CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Bachelor thesis

2020

Šimon Appelt

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Website Development as a Credence Good: A Field Experiment

Bachelor thesis

Prague 2020

Author: Šimon Appelt

Supervisor: doc. PhDr. Julie Chytilová Ph.D.

Academic Year: 2019/2020

Bibliographic note

APPELT, Šimon. *Website Development as a Credence Good: A Field Experiment* Prague 2020. 57 pp. Bachelor thesis (Bc.) Charles University, Faculty of Social Sciences, Institute of Economic Studies. Thesis supervisor doc. PhDr. Julie Chytilová Ph.D.

Abstract

There are many markets for credence goods which have been assessed in recent economic research, including taxi services, car mechanics, health care or electronics repairs. However, as no previous research inspects solely an Internet-based environment, the thesis examines the web development market as the representative of a new potential segment of markets for credence goods. In particular, the discrimination in overcharging based on gender or technical experience of a customer is assessed. For this reason, a natural field experiment was designed and subsequently, 341 Czech web developers and IT firms were approached via email to collect the proposed prices for a fictitious E-shop development contract. After the analysis of the outcome variables, the multiple linear regression model with the ordinary least squares (OLS) method was employed. The results suggest that male customers tend to get higher price proposals than women. The second implication is that customers who signalled technical experience in the email inquiry appear to get higher prices than the non-technical customers. However, the outcomes and the differences in proposed prices were not significant among the treatment groups. Other factors, including the number of employees, the region where the company resides and proposed technical solution, have a significant effect on the proposed price.

Abstrakt

Existuje mnoho odvětví ekonomiky, kde pravou hodnotu služby nebo zboží není možné zjistit ani po jejich zakoupení (tzv. "credence goods"), například taxi služby, opravy aut či elektroniky nebo oblast zdravotnictví. Ačkoliv v této sféře proběhla v poslední době řada ekonomických výzkumů, žádný z nich se nevěnoval čistě internetovému prostředí. Tato práce se zabývá zkoumáním jednoho z potenciálně nových segmentů služeb spojených s "credence goods", a sice tvorbou webových stránek. Zejména je zkoumána možná diskriminace při cenotvorbě zakázky na základě pohlaví a technické zkušenosti zákazníka. K tomuto účelu byl vytvořen experiment v přirozeném prostředí, v němž bylo pomocí e-mailu osloveno 341 českých webových vývojářů a firem s poptávkou na tvorbu e-shopu. Po analýze odpovědí (navržená cena, počet odpovědí atd.) byl následně vytvořen lineární regresní model s použitímmetody nejmenších čtverců (OLS). Výsledky naznačují, že mužským zákazníkům je navrhována vyšší cena než ženám. Druhým náznakem je vyšší cena pro zákazníky, kteří v e-mailu projevili technické znalosti, než pro laické zákazníky. Ovšem ani jeden z výsledků není signifikantní, stejně jako rozdíly cen mezi jednotlivými zkoumanými skupinami. Faktory, které signifikantně ovlivňují nabízenou cenu, jsou počet zaměstnanců, kraj, ve kterém živnostník či společnost sídlí, a nabízené technické řešení.

Keywords

Credence goods, discrimination, website development, field experiment, overcharging, expert services.

Klíčová slova

"Credence goods", diskriminace, tvorba webových stránek, "field" experiment, předražování, profesionální služby.

Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

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Prague, 5 May 2020

Signature

Acknowledgment

I would like to express my gratitude to my supervisor, doc. PhDr. Julie Chytilová Ph.D., for her valuable guidance from the field experiment to the final version of this thesis. In addition, I thank to my family and friends for their endless support throughout the whole studies.

Bachelor's Thesis Proposal

Institute of Economic Studies
Faculty of Social Sciences
Charles University in Prague

Author's name and surname: Šimon Appelt

Supervisor's name: doc. PhDr. Julie Chytilová Ph. D.

Proposed Topic:

Website Development as a Credence Good: A Field Experiment

Preliminary scope of work:

Research question and motivation

In my thesis, I would like to research the market for website design and development. The IT firms are usually described with positive adjectives like creativity and efficiency, but are those innovative firms also non-discriminating and honest with their customers?

Credence good is a type of good, where the true value cannot be evaluated by the customer even after consumption due to information asymmetry (Darbi and Karni 1973). The IT firms are not only providing the actual development of websites but they are also in the role of the consultants offering expert services for the whole process, allowing the behaviour of fraudulent expertise (Emons 1997), overtreatment or overcharging (Dulleck et al. 2011). My thesis would examine Czech IT firms and their services from the point of credence goods.

Research questions asked in the thesis are whether the IT firms are price discriminating and charge differently the customers according to the gender or the technical background of the client.

Contribution

My thesis broadens the topic of credence goods in the context of the market of website design and development, which is a crucial part of the IT industry. The research examines whether the Czech IT firms are taking advantage of information asymmetry and expert knowledge to price discriminate clients according to gender or technical background.

The thesis follows many other field experiments, wherein there were under scrutiny taxi drivers (Balafoutas et al. 2013), car repair shops (Rasch and Waibel 2018), or dentists (Gottschalk et al. 2019). In these field experiments there were introduced pieces of evidence on how different customers or patients are manipulated, defrauded or overtreated. My thesis brings evidence on whether the market for website development is prone to similar behaviour.

Methodology

In the practical part, I am going to carry out an experiment, in which I approach a selected sample of Czech IT firms with potential contracts for website development by email. To answer my research question I will change attributes for randomly selected firms, those attributes will consist of four categories: male/female with a technical background, male/female without a technical background. The main information I expect from the companies is hourly wage and an approximate estimate of hours spent on development (approximate total price). I will then compare if there is a statistically significant relationship

between price of the website development and gender or technical abilities of the client.

Outline

1. Abstract
2. Introduction
3. Theoretical part
4. Experimental part
5. Main results
6. Discussion
7. Conclusion

List of academic literature:

Bibliography

Balafoutas L., A. Beck, R. Kerschbamer, M. Sutter, What Drives Taxi Drivers? A Field Experiment on Fraud in a Market for Credence Goods, *The Review of Economic Studies*, Volume 80, Issue 3, July 2013, Pages 876–891, https://doi.org/10.1093/restud/rds049

Darby, Michael R. and E. Karni, "Free Competition and the Optimal Amount of Fraud," The Journal of Law and Economics 16, no. 1 (Apr., 1973): 67-88.

Domenighetti, G., Casabianca, A., Gutzwiller, F, and Martinoli, S. "Revisiting the Most Informed Consumer of Surgical Services." International Journal of Technology Assessment in Health Care, Vol. 9 (1993), pp. 505-513.

Dulleck, U. and R. Kerchbamer (2006): "On Doctors, Mechanics, and Computer Specialists: The Economics of Credence Goods," Journal of Economic Literature, 44(1), 5–42.

Dulleck, U., Kerschbamer, R., and Sutter, M. (2009). The Economics of Credence Goods: On the Role of Liability, Verifiability, Reputation and Competition. National Centre for Econometric Research, NCER Working Paper Series.

Emons, W.. "Credence Goods and Fraudulent Experts." *The RAND Journal of Economics*, vol. 28, no. 1, 1997, pp. 107–119. *JSTOR*, www.jstor.org/stable/2555942.

Gottschalk, F., M. Wanda and W. Christian, Health Services As Credence Goods: A Field Experiment (October 2019). Available at SSRN: https://ssrn.com/abstract=3036573 or http://dx.doi.org/10.2139/ssrn.3036573

Rasch, A. and Waibel, C. (2018), What Drives Fraud in a Credence Goods Market? – Evidence from a Field Study. Oxf Bull Econ Stat, 80: 605-624. doi:10.1111/obes.12204

Wolinsky, Asher. "Competition in a Market for Informed Experts' Services." *The RAND Journal of Economics*, vol. 24, no. 3, 1993, pp. 380–398. *JSTOR*, www.jstor.org/stable/2555964.

List of Tables

List of Figures

Acronyms

CZK Czech koruna

IT Information technology

ICT Information and communications technology

OLS Ordinary Least Squares

SEO Search engine optimization

VIF Variance Inflation Factor

Contents

1 Introduction

The information asymmetry between the seller and buyer is a commonly shared characteristic among many services. Moreover, there exists a group of goods and services in which the true value cannot be evaluated even after the consumption of the good or receiving the service. These characteristics were first recognized by Darby and Karni (1973) who introduced the term "credence goods".

The nature of credence goods and the information asymmetry permits the expert sellers to take advantage of the customers' lack of expertise and inability to evaluate the quality ex post. Dulleck and Kerschbamer (2006) introduce three types of possible fraudulent behaviour, those are overtreatment, undertreatment and overcharging (see section 2.2). Furthermore, strong incentives to cheat can be observed in a plethora of expert markets. (Emons, 1997) For instance, according to a field experiment in the Swiss market for dental care by Gottschalk, Mimra and Waibel (2019), a patient receives unnecessary dental overtreatment recommendation in 28 % of the visits.

In addition, elements of discrimination are observed in the markets of credence goods. For instance, the study by Balafoutas, Beck et al. (2011) showed that taxi drivers in Athens take foreigners on longer detours and charge them more than the local customers. In China according to Lu (2014), the doctors prescribe more expensive drugs to insured patients than to the uninsured ones as greater financial profits for doctors can be gained.

This thesis examines a new potential market for credence goods - the web development market. Web developers share similarity with the computer specialists who were approached by Kerschbamer, Neururer and Sutter (2019) in their recent study. The thesis investigates whether overcharging can be observed in the solely Internet-based environment and in particular, it focuses mainly on exploring the possible forms of discrimination in this market - the discrimination based on gender or technical experience.

Hence, to determine the possible discrimination, a field experiment was constructed, in which there were 341 Czech web developers or IT firms ap-

proached via an email with the potential contract for E-shop development. The 2x2 design of experimental variations allowed control for both gender and technical experience. The first variation was achieved by creating two fictitious identities of potential clients, one female and one male. The second variation was implemented by altering the text body of the email. In particular, the technical experience was signalled by using specific website development related terms and by stating a previous experience with E-shop administration. For each treatment, there is an average price proposal for the E-shop development recorded, along with the response rate and the proposed technical solution.

The structure of the thesis is as follows. Chapter 2 provides a review of the literature related to credence goods. In Chapter 3, the field experiment and its design are described in detail. Chapter 4 presents the results of the field experiment with the analysis of response rates, average price estimates, and different technical solutions proposed by the companies. The linear regression and the methodology is described in Chapter 5 with the interpretation of the results. Chapter 6 concludes the whole thesis.

2 Literature Review

There are many markets for credence goods which were assessed in economic research, including taxi services (Balafoutas, Beck et al., 2011), car mechanics (Rasch and Waibel, 2018), health care (Domenighetti et al., 1993; Gottschalk, Mimra and Waibel, 2019) or electronics repairs (Kerschbamer, Neururer and Sutter, 2019). Although the term "credence good" was firstly introduced by Darby and Karni, 1973, the topic gained popularity in recent economic research, especially, the field experiment format was employed in many studies (Gottschalk, Mimra and Waibel, 2019; Kerschbamer, Neururer and Sutter, 2019; Kerschbamer and Sutter, 2017). First, the following section introduces the cornerstone of credence goods - information asymmetry, subsequently, the three types of possible fraudulent behaviour is presented, and the last two subsections connect the phenomenon of credence goods with the topic of this thesis.

2.1 Information Asymmetry

Information asymmetry between sellers and buyers is an essential aspect of credence goods markets. This is caused by the fact that sellers act as experts in the given field. (Emons, 1997) The experts are better informed about the quality of the good or service than the customers. In contrast to experience goods (Nelson, 1970), where the quality can be observed after the purchase, in the case of credence goods, the quality may not be observable ex post. (Darby and Karni, 1973)

In the laboratory experiment by Dulleck, Kerschbamer and Sutter (2009), roles of liability, verifiability, reputation and competition are examined as the determinants of efficiency in the markets for credence goods. The study concludes that liability plays a major role in reaching efficiency, on the other hand, verifiability plays only a minor role. Furthermore, Dulleck, Kerschbamer and Sutter (2009) argue that under zero liability laws the sellers of credence goods treat the customers adequately in 50 % of the cases.

2.2 Overtreatment, Undertreatment and Overcharging

Apart from the information asymmetry, another common characteristic can be found among the professionals in the markets for credence goods. Sellers typically not only provide the service, but they also propose adequate treatment. This feature allows for three possible fraudulent attitudes: overtreatment, undertreatment or overcharging (Dulleck and Kerschbamer, 2006). Overtreatment describes a situation when an expert proposes and performs a treatment which adds little or no additional value to the customer; however, it raises the costs significantly. On the contrary, undertreatment leaves the customer with insufficient service, but he is charged at an average price. The third case, overcharging, occurs when the expert charges for a service that he has not performed. (Dulleck and Kerschbamer, 2006)

Not all of the three fraudulent behaviour patterns can be employed in every market for credence goods. For instance, it is unlikely not to reach the final destination when travelling by taxi, therefore, undertreatment cannot be observed in the market for taxi services. However, the overtreatment occurs when a longer route than necessary is chosen by the taxi driver and overcharging is observed when the driver manipulates the fares. (Balafoutas, Beck et al., 2011)

Moreover, there is evidence that the experts discriminate based on how they perceive the potential possibility of fraudulent behaviour. In other words, the acts of overtreatment, undertreatment or overcharging depend partially on the final customer. Returning to the taxi drivers, according to a field experiment by Balafoutas, Beck et al. (2011) in Athens, Greece; the Athenians (native locals) are charged differently from non-local Greeks or foreigners. Those are on average frequently overcharged and taken on a detour. In addition, Balafoutas, Beck et al. (2011) conclude that more informed customers tend to be less exposed to fraudulent behaviour.

Another potential discriminatory factor is the wealth of the customer. However, the nature of discrimination might differ. In the case of taxi rides, higher-income customers are both more overtreated and overcharged than

low-income customers. (Balafoutas, Beck et al., 2011) On the other hand, in the study by Gottschalk, Mimra and Waibel (2019) patients with higher socioeconomic status tend to have fewer overtreatments by Swiss dentists. Nevertheless, both results were either partly significant or diminishing with further experimental conditions, respectively.

2.2.1 Second-degree Moral Hazard

The third factor influencing the amount of fraud is second-degree moral hazard, a term created by Balafoutas, Kerschbamer and Sutter (2017). Unlike moral hazard raises demand due to higher incentive for risk-taking, the second-degree moral hazard raises the supplier-induced demand in reaction to the information from the buyer. Balafoutas, Kerschbamer and Sutter (2017) modified the original above-mentioned "taxi drivers" experiment in a way that some of the customers claimed that their taxi ride would be reimbursed by their employer. The results showed that passengers who claimed to be reimbursed were 13 % more likely to be overcharged. Similar conclusions were discussed in the context of Asian countries, in particular in the case of China, where the physicians can profit from the prescribed drugs. There is no separation between the physicians who prescribe the drugs and pharmacists who sell them. Lu (2014) found out that Chinese doctors prescribe 43 % more expensive drugs for insured patients than for the uninsured ones. The study also states that 80 % of the increase is motivated by physicians' greater financial profit rather than improving patients welfare (Lu, 2014) and therefore supports the second-degree moral hazard theory. (Kerschbamer and Sutter, 2017)

The significant role of insurance was verified in the market for computer repairs as well. Kerschbamer, Neururer and Sutter (2016) discovered that the final bill for a notebook repair increased by more than 80 % when the repair shop was informed of the insurance coverage. The study detects that the full reimbursement from a third party increases the price through two different channels, the overtreatment and overcharging. The overtreatment (overposition) occurred when a repair shop changed more parts than neces-

sary for the purpose of repair, and the overcharging was detected when the working-hours were inflated in contrast to the control groups.

2.3 The Role of the Internet

In the recent field experiment by Kerschbamer, Neururer and Sutter (2019), the impact of Internet reviews on the market for computer repairs was studied. The authors state that businesses with better ratings charge significantly less than those with worse reviews.

Moreover, in the first section of the study, the researchers examine the effect of information gained apriori on the Internet. The first part of the experiment is designed as follows. A person asks through the email whether she can drop her broken computer at the repair shop. Two different scenarios of self-diagnosis are built upon an email baseline. Both scenarios inform the repair shop about the possible source of the problem based on the Internet search - in one scenario wrong conclusions are made and in the second one correct. The results show that self-diagnosis increases the average price of computer repair in both scenarios. However, in the treatment group where wrong self-diagnosis was mentioned in the email, the average price for the repair more than doubled. (Kerschbamer, Neururer and Sutter, 2019)

In the study of Swiss dental market by Gottschalk, Mimra and Waibel (2019), one of the explanatory variables included in the model was the "informative webpage" indicator. The researchers assessed the dentists' websites and evaluated the informativeness of the website based on the biography of the doctor and the description of the provided services. The conclusions of the study suggest that dentists with more informative websites were more likely to recommend the overtreatment. (Gottschalk, Mimra and Waibel, 2019)

2.4 Gender Effects

There are several studies related to the role of gender in the credence goods markets. Two standpoints are differentiated, as the gender effects might be observed either in the role of expert (Agrawal, Green and Lavergne, 2019) or

in the customer role (Castillo et al., 2013). The study by Castillo et al. (2013) examines the gender discrimination of the customers in the taxi market in Lima, Peru. In particular, they investigate tased-based discrimination (Becker, 1957) and statistical discrimination (Phelps, 1972; Arrow et al., 1973) in price negotiation with taxi drivers. The results suggest that male customers yielded worse outcomes in the negotiation than women. However, after additional signalling, when statistical inference was controlled to be the same for both men and women, the taxi drivers showed no preferences based on gender. (Castillo et al., 2013)

Based on the previously mentioned studies, Gottschalk, Mimra and Waibel (2019) discuss the potential impact of gender in the market for dentist care. However, due to the experimental limitations to avoid the potential biases, only one male customer visited the dentists, and for that reason, the gender cannot be examined on the customer side. Therefore, only the gender of the dentists, the experts, was recorded and included in the model. There were no significant gender differences observed on the expert side, meaning that the proposed treatments between female and male dentists did not vary significantly. (Gottschalk, Mimra and Waibel, 2019)

3 The Field Experiment

In the following section, the field experiment is described, with the emphasis on the experimental setup, the description of both dependent and independent variables, and data collection.

To discover whether the IT firms in the Czech Republic charge differently the customers based on either gender or technical experience, the selected firms were approached by an email with a potential contract (development of an E-shop). The emails differed in the characteristics of a potential customer, hence four treatment groups emerged: male/female with technical experience and male/female without technical experience. The main information inquired from the companies was an approximate estimation of the price of the potential contract.

In addition, to minimize the company cost connected with reading through the email and answering to it, there was only one email sent per company. The text of the email is very direct and designed in a way not to be time-consuming to answer. Moreover, almost immediately after obtaining the response, there was a reply with a polite rejection sent to the company. Nonetheless, as the participants did not know about the experiment, the experimental design was submitted to the Commission for Ethics in Research of the Faculty to evaluate the procedure. The Commission granted permission to proceed.

3.1 Sampling Procedure

The final sample listed 341 Czech firms in the market for website development. To collect this amount of firms the Google Search engine was used. This approach is in many aspects similar to the "telephone directory" sampling method where certain biases occur, including non-coverage bias. (Lepkowski, 2011) Nevertheless, in the market for website development it is reasonable to assume the possession of a company website which is included in the Google Search engine; therefore the non-coverage bias should not apply in this case. Another bias of search engines applies since advanced

SEO and optimization of the company website leads to a better position in Google Search results and therefore increase the possibility of inclusion into the sample. However, for the research, this bias does not have a significant impact as optimization should be part of the know-how of each of the firms as it is a crucial part of their business. In addition, Google Reviews, for instance, were used in collecting repair shops in German cities in the recent study on credence goods by Kerschbamer, Neururer and Sutter (2019).

The sampling was carried out by regions of the Czech Republic and the search queries were constructed in the following manner: "tvorba webových stránek praha", "tvorba webových stránek zlínský kraj", etc. This is due to the limitation of Google Search where after a certain amount of search pages many irrelevant links are displayed (mainly articles related to web development). After collection of the dataset, the subjects were randomly allocated to the four treatments (see Table 2).

Together with the company email address, each observation was recorded in the dataset with several characteristics - city and region of operation, a number of employees, age of the firm and whether the subject is a company or natural person. Hereinafter, for simplicity, whenever it is referred to IT firm or company it corresponds to the subject, therefore either to the company or natural person. The collection of company attributes was done from the company website. If any of the information could not be found on the website, the official information from Business Register maintained by the Czech Statistical Office was used as a secondary source. Further description of the characteristics can be found in section 3.4.

3.2 Fictitious Identities and Experimental Variations

To assess the field experiment, two fictitious identities were created as this is a standard procedure, for both discrimination and credence goods experiments, pioneered by a study on discrimination conducted by Bertrand and Mullainathan (2004). The fictitious profiles consisted of a Czech generic name indicating gender and an email address registered at Gmail service (see Appendix 1). The role of fictitious email accounts is essential as the

newly created profiles along with the generic name are untraceable on the Internet and therefore do not provide any additional information which might influence the results.

From each email account, two variations of emails were sent: whether the client indicates the technical experience or not. Summary of the four experimental groups is presented in Table 1 with the count of subjects in brackets.

Table 1: Experimental variations and number of observations

		Technical experience		
		Yes	No	Total
Gender	Male	M-T (85)	M-NT (86)	171
	Female	F-T (85)	F-NT (85)	170
Total		170	171	341

To form the four experimental groups, the web developers and IT firms were randomly drawn from the full dataset consisting of 341 subjects. In this type of experiment, it is crucial to ensure that the data are randomly distributed and that the independent variables have approximately the same means for each of the treatment groups. Therefore, after the random draw, the means are tested whether there is no statistically significant difference among the groups. For the purpose of testing, the one-way ANOVA test was implemented and no evidence of differences in the means among the groups was found. Table 2 in section 3.4 summarizes the representation of each of the independent variables in the four experimental groups, with the total for the whole dataset in the last column.

To indicate technical experience, there were minor changes in the body of an email. First, there was a sentence demonstrating previous experience with E-shop administration added and the website development related terms, e.g. “web hosting” and “domain” were used. Second, to illustrate more technical awareness, there were bullet points used in the body of the email instead of a plain paragraph (both the original Czech version and translation

to English of all four emails are listed in Appendix 2).

The distinction between gender was solely based on the signature in the footer of the email and declension of used verbs. To clarify, the declension of verbs is specific for Czech language and with the declension, the reader can distinguish the gender already from the body of the email, this feature is lost in the translation to English.

3.3 Outcome Variables

Average price. The experimental emails were constructed to collect the estimated price of E-shop development contract with the given specification (see Appendix 2). When an expected range of workload and the hourly wage was received the average price was calculated by their multiplication. When the range of prices was given, the average of minimum and maximum price was stated as the average price. In the case of only one price estimate given, the price was considered as the minimum, maximum and average price for the observation.

Answered and State of response. The *answered* binary variable measures whether a company replied to the inquiry or not. On the contrary, a *state of response* describes what kind of reply was received from the company, a list of possible outcomes of the variable is summarized below.

- **Price proposal.** The variable indicates whether the IT firm states enough information to retrieve the average price of the contract. In other words, the company states either the price estimate or the working-time in combination with the hourly wage.
- **Phone/meeting.** Indicator of whether the IT firm requests a phone call or meeting in person before providing price information. This is due to the fact that in the experimental emails, there was no phone number given in the signature. Although the price information could be possibly retrieved after the suggested phone call, the information value would be low for the purpose of the thesis as the answers would suffer from biases based on age, the tone of voice, etc.

- **More details.** The IT firm asks additional questions before providing price information. Specifically, the complementary questions demanded more details regarding the assignment, for instance, to define the payment methods, the integration with billing systems or other technical specifications relevant to the E-shop development.
- **Full capacity.** The indicator of whether the IT firm currently accepts new contracts or not due to the full capacity. The variable recognizes only whether the full capacity is stated at this moment, but does not distinguish the cases in which a company is busy for the next month or, in some cases, even the whole year.
- **No E-shops.** The IT firm no longer provides the services in E-shop development. Various reasons influence this *state of response*, for instance, the IT firm lists E-shop development on its website among the provided services although this is no longer the case.
- **Other.** Any other response provided by the IT firm which does not fit any previous category. Only two answers are in this category, a developer who was medically indisposed and a firm which replied that they do not accept "anonymous" inquiries.

3.4 Independent Variables

The process of collecting the variables was introduced briefly in section 3.1, more detailed view on the collection accompanied by the description of variables is discussed below. The following independent variables were recorded for each subject.

Age. The variable describes how many years a given company operates in the market of web development.

Legal form. There are three legal forms included in the dataset, Private limited company (in Czech: *"společnost s ručením omezeným"*), Natural person (*"živnostník"*) and Joint-stock company (*"akciová společnost"*). Problems connected to legal forms are outlined later in this section. The share

of Joint-stock companies is substantially limited in the sample, it represents only approximately 2.1 % (7 firms) of all observed subjects. Moreover, in the collected responses with the price estimates, there was no Joint-stock company included.

Number of employees. There are six categories which represent the size of the given company. The categories are based on the official OECD methodology with the exception of the categories "10 - 19 employees" and "20 - 24 employees", which were merged together for the purpose of this thesis.

Regions. In the dataset there were both cities and regions recorded; however, the nature of the website development market does not limit the business operation to a specific city. Therefore the region was chosen as a more explanatory variable.

In addition, the regions were clustered into three groups, according to the average gross monthly wage of the ICT specialists in each of the regions. The average wages are taken for the year 2018 based on the most recent data from the Czech Statistical Office. (*Comparison of Regions in the Czech Republic* 2020)

- **Region High.** Regions where ICT specialists earn more than the national average wage in the given field (53 539 CZK). This variable consists only of the Prague region with the average gross wage of 64 552 CZK.
- **Region Medium.** Regions with wages below the national average, but higher than 45 000 CZK. The South Moravian Region, Central Bohemian Region and Plzeň Region met the criteria and were included.
- **Region Low.** The remaining 10 regions with average wages below 45 000 CZK.

The means of the covariates for each treatment group are presented in Table 2. For each of the independent variables, there was a one-way ANOVA test conducted assuring that the variances in the means between the groups are not significant. The assurance of the same means verifies the

Table 2: Representation of variables in the treatment groups

		Treatment				
Variable		M-NT	M-T	F-NT	F-T	Total
Age (years)		9.965	9.647	10.424	11.200	10.308
Legal form (%)	Private limited company	0.593	0.576	0.565	0.565	0.575
	Natural person	0.395	0.400	0.412	0.412	0.405
	Joint-stock company	0.012	0.024	0.024	0.024	0.021
No. of employees (%)	None	0.244	0.271	0.224	0.294	0.258
	1 - 5 employees	0.372	0.353	0.400	0.353	0.370
	6 - 9 employees	0.151	0.141	0.153	0.165	0.152
	10 - 24 employees	0.151	0.176	0.165	0.129	0.155
	25 - 49 employees	0.081	0.047	0.047	0.059	0.059
	50 - 99 employees	0.000	0.012	0.012	0.000	0.006
Regions (%)	Prague	0.291	0.235	0.235	0.247	0.252
	Zlín Region	0.035	0.059	0.059	0.047	0.050
	South Moravian Region	0.105	0.118	0.153	0.118	0.123
	Moravian-Silesian Region	0.070	0.106	0.129	0.094	0.100
	Pardubice Region	0.093	0.047	0.047	0.035	0.056
	Plzeň Region	0.058	0.059	0.047	0.059	0.056
	Hradec Králové Region	0.070	0.024	0.059	0.047	0.050
	Central Bohemian Region	0.047	0.082	0.059	0.047	0.059
	Liberec Region	0.047	0.035	0.071	0.035	0.047
	Karlovy Vary Region	0.023	0.012	0.012	0.024	0.018
	Ústí nad Labem Region	0.035	0.082	0.024	0.059	0.050
	South Bohemian Region	0.047	0.071	0.035	0.059	0.053
	Olomouc Region	0.047	0.047	0.047	0.082	0.056
	Vysočina Region	0.035	0.024	0.024	0.047	0.032

Note: There are no significant differences in means according to one-way ANOVA analysis.

even distribution of observed companies in the four treatment groups and it is vital for statistical inference in further sections.

If not stated otherwise, the primary source of all data are company websites, the secondary source is the Business Register maintained by the Czech Statistical Office. The secondary source was needed in rare cases in which some of the information was not observable from the website of which informativeness was generally very high. The company website was deliberately chosen as a primary source due to the common practice to "work with trade licence" (in Czech: *"pracovat na živnostenský list"*).

In the field of IT, there might be two illegal practices. First practice is when a registered company instead of employing its own programmers creates contracts with "self-employed" programmers based on the trade licence. These contracts are to some extent similar to a regular employment contract, but the company does not pay Social and Health Insurance derived from law. The second form involves a group of natural persons owning a trade licence that cooperate together under a "company" name.

The acquisition of data from the company website mitigates risks from both of these practices. Indeed, the second phenomenon can be observed from the data, as 36.23 % of natural person entrepreneurs had a team of one or more "employees". Due to this reason, the independent variable *number of employees* describes the company better than the *legal form* variable which is eventually not used in the linear regression.

4 Comparison of Means

A total of 341 emails were sent to the corresponding companies from which 262 did respond to the fictitious inquiry. The emails were sent on Thursday morning and generally, the IT firms responded almost immediately as by Friday midnight 83.6 % of the 262 responses were delivered, with 44.3 % firms responding within the first four hours and 63 % within Thursday. Each of the four sections covers part of the statistical analysis respectively: the nature of the response, price proposals, different technical solutions and response times for each treatment group (Male vs Female and Non-Technical vs Technical).

4.1 Types of Responses

In section 3.3 two additional variables were stated to confront the possibility of discrimination: whether each treatment group receives the same amount of responses and whether the *state of response* variables are equally distributed.

First, Table 3 presents the response return rate along with the F value and p-value from the one-way Kruskal–Wallis non-parametric test. In the gender treatment group, the number of returned emails amounted to 131 (approximately 77 %) for both male and female customers. In the treatment for technical experience, although the numbers differed, there is no evidence to reject the equality of the means which implies that discrimination cannot be observed in the response rate.

Table 3: Analysis of Response rates

	Male	Female	Non-Technical	Technical	Total
Answered	76.61% (131)	77.06% (131)	74.85% (128)	78.82% (134)	76.83% (262)
χ^2	0.01		0.753		
p-value	0.922		0.386		
Not delivered	0.58% (1)	0.59% (1)	1.17% (2)	0% (0)	0.59% (2)
Observations	171	170	171	170	341

In Table 4 the same analysis is conducted for each *state of response*. From the overall 262 responses out of 341 sent emails, not all of them provided the requisite price estimate, therefore, different *states of responses* had to be categorized (see section 3.3). The states are not mutually exclusive as there are multiple states assigned to one response (e.g. a company submits its price estimate, however, it is busy at the moment and does not take any new clients = *Price proposal* and *Full capacity*). There were 14 firms with two states of response.

Table 4: Analysis of States of response

	Male	Female	Non-Technical	Technical	Total
Price proposal	48.09% (63)	50.38% (66)	50.78% (65)	47.76% (64)	49.24% (129)
χ^2	0.137		0.238		
p-value	0.711		0.626		
Phone/meeting	22.14% (29)	12.98% (17)	17.19% (22)	17.91% (24)	17.56% (46)
χ^2	3.783		0.024		
p-value	0.052*		0.878		
More details	13.74% (18)	18.32% (24)	16.41% (21)	15.67% (21)	16.03% (42)
χ^2	1.017		0.026		
p-value	0.313		0.872		
Full capacity	12.21% (16)	15.27% (20)	12.50% (16)	14.93% (20)	13.74% (36)
χ^2	0.821		0.159		
p-value	0.365		0.690		
No E-shops	7.63% (10)	9.16% (12)	11.72% (16)	5.22% (7)	8.40% (22)
χ^2	0.198		3.577		
p-value	0.657		0.0586*		
Other	0.76% (1)	0.76% (1)	0% (0)	1,49% (2)	0.76% (2)
Observations	131	131	128	134	262

Note: *p<0.1; **p<0.05; ***p<0.01

The statistical significance can be observed only by two particular states - Phone/meeting and No E-shops - which indicates that the means are different in the given treatment at 10 % significance level. The first finding suggests that IT firms want to speak over the phone or meet in person

with male customers more than with female customers. The second finding implies that non-technical customers were told that an E-shop cannot be ordered from the given firm more frequently than the customers who showed a technical skill.

4.2 Price Proposals

4.2.1 Average Price

From the 262 received responses, there were 129 emails with an estimated price for the E-shop development. Although the assignment did not vary for each treatment, the results were extremely divergent. The estimated price ranged from only 4 500 CZK to estimates around 650 000 CZK.

As mentioned in section 3.3 the *average price* is constructed as the average of minimum and maximum price which appeared in the email response. In 68 cases there was only one price given, which was consequently recorded as a minimum, maximum and *average price*. On the contrary, the price range was given by 61 companies, with a maximum span of 550 000 CZK between the minimum and maximum price. When there was a high dispersion between the proposed prices, usually more than one technological solution was offered in the company response. This observational fact led to the creation of a new independent variable which differentiates between proposed technological solutions (see section 4.3).

Closer inspection of the data showed that all three variables (minimum, maximum and *average*) do not follow the normal distribution. This assumption was formally tested by the Shapiro-Wilk test (p-values: 2.2e-16, 6.369e-16 and 1.203e-15 respectively), which is the preferred normality test when the asymmetric distribution is suspected. (Yap and Sim, 2011) Therefore, as the assumptions for one-way ANOVA are not met, a nonparametric Kruskal-Wallis test by ranks is used to determine whether the samples come from the same distribution. The summary of means and medians with chi-squared and p-value statistics from the Kruskal–Wallis test is in Table 5.

Table 5: Analysis of Price proposals

		Male	Female	Non-Technical	Technical	Total
Minimum price	Mean	72 740 Kč	64 564 Kč	65 140 Kč	72 028 Kč	68 557 Kč
	Median	36 000 Kč	38 500 Kč	36 000 Kč	40 000 Kč	37 000 Kč
χ^2		0.837		0.387		
p-value		0.360		0.534		
Maximum price	Mean	101 979 Kč	95 725 Kč	101 809 Kč	95 701 Kč	98 779 Kč
	Median	60 000 Kč	42 500 Kč	45 000 Kč	60 000 Kč	50 000 Kč
χ^2		0.700		0.036		
p-value		0.403		0.849		
Average price	Mean	87 360 Kč	80 144 Kč	83 474 Kč	83 865 Kč	83 668 Kč
	Median	50 000 Kč	40 100 Kč	42 000 Kč	43 625 Kč	42 250 Kč
χ^2		0.700		0.095		
p-value		0.403		0.758		
Observations		63	66	65	64	129

The outcome variable *average price* indicates a difference between male and female, where for male customers the *average price* is higher by 7 000 CZK on average. The median for male potential customers is higher as well. However, the difference is not statistically significant. For the second treatment group, there is no disparity observable as none of the values are statistically significant.

4.2.2 Robustness

The mean of the *average price* is nearly twice as large as the median, approximately 83 700 CZK and 42 250 CZK, respectively. The data for the *average price* is skewed to the left, hence the high price estimates shift the mean to the right on the price axis. As the experiment is designed in a way to mitigate the potential misunderstanding in the inquiry, the possibility of outliers due to measure errors is ruled out. However, to test the robustness of the results from the previous section, several methods (z-score, boxplot, top 5 % and 10 %) for detecting the outliers were employed. After the outliers were removed using each method, the results showed the same trend

of charging more to men than women and to technical than non-technical customers. Although the results remained insignificant after each of the methods was applied, the robustness was successfully checked. The table with the methods and the results with p-values from the Kruskal-Wallis tests are summarized in Appendix 3.

4.2.3 Hourly Wage and Time Estimation

The hourly wage was mentioned in almost one-third of the price proposals (38 out of 129 emails) and the estimation of hours in only 14 %. For the reason of the small-sized result set for both hourly wage and time estimation, the analysis is done solely to illustrate the vast differences among the firms. The average hourly wage proposed for E-shop development was 709 CZK. The lowest wage was equal to 200 CZK and the highest wage amounted to 1200 CZK. Most of the hourly wages (71 %) were in a range between 600 and 1000 CZK.

Similarly, high dispersion can be seen in the estimated time of development where the minimum estimate was 20 hours and the maximum 300 hours. The mean of the suggested time estimations is 100 hours for the contracted E-shop development.

The working-time could be used to measure the scope of overcharging in the field of website development, however, most of the IT firms hesitated to give a time estimate beforehand. Hence, in order to exploit the working-time outcome variable fully, the experimental design would have to be changed and actual purchase of the service would have to be made which is in the case of the E-shop development unattainable due to financial and time constraints. In addition, it is presumable that the working-time cannot be retrieved even ex-post. In fact, this outcome variable is employed in several studies, for instance, Kerschbamer, Neururer and Sutter (2016) measures the working-time for computer repairs, however, they observe that only one-half of the repair shops state the time on the final bill.

4.3 Technical Solutions

The analysis of proposed prices showed that the price estimates differ based on the technical solutions offered by the IT firms. According to the responses, the most frequently proposed solutions for the development of E-shop can be summarized in four groups. It is important to emphasize that nine firms suggested two solutions in their response and therefore, the categories are not mutually exclusive. This observational fact is accounted for in the final model.

Custom solution. The company builds a tailor-made E-shop solution according to the customers' requirements (in Czech: "řešení na míru"). The average proposed price for this type of E-shop development is almost 143 000 CZK and it was offered in 32.6 % of the cases.

Open-source solution. The firm suggests E-shop development on an open-source platform. There are three platforms that were mentioned in particular, WordPress, PrestaShop and Joomla. The open-source software was proposed in 33.3 % of the responses with the average price amounting to 51 114 CZK.

Box/template solution. A ready-made B2C E-shop solution, which is fast to install, but not very customizable (in Czech: "krabicové/šablonové řešení"). Typically, one pays monthly the maintenance fees and the initial cost of setting up an E-shop is relatively low, approximately 32 500 CZK. From the 14 responses (18.6 %) with this solution, the most frequently mentioned ones in the context of the Czech market were Shoptet, Eshop-rychle.cz and Mioweb.

Not specified. The base category in which the solution is neither specified nor suggested by the respondent.

Figure 1 depicts the cumulative function of different technical solutions with the frequency of the proposed solutions. The figure shows the divergent distributions of each of the four categories and therefore illustrates the

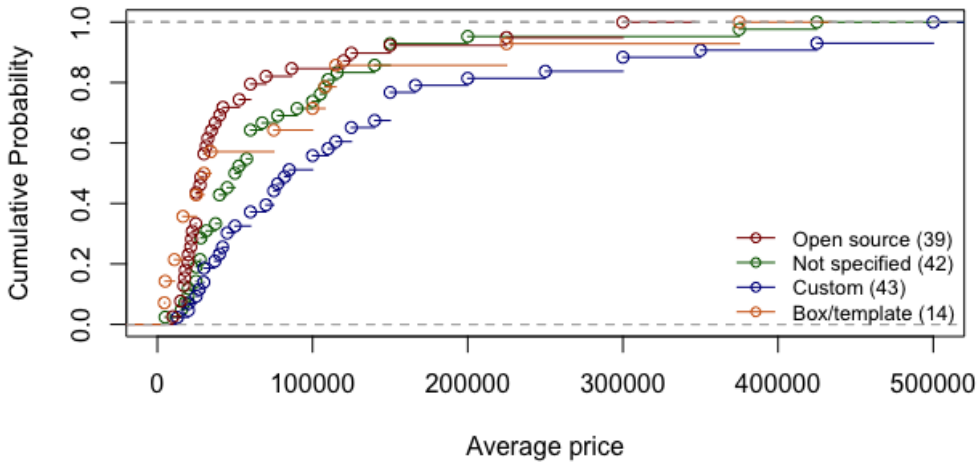

Figure 1: The cumulative function of Technical solutions

importance to control for this factor in the final model.

In the analysis of the *average prices* for each technical solution among the treatment groups, there was no significant difference to be observed. However, in the case of *Not specified* and *Open-source solutions* the frequency of proposed solutions differed in the treatment for technical experience. The possible explanation for the "shift" from *Not specified* to *Open-source* is due to the fact that the open-source platform (WordPress) is mentioned in the emails for the M-T and F-T variations (see Appendix 2). Both relative and absolute frequencies along with the average prices are shown in Table 6. The significance was tested by Kruskal-Wallis test and is marked by the asterisk symbol.

4.4 Response Time

In the introduction of the current section, the speed of email responses is briefly outlined. The response times are elaborated in Table 7, in which the cumulative frequencies of reactions are represented for each of the treatments. There is a significant difference between the Technical and Non-Technical response rates in the first hour; however, this is most likely due to the inaccurate measuring and time gap in sending the emails as they were not distributed in a bulk email but rather individually to increase the credibility. The emails for each treatment were sent on Thursday in the fol-

Table 6: Analysis of Technical Solutions

		Male	Female	Non-Technical	Technical	Total
Not specified	Frequency	0.302 (19)	0.348 (23)	0.508*** (33)	0.141*** (9)	0.326 (42)
	Avg. price	82 518 Kč	71 057 Kč	73 459 Kč	86 444 Kč	85 806 Kč
Custom	Frequency	0.349 (22)	0.318 (21)	0.308 (20)	0.359 (23)	0.333 (43)
	Avg. price	154 398 Kč	136 336 Kč	156 933 Kč	135 702 Kč	142 906 Kč
Open-source	Frequency	0.317 (20)	0.288 (19)	0.123*** (8)	0.484*** (21)	0.302 (39)
	Avg. price	59 178 Kč	49 195 Kč	49 694 Kč	55 506 Kč	51 114 Kč
Box/template	Frequency	0.127 (8)	0,091 (6)	0.138 (9)	0.078 (5)	0.186 (14)
	Avg. price	37 250 Kč	32 080 Kč	41 166 Kč	23 998 Kč	32 498 Kč

Note: Significant differences of frequencies from Kruskal-Wallis test are marked with asterisks.
*p<0.1; **p<0.05; ***p<0.01

lowing order: M-NT (9 am), M-T (9 am), F-NT (10 am), F-T (10 am). As the emails were sent individually, the gap between the first and last email at the given hour is vast. Any other differences in response times cannot be observed across the treatments.

Table 7: Analysis of Response time (cumulative frequencies)

Replied within	Male	Female	Technical	Non-Technical	Total
1 hour	12.21% (16)	4.58% (6)	1.49%** (2)	15.63%** (20)	8.40% (22)
4 hours	43.51% (57)	45.04% (59)	41.79% (56)	46.88% (60)	44.27% (116)
the same day	63.36% (83)	62.60% (82)	61.94% (83)	64.06% (82)	62.98% (165)
the next day	83.21% (109)	83.97% (110)	82.84% (111)	84.38% (108)	83.59% (219)
3-7 days	96.95% (127)	96.18% (126)	97.76% (131)	95.31% (122)	96.56% (253)
Observations	131	131	134	128	262

Note: Significant differences of frequencies from Kruskal-Wallis test are marked with asterisks.
*p<0.1; **p<0.05; ***p<0.01

Overall, the IT firms replied quickly as 44.27 % of all responses were delivered within the first four hours, 62.98 % within the same day and 83.59 % by the end of Friday (the next day). On the contrary, it can be seen that only 3.44 % of firms responded later than one week after the emails were distributed.

5 Regression Analysis

The section starts with the theoretical background of the ordinary least squares (OLS) method in the multiple linear regression (MLR) analysis. Consequently, the assumptions are introduced and tested with the appropriate methods. In the final subsections, the results are presented and discussed.

5.1 Ordinary Least Squares

The multiple regression analysis allows for explicit control for more than one factor that affects the dependent variable simultaneously, which is very convenient for empirical analysis. Similarly, the ordinary least squares (OLS) method is widely used in economic research for parameters estimations. In general, the form of the multiple linear regression model can be written as

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k + u,$$

where k is the number of independent variables, β_0 is the intercept, $\beta_1 ... \beta_k$ are the parameters for the corresponding explanatory variables $x_1 ... x_k$, for which the ceteris paribus effect is scrutinized. The u in the formula stands for the error term, which accounts for all unobserved factors which are not in $x_1 ... x_k$.

The OLS equation for k independent variables is written in the form:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \ldots + \hat{\beta}_k x_k,$$

where $\hat{\beta}_0$ is called the OLS intercept estimate and the $\hat{\beta}_1 ... \hat{\beta}_k$ are the OLS slope estimates of $\beta_1 ... \beta_k$. The OLS method determines the estimates based on the minimization of the sum of square residuals:

$$\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \ldots - \hat{\beta}_k x_{ik})^2$$

The solution of the minimization employs the first-order conditions, a set of *k+1* linear equations with the unknown parameters $\hat{\beta}_0 ... \hat{\beta}_k$ which are equal

to zero. After solving the equations, the OLS estimates are obtained and can be interpreted.

To interpret meaningfully the OLS intercept estimate, the explanatory variables $x_1 ... x_k$ are assumed to be possibly equal to zero which in this thesis is not the case. To interpret the partial effects of the slope estimates, we control for the independent variables which we do not examine. The coefficient in the fundamental case of $\Delta\hat{y} = \hat{\beta}_i \Delta x_i$, where i ranges from 1 to k, indicates the change from a one-unit shift in x_i, holding $x_k, k \neq i$ fixed. The previous interpretation comes from the level-level regression which denotes that neither the dependent nor the independent variable is transformed. However, in the following sections, the log-level regression models are proposed in which the dependent variable is in the logarithmic form. The interpretation alters to $\%\Delta\hat{y} = (100\hat{\beta}_i)\Delta x_i$ which means that a one-unit shift in x_i changes the dependent variable y by $100 \times \hat{\beta}_i$ per cent. (Wooldridge, 2013, pg. 68-82)

5.2 Assumptions and Tests

To have desired statistical properties, unbiasedness and efficiency, of the OLS estimators, the following assumptions have to be met.

The first assumption MLR.1 states that the population model should be linear in parameters. The MLR.2 assumption requires a random sample drawn from the population. In the field experiment, the sampling was not completely random as Google Search was employed. Therefore, there is a bias connected to the appearance in the search results (see section 3.1), which are based on the search engine algorithms.

The MLR.3 assumes that in the sample, the independent variables are neither constant nor there are exact linear relationships among them. To investigate the possibility of perfect collinearity among the independent variables, the *variance inflation factor* (VIF) was used. The VIF for coefficient i can be constructed as $\text{VIF}_i = 1/(1 - R_i^2)$ and the values range from 1 to infinity for each VIF_i. According to Wooldridge, 2013 (pg. 98), the arbitrary value above which the multicollinearity is problematic is usually

chosen as 10.

The assumption MLR.4 expects that the error term u has the expected value equal to zero given any independent variable. In other words, the model has exogenous independent variables. Under the assumptions MLR.1 to MLR.4, the OLS estimators are unbiased, which means that the expected value of the estimator $\hat{\beta}_i$ is the population parameter,

$$E(\hat{\beta}_i) = \beta_i, i = 0, 1, \ldots, k.$$

Furthermore, the homoskedasticity is assumed by the MLR.5, meaning that the variance of the error u does not vary given any independent variable. To verify the assumption, the studentized Breusch-Pagan test for heteroskedasticity was carried out. The studentized version was chosen as it relaxes the strong assumption of normally distributed error terms (Kleiber and Zeileis, 2008). The null hypothesis of the Breusch-Pagan test is that the assumption MLR.5 of homoskedasticity holds. The assumptions MLR.1 to MLR.5 are known as the Gauss-Markov assumptions and under them, the OLS estimators are the *best linear unbiased estimators* (BLUEs). The new terms in the acronym can be explained as follows, the estimator $\tilde{\beta}_j$ is *linear* if it can be written in the form $\tilde{\beta}_j = \sum_{i=1}^{n} w_{ij} y_i$ where y is the dependent variable and w_{ij} is a function of the sample values. Further, the word *best* stands for the "smallest variance", in other words, if there are two estimators, the *best* is the one with the lowest variance. (Wooldridge, 2013, pg. 93, 102)

Finally, the MLR.6 normality assumption expects that the population error is independent of the control variables and the error follows the normal distribution.

5.3 Results

Table 8 summarizes four OLS models, from the most basic one to the advanced models. The dependent variable *Average Price* is consistent throughout the models and it is transformed by the natural logarithm. The log-level models were chosen as the dependent variable has high variances, and the

interpretation of the log-level models is intuitive as most of the independent variables are binary (see section 5.1). Since nine firms suggested two prices for different technical solutions, the number of observations is 138 although there were only 129 firms responding with price proposals. To be able to use explanatory variables controlling for technical solutions, the prices given by the nine firms were extended into two rows in the dataset (see section 4.3).

First, the basic model (1) consists of the two treatment groups and their interaction, however, none of the regressors is significant, which is in alignment with section 4.2 where no significance was observed after the Kruskal-Wallis test. Although the independent variables that control for the treatment groups are not significant in the three extended models (2), (3) and (4) as well, there are several insightful remarks drawn from the coefficient signs in the discussion of results in section 5.4.

Subsequently, in the second model (2) more explanatory variables were added. *Age*, the only non-binary variable in the following models, was in addition included in square form Age^2 as well. Therefore, the interpretation is as follows: $\beta_{Age} + 2 \times \beta_{Age^2} \times \text{Age}$, which indicates that the *Age* increases the *Average Price* only to a breaking point of 13 years. After that, an additional year yields a decrease in the *Average Price*. Both *Age* and Age^2 are significant at 10 % significance level. Furthermore, the dummy variables connected to the number of employees were included in the models unlike the *Legal form* variable (see Table 2), which was omitted due to the high correlation (-0.72) with the *None employees*. In addition, to avoid the dummy variable trap, the *1-5 employees* base variable is omitted from the regression as well. From the results, the significant variables are *None employees*, *10-24 employees* and *25-49 employees* at the significance levels of 10 %, 5 % and 1 % respectively. Further, the assumptions were examined. All the VIF_i in the second model are well below 10 (even below 5), and hence the MLR.3 holds. Followingly, the studentized Breusch-Pagan test was performed with the p-value approximately equal to 0.21, thus the null hypothesis of homoscedasticity cannot be rejected and MLR.5 is fulfilled.

To verify assumption MLR.6, the histogram of residuals distribution was analyzed and formal Shapiro-Wilk normality test was conducted, with no evidence to reject the normality (p-value = 0.34).

Model (3) proposes two new binary variables, *Region High* and *Region Medium* (described in section 3.4). The individual regions were omitted to avoid overfitting the model, however, the only de facto individual region included is Prague as the *Region High* is composed of only this region. The *Region High* is significant at 10 % significance level and it can be stated that if the subject operates in Prague, the proposed *Average Price* increases by 36.8 %. The *Region Medium* increases the proposed price as well, although this estimation is not significant. All of the other variables remained significant with the exception of *None employees* where the negative coefficient decreased from -0.356 to -0.276 resulting in the p-value of 0.192. The assumptions are fulfilled similarly to the previous model despite the tests having lower p-values, to be more specific, approximately 0.14 in the Breusch-Pagan test and 0.17 in the Shapiro-Wilk test.

Besides the above mentioned independent variables, the final model (4) controls for different technical solutions (introduced in section 4.3). As before, to avoid the dummy variable trap, only three out of four possible variables are included - *Custom*, *Open-source* and *Box/template* solutions. The anticipated significance was confirmed for the technical solution regressors with the 5 %, 10 % and 1 % significance level respectively. All of the technical solutions dummy variables have large coefficients, the *Custom* solution increases the price by 42.8 %, on the contrary *Open-source* and the *Box/template* solutions decrease the price by 38.6 % and 100.3 % from the base group of *Not specified*. Moreover, intuitively, large effects can be found by *10-24 employees* and *25-49 employees* variables with the coefficients of 0.588 and 0.880. When the model was extended by the technical solutions explanatory variables the variables *Age* and Age^2 are no longer significant.

In contrast to the previous model (3), the adjusted R^2 of the final model doubled and the p-value from the Breusch-Pagan test for heteroskedasticity

Table 8: Results of the OLS models

	Dependent variable:			
	log(Average Price)			
	(1)	(2)	(3)	(4)
Female	−0.120	−0.193	−0.213	−0.143
	(0.242)	(0.231)	(0.230)	(0.204)
Non-Technical	0.002	−0.109	−0.123	−0.148
	(0.241)	(0.223)	(0.222)	(0.209)
Female × Non-Technical	−0.110	−0.026	−0.017	−0.092
	(0.340)	(0.318)	(0.316)	(0.280)
Age		0.079*	0.097**	0.031
		(0.045)	(0.047)	(0.043)
Age^2		−0.003*	−0.004*	−0.002
		(0.002)	(0.002)	(0.002)
None employees		−0.356*	−0.276	−0.299
		(0.207)	(0.210)	(0.186)
6-9 employees		0.135	0.156	−0.019
		(0.245)	(0.244)	(0.218)
10-24 employees		0.581**	0.512**	0.588***
		(0.230)	(0.232)	(0.206)
25-49 employees		0.944***	0.855**	0.880***
		(0.329)	(0.331)	(0.294)
Region High			0.368*	0.340*
			(0.196)	(0.174)
Region Medium			0.162	0.139
			(0.210)	(0.186)
Custom				0.428**
				(0.186)
Open-source				−0.386*
				(0.204)
Box/template				−1.003***
				(0.253)
Constant	10.956***	10.567***	10.368***	10.798***
	(0.181)	(0.264)	(0.283)	(0.301)
Observations	138	138	138	138
R^2	0.009	0.199	0.221	0.405
Adjusted R^2	-0.013	0.142	0.153	0.337
F Statistic	0.404	3.529***	3.246***	5.974***
Note:				*p<0.1; **p<0.05; ***p<0.01

increased, therefore the assumptions MLR.1-MLR.5 hold. However, the normality test rejected the null hypothesis of normally distributed residuals at a 5 % significance level (p-value $\doteq$ 0.038). Therefore, as the MLR.6 does not hold, exact statistical inference cannot be obtained. The VIF_i did not rise above 5 for any of the new variables.

5.4 Discussion

The first model confirms the findings from section 4.2 stating that there are no significant differences in the average price among the treatments which are not jointly significant as well. Moreover, the model has R^2 of only 0.006 and negative adjusted R^2, indicating a poor model.

Despite the fact that the treatment variables are not significant in any of the models, the coefficients support the trend outlined in section 4.2 that female and non-technical customers yield lower proposed prices. The findings contradict the anticipated outcome that non-technical customers will face higher prices of the contract. A possible explanation is that when signalling higher technical skills and previous experience with an E-shop platform, the firms expect that the customer knows the demanding process of development and therefore is charged more than a "new customer". As far as the gender treatment group, the results are in alignment with the study by Castillo et al. (2013), where male customers are quoted higher initial prices. However, after Castillo et al. (2013) ruled out the taste-based discrimination by further experimental adjustments, the competitive taxi market was gender-blind which corresponds to the findings of this thesis.

For the remaining models (1), (2) and (3), the reported adjusted R^2 increases and the F statistics reveals joint significance for all of the regressors in each of the models.

Two independent variables are significant in all three models, *10-24 employees* and *25-49 employees*. Both explanatory variables increase the average aplenty which was expected as larger firms have higher fixed costs than small firms or natural persons, and therefore, they tend to sign more complex contracts or charge more. The firms with *10-24 employees* and *25-49*

employees charge ceteris paribus approximately 50-60 % and 85-95 % more than the small firms with *1-5 employees*, respectively.

Another significant partial effect can be observed when the firm or natural person resides in Prague, the price is approximately 35 % higher than the base group of Region Low. Besides the fact that in Prague the average monthly gross wage of ICT specialists was circa 20 % higher than the national average (*Comparison of Regions in the Czech Republic* 2020), other factors influence the higher prices as well, for instance, higher office rental prices.

6 Conclusion

The thesis examines the market for website development from the point of credence goods. In the field experiment, 341 Czech web developers and IT firms were divided randomly into four treatment groups and approached via an email to detect a possible trend of overcharging across the treatments. The four treatment groups were based on gender and technical skill: male/female with technical experience and male/female without technical experience. Furthermore, other outcome variables were recorded - the frequencies and types of responses, proposed technical solutions, and response time.

First, whilst the overall rate of return was generally high (76.8 %), there was no evidence of discrimination as the rates of return did not vary across the treatments. However, the findings suggest significant differences in types of responses, for instance, the male customers were asked whether a phone call or meeting in person is possible to clarify the contract in approximately 22 % of the cases, on the contrary, the same answer was given to only 13 % of emails sent by women. Another statistically significant disparity was observed in the treatment for technical experience in which the non-technical customer faced rejection due to the fact that the web developer or IT firm stated that they do no longer develop E-shops in 11.7 % of cases, whereas, for technical customers, it occurred only in 5.2 %.

Second, the proposed prices for the specific E-shop fluctuated strongly as the minimum price equalled to 4500 CZK and the maximum was estimated to be more than 600 000 CZK. With regard to the discrimination, the findings show that there is no significant difference in the average proposed prices among the treatment groups. Nevertheless, the insignificant results of the OLS models suggest that male customers and technically skilled customers will yield higher prices. This supports the conclusions by Castillo et al. (2013), whose research on the taxi market in Lima, Peru, showed that at first, the male customers are worse off in the price negotiation; however, when the statistical inference is set to be the same for both genders, the

competitive market becomes gender-blind. Furthermore, the higher price estimates for the technical customers are in alignment with Kerschbamer, Neururer and Sutter (2019) who discovered that when a customer states the correct technical self-diagnosis when asking for a computer repair, the average price of the repairment increases compared to the baseline of no self-diagnosis. As the *Non-Technical* variable in this thesis is not significant, it can be at least stated that showing a technical skill does not decrease the final price in comparison to not stating any previous experience.

Based on the results of the final OLS model, the following explanatory variables significantly influence the average price: the size of the company in terms of the number of employees, the location of IT firm operation and the proposed technical solution. Regarding the technical solutions, there were three technical approaches employed in particular. The most expensive one was the custom E-shop development with the average price of almost 143 000 CZK, then, it was a solution based on open-source software (WordPress, PrestaShop, Joomla, etc.) with an average estimate of approximately 51 000 CZK and lastly, the box/template solution (Shoptet, Eshop-rychle.cz, Mioweb) with 32 500 CZK. The technical solution was *not specified* in 42 cases out of 129 price proposals and the average price for the *not specified* category was 85 800 CZK. As the technical customers mentioned an open-source solution in the inquiry email, this type of solution was proposed significantly more to them than to the non-technical customers (48.4 % for technical customers in contrast to 12.3 % for non-technical customers). Equally, the firms did not specify the technical solution in the responses for non-technical customers more frequently. This encourages the fact that the web developers were indeed distinguishing between the treatment groups and therefore it supports the overall conclusion of the thesis that there is no significant discrimination based on gender or technical experience in the terms of overcharging to be observed in the market for website development.

Limitations of the field experiment lie in the design, which does not allow to examine the possibility of undertreatment (insufficient technical solution

or support is provided) or overtreatment (unnecessary features are included). This limitation is caused by the time and financial constraints as the E-shop development is extremely demanding. In addition, this limitation causes that the overcharging can be determined only from price estimates unlike in the studies in which the final good or service is paid for, e.g. taxi rides (Castillo et al., 2013), computer repairments (Kerschbamer, Neururer and Sutter, 2019) or dental visits (Gottschalk, Mimra and Waibel, 2019).

References

Agrawal, Anjali, Ellen P. Green and Lisa Lavergne (2019). "Gender effects in the credence goods market: An experimental study". In: *Economics Letters* 174, pp. 195–199. ISSN: 0165-1765. DOI: https://doi.org/10.1016/j.econlet.2018.11.019. URL: http://www.sciencedirect.com/science/article/pii/S0165176518304774.

Arrow, Kenneth et al. (1973). "The theory of discrimination". In: *Discrimination in labor markets* 3.10, pp. 3–33.

Balafoutas, Loukas, Adrian Beck et al. (Apr. 2011). "What Drives Taxi Drivers? A Field Experiment on Fraud in a Market for Credence Goods". In: *Review of Economic Studies* 80. DOI: 10.1093/restud/rds049.

Balafoutas, Loukas, Rudolf Kerschbamer and Matthias Sutter (2017). "Second-Degree Moral Hazard In A Real-World Credence Goods Market". In: *The Economic Journal* 127.599, pp. 1–18. DOI: 10.1111/ecoj.12260. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/ecoj.12260. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/ecoj.12260.

Becker, Gary S (1957). *The economics of discrimination*. University of Chicago press.

Bertrand, Marianne and Sendhil Mullainathan (2004). "Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination". In: *The American Economic Review* 94.4, pp. 991–1013. ISSN: 00028282. URL: http://www.jstor.org/stable/3592802.

Castillo, Marco et al. (2013). "Gender differences in bargaining outcomes: A field experiment on discrimination". In: *Journal of Public Economics* 99, pp. 35–48. ISSN: 0047-2727. DOI: https://doi.org/10.1016/j.jpubeco.2012.12.006. URL: http://www.sciencedirect.com/science/article/pii/S0047272713000042.

Comparison of Regions in the Czech Republic (Jan. 2020). The Czech Statistical Office. Accessed: 2020-04-14. URL: https://www.czso.cz/csu/czso/18-information-society-xqv6ou41ft.

Darby, Michael R. and Edi Karni (1973). "Free Competition and the Optimal Amount of Fraud". In: *The Journal of Law Economics* 16.1, pp. 67–88. ISSN: 00222186, 15375285. URL: http://www.jstor.org/stable/724826.

Domenighetti, Gianfranco et al. (Feb. 1993). "Revisiting the Most Informed Consumer of Surgical Services: The Physician-Patient". In: *International journal of technology assessment in health care* 9, pp. 505–13. DOI: 10.1017/S0266462300005420.

Dulleck, Uwe and Rudolf Kerschbamer (2006). "On Doctors, Mechanics, and Computer Specialists: The Economics of Credence Goods". In: *Journal of Economic Literature* 44.1, pp. 5–42. ISSN: 00220515. URL: http://www.jstor.org/stable/30032295.

Dulleck, Uwe, Rudolf Kerschbamer and Matthias Sutter (Jan. 2009). "The Economics of Credence Goods: On the Role of Liability, Verifiability, Reputation and Competition". In: *National Centre for Econometric Research, NCER Working Paper Series*.

Emons, Winand (1997). "Credence Goods and Fraudulent Experts". In: *The RAND Journal of Economics* 28.1, pp. 107–119. ISSN: 07416261. URL: http://www.jstor.org/stable/2555942.

Gottschalk, Felix, Wanda Mimra and Christian Waibel (Dec. 2019). "Health Services as Credence Goods: A Field Experiment". In: *SSRN Electronic Journal*. DOI: 10.2139/ssrn.3036573.

Kerschbamer, Rudolf, Daniel Neururer and Matthias Sutter (June 2016). "Insurance coverage of customers induces dishonesty of sellers in markets for credence goods". In: *Proceedings of the National Academy of Sciences of the United States of America* 113. DOI: 10.1073/pnas.1518015113.

— (Jan. 2019). "Credence Goods Markets and the Informational Value of New Media: A Natural Field Experiment". In: *SSRN Electronic Journal*. DOI: 10.2139/ssrn.3350485.

Kerschbamer, Rudolf and Matthias Sutter (Feb. 2017). "The Economics of Credence Goods – a Survey of Recent Lab and Field Experiments*". In:

CESifo Economic Studies 63.1, pp. 1–23. ISSN: 1610-241X. DOI: 10.1093/cesifo/ifx001. eprint: https://academic.oup.com/cesifo/article-pdf/63/1/1/10819204/ifx001.pdf. URL: https://doi.org/10.1093/cesifo/ifx001.

Kleiber, Christian and Achim Zeileis (2008). *Applied econometrics with R*. Springer Science & Business Media.

Lepkowski, James (Jan. 2011). "Telephone Sampling: Frames and Selection Techniques". In: pp. 1585–1586. ISBN: 978-3-642-04897-5. DOI: 10.1007/978-3-642-04898-2_96.

Lu, Fangwen (2014). "Insurance coverage and agency problems in doctor prescriptions: Evidence from a field experiment in China". In: *Journal of Development Economics* 106.C, pp. 156–167. DOI: 10.1016/j.jdeveco.2013.09. URL: https://ideas.repec.org/a/eee/deveco/v106y2014icp156-167.html.

Nelson, Phillip (1970). "Information and Consumer Behavior". In: *Journal of Political Economy* 78.2, pp. 311–329. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/1830691.

Phelps, Edmund S (1972). "The statistical theory of racism and sexism". In: *The american economic review* 62.4, pp. 659–661.

Rasch, Alexander and Christian Waibel (2018). "What Drives Fraud in a Credence Goods Market? – Evidence from a Field Study". In: *Oxford Bulletin of Economics and Statistics* 80.3, pp. 605–624. DOI: 10.1111/obes.12204. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/obes.12204. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/obes.12204.

Wooldridge, Jeffrey M (2013). "Introductory Econometrics: A Modern Approach (5 th Eds.)" In: *Mason, OH.: Cengage Learning*.

Yap, Bee and C. Sim (Dec. 2011). "Comparison of various types of normality tests". In: *Journal of Statistical Computation and Simulation* 81, pp. 2141–2155. DOI: 10.1080/00949655.2010.520163.

Appendix

Appendix 1: Fictitious identities in the field experiment.

Table A.1: Fictitious identities (full name, e-mail address)

Fictitious identities	Full name	E-mail address
Male	Ondřej Navrátil	ondrej.navratil9@gmail.com
Female	Tereza Navrátilová	tereza.navratilova10@gmail.com

Appendix 2: Variations of the emails with a common subject (in Czech). For English version see Appendix 3.

Subject: Tvorba e-shopu - poptávka

Email 1 (Male Non-Technical)

Dobrý den,

rád bych u Vás poptal nové webové stránky pro svůj obchod. Jednalo by se o kompletní vytvoření webu (momentálně žádný nemám) i s e-shopem včetně designu. Na webu by byly stránky s textem o společnosti, produktech, kontakt a samotný e-shop s možností spravovat produkty (cca 150 položek), ceny včetně nastavení akcí a promokodů, atd.

Mohl bych Vás poprosit o přibližný odhad ceny než bychom se posunuli dále? Tj. předběžný nástřel počtu hodin a hodinovou sazbu pro tento projekt. Děkuji.

S pozdravem

Ondřej Navrátil

Email 2 (Male Technical)

Dobrý den,

rád bych u Vás poptal nové webové stránky pro svůj obchod. Jednalo by se o kompletní vytvoření webu (momentálně žádný nemám) i s e-shopem včetně designu. Níže posílám detaily zakázky:

- Tvorba custom designu
- Homepage a několik statických stránek (o společnosti, o produktech, kontakt)
- E-shop s cca 150 produkty
  - Snadná administrace, včetně nastavení akcí a promokodů

Sám mám osobně zkušenosti s administrací e-shopů ve WooCommerce na WordPressu, ale nebránil bych se jakémukoliv řešení, které bude snadno ovládatelné. Doménu i hosting mám již zakoupené.

Mohl bych Vás poprosit o přibližný odhad ceny než bychom se posunuli dále? Tj. předběžný nástřel počtu hodin a hodinovou sazbu pro tento projekt. Děkuji.

S pozdravem
Ondřej Navrátil

Email 3 (Female Non-Technical)

Dobrý den,

ráda bych u Vás poptala nové webové stránky pro svůj obchod. Jednalo by se o kompletní vytvoření webu (momentálně žádný nemám) i s e-shopem včetně designu. Na webu by byly stránky s textem o společnosti, produktech, kontakt a samotný e-shop s možností spravovat produkty (cca 150 položek), ceny včetně nastavení akcí a promokodů, atd.

Mohla bych Vás poprosit o přibližný odhad ceny než bychom se posunuli dále? Tj. předběžný nástřel počtu hodin a hodinovou sazbu pro tento projekt. Děkuji.

S pozdravem
Tereza Navrátilová

Email 4 (Female Technical)
Dobrý den,

ráda bych u Vás poptala nové webové stránky pro svůj obchod. Jednalo by se o kompletní vytvoření webu (momentálně žádný nemám) i s e-shopem včetně designu. Níže posílám detaily zakázky:

- Tvorba custom designu
- Homepage a několik statických stránek (o společnosti, o produktech, kontakt)
- E-shop s cca 150 produkty
  - Snadná administrace, včetně nastavení akcí a promokodů

Sama mám osobně zkušenosti s administrací e-shopů ve WooCommerce na WordPressu, ale nebránila bych se jakémukoliv řešení, které bude snadno ovládatelné. Doménu i hosting mám již zakoupené.

Mohla bych Vás poprosit o přibližný odhad ceny než bychom se posunuli dále? Tj. předběžný nástřel počtu hodin a hodinovou sazbu pro tento projekt. Děkuji.

S pozdravem
Tereza Navrátilová

Appendix 3: Variations of the emails with a common subject (in English). The original emails were sent in Czech.

Subject: E-shop development - inquiry

Email 1 (Male Non-Technical)

Dear Sir/Madam,

I would like to inquire about a new website for my business. It would be a full development of the website (currently I do not possess any) including an e-shop along with its design. On the website, there would be texts about the company, products, contact and the e-shop itself with a possibility to manage the products (circa 150 items), prices including settings of the campaigns and promotion codes, etc.

Please, may I ask you for an approximate price estimation before moving to the next stage? I.e. the preliminary guess about the time of work in hours and hour rate for the project. Thank you.

Best regards,
Ondřej Navrátil

Email 2 (Male Technical)

Dear Sir/Madam,

I would like to inquire about a new website for my business. It would be a full development of the website (currently I do not possess any) including an e-shop along with its design. Below I summarize the details:

- Own custom design
- Homepage a few static pages (about the company, products, contact)
- E-shop with circa 150 items
  - Easy management, including settings of the campaigns and promotion codes

Personally I have experience with e-shop administration in WooCommerce on WordPress, but I am for any solution, which is easy to use. Domain and

webhosting are already bought.

Please, may I ask you for an approximate price estimation before moving to the next stage? I.e. the preliminary guess about the time of work in hours and hour rate for the project. Thank you.

Best regards,
Ondřej Navrátil

Email 3 (Female Non-Technical)
Dear Sir/Madam,

I would like to inquire about a new website for my business. It would be a full development of the website (currently I do not possess any) including an e-shop along with its design. On the website, there would be texts about the company, products, contact and the e-shop itself with a possibility to manage the products (circa 150 items), prices including settings of the campaigns and promotion codes, etc.

Please, may I ask you for an approximate price estimation before moving to the next stage? I.e. the preliminary guess about the time of work in hours and hour rate for the project. Thank you.

Best regards,
Tereza Navrátilová

Email 4 (Female Technical)
Dear Sir/Madam,

I would like to inquire about a new website for my business. It would be a full development of the website (currently I do not possess any) including

an e-shop along with its design. Below I summarize the details:

- Own custom design
- Homepage a few static pages (about the company, products, contact)
- E-shop with circa 150 items
  - Easy management, including settings of the campaigns and promotion codes

Personally I have experience with e-shop administration in WooCommerce on WordPress, but I am for any solution, which is easy to use. Domain and webhosting are already bought.

Please, may I ask you for an approximate price estimation before moving to the next stage? I.e. the preliminary guess about the time of work in hours and hour rate for the project. Thank you.

Best regards,
Tereza Navrátilová

Appendix 3: The methods for detecting the ourliers and corresponding results for each methods.

Table A.2: Methods for detecting outliers

Method	Average price limit	Removed observations
Z-score	425 000+ CZK	4
Top 5 %	350 000+ CZK	6
Boxplot	225 000+ CZK	11
Top 10 %	200 000+ CZK	13

Table A.3: Price proposals without outliers (z-score method)

Z-score method	Male	Female	Non-Technical	Technical
Minimum price (mean)	62 830 Kč	50 957 Kč	48 130 Kč	65 235 Kč
χ^2	0.911		0.905	
p-value	0.340		0.341	
Maximum price (mean)	87 289 Kč	83 091 Kč	80 929 Kč	89 284 Kč
χ^2	0.744		0.274	
p-value	0.388		0.600	
Average price (mean)	75 060 Kč	67 024 Kč	64 530 Kč	77 259 Kč
χ^2	0.752		0.403	
p-value	0.386		0.526	
Observations	61	64	62	63

Table A.4: Price proposals without outliers (top 5 % method)

Top 5 % method	Male	Female	Non-Technical	Technical
Minimum price (mean)	58 878 Kč	50 178 Kč	47 280 Kč	61 448 Kč
χ^2	0.817		0.822	
p-value	0.366		0.365	
Maximum price (mean)	82 078 Kč	74 093 Kč	71 600 Kč	84 272 Kč
χ^2	0.781		0.299	
p-value	0.377		0.585	
Average price (mean)	70 478 Kč	62 135 Kč	59 440 Kč	72 860 Kč
χ^2	0.780		0.430	
p-value	0.377		0.512	
Observations	60	63	61	62

Table A.5: Price proposals without outliers (boxplot method)

Boxplot method	Male	Female	Non-Technical	Technical
Minimum price (mean)	53 204 Kč	44 446 Kč	46 402 Kč	51 031 Kč
χ^2	0.671		0.184	
p-value	0.413		0.668	
Maximum price (mean)	67 976 Kč	64 227 Kč	64 460 Kč	67 671 Kč
χ^2	0.578		0.011	
p-value	0.447		0.916	
Average price (mean)	60 590 Kč	54 337 Kč	55 431 Kč	59 351 Kč
χ^2	0.586		0.045	
p-value	0.444		0.832	
Observations	57	61	60	58

Table A.6: Price proposals without outliers (top 10 % method)

Top 10 % method	Male	Female	Non-Technical	Technical
Minimum price (mean)	53 204 Kč	40 021 Kč	44 646 Kč	48 417 Kč
χ^2	1.316		0.181	
p-value	0.251		0.670	
Maximum price (mean)	67 976 Kč	58 777 Kč	61 315 Kč	65 349 Kč
χ^2	1.186		0.012	
p-value	0.276		0.912	
Average price (mean)	60 590 Kč	49 399 Kč	52 980 Kč	56 883 Kč
χ^2	1.209		0.045	
p-value	0.272		0.832	
Observations	57	59	59	57