerning the price discrimination against nationality cannot be made other than that there are differences. But these differences could have multiple reasons. To further investigate the differences in models between insurance companies more data and a genuine statistical analysis with interaction models would be needed.

But the visualization shows another interesting thing. For the Baloise model it is visible, that the median line of the box plot is always at the bottom of the bottom of the interquartile range with no whiskers to the bottom except for France. BaloiseDirect M is the only model of the four with such a consistent pattern in itself. This means that more then half of the prices are at almost the same level with multiple outliers to the top. This suggests that Baloise has an statistical model which calculates (almost) the same price for most of the people from the same country. The price is then adjusted to the top from there on if special conditions hold. This is interesting since none of the other visualizations comparing the insurance models show results of Baloise discriminating more against e.g. younger people.

DISCUSSION

Although our dataset is not covering all possible variations of the demographic traits that users can input to generate a quote from the comparison website comparis.ch, we can provide some indicative evidence. Our results show, that there certainly is price discrimination in the car insurance market and that there are good reasons to further look into this topic. Different demographic traits such as nationality for example lead to vastly different prices holding everything else constant. While we do not assume that these prices are random, we can not verify the cause of the price differences. There are three interpretations for this. First, if we assume, that the price discrimination is completely a result of the risk models employed by the insurers, then the results found in the analysis are representative of the real costs, which are caused by the drivers according to certain attributes. When looking at the age for example, this is very plausible. It makes sense, that younger people with less experience on the road and older people with slower reflexes and decreasing senses are responsible for more accidents then people in their middle ages with a very long driving experience. So the method of evaluating car insurance models lets us indirectly recreate the relative cost differences for the investigated variables. Secondly, we could also assume that there is too little competition in the car insurance market, so that companies can skim the market by charging a discriminatory price that is above the price that the respective model would

indicate. However, the design of our paper does not allow to draw any final conclusions for the price differences.

LIMITATION

An obvious and important limitation to this paper is the relatively small sample. Since we had to collect the data by hand we were unfortunately restricted to a selected number of searches with limited variable parameters. In addition, the data has the characteristics of a large spread with many outliers. Especially with such a small sample outliers can have a significant impact, distorting the analysis.

Because of this, especially the results of the part comparing the different insurance models need to be taken with caution. The presented results do not necessarily need to be a consequence of different statistical models. As mentioned, the models do not cover all searches, meaning the analysis of the insurance models are not necessarily based on the same input parameters. To control for such distortions a proper regression analysis would be needed, but that would not make much sense in this case because of the small sample and it would be out of the scope of this paper.

Another limitation are the uncontrollable factors when collecting the data. We made sure, that all the input parameters where the same, but we could not control for variables like place, time or used device. Dynamic pricing is very common among online services, e.g. for booking flights McAfee and Te Velde, 2006. We do not know if Comparis also accounts for such parameters. If they do there would be inconsistencies in our data, since we conducted the data among several weeks, from different countries and on devices from different brands.

CONCLUSION AND OUTLOOK

The goal of this paper was to do a exploratory inquiry on how insurance companies in Switzerland set up their pricing models for individuals. We were able to get a sample insight into these models by web scraping the online price comparison service Comparis. The purpose of this was to find out what variables have larger or smaller impact on the pricing for an individuals car insurance. After analyzing the results we can come to the conclusion that the biggest factor in the car insurance market in Switzerland is nationality. Out of the 5 tested nationalities we found the largest influence by the nationality Kosovo. Also we can conclude that not every insurance prices the same way as there differences in the impact of certain factors. As one can see in figure 7 where we tested the impact of the date, on which the driving test was taken, models and trends of the impact on pricing can even be contrary. This can be seen in the comparison of

AXA and the other three companies. Generally speaking we were searching for price discrimination in the insurance market and we can say that we found some evidence that there is in fact price discrimination in insurance markets and were also able to see some of the factors with larger impact. Furthermore their are some results that surprised us, such as that there is no significant difference between the genders when it comes to pricing.

To give an outlook of possible follow up papers, one could question the justification that lies behind these results. What is the normative justification for the different prices? There is a lot of room for further investigations, since we only used a small data set and as well we did not point out everything one could mention. Furthermore one could investigate the specific reasons for this price discrimination and if they are morally correct and statically proven. One could as well investigate the individual companies and have a look at which model is more influenced than others. These are just some topics to go deeper into the research of the Swiss insurance market.

5023 Words

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