CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES
Institute of Economic Studies

Bachelor thesis

2017   **Tereza Hudcová**

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Analysis of Czech P2P lending investors' behaviour drivers

Bachelor thesis

Prague 2017

Author: Tereza Hudcová

Supervisor: Mgr. Petr Polák, MSc.

Academic Year: 2016/2017

Bibliographic note

Abstract

This empirical study develops an analysis of peer-to-peer lending market in the Czech Republic by analysing uniquely collected dataset from Czech P2P lending platform Zonky and information obtained directly from its investors. The research question investigates, if there exists correlation between peer-to-peer investors' risk attitude, which is inferred by validated survey method, and their real behaviour on platform. The thesis' results show that investors in online environment behave way riskier than they, from the theoretical point of view, actually should. Results also confirmed that investors' risk attitudes are domain specific. Subsequently, OLS estimation method uncovers that the only factor, that is highly statistically significant, in terms of the impact on lenders' expected return, is the interest rate stated at loan request. This finding further supports lenders' inclination to greater risk, resulting in lack of concern with borrower's characteristics.

Abstrakt

Tato studie se zaměřuje na zkoumání peer-to-peer lending trhu v České republice pomocí analýzy unikátně získaných dat z české P2P lending platformy Zonky. Hlavním cílem této práce je hledání možné korelace mezi postojem k riziku peer-to-peer investorů, který je odvozen ze standardizovaných postupů, a jejich reálným chováním na platformě. Bylo zjištěno, že investoři se v online prostředí chovají ještě rizikověji, než by z teoretického hlediska měli. Práce také potvrdila specifičnost postoje k riziku z hlediska různých oblastí života. Následně bylo pomocí lineární regrese dokázáno, že jediný faktor, který je vysoce statisticky signifikantní, co se vlivu na očekávaný výnos investorova portfolia týče, je úroková míra u žádosti o půjčku. Tento poznatek dále podporuje sklon investorů k většímu riziku, což má za výsledek faktický nezájem o charakteristiky žadatele o půjčku.

Keywords

Peer-to-Peer Lending; Determinants of Funding Success; Risk Preference; Investment; Czech Republic;

Klíčová slova

Peer-to-Peer Lending; Faktory ovlivňující zafinancování půjčky; Rizikové preference; Investice; Česká republika;

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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Signature

Acknowledgment

Bachelor Thesis Proposal

Author	Tereza Hudcová
Supervisor	Mgr. Petr Polák, MSc.
Proposed topic	Analysis of Czech P2P lending investors' behaviour drivers

Research question and motivation

A significant advancement of information technology in the last few decades has led to the development of electronic marketplaces, where the role of the traditional financial intermediaries becomes less important or even redundant for the interaction between its participants. A case in point is the peer-to-peer (P2P) lending market where lenders (or investors) bid to finance unsecured loans. For borrowers, online P2P lending is an opportunity not only to receive a loan without a financial institution involved in the decision process, but also a possibility to obtain better conditions than in the traditional banking system. Thus, there is a big room for the analysis of the factors which determine investors' behaviour when deciding whether to fund a loan or not.

Contribution

Even though the P2P lending platforms have been present for more than a decade, the research on this sphere still can be described as scarce. Moreover, to the author's best knowledge, there is no existing analysis of the P2P lending market within the Continental Europe. In addition, Czech P2P lending platforms, which have experienced an impressive development in the past years as well, also haven't been further analysed. Therefore, one of the primary aims of this bachelor thesis is to take an insight into the European branch of this field and then select particular Czech platform and analyse its data at the microeconomic level.

Methodology

Selection of a Czech P2P platform with available data and analyse it on the micro level. In addition, conducting a survey among its Czech P2P in order to trace the determinants of their decision making. Subsequently, the results will be used for regression model estimation, which can be further compared with the existing findings from the literature.

Outline

1. Introduction
2. Overview of European and Czech P2P Lending Market
3. Literature Review
4. Methodology and Conceptual Framework
5. Empirical Part and Results
6. Conclusion

Core bibliography

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List of Acronyms

CLM Classical Linear Model

CZK Czech Crown

OLS Ordinary Least Squares

P2P Peer-to-Peer

P2B Peer-to-Business

SME Small and Medium Enterprises

UK The United Kingdom

USA The United States of America

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1   Introduction

The term *P2P lending* refers to the new breed of market interaction practised by individuals, who can virtually meet at online platforms in order to broker consumer loans without the mediation of traditional bank institution.

Such electronic marketplaces, which in practise act as financial match-makers (alternatively mediators) between lenders and borrowers, have e-merged massively 10 years ago in the countries like the USA, the United Kingdom or China and nowadays belong to the fastest growing segments of financial services' area. As an evidence, Transparency Market Research claims that *"the opportunity in the global peer-to-peer market will be worth $897.85 billion by the year 2024, from $26.16 billion in 2015."* [1]

Since the very first platform of its kind in the world, Zopa, was launched in 2005 in the UK, online P2P lending has quickly become a substitute to the traditional ways of financing, mainly due to lower transcation costs and the overall ease of the process.

Originated loans are granted without collateral, which essentially forces lenders to be exhibited to an inherent level of risk connected with the like-lihood of default. Problem of information asymmetry becomes more severe here, as the lenders seek valid and reliable information about the borrower, whereas the other party could be interested in hiding some relevant char-acteristics, in order to get the lowest feasible interest rate and fund the targetted amount of the loan as quickly as possible (Bachmann et al., 2011).

Even though there exist markets in the United States, China, India or the United Kingdom, that are borader in terms of volume, the network of P2P platforms in the central Europe, as well as in the Czech Republic, so far not being thoroughly analysed, has found its sound position as well.

The primary topic, which this research focuses on, is determining lenders' risk and time preferences by conducting a survey among the lenders of cur-rently most popular P2P lending entity in the Czech Republic – Zonky. The challenge is to disclose potential relationship between the individual's risk

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[1]http://www.nasdaq.com/article/the-rise-of-peertopeer-p2p-lending-cm685513

preferences, resulting from the declared answers, and data extracted from the platform capturing lenders' real behaviour. More precisely, the main target is to uncover possible linkage between investor's risk attitude and the value of the expected return of his portfolio. Merging together those two viewpoints is expected to produce valuable results.

Furthermore, the most important determinants influencing Czech P2P investors' portfolio of funded loans are being traced. The objective is to detect the factors that have crucial impact in terms of explaining the value of expected return of investors' portfolio.

The thesis represents a valuable contribution to the current research work for several reasons. Firstly, there are number of studies examining on previously mentioned big P2P lending markets abroad, but comprehensive review of the peer-to-peer lending environment in the Czech Republic, analyzing uniquely collected microdata, has not been created so far. Secondly, to the best knowledge of the author of this thesis, in peer-to-peer lending research, no previous study matched the perspective of real online behaviour with experimental survey method. Thirdly, this thesis also lays possible foundations for future researchers examining on Czech P2P lending market.

The thesis consists of 6 chapters and the remainder is organised as follows: First, the whole concept of the idea of peer-to-peer lending field is presented, including market participants, the description of lending process and other important characteristics. After preliminary glance, the central European together with Czech P2P market is introduced in the rest of Chapter 2. Subsequently, Chapter 3 summarizes available peer-to-peer lending literature findigs related to the focus of this thesis. Theoretical framework together with metodology and inference of variables is introduced in Chapter 4. In the Chapter 5, results are presented and major implications are being discussed. Finally, Chapter 6 concludes.

2 The background of online P2P lending market

2.1 Concept of peer-to-peer lending

With the advancement of information technology, electronic markets experienced a rapid growth (Malone et al., 1987). A case in point is online peer-to-peer lending. It refers to the unsecured loans between lenders and borrowers on particular online platforms, who act as middlemen, while intermediation of financial institutuion is not required (Bachmann et al., 2011).

Vast majority of all P2P platforms are operating under the same principle – they enable interaction between borrowers and lenders (investors), where the platform usually acts as their joint intermediary. Borrowers search for the best credit circumstances given their level of risk and credit history. Thus, online peer-to-peer lending can be a way how to receive even better credit conditions than in the traditional banking system. From the lenders' perspective, it can be viewed as an investment model, where the risk is related to the credit rating of funded loans. The platform itself usually benefits from charging fees for realized operations (Galloway et al., 2009).

Today, mainly as a consequence of legal requirements varying from state to state, lending platforms usually operate only on a national level (Berger and Gleisner, 2009). Using this notion, they can be divided into two main types: commercial and non-commercial, also called microfinance (Ashta and Assadi, 2009). Having a closer look at the commercial forms, all of them are oriented as a for-profit companies centralized on purely national market. There are several differences between commercial and non-commercial ways of lending. Probably the most crucial one is, that microfinance lending is strongly not-for-profit oriented concept, quite similar to donating, where lender cannot expect some significant amount of yields in forms of interest for the risk he is exposed to.

An alternative way how one can differentiate between specific lending platforms is based on the borrower-lender matching principle. There are two main approaches which peer-to-peer intermediaries usually adopt (Milne and Parboteeah, 2016).

The first and former one is an online auction approach. In this case, borrowers state the highest interest rate they are willing to pay when applying for a loan. Subsequently, lenders indicate the minimum interest rate they would like to reach for given amount of risk. The platform here serves as a matchmaker and conducts a *reverse auction* for generally agreed period of time. The word 'reverse' refers to sequential process of bidding down the interest rate. After the time span elapses, 'winners' of the auction are actually the investors who offered the lowest interest rate, provided that this digit is below or equal to the maximum interest rate borrower stated at the very beginning of the process.

Another approach is more up-to-date compared to the previous one, as it is adopted by vast majority of currently operating platforms. The process can be characterized by indirect matching of borrowers and lenders by publicly announced credit ratings (with corresponding interest rate) determined for each borrower in conformity with his/her risk category. This path is probably easier for both groups to understand, but generates, on the other hand, delays in matching, as the process of loan funding stops at the point when the desired loan amount is collected and there are usually either more lenders than borrowers or vice versa.

2.2 Lending procedure

When using different approaches which platforms follow in order to distinguish one from another, it is more than adequate to gain the basic perception about the overall principles of peer-to-peer lending process. Of course, there are some specific variations among different P2P entities, but the core usually remains fairly similar.

Before any action (either borrowing or lending), every user is required to register on the platform and verify his/her identity, bank account and also (in case of borrower) provide information about their income and credit history.

Loan applicants are afterwards asked to disclose the purpose of the loan,

loan amount, payback period and interest rate that they are willing to pay. Additionally, the platform might also request some further personal information (such as education, occupation or number of children), in order to take extra factors into account when evaluating borrower's solvency.

After all given documents/facts are verified at numerous data sources (credit bureaus, insolvency registry, social networks, etc.) and proposal approval, the platform assigns credit score (also called rating) coupled with particular interest rate to the loan request, in order to help investors with risk management.

Approved loan requests (including information like loan amount, payback period, credit score, loan purpose, story of the borrower) are placed on public marketplace of the platform. Those applications are also often called credit listings. Then prospective investors search those requests and decide whether to fund particular loan or not. If the whole amount is funded, the listing becomes a loan and is provided to the borrower.

After transferring the funds, administrative fee from the intermediary is charged. Obviously, those transaction fees vary from platform to platform.

Borrower repays the loan through monthly instalments, where the third party (intermediary) is responsible to allocate the repaid capital to every lender who contributed to this loan. In case of default, platform interacts with the borrower and undertakes legal procedure, if necessary, in order to guarantee the investors the maximum compensation possible.

2.3 Competitive advantages of peer-to-peer lending

Besides the fundamental principle of exploiting new technologies, where the Internet is considered as a primary tool enabling disintermediation, Milne and Parboteeah (2016) highlight four main benefits of P2P platforms over the traditionally established procedures of banks:

(i) Investment via P2P lending offers substantially better rates of return than on avaiable bank deposits combined with low fees for platforms.[2]

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[2]For example, standard savings account named *Genius* at Czech MONETA Money Bank, offers the

(ii) Credit can be provided to individuals who would normally barely accessed bank loan.

(iii) Perception of social value of P2P lending.

(iv) Technical progress improving the speed and quality of provided services.

Firstly, mainly because of fairly narrow nature of activities P2P platforms are concentrating at, lenders are able to gain considerably greater returns than they would have obtained at usual bank deposit accounts. Furthermore, platforms also connect investors and borrowers without any additional interest mark-up. This can be considered as the balancing weight on the scale, as higher yield somehow compensates for undergone risk.

Secondly, credit can be accessed by borrowers who would normally not have a chance to get a loan from traditional bank. However, this implies almost in-built adverse selection and therefore, platforms are even more pushed to examine on diligent screening of potential borrowers.

The third reason, why P2P lending option is an attractive alternative to traditional banking, is a simple claim, that this type of finance institutions is more beneficial for the overall welfare of society. As banks or other conventional financial institutions are usually concentrating on gaining higher profit, market share, etc., some specific groups of people, who simply 'don't like' or 'don't trust' banks, may keep the opinion that platforms care about the users' interests significantly more.

The last bullet point is rather technological. Banks spend large amounts of money on technology, but the biggest part of those expenditures accounts for the maintanence of already existing systems (Milne and Parboteeah, 2016). On the contrary, relatively newly established P2P platforms can create and develop their own software that utilizes the facilities of the new Web 2.0 technology. This action results not only in improvement of the quality of provided services, but also enables transactions to be more transparent.

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interest rate 0.1% p.a.; savings account at ČSOB bank with balance lower or equal to CZK 250,000 has the interest rate of 0.2 % p.a.

2.4 Emergence of P2P lending in Europe

Recent report published by KPMG and AltFi Data entitled *Alternative Lending Market Trends in Continental Europe 2016* argues that the United Kingdom, as a pioneer of peer-to-peer lending, generates four times more of aggregated loans than the rest of Continental Europe and therefore still preserves the title of ultimate leader in today's European alternative finance scene. However, other players are quickly catching up.

Ranging after the UK, the top three of alternative lenders also includes France and Germany. Nonethless, Scandinavian and Baltic states like Latvia, Estonia or Sweden are not lagging behind as well. According to the authors of the report, when excluding the UK, Latvia experienced the third highest volume of the funded loans in 2016 up to the third quarter. The cumulative numbers for France and Germany in 2016 through Q3 are €188.5 million and €162.2 million, respectively. Summary suggests that countries like Italy, Poland, Lithuania and Slovakia currently belong to the secondary players in this market (KPMG, 2016).

Figure 1: Peer-to-peer lending market within the Continental Europe
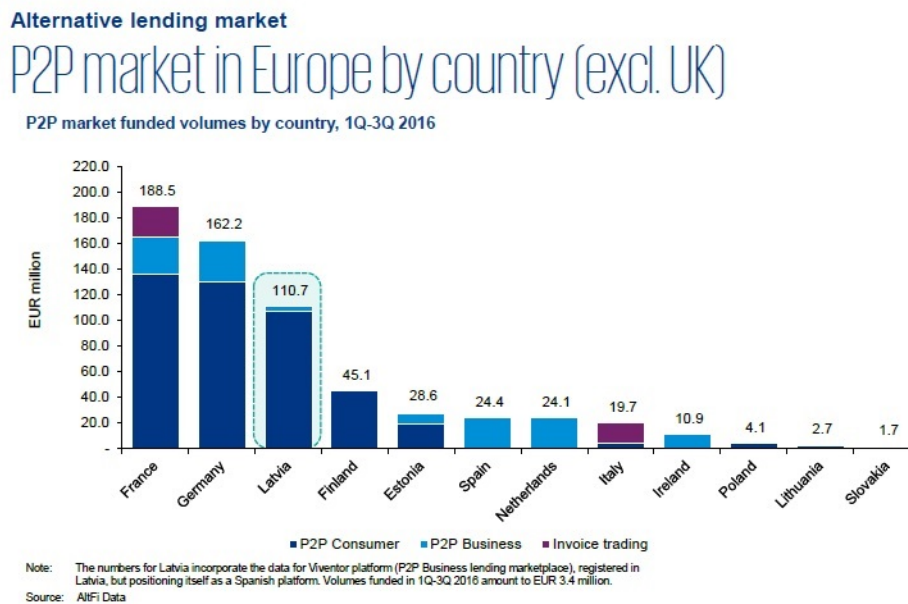
Source: (KPMG, 2016)

P2P consumer lending represents the largest component of alternative online lending market with 72% of total volumes in the first three quarters of 2016. Even though peer-to-business (P2B) lending has generated a significant amount of money as well, it has not managed to outpace the growth of P2P branch. From 2013 to the third quarter of 2016, P2P consumer lending within the Continental Europe has increased from €160 million to €450 million.

The report indicates top platforms from 6 countries of Continental Europe providing consumer loans not only in Europe, but also worldwide. Within Continental Europe area, P2P consumer lending market is dominated by Younited Credit, French platform established in 2009, which also operates in Italy and Spain. The largest German P2P lending marketplace, Auxmoney, occupies the second place. Mintos and Twino, both originating from Latvia, can be found on the third and fourth places and also are the two platforms experiencing the biggest growth from the 2015 till the third quarter of 2016.

Figure 2: Top European P2P platforms (excluding UK)
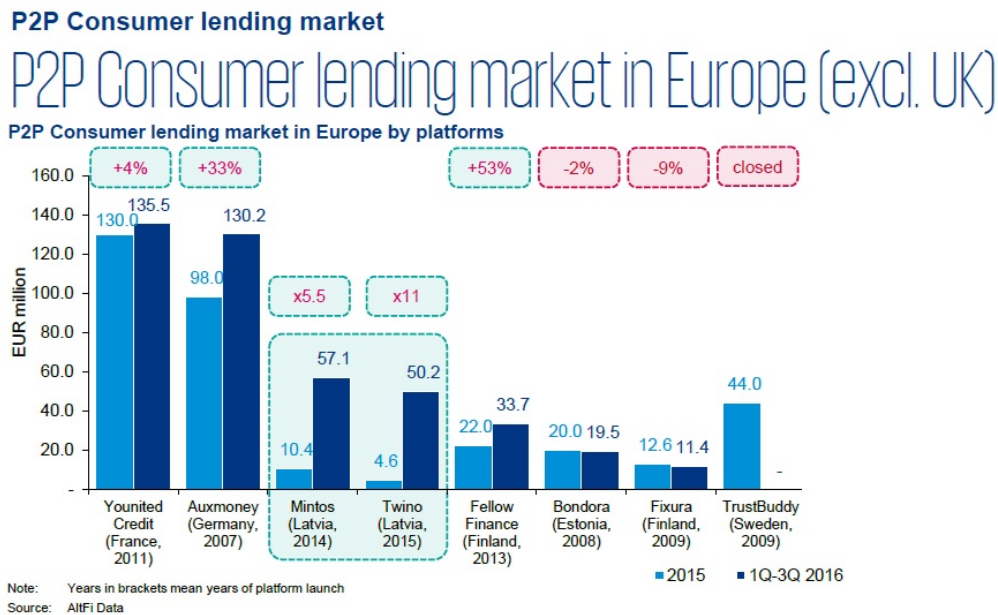
Source: (KPMG, 2016)

The previously indicated growth of European platforms, some of them even doubling their volumes annually in recent years, together with indisputable advantages relative to banks, has created numbers of ambitious predictions about the future market share of this field. However, even though the amount of peer-to-peer transactions has briskly increased from quite low base, in May 2016 it constituted only 1% of the stock of bank lending worldwide, which is still rather small fraction (Milne and Parboteeah, 2016). For this reason, nowadays it is too early to publish any relevant predictions on to which extent will P2P emerge in the few years from now.

2.5 Situation on the Czech P2P/P2B market

Examining on the national market, there are three main platforms dominating the current Czech consumer peer-to-peer lending field – Bankerat, Benefi and, probably most popular one, Zonky.

Bankerat, as the very first Czech P2P project established in 2010, is currently the player with the largest number of registred users (based on its own public statistics, over 47 thousand). However, together with portal Benefi, it is targetted on substantially riskier clients, who simply could not get a regular bank loan. Therefore, the average interest rate at Benefi lies somewhere around 20% and in case of Bankerat almost 40%. Due to hazardous structure of clients, the screening process is also more complicated. As the founder of Benefi, Roman Matoušek confirms, risk management of each platform is the most difficult thing to tackle and estimated deafult rates often fail to predict the reality (Černý, 2016).

It is important to emphasize, that both of those platforms, and presumably all entities of this 'controversial' kind in the Czech Republic, are expected to quickly leave the Czech peer-to-peer lending market (for instance, portal Benefi.cz currently already does not provide new loans). The reason for that is the amendment of Czech national law, more precisely, consumer credit act.[3] According to the changes that came into force in December

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[3]Act no. 257/2016 Coll.

2016, every institution providing credit has to meet certain criteria, e.g. receive a licence from the Czech National Bank connected with condition of having the initial capital at least CZK 20 milion. The expected implications are fairly straightforward – more transparent market coupled with greater protection of consumer's rights.

Apart from previously listed companies, there are also other platforms like Prestito, Žlutý Meloun or Banking Online,[4] which also operate on Czech consumer peer-to-peer lending market and differ only slightly in loan originating process.

Except the above mentioned alternative form of retail consumer lending, additional platforms applying the same concept on funding small and medium enterprises (SMEs), also emerged in the Czech Republic. A typical examples include platforms like PůjčMéFirmě or Symcredit.[5] Another distinct project named Investiční Aukce,[6] created in 2013, focuses on P2B *factoring*. This term refers to the financing of SMEs' invoices, as especially those can find themselves in serious problems when finding cashflows for an invoice having even only three-month repayment date. On the other hand, this also requires greater amounts of money that investors are obliged to contribute and therefore, is not suitable for every individual.

Zonky

For the reason that this Czech platform is at the centre of research focus of this thesis, it is important to shed light on its characteristic concept, history and other publicly presented information.

Launched in June 2015 by investment group PPF, start-up project Zonky quickly managed to get into the subconscious of the public by promoting human approach when considering borrowers' loan requests. Advertising catchword *"People lend to people"*[7] speaks for itself and justly assigns this business to the concept commonly named as sharing economy, where every-

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[4]www.prestito.cz, www.zlutymeloun.cz, www.banking-online.cz

[5]www.pujcmefirme.cz, www.symcredit.cz

[6]www.investaukce.cz

[7]*"Lidé půjčují lidem."*

one uses *Uber* or seeks acommodation thorugh *Airbnb* (Kalouš, 2015).

On Zonky, individuals can request loans amounting from CZK 20,000 up to CZK 500,000 with maximum duration of 7 years, where every single application is judged individually. Each borrower is obliged to attach ID card, another document confirming his/her identity, plus valid bank statement. After diligent screening (including for example verification at Czech Non-/Banking Credit Bureau lists, phone calls to the borrower, etc.), platform decides whether the client is credible enough and if so, the final offer assigning the borrower concrete rating with corresponding interest rate is created. See Table 1 for currently listed values.

Table 1: Ratings and interest rates on Zonky

Rating	Interest rate
A**	3.99%
A*	4.99%
A++	5.99%
A+	8.49%
A	10.99%
B	13.49%
C	15.49%
D	19.99%

Source: www.zonky.cz

If borrower and platform agree on the conditions given, the loan is posted at the so-called 'marketplace', where investors can see users' confirmed identity/income verification, rating (coupled with interest rate), loan amount plus total amount of money, that has been already contributed by others, remaining time at the marketplace (the maximum scope is 7 days) and short story including the purpose of the loan. In case of any uncertainties, lenders can raise additional questions to the borrower.

If the loan is not fully funded within the seven-day time span, the request is cancelled and borrower does not have to pay any fees to the platform. In the case of funding being successful, i.e. the loan is completely financed, the

platform charges one-off fee of 2% of the loan amount from the borrower, whereas lenders pay service fee which equals 1% of the total amount invested every year. Thus, this in fact effectively reduces listed interest rates by 1% as well. The minimum amount that can be invested is CZK 200 and every loan has to be funded by at least 4 lenders. The online environment on Zonky is anonymous in terms of publishing real names and surnames of its users (in contrast to portal Benefi, where the identity of an individual is publicly stated). Thus, both borrowers and investors can be distinguished only by their nickname.

As mentioned previously, the information published at the marketplace is limited and on Zonky's website there is no coherent summary of all relevant data. Therefore, some investors have created specific portals on their own initiative. Those websites[8] offer various functions like notifications for lenders on newly published loan requests based on desired rating, overall statistics or also the so-called autoinvest function, which is a tool that automatically places previously confirmed amount of money on loans of preselected ratings, based on ivestor's desired strategy. This procedure is much more quicker than hand-operated investing directly on Zonky's webpage. A lot of lenders are therefore also using their own *robots*, privately-developed software whose main function is to extract data from Zonky and possibly realize bids on preselected ratings. Robots are created usually with the help of web services and are working under the same principle as earlier discussed webpages.

The thorough screening procedure from both platform's and lender's perspetive is probably the cornerstone of unnaturrally low deafult rate which this hybrid of zebra and donkey experiences. This is also the main cause of demand exceeding supply of the loans (in accordance with their statistics, the fastest loan request in Zonky's history was funded in 6 seconds) and as a result, it is a lot harder for newcomers to enter the closed investors' community (over 3,000 individuals on waiting lists in March 2017) and one has to receive so-called 'promocode' from another already registred investor,

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[8]e.g. www.zotify.cz, www.donky.cz or www.zvonkohra.info

in order to outrun the people in the queue.

However, as co-founder Zuzana Tvarůžková at one of Zonky's public workshop held on March 9, 2017, said, this successful rate is not normal and what is more, even unsustainable in the future. Thus, it is expected to fluctuate somewhere around 3 to 5 % in the following years, which also corresponds to the average bank loan default rate published by Czech National Bank (3.1% in January 2017).[9] Table 2, which was also presented by Zonky during previously mentioned meeting, displays expected and actual default rates sorted by the rating. The variable *default base* refers to the loans that experienced a late instalment at least once. One quickly notices, that platform operates more than 2% under its estimated expected default rate and therefore, loses notable amount of money by inefficient risk management.

Table 2: Defaulted loans at Zonky until March 9, 2017

Rating	Default base	Defaulted loans	Actual default rate	Expected default rate
A**	51	0	0,00%	0,70%
A*	243	0	0,00%	0,84%
A++	534	3	0,56%	1,13%
A+	337	2	0,59%	2,41%
A	310	2	0,65%	3,70%
B	252	1	0,40%	5,13%
C	220	8	3,64%	6,56%
D	139	6	4,32%	10,14%
Total	2086	22	1,05%	3,33%

Source: Zonky's publicly held workshop

All in all, the evolution of Zonky in the long-run is still questionable. It has been frequently speculated, whether the primary intention of PPF is just to create a Czech peer-to-peer lending laboratory, give the whole concept a try, develop some learning-by-doing know-how and leave to markets abroad. As an evidence, 2 years ago, brand Zonky had already been registred in 40 countries (Kalouš, 2015). Whatever turns to be true, the team around this

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[9]https://www.cnb.cz/cs/statistika/menova_ bankovni_ stat/bankovni_ statistika/

platform undoubtedly mastered spreading of the whole idea of peer-to-peer lending among Czech public, as almost everyone knows Magda from TV advert, who managed to borrow money and bought a caravan using Zonky.

3   Literature review

Despite P2P lending being relatively young concept, several researchers have already studied this field, examining on its unique factors and characterictics. Emekter et al. (2015) indicates three main streams that have emerged in current research work.

The first one focuses on the reasons why online peer-to-peer lending has experienced such rapid growth and development. Hulme and Wright (2006) conducted case study of Zopa, the first peer-to-peer platform in the world, stating that this emerging breed of financial relationships may indeed become rival to traditional banking sector.

Next stream examines on determining the aspects that influence funding success and risk of default. Research paper by Iyer et al. (2009) claims, that even though lenders rely mostly on "hard" factors, they also additionally use the opportunity to assess borrower's creditworthiness by analysing "soft" information like personal descriptions or photos. Another interesting fact that has been confirmed from theoretical framework is the evidence of taste-based discrimination. For example, Pope and Sydnor (2011) proved that there exist significant racial disparities between whites and afro-americans in terms of scuccessful loan funding. What is more, Ravina (2008) found that borrowers perceived as beauty indeed experience significantly increasing probability of loan being funded.

The last group of research investigates the performance of P2P lending for a given level of the risk. The focus on this branch is still very scarce and so far, only few papers (Emekter et al., 2015; Berkovich, 2011; Polák, 2017) have tried to fill this gap.

3.1   Information asymmetry

Information asymmetry, a situation arising when one party has relevant information which remains hidden to the other one (Vining et al., 1999), is the fundamental problem of finance sector in general. Imperfect information creates room for obstacles both before (*adverse selection*) and also after the

loan has been funded (*moral hazard*). According to Bester (1987), *"Adverse selection occurs when borrowers differ with the respect to the probability of repaying their loan."* The phenomenon of moral hazard is widely spread over the whole economy (well-known for example, in insurance sector) and in case of loan funding occurs because the likelihood of success (i.e. the probability of loan being repaid) depends on the effort of the borrower, which is unobservable to lender (Arnott and Stiglitz, 1988).

Meng (2016) states two main reasons, why in field of peer-to-peer lending, the problem of asymmetric information becomes even more severe when compared to traditonal banking.

First one is a fact that in online environment, borrowers and lenders do not meet face-to-face. In real world, if lenders and borrowers are close friends, more credible borrowers can be selected and in case of any complications, lenders can force the debtors to repay the loan more easily (Berger and Gleisner, 2009). For instance, as an extension to personal profiles, U.S. platform Prosper.com offers its members to enter groups, which screen and review the individuals' creditworthiness. Everett (2008) examines on the impact of group membership on likelihood of loan default, using data of 13,486 sucessfully funded loans on Prosper, that also covers their ex post performance. He concludes that there is indeed statistically significant negative relationship between default rate and group membership, especially if the group fosters real-life personal networks like for example, same residence, company occupation or identical university.

Secondly, the burden regarding the analysis of all relevant documents of borrowers' credibility done by banks, creates an in-built information asymmetry that becomes harder to detect, as one acts in anonymous online environment (Emekter et al., 2015). Therefore, lenders are obliged to judge the trustworthiness of a borrower only from publicly avaiable data, which makes mitigating information asymmetry the crucial foundation of sucessful lending process.

3.2 Factors reducing information asymmetry

For the sake of allowing lenders to make a decision using as much information as possible, P2P intermediary forces his borrowers to provide financial data that are further controlled and validated by independent outside agencies. Moreover, many platforms also expect borrowers to state demographic facts like gender or age. Additionally, social information about borrowers' hobbies, family or the story about the loan purpose can be added. This part of request, however, cannot be verified at all.

Bachmann et al. (2011) calls those factors determinants of peer-to-peer lending, as they have main impact on the successfull loan funding. By reviewing several already existing articles, he further divides the above-mentioned factors into three main groups - financial determinants, demographic characteristics and so-called "soft" factors. On the other hand, Chen and Han (2015) use slightly different cathegorization, distinguishing only between hard and soft factors. According to them, hard factor can be defined as *credit information that can be accurately quantified, easily stored and efficiently transmitted*; whereas soft factor is *an information that is fuzzy and hard-to quantify about borrowers*. Iyer et al. (2009) suggested that, when using avaiable information from those hard and soft factors, lenders are able to infer one third of variation in borrower's creditworthiness - so by reviewing all publicly listed data, they can evaluate one third of individual's credit risk.

3.3 Measuring individual's risk attitude in a survey

Based on the previous literaure findings (see Falk et al. (2016); Lönnqvist et al. (2015) or Zaleskiewicz (2001)) risk aversion/seeking preferences affect individual' s choices in numberless situations - for example, financial decisions, choices regarding education, family or health. Those are further associated with important real-life behavioral patterns and can be observed not only at the individual, but also at the aggregate level (Falk et al., 2016).

There are several validated methods how to measure person's risk prefer-

ences that are frequently used during closed laboratory experiments. However, as Ding et al. (2010) emphasizes, these techniques are not optimal when the data is gathered by online survey, where time efficiency and parsimony play major role.

In order to infer risk attitudes properly in a questionnaire setting, researchers usually adopt two main approaches. The first practise refers to the incentivised measures, such as lottery choice tasks (e.g. Donkers et al. (2001) or Holt and Laury (2005)). Here, using definition from *Theory of Financial Decision Making* (Ingersoll, 1987), it is assumed that a person is risk averse when choosing a sure option instead of a lottery having an equal expected value. The other method is based on so-called 'Likert statements', where individuals are supposed to rate themselves either in general fields/domains of life, or specify the level of agreement with certain situations (Weber et al., 2002), which is a practise largely used also in psychology.

Generally, the current research work produces quite consistent and similar results. Various authors have confirmed, that risk attitudes are indeed domain specific, when it comes to self-assesment scale. As an illustration, among variety of life domains, Ding et al. (2010) indicates that respondents are most risk averse towards their health. On the other hand, they incline heavily to risk seeking behavior when it comes to leisure. Another observed pattern refers to the gender differences. Byrnes et al. (1999) performed a meta-analysis of risk preferences and related behaviours in many spheres of life and concluded, that men are generally more risk seeking, even though the difference varies depending on particular domains.

3.4   Approach of this thesis

Although Bachmann et al. (2011) and Chen and Han (2015) use somewhat different viewpoints on classification of determinants that influence lender's decision, both papers are basically discussing the same variables including credit rating with corresponding interest rate, default rate or demographic and social characteristics. Thus, those factors are constituting the core of

created survey used to uncover the most important aspects that influence investors' decisions on the Czech peer-to-peer lending market (more precisely, on platform Zonky).

From previous literature overview, the lending decision can be divided into two stages - firstly, investors have to choose the platform which they find credible enough to provide secure and reliable transcations. Second phase refers to the judgement of the information that is displayed at the particular loan request. Therefore, factors that influence lending decision are derived from the following elements: the characteristics of platforms/intermiediaries, borrowers and single loan requests.

According to the previously mentioned three groups, the list of variables is constructed in Chapter 4, summarizing all factors, that should be (as indicated by prior literature findings) important for investors when allocating their funds into loans with different ratings, that is, when creating their final portfolio.

Moreover, the thesis also adopted validated survey methods that are frequently used when inferring individual's risk attitude, as one of the main targets is also determining and understanding investors' risk/time preferences. Subsequently, those preferences are further matched with investors' corresponding real behaviour captured by unique dataset that was extracted from the platform. Process of merging previously mentioned viewpoints together expresses the main idea of the research question, that this thesis focuses on. After thorough search of the relevant literature, that author of this thesis performed, this perspective appears not to be investigated by other researchers so far. Thus, it represents a substantial contribution to current research work.

4   Methodology and conceptual framework

4.1   Related terminology from the portfolio theory

As the exact procedure of choosing an optimal combination of loans in order to diversify the risk following the concept of portfolio theory (Markowitz (1952) and further Sharpe (1964)) is not at the centre of this thesis' research focus, only some basic terms are discussed, as they are important in the sake for the determination of variables that are adopted in created models or other computations.

Because each investor keeps different attitude towards risk, the representation of his preferences in terms of indifference curves also varies. The difference originates in the willingness of taking more risk in order to receive additional return. In the Expected utility framework, every decision-taker keeps different attitude towards risk, which can be described by the shape of his utility function (Gravelle and Rees, 2004). For risk averse individual, it is strictly concave, a person who is neutral to risk experiences linear utility function and finally, risk seeker's utility function can be described as strictly convex.

Next, investor is about to make decision not only which loans he would like to fund, but also how much money is assigned to each one of them in order to minimize risk for given expected return (Guo et al., 2016). It will not be further examined on solving this typical propostition of portfolio optimization problem, but the following terminology is substantial for further inference of the dependent variables that this thesis adopted.

For given investor i, based on the interest rate r_j coupled with particular rating, his expected return μ_i can be directly predicted, using a weighted average of all his investments into loans with different ratings, where w_{ij} represents the weight of given loan with rating j connected with particular interest rate. The formula is as follows:

$$\mu_i = \sum_{i=1}^{n} w_{ij} r_j \tag{1}$$

Another measure that this thesis adopts is 'duration of P2P loans'. Dur-

ation, by definition, is a measure of sensitivity of a principal to a change in interest rates. It reveals how much time (usually how many years) will it take for the interest payments generated by fixed-income investment to repay the provided principal. Duration (for example, in terms of bonds) involves fairly intricate calculations using present value, yield, coupon or final maturity. Thus, a modified version of duration, that slightly differs from the definition in finance, in order to capture specific features of P2P lending market, was created and is further explained in next subsection.

4.2   The inference of variables and measurement

Variables inferred from extracted dataset

The following variables were computed for every investor registered on portal Zonky using uniquely collected microdata extracted from the website by already mentioned robot.

The first explained variable ER_i refers to the expected return of lender's portfolio and can be obtained as follows:

$$ER_i = 100 \cdot \frac{\sum_{i=1}^{n} w_{ij} r_j p_j}{\sum_{i=1}^{n} w_{ij} p_j} \tag{2}$$

Where w_{ij} refers to the amount in CZK which was funded by investor i to loan j and r_j is the interest rate connected with the rating of the loan.

Because some fraction of ith investor's currently funded loans has already been repaid back and this definitely influences his expected return, the term p_j was incorporated. Its value lying within the interval from $< 0, 1 >$ refers to the proportion of the principal that remains to be paid back from each loan in month k, which is the difference between the total length of loan's repayment in months and the date since the loan was fully funded at marketplace.

$$p_j = \frac{\sum_{i=1}^{k} Instalment_i}{LoanAmount} \tag{3}$$

Because Zonky provides no visible information about loans ex post, the computation assumes that all instalments are paid regularly and in time. It is also assumed that there are no early loan repayments present.

As the rate of expected return in terms of weighed average of interest rates in percent is about to be expressed, the whole term is divided by total sum of invested amounts times the proportion of repaid principal and multiplied by 100 in order to better interpret the data.

The second variable D_i was created for the purpose of describing a quasi-duration of peer-to-peer investors' portfolio of loans.

$$D_i = \frac{\sum_{i=1}^{n} w_{ij} t_j p_j}{\sum_{i=1}^{n} w_{ij} p_j} \qquad (4)$$

Here w_{ij} is again, the total amount of money invested by individual i to loan j and variable t_j represents the number of months remaining until loan j will be repaid. The formalization of term p_j remains the same as in expected return's case. The final value of the modified duration refers to the number of months, that remain until the portfolio of investor's loans will be repayed in regular instalments.

Variables measured by Likert scale

Determinants of lending decision

According to the factors, that were frequently indicated to have major impact on funding success (Chen et al., 2014; Liu et al., 2015; Pope and Sydnor, 2011; Wan et al., 2016), the list of independent variables is created. Each one was formulated in terms of general statement about the platform itself, its borrowers and particular loan requests where investors use a Likert scale ranging from 1 (=strongly disagree) to 5 (=strongly agree) to express, how much is certain factor important to them (all statements can be found in questionnaire in Appendix A). Table 3 summarizes three groups of characteristics that were used connected with particular variable.

Table 3: Variables influencing lending decision

Characterictics of a platform	Low service fee	*LowFee*
	Communication with borrower	*Communication*
	Protection of private information	*InfoProtection*
Characteristics of a borrower	Income verification	*Income*
	Borrower's region	*Region*
	Photo posted at loan request	*Photo*
	Numerical values in borrower's story	*Numbers*
Characteristics of loan request	High interest rate	*HighInterest*
	Loan with big amount	*BigAmount*

Willigness to take risk

Next group of variables refers to the un-/willingness of lenders to undergo risk in different life domains – $Finance, Leisure, Health, Career$ and $Family$. Here, no general sentences in the questionnaire were created, lenders are only expected to rate themselves using the same Likert statements' approach as above (that is, person who is completely unwilling to take risk ticks 1, whereas risk seeker chooses to rate himself using number 5).

Lender's degree of risk and time preferences

Risk and time preferences affect the individual's choices in many situations (and lending decision is not the exception). Therefore, a modification of validated survey module proposed by Falk et al. (2016) was used and incorporated approximately in the middle of the questionnaire.[10] Questions are set as a sequence of standard economic choice experiments on risk taking and time discounting. The detailed tree for the staircase procedures on risk and time preferences can be found in Appendix B. Subsequently, the degree of each investor's preferences was derived.

Variable $RiskDegree$ ranges integer values from 1 (=risk averse) to 8(=risk seeking) and reflects investor's risk preferences resulting from the answers of previously mentioned validated survey method.

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[10]The original online preference module is accessible at www.global-preferences.org.

$TimePreference$ is a variable taking integer numbers again from 1 (=the least patient) to 8 (=the most patient) and was obtained by similar procedure as $RiskDegree$, using only slightly different sequence of questions targetted on time discounting.

Demographic factors

The section concentrating on gaining demographic information about lenders was included to the survey as well. Age stands for a continuous variable measured in years, $Male$ is a binary variable taking a value 1 if a lender is man and 0 otherwise. $UniDegree$ is also a dummy variable equal to 1, if an individual reached higher than secondary-school education and 0 if he or she did not.

4.3 Correlation investigation

The main objective of this thesis is to detect, whether there exists correlation (that is, the extent to which 2 variables have a linear relationship) between lenders' real behaviour on platform Zonky and responses that they state in a survey (those are further transformed into particular risk and time preference degrees). More specifically, an emphasis is put on risk behaviour captured by investors' expected return (variable ER_i) and time preferences characterized by duration of funded loans (D_i), compared with the degree of risk and time preferences gained from the survey. Thus, the following quantity is being traced.

$$\rho_{ER,RiskDegree} = \frac{Cov(ER, RiskDegree)}{\sqrt{Var(ER)} \cdot \sqrt{Var(RiskDegree)}} \tag{5}$$

$$\rho_{D,TimePreference} = \frac{Cov(D, TimePreference)}{\sqrt{Var(D)} \cdot \sqrt{Var(TimePreference)}} \tag{6}$$

4.4 Empirical model

Because of the nature of dependent variable, ER, this thesis adopted Ordinary Least Squares model, which of course cannot be performed without

verification of fundamental criteria. This procedure, following the CLM assumptions stated by Wooldridge (2015), is performed in Appendix C.

The following regression tests the impact of various loan characteristics together with demographic factors on the lender's final portfolio, more precisely, on the value of expected return, that they anticipate to gain from the investment.

It is important to emphasize, that there are more characteristics about platform, borrower or loan request in the survey being asked. Those variables were excluded before the model estimation, in order to find the best model-fit for the sake of producing relevant outcomes.

$$
\begin{aligned}
ER = &\beta_0 + \beta_1 \cdot LowFee + \beta_2 \cdot Communication + \beta_3 \cdot InfoProtection \quad (7) \\
&+ \beta_4 \cdot Income + \beta_5 \cdot Region + \beta_6 \cdot Photo + \beta_7 \cdot Numbers \\
&+ \beta_8 \cdot HighInterest + \beta_9 \cdot BigAmount + \beta_{10} \cdot Male \\
&+ \beta_{11} \cdot Age + \beta_{12} \cdot UniDegree + u
\end{aligned}
$$

Note that variables at β_1 to β_9 coefficients are measured by Likert scale and therefore should be treated as ordinal and their rescaling is crucial in order to account for effects of all possible outcomes. This step is done by statistical software (model was estimated using *gretl 2016d*).

5 Data collection, descriptive analysis and empirical part

5.1 Extracted microdata

As portal Zonky has refused to provide its data for the sake of academic research – due to protection of either clients' private information or its risk-management mechanisms, robot was created and used to extract every visible information that has been published on platform's webpage since its introducing in June 2015. Thus, the set consisting uniquely collected microdata, such as characteristics of every single loan (its ID number, loan amount, months of repayment interest rate, borrower's story, etc.) or database of all lenders' nicknames (and their publicly visible bids on each loan) was obtained and further analysed using *MS Excel* software.

The following piechart depicts the distribution of the loan requests based on borrowers' residence. It is apparent, that marketplace on Zonky is dominated by inhabitants mainly from the Central Bohemian Region or the capital.

Figure 3: Loan distrbution based on borrower's region
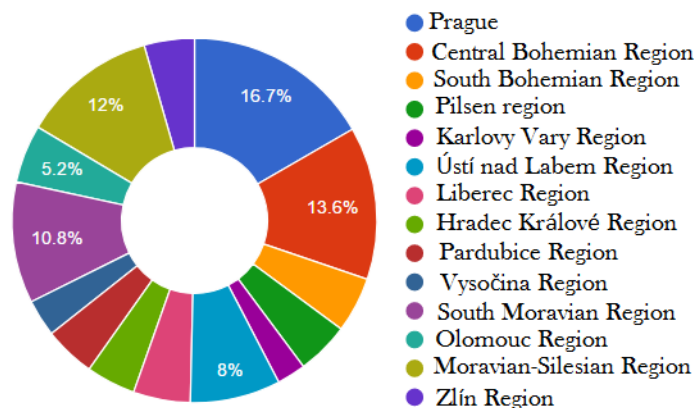
Source: Author's own computations inspired by www.zotify.cz

Figure 4 presents the overview of loan purposes on portal Zonky. The majority of funded loans is used for debt refinancing (almost 41%). The

second largest share is devoted to motor vehicles' loans (20%), followed by household loans (15.8%).

Figure 4: Loan purposes on Zonky
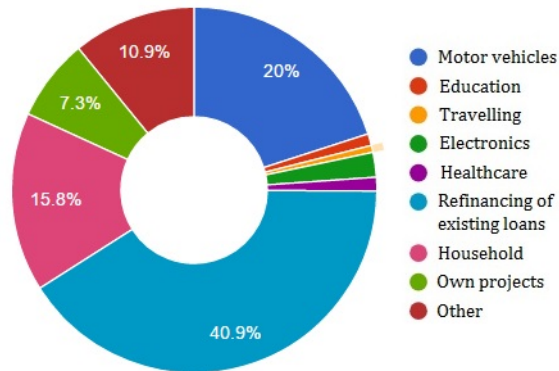
Source: Author's own computations inspired by www.zotify.cz

Figure 5 shows distribution of loans based on the type of borrower's income. It can be concluded, that vast majority of borrowers are either employed, self-employed or entrepreneurs.

Figure 5: Types of borrowers' income on Zonky
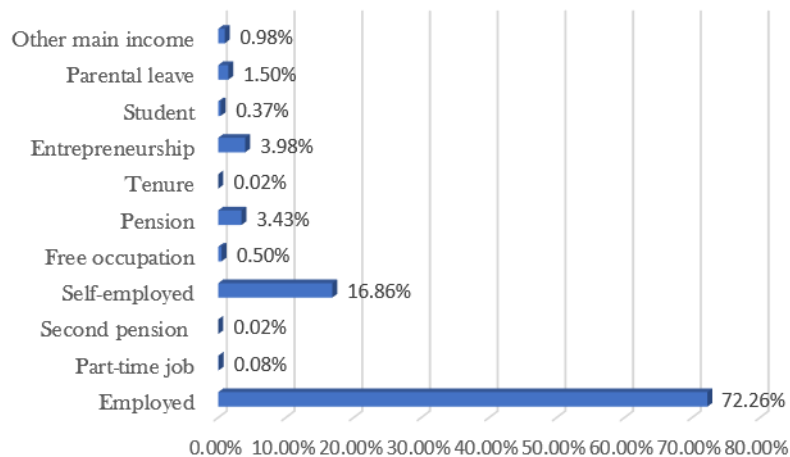
Source: Author's own computations using extracted data

Tables 4 and 5 provide distribution of all loans that were funded until April 26, 2017. Most of them (more than two thirds) belong to the credit grade which is not worse than A, with the total number of 3,442 issued loans

worth CZK 532, 987, 000.

Table 4: Distribution of loans based on rating on Zonky

Rating	Number of loans	Per cent	Amount in CZK	Per cent
A**	127	2.62	28 100 000	4.24
A*	581	11.99	104 925 000	15.82
A++	1217	25.11	195 951 000	29.55
A+	827	17.06	119 619 000	18.04
A	690	14.24	84 392 000	12.73
B	583	12.03	61 116 000	9.22
C	509	10.50	46 138 000	6.96
D	313	6.46	22 881 000	3.45
Grand Total	4847	100	663 122 000	100

Source: Author's own computations using extracted data

Table 5 demonstrates that more than half of loans on Zonky is issued for 4 years or more, which signals low liquidity of undertaken investment.

Table 5: Distribution of loans based on length of repayment on Zonky

Length of repayment	Number of loans	Per cent
6 months and less	28	0.57
6-12 months	115	2.37
12-24 months	545	11.24
24-36 months	672	13.86
36-48 months	809	16.69
48-60 months	755	15.58
more than 60 months	1923	39.67
Grand Total	4847	100

Source: Author's own computations using extracted data

Last, but not least, Table 6 reports some further statistics that has been computed from the dataset. Note the very small number of questions raised on particular loan request on average - this signals, that lenders' concern with borrower's story behind the request is not that big. It is also proper

to mention that the maximum loan amount offered on Zonky was recently changed from CZK 300,000 to CZK 600,000; which had the impact on average loan amount as well.

Table 6: Additional statistics about loans issued so far

Average	loan amount	CZK 136 811
	interest rate	9.75%
	length of repayment in months	54
	# of investors funding each loan	140
	time within the loan is funded	23 hours 45 minutes
	# of questions asked at each loan request	1.66

Source: Author's own computations using extracted data

5.2   Survey

A survey[11] belongs to one of the quantitative research methods and cannot be replaced when gathering microdata. Nowadays, online surveys are experiencing increasing popularity among researchers, as the costs of conducting are far below those of laboratory experiments or face-to-face interviews. Moreover, they are substantially easier to implement, lower (or even prevent) interviewer bias and also allow quick data collection. The survey of this kind can be also viewed as less irritating to respondents, as they can freely choose the time and place, where to complete it. Despite the advantages, there are also threats to quality of obtained data. Because the Internet stands for a medium itself, its users are naturally biased as well. What is more, the answers have been drawn from the group of investors registered on Czech P2P lending platform Zonky and therefore, certain degree of self-selection bias might be present in gathered sample and this issue needs to be resolved.

Thus, certain number of submitted responses, that is reasonably big for statistical analysis, was randomly selected from all obtained answers. The main purpose of this procedure was to achieve random sampling of our set drawn from group of population, however, at the cost of losing some relevant

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[11] An online questionnaire can be found in Appendix A.

answers.

Questionnaire is divided into four main parts. At the very beginning, all investors are asked to type their nickname, in order to match their answers with their real behaviour on marketplace, so that those two perspectives can be compared. This is the key part of adopted approach, that offers new and original perspective, when evaluating lenders' behavioural patterns. Next section is devoted to the inspection of all determinants, that could be influential when making a lending decision. Afterwards, inference of individual risk and time prefernces is made using previously mentioned validated staircase procedure. Then, lenders are asked about their risk perception in various life domains and in the end, are also expected to fill some demographic information.

5.3   Data collection

Online questionnaire was distributed on various webpages, which the investors of platform Zonky tend to seek in order to gain as much valid responses as possible. These include for example, Facebook group called *Investor on Zonky*, which counts almost 3,500 members, or formerly mentioned online independent statistics (www.donky.cz). The time span for collecting answers was set on 10 days.

After elapsed time, total number of 135 answers were collected, from which one response filled out by the same nickname was extracted as a duplicit. Subsequently, the procedure of using random numbers reduced the final dataset used for statistical analysis to 103 responses. This is still a sufficient number of answers that can be used for quantitative analysing of gathered data. The following table provides short respondents' overview.

Table 7: Sample description, *N=103*

Item		Frequency	Per cent
Gender	Male	93	90.29%
	Female	10	9.71%
With university degree		57	55.34%
Using own robot or autoinvest tool		38	36.89%
Average age		34 years	

5.4   Correlation results

In case of relationship between ER and $RiskDegree$, obtained value is $\rho_{ER,RiskDegree} = 0.05$. The higher the value of $RiskDegree$ depicted on horizontal line, the the more risk seeking an investor is expected to be. Therefore, the existence of some distinct form of characteristic functional relationship was assumed to exist (lenders that are strongly risk averse should be experiencing low expected return of their portfolio and vice versa for risk seeking investors). The opposite is further proven by depiction of scatterplot, showing that there is indeed no linear (as well as non-linear) relationship between $RiskDegree$ inferred from a survey and expected return of particular investor. For instance, the individual with strongly risk-averse degree (equal to 2) is in fact experiencing the expected return of his/her portfolio amounting almost to 14%, which can be described as very risky one.

Figure 6: Scatter plot between risk degree and expected return, *N=103*
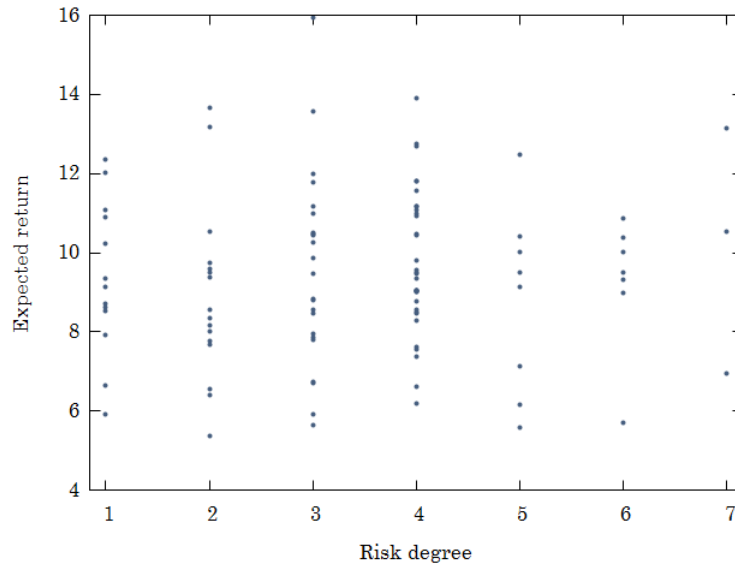
Having look at the correlation between *Duration* and *TimePreference*, here $\rho_{Duration,TimePreference}$ is equal to -0.27. The implied result is fairly confusing, because it would mean that the more patient the investor is in terms of receiving money in a later period, the lower duration he experiences, which is of course not meaningful. This defect was probably caused by inappropriate question setting in the survey method, which is further explained in Section 5.8.

Figure 7: Scatter plot between time preferences and duration, *N=103*
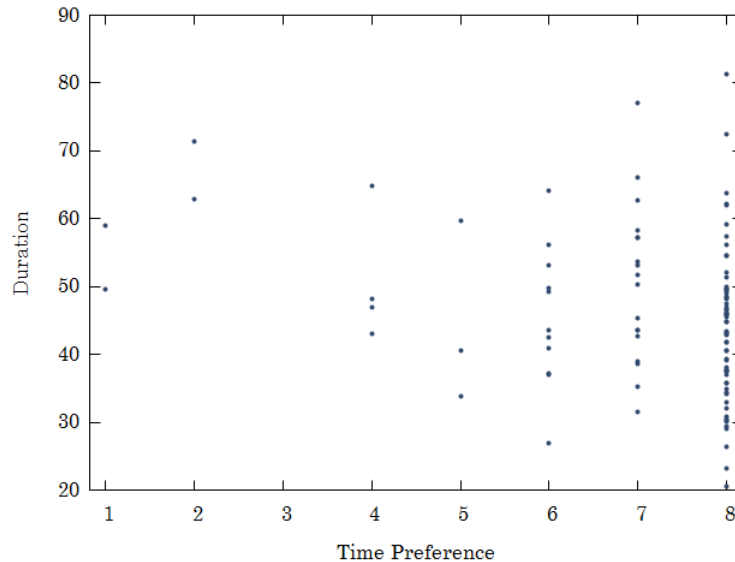
5.5 Estimated model

Table 8 displays the estimated coefficients using OLS regression model proposed in Chapter 4. Dependent variable, ER, stands for previously defined expected return of lender's portfolio expressed in percent. For better interpretation of results, variables measured by Likert scale were re-scaled using software (*strongly disagree* or *disagree* was transformed to -1, *neutral* was set to 0 and *agree* or *strongly agree* to 1). According to paper by Carifio and Perla (2007), this procedure of re-scaling Likert variables is valid, as well as applying OLS regression and further testing using t-test or F-test.

Results indicate, that excluding constant, the only variable that is significant at 1% level is $HighInterest$. That is, lenders who find high interest rate at loan request as important, holding other factors fixed, experience on average an 0.75 percentage-point increase in their expected return. Coefficient at next variable, $Numbers$, referring to numerical values included in the borrower's story, has negative sign and investors who find those numbers important, ceteris paribus decrease their expected return on average by 0.54 percentage points. Even though coefficient at $Male$ causes the biggest nominal change in ER, it is significant only at 10% level. Thus, men, holding other factors fixed, should be having on average by 1.34 percentage points greater expected return of their portfolio, compared to women. However, this result is partially caused by structure of our sample, as the share of women was less than 10% and therefore shouldn't be taken as general implication.

Table 8: OLS regression

	Coefficient	Standard error	t-ratio	p-value
β_0	6.59269	1.45008	4.5464	0.0000***
$LowFee$	−0.0661243	0.252036	−0.2624	0.7936
$Communication$	0.142843	0.260847	0.5476	0.5853
$InfoProtection$	0.113669	0.271743	0.4183	0.6767
$Income$	0.170115	0.311603	0.5459	0.5865
$Region$	0.0992156	0.185674	0.5344	0.5944
$Photo$	−0.203624	0.199223	−1.0221	0.3095
$Numbers$	−0.541390	0.225995	−2.3956	0.0187**
$BigAmount$	0.115226	0.327069	0.3523	0.7254
$HighInterest$	0.756028	0.241475	3.1309	0.0024***
Age	0.0240896	0.0260889	0.9234	0.3583
$Male$	1.34352	0.705202	1.9052	0.0600*
$UniDegree$	0.126000	0.417824	0.3016	0.7637

$N = 103$ $R^2 = 0.210273$ $Adjusted - R^2 = 0.104976$

$F(12, 90) = 1.996951$ $P - value(F) = 0.033387$

P-value below 0.01 indicates statistical significance at the 1 % level and is marked with ***. ** marks significance between 1 and 5 and * describes significance between the 5 and 10 percent levels, respectively.

5.6 Willingness to undergo risk in different life domains

Depiction of relative frequencies in Appendix D, as well as the following descriptive statistics, confirms that risk attitudes of investors are indeed domain specific. When it comes to health and family, respondents incline heavily towards risk aversion, whereas lean only slightly towards risk seeking in leisure activities, finance and career.

Table 9: Descriptive statistics for domain risk attitudes, *N=103*

Domain	Mean	Standard deviation
Finance	3.34	0.83
Leisure	3.39	1.06
Career	3.04	1.06
Health	1.99	0.93
Family	1.89	0.94

Another result which reinforces the conlcusion of risk attitudes of investors' being domain specific is the following correlation table. Here, all values are fairly low, the only moderately correlated relationship is between health and family, 0.55.

Table 10: Correlation matrix, *N=103*

Finance	Leisure	Career	Health	Family	
1.0000	0.3149	0.3628	0.2180	0.1844	**Finance**
	1.0000	0.3456	0.4398	0.2098	**Leisure**
		1.0000	0.2587	0.2811	**Career**
			1.0000	0.5469	**Health**
				1.0000	**Family**

Finally, to trace whether women are more risk averse than men, the average within all domains was calculated for each gender.

Table 11: Average willingness to undergo risk by gender *N=103*

Men	Women
2.75	2.5

5.7   Discussion

This study performed analysis of uniquely collected microdata not only from the webpage of Czech peer-to-peer lending platform Zonky, but also from conducted survey among the community of its registered investors. Subsequently, those two sets were merged together and following conclusions arose.

In particular, this research has confirmed that there is indeed no correlation between the riskiness of investor's portfolio expressed in terms of expected return and the degree of his risk preference. Thus, in real world of online environment, lenders were proven to behave much more riskier than they state about themselves in survey.

This important finding creates room for several possible scenarios. Firstly, lenders' hazardous behaviour can cause issues in terms of prospective image of the platform. Deputies of Zonky confirmed several times, that the default rate is about to increase, which will be probably followed by criticism from the lenders' side and can harm the platform's popularity among public, which is thought to be cornerstone of the Zonky's philosophy. Next danger relates to the risk of such portfolios. Even though loans with ratings B,C or D offer the highest possible return in terms of interest rate, the credit grade was assigned to those requests for a reason, meaning that the borrowers are probably being riskier, in terms of greater inclination to default. Thus, investors should be more cautious towards possible likelihood of late repayments or even default of the loan.

Lenders' inclination to greater risk in real life can be further supported by developed and validated model, where the only variable that was highly statistically significant was high interest rate displayed at loan request. This result is partially consistent with previous literature findings (Meng, 2016; Bachmann et al., 2011). On the contrary, other papers usually indicated much more statistically significant determinants of lending decision, that relate either to a single borrower (income verification, existence of bank account, additional demographic information) or to a platform (e.g. pro-

tection of private information), that remain redundant in adopted model. An explanation might come from the investors' knowledge of Zonky's diligent screening procedure combined with actual default rate being lower than expected one. Being assured, that the verification was already done by intermediary (and is probably successful, when it comes to number of loan defaults), causes less concern with borrower's story, which is further confirmed by data extracted from the platform, where the average number of questions raised to borrower at one request is less than two. Furthermore, this also implies increased usage of robots or autoinvest tools (that are regularly used by one third of survey respondents), which place the bids on loans automatically, and therefore lenders presumably do not find previously mentioned characteristics important.

Next, it proved to be true that investors' risk attitudes are domain specific. This domain sensitivity is visible from fairly low intercorrelations from self-assesed scaling. Additionally, results demonstrate that women are slightly more risk averse than men. Both is in conformity with former research papers by Ding et al. (2010) or Dohmen et al. (2005).

5.8 Limitations

Studies analysing data using online survey face many limitations and this one is not the exception.

From the perspective of this thesis, the first drawback to be pointed out is, that extracted microdata accounts only for publicly visible information and does not cover loan performance ex post. That is, the values of expected return and duration might be slightly different, considering real setting. For example, if borrower struggles with loan repayment and the funds are transferred later than anticipated, the expected return of an investor would differ. The same would apply if on the other hand, borrower decides to repay the whole amount before the due date.

As already mentioned in Section 5.3, it is also important to stress out that there might be some degree of self-selection bias within the sample of

respondents. Even though the survey was pursued to be shared on as many webpages about Zonky as possible, due to unwillingness or lack of concern of majority of them (e.g. portal Zonky refused to include a questionnaire to its newsletter notifications to lenders), the answers were collected only from two communities – Facebook group called *Investor on Zonky* and independent statistics www.donky.cz. Plus self-selection bias may also occur because only those, who wanted to complete the questionnaire, did so.

Next drawback is related to the size of the sample. Even though the number is reasonably big for data analysis and all necessary assumptions for model construction are met, the greater amount of answers was expected to be collected, not only with respect to the total number of registered users on Zonky's webpage, but also due to the fact, that investors frequently gather and interact with each other on previously mentioned webpages. Thus, the result might not precisely capture the behaviour of the community as a whole.

Another issue that arised during the process of responses' collection was the construction of staircase-time procedure used for inferring investors' time preferences. The question to choose receiving money now, or in a year, was combined with the assumption of no inflation present. Thus, vast majority of rational respondents was marked as *the most patient*, as they ended up at the point receiving the highest amount of money in a year, without any doubts regarding money losing its value. Therefore, tracing of relationship between loan's duration and those time preferences has produced misleading results and this method has shown not to be appropriate.

Most importantly, one has to bear in mind that by the construction of used survey method, all determinants are traced only hypothetically and real behaviour that captures decision making process might be different. Nonethless, this is very formidable task to overcome in the experimental environment in general. Thus, research relies on those inferred preferences together with real data outcomes, which was the purpose of this thesis as well.

6   Conclusion

This thesis investigates the research question: *Is there a relationsip between risk degree of P2P lending investors and their real behaviour?* by merging together the analysis of uniquely extracted microdata with reponses from survey conducted among the investors of Czech peer-to-peer lending platform Zonky. Results of the thesis indicate, that lenders in online environment behave way riskier than they, from the theoretical point of view, should, based on their risk degree, that was inferred using validated survey method, based on Falk et al. (2016). This is a very novel approach compared with already existing topics that can be found in P2P lending research. To the best of author's knowledge that can be supported by thorough search through the existing peer-to-peer lending literature, no study has matched the previously mentioned two perspectives or concentrated solely on investors' behaviour drivers.

Second focus of this thesis relates to the investigation of determinants influencing lenders' expected return. Relying on statistics, the only factor, that appears to be influential, when it comes to the final image of lender's portfolio, was high interest rate at loan request. From the results, it can be deducted, that lenders rely heavily on Zonky's screening procedure of potential borrowers, plus do not percieve the actual level of risk, which is further supported by above mentioned findings. Next factor, that reinforces lack of lender's interest about borrower's characteristics, is the low actual default rate on Zonky.

The thesis indicates that lenders do not concern with borrower's qualities to such an extent. This result is not consistent with the findings inferred by previous literature. In contrast with P2P lending markets in different countries, where researchers have found several factors about borrower, that are highly statistically significant, Czech community of investors on Zonky puts emphasis solely on interest rate, when making a lending decision. Investors, knowing that Zonky performs diligent verification of all relevant characteristics in advance, are therefore using automatic bidding software (so-called

robots) increasingly more.

Furthermore, this thesis, as the pioneer using this new perspective for analysis, creates foundations for future researchers who will potentially examine on Czech P2P lending scene. Undertaken study could have been deepened by gaining additional information, that covers data about loans based on their past performance, so that more accurate and refined conclusion could be made, but this is a formidable task to do. Future research can also use available data to investigate herding behaviour of investors or try to gain greater number of responses from investors in order to better explain, what drives their portfolio selection.

To summarize, even though the platform presents itself as an element of previosuly mentioned sharing economy concept, where a strain is put of social value, interpersonal connections and real-life stories, investors actually tend to behave in a completely opposite, rather anonymous and risky way, where primarily quantitative figures matter.

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Appendix A: Online Questionnaire

Dotazník pro P2P investory (Questionnaire for P2P investors)

1. Zadejte prosím Vaši přezdívku na portálu Zonky (dbejte prosím na správnost malých/velkých písmen) *

(Please type your nickname on Zonky, pay attention to the accuracy of lowercase and uppercase letters)

_____

2. Prostřednictvím jakých dalších P2P platforem investujete? *

(Through which online P2P platforms do you invest?)

- ☐ Bankerat
- ☐ Benefi
- ☐ Ferratum P2P
- ☐ Fundlift.cz
- ☐ Investiční Aukce
- ☐ PůjčMéFirmě
- ☐ Symcredit
- ☐ Zahraniční platformy (např. Bondora, SavingsStream, Zopa...) (Foreign platforms)
- ☐ Zonky
- ☐ Žlutý meloun

3. Prosím zaškrtněte, jaké doplňkové nástroje při investování používáte: *

(Please tick all additional investment tools that you use.)

- ☐ E-mailové notifikace Zonky (E-Mail notifications from Zonky)
- ☐ Upozornění o nové půjčce přes mobil / Zotify / pushbullet (Mobile notification/Zotify/pushbullet)
- ☐ Funkce autoinvest na portálu Zotify (Autoinvest function on portal Zotify)
- ☐ Mobilní aplikace (Zonkoid / Zonkios) (Mobile applications)
- ☐ Jiný / vlastní robot (Other / Own robot)

Žádné doplňkové nástroje nepoužívám (I do not use any additional tools)

V následujících otázkách prosím vyberte jednu odpověď :
(In following questions, please mark only one oval per row)

4. Při rozhodování o investici na platformě Zonky je pro mne důležité: *
   (When making a lending decision, the following is important for me:)

	1 = Silně nesouhlasím (Strongly Disagree)	2 = Nesouhlasím (Disagree)	3 = Jsem neutrální (Neutral)	4 = Souhlasím (Agree)	5 = Silně souhlasím (Strongly Agree)
Že Zonky má nízké servisní poplatky (That Zonky guarantees low service fee)	⬭	⬭	⬭	⬭	⬭
Že mi Zonky zaručí kredibilní žadatele o půjčku (That Zonky guarantees credible borrowers)	⬭	⬭	⬭	⬭	⬭
Komunikace týmu Zonky s oběma stranami během doby splácení půjčky (That Zonky communicates with both sides during the loan repayment)	⬭	⬭	⬭	⬭	⬭
Že Zonky užije dostatečných nástrojů k ochraně osobních údajů uživatelů (That Zonky guarantees safety protection)	⬭	⬭	⬭	⬭	⬭
Mít pocit bezpečnosti při uskutečňování transakcí (Feeling safe during transactions' realization)	⬭	⬭	⬭	⬭	⬭

5. Při rozhodování o investici je pro mne u žádosti o půjčku důležité: *
   (When making a lending decision, the following is important for me:)

Ověření žadatele o půjčku v registrech (Registry verification)	⬭	⬭	⬭	⬭	⬭
Ověření příjmů žadatele o půjčku (Income verification)	⬭	⬭	⬭	⬭	⬭
Typ příjmu žadatele o půjčku (Type of borrower's income)	⬭	⬭	⬭	⬭	⬭
Kraj, ze kterého žadatel pochází (Borrower's region)	⬭	⬭	⬭	⬭	⬭
Fotografie/obrázek u půjčky (Photo at loan request)	⬭	⬭	⬭	⬭	⬭
Číselné údaje uvedené v příběhu (Numerical values in borrower's story)	⬭	⬭	⬭	⬭	⬭

6. Raději investuji do: * (I would rather invest into)

	1 = Silně nesouhlasím (Strongly Disagree)	2 = Nesouhlasím (Disagree)	3 = Jsem neutrální (Neutral)	4 = Souhlasím (Agree)	5 = Silně souhlasím (Strongly Agree)
Půjčky s dlouhou dobou splácení (Loan with long time of repayment)	◯	◯	◯	◯	◯
Půjčky na vysoké částky (Loan with big amount)	◯	◯	◯	◯	◯
Půjčky nabízející vysokou úrokovou míru (Loan with high interest rate)	◯	◯	◯	◯	◯

7. Využíváte možnosti položit žadateli o půjčku otázku?
   (Do you use the possibility to ask borrower a question?)

   ◯ Ano

   ◯ Ne

Rozhodování (Decision making)

Představte si, prosím, následující situaci: Máte na výběr mezi jistým vyplacením určité sumy peněz NEBO losováním, kde byste měli stejně velkou šanci získat buď 3000 Kč, nebo nic.

(Imagine the following situation: You can choose either sure payment or playing a lottery, where there is a same chance of receiving 3000 CZK or nothing.

8. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 1600 Kč? *
   (What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 1600 CZK?)

   ◯ šance 50/50   (Lottery 50/50)   *Skip to question 9.*

   ◯ jisté vyplacení   (Sure payment)   *Skip to question 10.*

9. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 2400 Kč? *
   (What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 2400 CZK?)

   ◯ šance 50/50   (Lottery 50/50)   *Skip to question 11.*

   ◯ jisté vyplacení   (Sure payment)   *Skip to question 12.*

10. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 800 Kč? *
    (What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 800 CZK?)

    ◯ šance 50/50   (Lottery 50/50)   *Skip to question 13.*

    ◯ jisté vyplacení   (Sure payment)   *Skip to question 14.*

11. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 2800 Kč? *

(What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 2800 CZK?)

◯ šance 50/50 (Lottery 50/50) *Skip to question 15.*

◯ jisté vyplacení (Sure payment) *Skip to question 15.*

12. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 2000 Kč? *

(What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 2000 CZK?)

◯ šance 50/50 (Lottery 50/50) *Skip to question 15.*

◯ jisté vyplacení (Sure payment) *Skip to question 15.*

13. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 1200 Kč? *
(What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 1200 CZK?)

◯ šance 50/50 (Lottery 50/50) *Skip to question 15.*

◯ jisté vyplacení (Sure payment) *Skip to question 15.*

14. Čemu byste dali přednost: losování s 50% šancí vyhrát 3000 Kč a 50% šancí nezískat nic, NEBO jistému vyplacení 400 Kč? *

(What would you prefer, lottery with 50% chance to win 3000 CZK and 50% to receive nothing, or sure payment of 400 CZK?)

◯ šance 50/50 (Lottery 50/50) *Skip to question 15.*

◯ jisté vyplacení (Sure payment) *Skip to question 15*

Vyplacení peněz okamžitě nebo za rok
(Receiving money now vs. in a year)

Představte si, že máte možnost vybrat si mezi okamžitým vyplacením peněz a vyplacením peněz za 12 měsíců. Částka k okamžitému vyplacení je stejná v každé z následujících situací. Částka k vyplacení za 12 měsíců se v každé situaci mění. U každé z těchto situací bychom chtěli vědět, co byste si vybrali. Předpokládejme, že neexistuje inflace, tj. že budoucí ceny jsou stejné jako dnešní.

(Imagine that you have the possibility to choose between immediate payment or payment in a year. The amount of money received now is same for every given situation. The amount of money paid in a year is changing. In every situation we would like to know what would you choose. Assume, that there is no inflation, that is that future prices are the same as prices today.)

15. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1540 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 1540 CZK in a year?)

    ◯ Okamžitě   (Now)   *Skip to question 16.*
    ◯ Za 12 měsíců   (In 12 months)   *Skip to question 17.*

16. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1850 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 1850 CZK in a year?)

    ◯ Okamžitě   (Now)   *Skip to question 18.*
    ◯ Za 12 měsíců (In 12 months)   *Skip to question 19.*

17. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1250 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 1250 CZK in a year?)

    ◯ Okamžitě   (Now)   *Skip to question 20.*
    ◯ Za 12 měsíců   (In 12 months)   *Skip to question 21.*

18. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 2020 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 2020 CZK in a year?)

    ◯ Okamžitě   (Now)   *Skip to question 22.*
    ◯ Za 12 měsíců   (In 12 months)   *Skip to question 22.*

19. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1690 Kč za 12 měsíců? *
    (Would you prefer receiving 1000 CZK now or 1690 CZK in a year?)

    ◯ Okamžitě   (Now)   *Skip to question 22.*
    ◯ Za 12 měsíců   (In 12 months)   *Skip to question 22.*

20. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1390 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 1390 CZK in a year?)

⬭ Okamžitě   (Now)   *Skip to question 22.*

⬭ Za 12 měsíců   (In 12 months)   *Skip to question 22.*

21. Zvažte následující: Dali byste přednost okamžitému vyplacení 1000 Kč nebo vyplacení 1120 Kč za 12 měsíců? * (Would you prefer receiving 1000 CZK now or 1120 CZK in a year?)

⬭ Okamžitě   (Now)   *Skip to question 22.*

⬭ Za 12 měsíců   (In 12 months)   *Skip to question 22.*

Podstoupení rizik (Risk undertaking)

22. Jak velké riziko jste ochotni podstoupit v následujících oblastech života? (ohodnoťte mezi 1-5) *

(How big risk are you willing to undertake in the following domains of life?)

	1 = nejsem připravený/á podstoupit žádné riziko (Not ready to undertake risk)	2	3	4	5 = jsem velmi připravený/á podstoupit Riziko (Ready to undertake risk)
Finance	⬭	⬭	⬭		⬭
Volný čas	⬭	⬭	⬭		⬭
Kariéra	⬭	⬭	⬭		⬭
Zdraví	⬭	⬭	⬭		⬭
Rodina	⬭	⬭	⬭		⬭

23. Jaké produkty využíváte na finančních trzích? * (Which of the products do you use?)

☐ Spořící účet (Savings account)

☐ Termínovaný účet / vklad (Deposit account)

☐ Investování do podílových fondů (Mutual funds)

☐ Investice do dluhopisů (Bonds)

☐ Investice do akcií (Shares)

☐ Žádné nevyužívám (None)

24. Jsem: * (I am a:)

⬭ Muž (Man)

⬭ Žena (Woman)

25. Váš věk (uveďte prosím číslici): * (Your age, please insert number)

_____

26. Nejvyšší ukončené vzdělání *
(Highest education attained)

◯ Základní (Primary school)

◯ Středoškolské (Secondary school)

◯ Středoškolské s maturitou (School leaving exam)

◯ Vysokoškolské (University degree)

27. Můj hlavní příjem plyne: * (Source of income)

◯ ze zaměstnání (employed)

◯ z podnikání (OSVČ) (self-employed)

◯ vlastním firmu (business owner)

◯ jiné (other)

Díky moc za vyplnění dotazníku.
**Thank you very much for filling out the form.**

Appendix B: Staircase procedure

The staircase procedure was applied from the research paper by Falk et al. (2016), who created an experimentally validated survey module to measure key economic preferences - risk aversion, time discounting, altruism and positive/negative reciprocity in a effective and parsimonious method.

Researchers propose two ways how to measure those variables: Preference and Staircase Module. The modified version of so-called *staircase method* was applied, because it prioritizes time efficiency, which is definitely more convenient for online surveys, as respondents are expected to answer the sequence of only 3 questions.

What is more, the items of this method are experimentally verified. Thus, the individual's preferences are able to explain the behaviour in stimulated choice experiments, which sucessfully predict behaviour in real-life situations. This was the main reason why this method was chosen, as the primary objective of this reserach is to compare measured survey items with real behaviour of an investor on webpage.

Modified tree for staircase risk task:
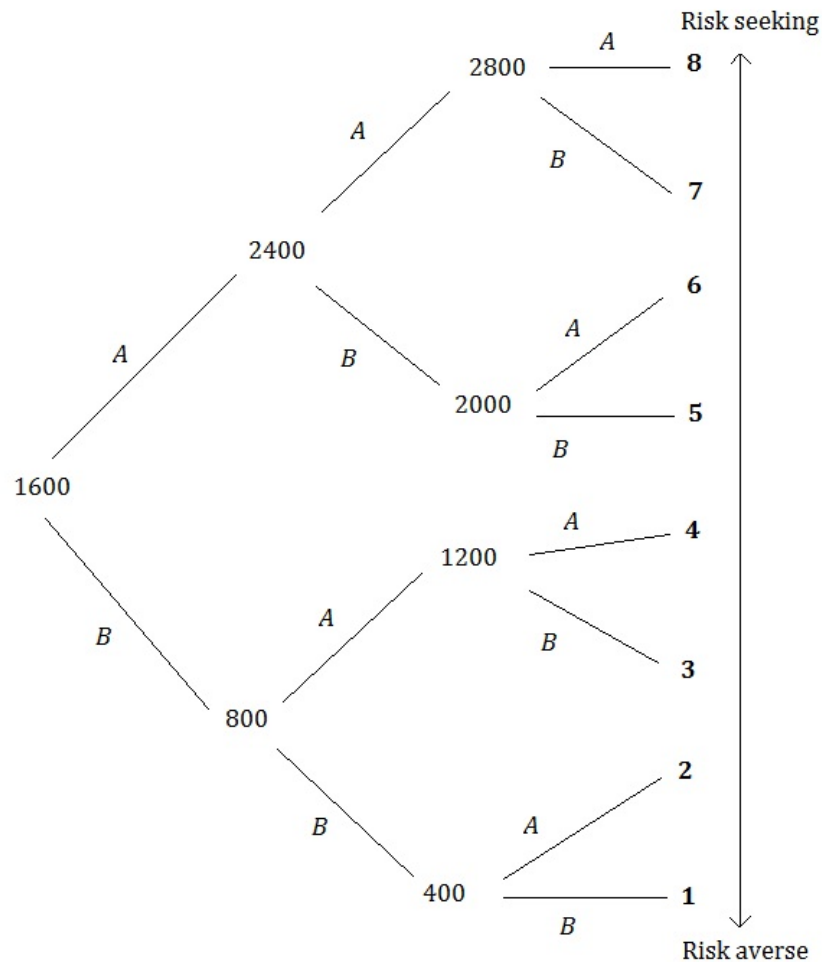
The staircase procedure works in the following manner: Each respondent was asked if s-/he wanted to receive 1600 CZK as a sure payment or rather would preferred 50% chance to receive 3000 CZK or nothing. Here, numbers refer to the safe amount of money received, letter A stands for choice of sure payment and letter B means a lottery selection. If an individual opted for safe choice (letter B), the amount of money offered as a sure payment decreased to 800 CZK. In the case of choosing a participation in a lottery, the safe amount went up. Going further through the structure uses the same logic.

Modified tree for staircase time task:
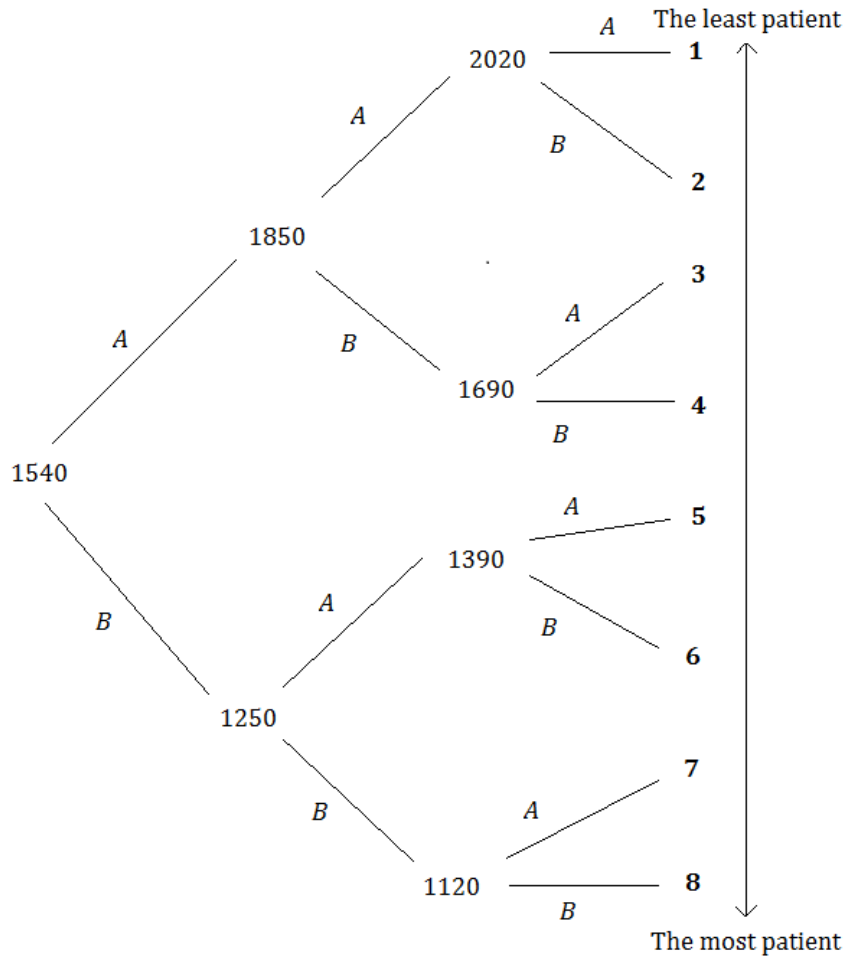
The staircase procedure of time preferences works as follows: Each respondent was asked if he or she wanted to receive 1000 CZK now or would preferred to obtain 1540 CZK in 12 months from now. Here, numbers refer to the amount of money received now, letter A stands for option of today's payment and letter B is the option of receiving x Czech Crowns in 12 months. If respondent opted for payment today (letter A), the amount of money offered in a year was adjusted upwards on 1850 CZK. On the other hand, if an individual chose option B, the particular payment in 12 months decreased to 1250 CZK. The rest of the tree follows the same principle.

Appendix C: OLS Assumptions

Multiple Linear Regression (MLR) Assumptions:

1. **Random sampling** - In order to guarantee the property of sample being random, a group from the set of all submitted responses was randomly drawn. This reduced the initial set of 135 individuals to $N = 103$.

2. **Linearity in parameters** - Dependent variable, ER, can be expressed a linear combination of the explanatory variables and error terms u.

3. **No perfect collinearity** - In the sample (as well as in underlying population), none of the explanatory variables is constant and there are no exact linear relationships among those variables.

   To check whether strong multicollinearity is present between predictors, VIF test was performed. For each estimated coefficient β_j, we calculate Variance inflation factor using the following formula.

$$VIF_j = \frac{1}{1 - R_j^2}$$

Here, R_j^2 is a coefficient of determination from the regression $X_1 = \alpha_2 X_2 + \alpha_3 X_3 + ... + \alpha_k X_k + \alpha_0 + e$ with variable X_j on the left hand side and all other predictor variables on the other side. Values of VIF that are greater than 5 may indicate a multicollinearity problem. The table demonstrates only minor correlations between explanatory variables. Thus, the presence of multicollinearity can be ruled out.

Variable	VIF	Variable	VIF
$LowFee$	1.098	$Communication$	1.485
$InfoProtection$	1.423	$Income$	1.301
$Region$	1.130	$Photo$	1.160
$Numbers$	1.211	$BigAmount$	1.084
$HighInterest$	1.126	Age	1.149
$Male$	1.152	$UniDegree$	1.140

4. **Zero conditional mean** - Expected value of an error term u given any explanatory variable is equal to zero, that is: $\mathbb{E}(u|X) = 0$.

5. **Homoskedasticity** - To check, whether the variance of errors is constant, that is, $Var(u|X) = \sigma^2$, White's test for heteroskedasticity was conducted. Test statistics indicates, that H_0 cannot be rejected, thus, the variance of error term is the same across all values of explanatory variables.

White's test

   H_0 : Homoskedasticity vs. H_A : Heteroskedasticity is present

   Test statistic: $LM = 84.9582$

   with p-value $= P(\chi^2(86) > 84.9582) = 0.511507$

6. **Normality** - The error u is independent of all explanatory variables and is normally distributed with mean equal to zero and variance σ^2. If normality holds, MLR.4. and MLR.5. are met automatically. Doornik–Hansen test on normality of residuals was conducted, mainly due to its superior propeties in small samples. Result of approximate normality is further supported by the shape of error term's distribution.

Test for normality of residual

   H_0 : u is normally distributed vs. H_A : u is not normally distributed

   Test statistic: $\chi^2(2) = 0.15246$

   with p-value $= 0.926603$
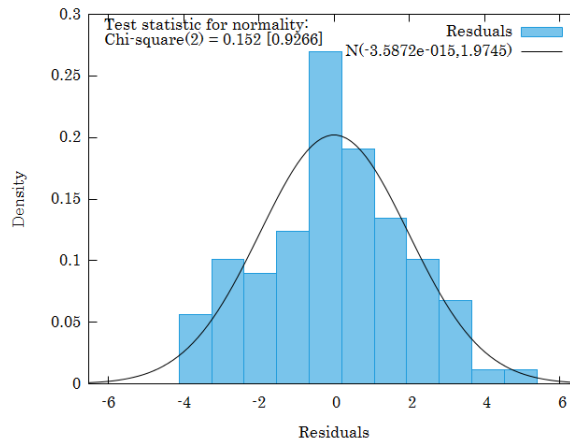
Appendix D: Willingness to take risks in different life domains

The following charts are demonstrating relative frequencies of respondents' risk attitude in field of finance, leisure, career, health and family.