

# Using Big Data to Discriminate Charged Price in the Car Insurance Industry: Evidence from United States

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**Abstract:** The purpose of this paper is to examine the gender-based discrimination in car insurance rates and whether the reasons provided by the car insurance companies for the different rates are valid or not. The paper studies the average annual premiums paid by men and women across different age groups from 16 years old to over 56 years old along with the percentage differences. Additionally, the concept of big data and how it is utilized by businesses to apply personalized price discrimination is investigated. The research design is conclusive and secondary data is used in both qualitative and quantitative forms. Qualitative data is collected from articles for the literature review and as for the quantitative data it is in the form of reports and surveys. The data shows that at lower age groups women pay less than men for car insurance but as the age increases men start paying less. The paper reaches a conclusion that gender is not necessarily a crucial risk-factor as the regular factors such as driving record can provide accurate risk determinants.

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## 1 Introduction

Price discrimination is a pricing strategy adopted by lots of firms across different industries but it is more evident in monopoly and oligopoly. Its primary aim is to reduce consumer surplus and receive the maximum price customers are willing to pay for a product. Price discrimination takes different forms

and degrees. This paper will discuss conditions necessary for price discrimination along with its types. Additionally, the paper will go through the concept of big data which is becoming increasingly important to modern day businesses and its relationship with price discrimination. The use of big data in price discrimination has raised a debate regarding consumers' privacy and whether consumers are aware of the fact that businesses are gathering their online information for marketing purposes and pricing strategies or not. Among the industries that use price discrimination is the car insurance industry, they set rates based on the different costs of different groups of individuals by analyzing their risk factors. The risk factors include gender and age which have been debated whether or not it is fair to include as determinants.

This paper will first review some conditions and types of price discrimination, along with the use of big data and technology in price discrimination in the literature review. Then the paper will examine the car insurance industry and their gender-based price discrimination.

## 2 Literature review

When the same product is sold at different prices to different consumers, it is known as price discrimination<sup>[1]</sup>. Additionally, some economists believe that price discrimination is when products that are quite similar but non-identical are sold at prices that are not reflecting the cost differences. Examples include paperback and hardcover books, senior and student discounts, and lunch versus dinner prices at restaurants. Moreover, when there is a difference between the price ratio and the marginal cost ratio of two different goods then the firm is price discriminating<sup>[2]</sup>. For instance, if a hardcover book sells for \$30 while the electronic

version sells for \$10, this means that the price ratio is 3:1. But if the hardcover marginal cost is \$2 while the electronic marginal cost is \$1 then the marginal costs ratio is 2:1, this shows that the company is practicing price discrimination. However, price discrimination has been criticized by some economists who argue that there are cost-based explanations for price differences<sup>[1]</sup>. Although there is no formal or fixed definition for price discrimination, but it is generally accepted that price discrimination exists whenever there is price variation that cannot be explained by differences in costs.

## 2.1 Conditions for price discrimination

In order for the firm to be able to use price discrimination, there are certain conditions. First, some market power is crucial. Second, the firm must be able to sort and segment its consumers, and third the firm must avoid the problem of resale<sup>[3]</sup>. When it comes to market power, price discrimination occurs naturally in monopoly and oligopoly. Firms have more incentive to price discriminate when consumers are willing to purchase the product at a higher price compared to its marginal cost. Yet, it is more profitable for the firm to lower the price to marginal consumers instead of decreasing the price to all consumers. In order to determine the marginal consumers, the company has to divide its consumers into segments. It is much easier for companies to segment consumers based on exogenous characteristics like age, rather than endogenous characteristics like purchasing time<sup>[3]</sup>. Additionally, a major challenge of selling at different prices is reselling, where some consumers purchase a product at a discounted price and resell it. Firms must find a way to prevent resale, some mechanisms include: legally restricting the resale of the firm's products, or modifying the products; for instance, software companies selling at discount value to students can provide them with software with limited capabilities compared to the regular software versions. Certain goods are hard to resell due to their nature, this include services, and electric power<sup>[3]</sup>.

## 2.2 Types of price discrimination

### 2.2.1 First-degree price discrimination

According to Pigou (1920), the first-degree price discrimination or the ideal degree is charging different prices for all different units of a good, where the price charged is equal to the demand price and buyers are left with no consumer surplus<sup>[4]</sup>. If perfect information

about the consumers is known to the firm, it would charge the maximum amount every customer is willing to pay; however, this method of price discrimination is somewhat not feasible as firms most likely won't be able to have perfect information about the willingness to pay of the consumers<sup>[5]</sup>.

### 2.2.2 Second-degree price discrimination

When firms charge different prices based on the number of units sold of the same good, and not based on consumers, it is known as nonlinear pricing or second-degree price discrimination<sup>[3]</sup>. According to Armstrong (2006), quantity discounts take place when an increase in the number of units purchased of a specific product result in a decrease in the per-unit price of that product<sup>[6]</sup>. Even though quantity discounts can be beneficial to buyers who buy in bulk at lower prices, it is definitely a disadvantage for low-inventory buyer who pays higher prices<sup>[5]</sup>.

### 2.2.3 Third-degree price discrimination

If a firm was able to distinguish its customers and divided them into different groups based on certain traits or characteristics and charge different price to each different group, then third-degree price discrimination is obtained<sup>[4]</sup>. The market is segmented into low-demand groups and high-demand groups by the firm. This is considered a more practical strategy for the firm which is grouping consumers by what firm believes their price elasticities' of demand to be<sup>[5]</sup>. For example, discounted tickets are sold to students and senior citizens by movie theatres. This is because students and seniors have lower income, and seniors are more likely to spend their nights at home so they have a more elastic demand compared to adults.

### 2.2.4 Two-part tariffs

A pricing scheme known as two-part tariffs is when a consumer have to pay a fixed fee in order to consume a good of any amount, and then based on their usage they pay a variable fee<sup>[3]</sup>. A well-known example is amusement parks where consumers pay an entry fee, and for each ride inside the park further fees have to be paid. Telephone service is also an example of two-part tariffs where a fixed monthly fee is required and additional fees based on the usage is paid.

### 2.2.5 Bundling discounts

Reducing the price of one product if the consumer buys another product along with it is known as bundling discounts<sup>[6]</sup>. There are two types of bundling: pure

bundling and mixed bundling. Pure bundling is when the products must be purchased as a bundle and the consumer cannot purchase the items individually. Mixed bundling, on the other hand, is when prices are set for both individual items and a bundle; consumers are able to purchase items separately or as a bundle<sup>[6]</sup>. Pure bundling is considered an inefficient practice unless the products are perfect complements. In mixed bundling, consumers are generally divided into three groups, the first group has a strong taste for the two products so they buy the bundle, the second group prefer product one over product two so they just buy product one, the third group have a reverse tastes and buy product two<sup>[6]</sup>.

### **2.3 Big data and first-degree discrimination**

Most economists used to think first-degree price discrimination is unattainable and hard to apply, but is that really true? Well, maybe in the past as consumer information were hard to obtain and time-consuming. But thanks to big data personalized price discrimination is now possible. The ability to gather a great amount of data from various sources, and utilize these data in producing new observations, measurements, and predications concerning customers on an individual level, is known as big data<sup>[7]</sup>. Big data makes it easier to collect customer's information at lower costs, which enable the firms to divide customers into different segments and customize their marketing and pricing strategies accordingly. This has encouraged companies to shift from third-degree price discrimination to personalized or first-degree price discrimination. However, companies that hold large amounts of data still face some challenges which include; the complexity of the process and computing power, competition because even if the firm is aware that one customer is willing to pay a higher price, the firm cannot raise its prices, and resale of the products by customers who take advantage of the price differences<sup>[7]</sup>. Moreover, if the firm was not able to apply the personalized pricing strategy effectively, it risks alienating the customers who might think of this strategy as unfair.

#### **2.3.1 Driving forces behind the use of big data**

The widespread use of the internet as well as smart phones which enable users to have access to maps, search engines, video and music streaming websites and services, opened a new door for businesses to collect different data types about consumers<sup>[7]</sup>. For instance, firms can track user's browsing history, location,

retail purchases, and their preferences through social networks such as Face book. Furthermore, online sites can place cookies, which record the user's information and interactions with the site and on the long run build a picture for the user's internet history. However, applications and websites requiring an account are considered easier as users usually provide the site with personal information that can be used by the company<sup>[7]</sup>. In addition, selling targeted marketing is extremely profitable; companies such as Google and Face book earn most of their revenue by doing so. Placing ads targeting a specific group of consumers based on their personal traits is valuable to companies. Nowadays there is an industry of information intermediaries and data brokers which sell and buy consumers data which is used by marketing agencies to put together a digital profile for each individual customer<sup>[7]</sup>.

#### **2.3.2 Privacy**

Most web browsers ask for users acceptance for the cookies used to track their online surfing behavior. It was found that a huge number of users allow cookies<sup>[7]</sup>. Nonetheless, advocates of privacy argue that most users are unaware that these tools are used by advertisers as a way of data gathering regarding user's internet use. Others argue that it might be deliberate ignorance from consumers, as the cost of reviewing settings of privacy outweighs gained benefits<sup>[7]</sup>.

## **3 Car insurance industry**

### **3.1 Factors considered in car insurance policies**

Insurance Companies consider various factors when setting rates, these factors include: driving experience, residence, gender, age, marital status, vehicle type, claims history and severity<sup>[8]</sup>.

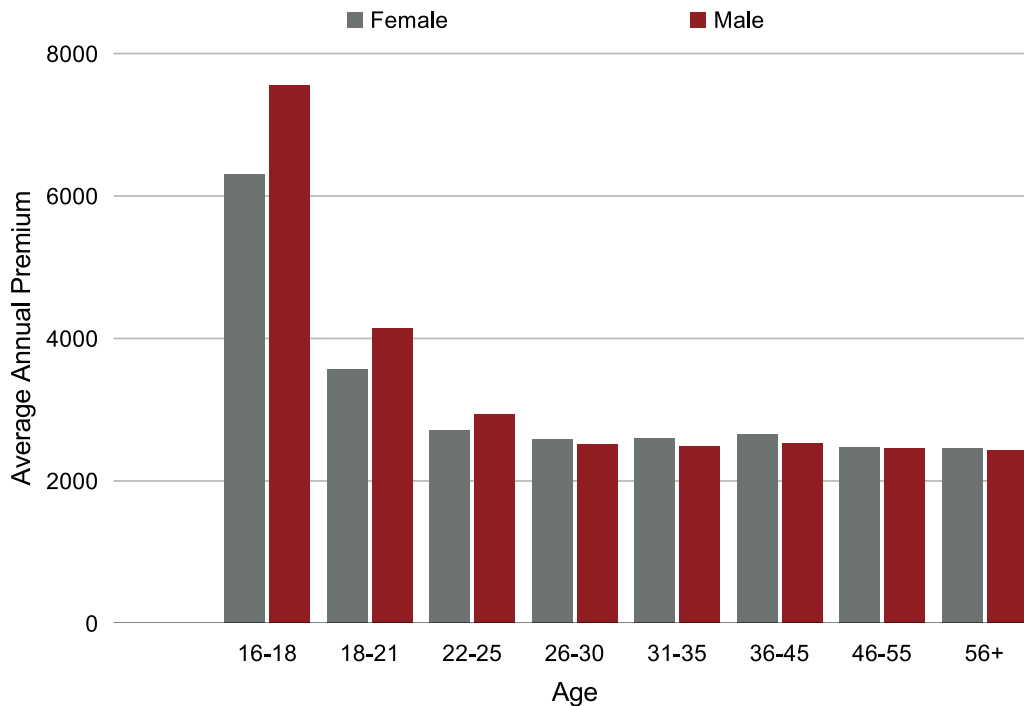
### **3.2 Risk-based pricing**

Charging higher prices due to a difference in the costs of serving different groups of buyers, is known as risk-based pricing, this pricing method is widely used in insurance markets<sup>[7]</sup>. Prices are set based on the risk that an individual would be involved in the outcome which is covered by the policy. Big data enables insurance companies to have a better measurement of risks including record of driving behaviors of individuals. Individuals with higher rates of traffic accidents tend to pay more for car insurance, so it is thought that risk-based pricing might reduce risky behavior. However, some concerns regarding fairness arise when certain

risk factors are out of individuals' control<sup>[7]</sup>. Generally, high-risk individuals are less favored in the risk-based pricing compared to low-risk individuals, and nondiscrimination policies can actually benefit high-risk individuals as well as cause problems of adverse selection.

### 3.3 Average annual premium in the United States

The following data was obtained from Finder which is a service website that aims at facilitating the decision-making process for Americans in different sectors including insurance<sup>[9]</sup>. The different insurance premiums paid by males and females are represented in the graph below (Figure 1).



**Figure 1.** Average Annual Premium for Males and Females across Different Age Groups. Source: Finder<sup>[9]</sup>

The figure above shows that between the age group 16-18, average annual premium is greater compared to older age groups. Additionally, between the age group 16-18 males pay more than females. The same trend can be observed between the age groups 18-21 and 22-25 where men also pay more than women. However, as the age increases the average annual premium paid by

females starts to become greater than the average annual premium paid by males.

Using the data of the average annual premium for males and females, the difference between males and females was calculated to find out the amount of money men pay more or in some cases less than women. Then the percentage difference was calculated in order to provide a better picture.

**Table 1.** Differences between Males and Females. Source: Finder<sup>[9]</sup>

Age	Female	Male	Difference between Males and females	Percentage Difference
16-18	\$6,304	\$7,560	\$1,256	18%
18-21	\$3,571	\$4,144	\$573	15%
22-25	\$2,709	\$2,929	\$220	8%
26-30	\$2,591	\$2,518	-\$73	-2%
31-35	\$2,602	\$2,480	-\$122	-5%
36-45	\$2,650	\$2,533	-\$117	-5%
46-55	\$2,471	\$2,460	-\$11	-2%
56+	\$2,454	\$2,426	-\$28	-1%

The table above shows that males between 16-18 years old pay \$1,256 more for car insurance compared to females, which is equivalent to 18% difference. Males between 18-21 years old pay \$573 more than females which is about 15% more. Similarly, Males between 22-25 years old pay \$220 more which is equal to 8% difference. However, all other age groups show that female are being charged greater average annual premium with a maximum of 5% and a minimum of 1% compared to males.

#### **The Reason why Younger Men are charged more than Younger Women**

According to Danise (2019), when observing the percentage of male drivers involved in fatal car accidents it tends to be much greater compared to female drivers<sup>[10]</sup>. Additionally, fatal drunk driving accidents are more likely to be caused by male drivers relative to female drivers. Moreover, men drivers are more inclined to cause speeding car accidents. All these reason contribute to the fact that men tend to pay more for their car insurance premium compared to women

#### **The Reason why Older Women are charged more than Older Men**

According to Collinson & Brignall (2010), some insurance companies charge older women higher insurance rates compared to men of the same age<sup>[11]</sup>. These insurance companies claim that older women are responsible for more insurance claims. Insurers can not specify why they believe women become worse drivers as they age. However, they speculate that it might be because women tend to rely on their husbands for most of the car journeys so when their husband are unable to drive, women are obliged to drive but they are less confident and less experienced.

#### **The Reason why Younger age groups are charges more**

Car insurance rates generally start to decrease as age increase, this because teens and younger drivers are less experienced drivers and statistics show that individuals under 25 years old are more likely to be involved in car accidents(CarInsurance.com, 2018). This means that younger age groups are considered high-risk for insurance companies, and higher risks means higher rates.

### **3.4 Banning gender-based discrimination in car insurance**

Hawaii, Montana, Massachusetts, North Carolina, and Pennsylvania are states that have actually banned using gender in setting rates of car insurance<sup>[8]</sup>. California has recently joined these states and has banned the gender based discrimination, California Department of Insurance has issued rules that prohibits price discrimination based on gender and requires rates to be set based on driving record, miles driven, and driving experience, primarily, not personal traits<sup>[12]</sup>. This is because gender is a factor which is out of individuals' control so it is unfair to use as a risk factor instead the rates should be determined based on the factors that are actually in the driver's control. Additionally, factors that are usually used as a justification for gender discrimination are already covered by mandatory factors such as type of vehicle, and driving record<sup>[12]</sup>.

## **4 Conclusion**

To conclude, the data shows that at lower age groups men pay greater average annual premium compared to women. But as the age increase women pay slightly higher. Insurance companies argue that the differences is due to statistics showing that younger men are more likely to be involved in fatal car crashes so they are high-risk. On the other hand, men pay less as they age while women pay more as they age. Insurance Companies claim this is due to the fact that older women are responsible for more insurance claims so insurers are forced to charge those more. However, some states have actually banned gender-based price discrimination in car insurance, because the reasons and the factors the insurance companies use to explain the rate difference between genders can actually be obtained from mandatory factors such as driving records. The fact that the trend is not even consistent, and not showing the same differences between genders throughout the entire age groups makes it suspicious and it does seem more logical to base the risk factors on traits that are actually controllable rather than uncontrollable traits such as gender. It is recommended that other States follow the footsteps of California and prohibits the use of gender as a risk factor in order to avoid alienating consumers. Moreover, Insurance Companies can benefit from banning gender-based

discrimination as it would provide them with a better public image. Furthermore, Insurers would convince their consumers that they care about gender equality which is a major topic in the American society nowadays.

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