Assessment of Investor's Portfolio of P2P Loans and Structured Certificates of P2P Loans

Ocenění investorského portfolia P2P půjček a strukturovaných certifikátů P2P půjček

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Abstract

The aim of the paper is to evaluate the P2P loan portfolio of the company Zonky and the portfolio of structured certificates of P2P loans. P2P loans are a part of a new economic concept, based on people's co-operation. In particular, the position of the investor who has financial surpluses and is modelling their investment portfolio, is investigated in such a way as to achieve the optimal profitable allocation of resources. Markowitz's portfolio concept is applied, adjusted to be compatible with various ratings for P2P loans. The paper concludes that the concept of P2P loans has a perspective. It is conditioned by the low interest rates banks apply to citizens' deposits and the reluctance of banks to lower interest rates on credit cards and consumer and overdraft loans.

Keywords

P2P loan, structured P2P loan certificate, investment, Markowitz portfolio theory, profitability

JEL Codes

JEL: C58, D53, G11, G23

Abstrakt

Cílem příspěvku je ocenit investorské portfolio P2P půjček u společnosti Zonky a portfolio strukturovaných certifikátů P2P půjček. P2P půjčky jsou součástí nového konceptu ekonomiky, založeného na kooperaci lidí. Zkoumáno je především postavení investora, který má finanční přebytky a modelování jeho investičního portfolia takovým způsobem, aby docházelo k optimální výnosné alokaci prostředků. Je aplikováno Markowitzovo pojetí portfolia, které je adjustováno, tak aby bylo kompatibilní s různými ratingy u půjček typu P2P. Příspěvek dochází k závěru, že koncept půjček P2P má perspektivu. Podmínkou jsou nízké úrokové sazby bank na depositech občanů a neochota bankovních domů snižovat úroky u kreditních karet, spotřebitelských a kontokorentních úvěrů.

Klíčová slova

P2P půjčka, strukturovaný certifikát P2P půjček, investice, Markowitzova teorie portfolia, výnosnost

Introduction

This paper deals with the concept of P2P (Peer-to-Peer) loans from the point of view of the lender (the investor placing their funds in individual loans). The paper examines the system of debtor verification for P2P loan lenders. The first part of this paper focuses on the concept of P2P loans, their advantages and disadvantages, and the introduction of possible perspectives. This includes the presentation of the debtor rating system and the current view on the company Zonky in terms of some credit parameters. Furthermore, attention is paid to the concept of structured P2P certificates and to foreign platforms into which investors' funds are invested. The second part of the paper focuses on the valuation of investors' portfolios. In particular, the profitability of the investment when choosing a conservative approach to the allocation of an investor's funds is examined. The third part of the paper presents a single-factor model of the stress test calculation of the loan portfolio of P2P loans. Data on the default rate from the past financial crisis in 2008–2013 were used and were extracted to date. The result is discovering what the profitability of the portfolio would be if there was a crisis now identical to that of 2008–2013. The paper also deals with the diversification of the portfolio, i.e. how many loans are needed to make a profit.

The goal of the paper is to evaluate, by the application of an adjusted Markowitz portfolio, the profitability of a given investor's strategy who allocates their finances to P2P loans provided by the company Zonky, to evaluate the investment in structured P2P certificates and to determine whether investment in a chosen strategy can be profitable.

The paper does not concern the comparison of national P2P lenders with foreign P2P platforms, as the value of the risk that would have to be accounted for in the model would increase. Exchange rate risk would have to be taken into account (the Czech koruna has appreciated against the euro and US dollar), and evaluation of the risk from Brexit would be problematic.

1 Research methods

The paper will describe the concept of P2P loans as another concepts of the shared economy and the concept of structured P2P certificates. The advantages and disadvantages of P2P loans from the perspective of the investor and the debtor, the debtor verification system for P2P loan platforms and the way of issuing ratings will be presented.

The expected yield is determined by the difference between the annual interest, the risk costs and the investor's fee. Volatility is calculated from the historical time series. The average annual return for the investor will be stated, including the context of the quality of the risk management and the default rate on selected P2P platforms.

The paper deals with the P2P loans offered by the company Zonky, which is represented by the Zonky slogan: "People lend to people. Cheaper and calm".[1]

1 *ZONKY.CZ (2017 c)*

Zonky s.r.o. is registered by the Czech National Bank as a provider of small-scale payment services. Zonky cooperates with PPF Bank.[2] The is a strong player, Home Credit, stands behind Zonky's service. This non-banking company has created a strong background for the whole concept. Zonky firstly checks the applicant for the loan. Proof of income is a basic necessity that every applicant must provide. The applicant for the loan is checked in the currently most widely used registers (CBCB – Czech Banking Credit Bureau, SOLUS).[3]

Zonky is a new service that aims to reduce the cost of loans to people. It was inspired abroad where there are hundreds of similar services. P2P services connect people who want to borrow with people who have extra money. Unlike banks, most of the income returns just to the people who lent their money. P2P services live on their mediation fees.[4]

Loans between people take place very easily. The applicant fills in the loan application. The more information they provide about themselves and their project, the more chance they have to be approved for a loan. Upon approval of the application, Zonky asks the applicant to write a short and catchy story intended for investors. The loan application is then exposed for two days at the "Marketplace" where investors see it and can assess whether it is attractive to them. Once the required amount is reached, Zonky transfers the money to the applicant's bank account and takes care of the other necessary actions.[5]

From 15 August 2017 Zonky launched a secondary market. This is a place where investors can buy and sell participations, namely shares in individual loans. The secondary market serves primarily for the liquidity of money, so investors get much faster access to money they have already invested.[6]

The calculation of the sale of P2P loans by Zonky on the secondary market reflects new fees for investors, for calculating the expected return on an individual rating adjusted by the new charges and a fee for the sale on the secondary market. The number of instalments for which it is the least disadvantageous to sell a loan in a given rating is calculated.

This paper deals with the modelling of Zonky's investment portfolio and the investor portfolio of the investment in a structured P2P certificate. Applying the modified Markowitz concept of the portfolio will evaluate the profitability of the investor's strategy. An investor follows two conflicting objectives, which must balance each other. The Markowitz model takes both objectives fully into account. The method uses indifference curves that represent investor preferences for risk and profitability. Markowitz's portfolio concept is modified to be compatible with various ratings of P2P loans. Evaluation of the investment in structured P2P certificates is included and determination of whether an investment in a chosen strategy can be profitable.

2 *PŮJČKA.CO (2017)*
3 *Půjčky přehledně (2016)*
4 *AKTUÁLNĚ.CZ (2017)*
5 *PŮJČKY.CZ (2017)*
6 *KRČÁLOVÁ, G. (2017)*

In the paper, a single-factor stress test model for the P2P loan portfolio of Zonky will be compiled. Data from the financial crisis of 2008–2013 is used as the default variable. The main indicator is the share of consumer loans with defaults in the total volume of consumer loans. Other assumptions of the model include ratings of loans broken down by quality, quantified risk costs, and fixed fees for the investor for each rating.

2 Concept of P2P loans

The concept of P2P loans is another concept of the shared economy that works on the basis of people's collaboration. It means the providing of loans among people. Similar concepts, of course, have penetrated into financial services: apart from the already mentioned concept of P2P loans, there are insurance services within the so-called club insurance companies. P2P loans are primarily a service that directly mediates the transfer of money from investors to debtors. "P2P lending has grown rapidly in recent years and is a new source of fixed income for investors. Compared to stock markets, P2P investments have less volatility and a low correlation. They also offer higher returns than conventional sources of yield".[7] On one hand is an investor with surplus financial resources, and on the other hand is a client who needs to borrow, and the platform mediates this engagement. This concept de facto eliminates traditional lenders (banks).[8] In the Czech Republic, the first platform for this lending and financing method appeared in 2011 in the form of the company Bankerat. There are currently six companies that specialise in P2P loans. These companies are very different from each other, both in the way they work and specifically in the results they achieve.

2.1 Advantages and disadvantages of P2P loans from an investor and debtor point of view

The advantages of investing from an investor point of view lie mainly in its simplicity, with a clearly defined demand for loans and a subsequent offer from investors in real time. A further advantage of this method of investing is the interest yield. At present, when interest rates on deposit products are declining sharply, there are not many opportunities to invest, and with investment in funds and capital instruments there are transaction costs and knowledge barriers. However, there is a need to distinguish between individual P2P lenders. The disadvantages, above all, are the incompetence of some providers of these types of loans with regard to the negligent auditing of debtors. The interest rate indicator serves as evidence of this. Bank consumer credit rates, overdraft rates and credit card loans rates average an APRC of 11% per annum, and some providers offer an interest rate of tens of percent per year.[9] The quality of debtors in terms of their creditworthiness is very low in

7 *GALLAND, D. (2017)*

8 *SUNDARARAJAN, A. (2016), pp. 145–150*

9 *ČESKÁ BANKOVNÍ ASOCIACE (2017)*

these portals because they accept much higher interest than is determined by the banking market, which is the major provider of loans in the economy. Low creditworthiness is associated with a much higher level of default, and this is reflected in the low ability to recover the funds invested. A similar situation applies to P2P lenders. It was found that higher interest rates charged to high-risk borrowers are not enough to compensate for the higher probability of loan default.[10]

From the position of the debtor, the greatest advantage is the possibility of refinancing: through this type of financing the interest rate on older loans can be significantly reduced and in the final to overpay on the interest much lower. Of course, this assumption is based on the parameter of a substantially lower interest rate on the P2P loan platform. Currently, loan refinancing is one of the most common offers on these platforms. There are still high-interest loans on the market that do not reflect the current low interest rates. Another benefit for debtors is the simplicity and transparency: all the costs involved in acquiring such a loan on these platforms are immediately known. A disadvantage for debtors may be the increased degree of creditworthiness testing, when the overall financial situation is examined. Here again, each provider has different internal credit control rules. A higher level of debtor credit rating means security for both the debtor themselves and the potential investor.

2.2 The concept of structured P2P certificates

Structured P2P certificates are a new structured financial product that has been formed with the expansion of P2P loans. The meaning of this structured product lies in investing in a company that allocates the embedded resources to several P2P platforms. Thus, the investor invests a certain amount without actually taking part in the investment process in any way. The issuer of the "Symphony P2P certificate" is the Symphony Lending Trust, a US-based trust company. Investments are taking place on several of the world's P2P investment platforms: Lending Club (USA), Prosper (USA), Funding Circle (Great Britain) and Bondora (Estonia).[11]

Since the financial crisis, traditional banks have found it more difficult to lend, while savers have struggled to generate income. In this environment, peer-to-peer lending has boomed, as it offers a way for businesses or individuals to borrow more cheaply, and a competitive rate of return for those compared to lend to them. Online P2P platforms such as Funding Circle connect borrowers with lenders who want a higher level of interest than their bank will offer. Peer-to-peer investment trusts gain exposure to the loans made on these platforms, usually for the purpose of dividend income and capital growth. Some trusts also take a direct equity stake in the platforms themselves.[12]

10 EMEKTER, R., TU, Y. and B., LU, M. JIRASAKULDECH (2015)

11 SYMCREDIT (2017)

12 LAWRIE, E. (2016)

In the Czech Republic, SymCredit, which is active in the P2P lending market and specialises in projects and companies financing, is involved in this investment.

The parameters of this investment are as follows:

- Interest rates between 6.5% and 8%
- Maturity of 3 and 5 years
- Placement of capital into a reserve fund
- Potential bonus interest at maturity
- International diversification
- Loans in established and successful P2P platforms
- Minimum investment of 1,000 Czech korunas

A trustee may invest their share capital (no leverage effect) plus the yields from loans from certificate holders. The investment by its nature has no guarantee. There is a reserve fund, which is, however, insufficient, with a loss margin of 3%. In practice, this means that for every $100 from investors (certificate holders), the trust company holds $103 in assets, and in the case of a loss less than 3%, the investor receives at least the investment made. Unlike loans, in which the investor inserts funds separately and can sell them on the secondary market, these structured certificates cannot be sold. They are not traded on any market.

2.3 Debtor verification system for P2P loan platforms

The system of debtor verification not only for these platforms, but especially for banks, belongs to the internal affairs of specific institutions, and these systems are not publicly available. These are, in particular, models that examine the creditworthiness of the client. For banks, the responsibility for this system lies with risk management, which mainly assesses the credit risk (credit risk, counterparty risk). This risk means that a debtor will not be able to repay. Each credit company has its own scoring models and uses traditional or innovative techniques to assess the risk (risk management). For example, three components of credit risk are assessed: probability of default, failure exposure and default rate. Probability of default (PD) can be assigned to the client based on sixteen economic-demographic parameters. These parameters relate in particular to type of employment, entrepreneurial activity, number of dependents, place of work, business activities, etc. For each parameter, the probability of default is fixed.[13] In general, banks have a clear set of procedures and methods for assessing the creditworthiness of debtors. Banks are under the supervision of the regulator, which by its nature supervises the entire credit approval process and can assess the adequacy and relevance of the models used.

There is only one provider in the Czech Republic that provides added value for creditors in the form of quality risk management. Zonky, as the only provider of P2P loans, has access to basic credit databases (SOLUS, NRKI – Non-Banking Client Information Register, operated by its interest association CNCB and thus also to BRKI – Banking Client Information

13 ANDERSON, R. (2007) pp. 125–150

Register, operated by CBCB). These databases operate on the principle of reciprocity, i.e. Zonky has the obligation to add their debtors to these databases as well. However, the most important positive aspect is the existence of risk management. This service is tasked to examine prospective debtors and evaluate them with a rating that expresses their quality. Rating ranges from A** to D, with A** being the best rating expressing the high creditworthiness of the debtor while D meaning the highest risk. Each rating has a fixed interest rate on the loan and a cost surcharge which expresses the cost in case of default. This surcharge is not fixed, but may vary with respect to the situation. As mentioned above, each credit institution reflects its parameters in its models, and these parameters are the subject of business know-how. Table 1 shows that parameters of Zonky are set appropriately, as is apparent from the listed default rate by individual ratings.

Table 1: Zonky default rate from foundation to 31 May 2017

Rating	Base of failure	Loans in default	Actual rate of default	Expected default rate	Expected risk costs
A**	70	0	0.00%	0.70%	0.49%
A*	362	0	0.00%	0.84%	0.59%
A++	755	3	0.40%	1.13%	0.79%
A+	515	3	0.58%	2.41%	1.69%
A	430	6	1.40%	3.70%	2.59%
B	364	1	0.27%	5.13%	3.59%
C	335	10	3.64%	6.56%	4.59%
D	205	13	6.34%	10.14%	7.10%
Total:	3,036	36	1.19%	3.33%	2.33%

Source: Newsletter sent to Zonky's investors to 31 May 2017.

Table 1 shows that the number of loans invested in is relatively small, which relates to the short existence of the company. However, this number also has a corresponding value. Default loans total 36, which corresponds to a default rate of 1.19%. For comparison, in the banking sector, at present, the default rate is around 3.1%.[14] Such a low default rate indicates a high-quality risk management system. There are no default loans in the rating categories A** or A*. The most defaults are on loans at lower ratings, which is logical and corresponds to their character. Interestingly, the current rate of default is well below the expected level of default set by the company itself. This means that society is not fulfilling the basic mission of each society, i.e. to maximise profit. For investors, on the contrary, this fact means that they generate an almost risk-free very decent yield for today's low interest rates. In the future, this model is not sustainable and it is expected that the default level will increase to the expected level. In practice, this will mean that debtors who are not able to get a D rating today will be in this rating, and D-rated debtors will move to a Contract-rating. However, the choice of investment will still depend on the particular investor and their risk profile.

14 CZECH NATIONAL BANK (2017 b)

A higher degree of bank digitisation and automation improves the potential for rapid investment and return. Automation with elements of artificial intelligence is deployed in many areas of banking activities, but it cannot be assumed that some of the advantages of P2P lending may be gradually offset. Loan lending cannot be fully automated because there always has to be a human factor that affects rating assignment. The economy is evolving and risk management which can identify the risks and work with them will always be needed.

Table 2: Expected profitability of Zonky Investor

Rating	A**	A*	A++	A+	A	B	C	D
Interest p.a. in %	3.99	4.99	5.99	8.49	10.99	13.49	15.49	19.99
Risk costs in %	0.49	0.59	0.79	1.69	2.59	3.59	4.59	7.10
Investor´s fee in %	1	1	1	1	1	1	1	1
Expected revenue in %	2.50	3.40	4.20	5.80	7.40	8.90	9.90	11.89
Volatility in %	0.25	0.30	0.40	0.85	1.30	1.80	2.30	3.55

Source: Authors: data taken from[15].

Table 2 shows individual ratings and their parameters such as interest rate, risk costs and investor's fee. The expected return is determined by the difference between the annual interest, the risk costs and the investor's fee. Volatility is calculated from the historical time financial series. According to Table 2, the volatility is relatively low. The greyed-out rating A is an illustrative example of the application of risk costs: the 2.5% risk means that three out of 100 loans will go to a total loss, or that of 100 loans, five will have problems but 50% of the principal will be recovered. It can also mean any combination – two out of 100 loans will go to full loss, another four will have a repayment problem, but two will be fully paid off, and from the remaining two loans 50% will be recovered. Three conclusions can be drawn from this: in one case, it could be an unexpected event; in one case the client could have lied, and in one case it could be a human error. The risk costs need to be calculated in the investor portfolio. It is also necessary to model the investor portfolio, with at least 100 loans, to see a clear trend. A small portfolio can be very volatile and inaccurate in expected earnings calculations. This yield is, of course, gross (before tax). Revenue taxation is not dealt with in this paper.

For Czech P2P lending platforms, risk management is of course very limited, because the whole market is very small and these platforms have limited resources. The bulk of their budget goes to IT and promotion (marketing). Most P2P providers do not even have elementary access to some registers – e.g. SOLUS, NRKI – to check their debtors. It turns out that the lender who decides whether to invest in the loan or not takes on all the risk. Such operations take place on the basis of an auction where the lender offers interest rates and methods of securing and the debtor either accepts this offer or not. This type of lending means that the provider is only a mediator between the supply and demand, not an active participant.

15 ZONKY (2017 a)

For P2P foreign platforms, of course, risk management is far greater, which is related to the size of the market and the amount of loans. Risk management is a necessity if the platform wants to be attractive to investors, and the cost of this department is paid through the volume of loans, very large in foreign platforms. In this paper, I mention the foreign platforms into which investments are made through a structured P2P certificate. The Czech investor investing funds in this certificate has a lack of information and this lack of information should have a major influence on whether to invest or not. Foreign P2P platforms have different risk management methods. Risk management is also based on social aspects that are different – for example, USA vs. Czech Republic. There are different consumer behaviour, saving rates, etc. and P2P loans in the US mean something different than in the Czech Republic. It can be assumed that risk management in the US is at a much lower level than in the Czech Republic.

Table 3: Average annual return for the investor on selected P2P platforms to 31 May 2017

P2P platform	Average annual return for the investor
Lending Club (USA)	6.4%
Bondora (Estonia)	14.4%
Funding Circle (Great Britain)	7.0%
Prosper (USA)	Data not available
Zonky (Czech Republic)	7.5%

Source: Data taken from web pages of P2P platforms.[16]

Table 3 shows that P2P foreign platforms have a comparable return to Zonky, which belongs among the largest and highest quality from the risk management point of view. Higher returns are logically linked to higher borrowing costs for debtors. Table 4 directly reflects the relationship between the quality of the risk management of individual P2P platforms and the rate of defaults.

Table 4: Rate of defaults in selected P2P platforms to 31 May 2017

P2P platform	Rate of default
Lending Club (USA)	7.26%
Bondora (Estonia)	10.46%
Funding Circle (Great Britain)	2.0%
Prosper (USA)	Data not available
Zonky (Czech Republic)	1.19%

Source: Authors' calculations, data taken from web pages of P2P platforms.[17]

16 *Lending Club (2017)*

17 *Lending Club (2017)*

Table 4 clearly shows that the degree of default in selected foreign platforms within structured certificates is significantly higher than in Zonky. The Zonky loan platform is a separate financial brand in the Home Credit Group owned by PPF. It can be assumed that the difference is related to the quality of risk management. For Funding Circle, this indicator is low and is approaching the Zonky default rate, but 45% of loans have delinquency (so-called recovery), i.e. 45% of loans are not repaid on time.

2.4 Secondary market of P2P loans

The secondary market generally operates as a sale of already purchased financial instruments. It is a market where supply and demand for assets are met. In the P2P segment, it is a tool for obtaining liquidity for investors. Funds invested in loans are deposited over the maturity of the loan, which varies greatly, and an investor who needs funds for other purposes can prematurely sell their loans through this market to investors. This paper deals with the secondary market in Zonky. The main advantage of the secondary market is the premature acquisition of funds that the investor can use for more profitable alternatives, thus not losing revenue through opportunity costs. This sale option is not free of charge. Zonky charges 1.5% of the principal (one-off sale charge), which greatly reduces the return on newly purchased loans without a longer history of previous repayment.

Sales conditions are relatively strict, as the secondary market accentuates the quality of the loans:

- Loans where at least one instalment has been paid can be sold on the secondary market.
- Loans that were never more than one day overdue can be sold on the secondary market: this condition reflects the fact that it is not possible to sell delinquent loans, which is an advantage for investors who can buy seamless loans, and also an advantage for novice investors who can build a new portfolio of "old" loans that have a history.

Table 5: The number of instalments after which it is least disadvantageous to sell the loan in the particular rating

Loan length in months	A**	A*	A++	A+	A	B	C	D
6	6	6	6	6	6	6	6	5
12	11	11	10	10	9	8	8	7
18	14	13	13	12	11	10	10	9
24	16	15	15	14	13	12	11	11
30	18	17	16	16	14	13	13	12
36	20	19	18	18	16	15	14	13
42	22	20	19	19	17	16	15	15
48	23	22	21	21	19	17	17	16
54	25	23	22	22	20	18	18	17

Loan length in months	A**	A*	A++	A+	A	B	C	D
60	26	24	23	23	21	19	19	18
66	27	26	25	24	22	21	20	19
72	29	27	26	26	23	22	21	20
78	30	28	27	27	24	23	22	21
84	31	29	28	28	25	24	23	22

Source: Authors' calculations (the calculation reflects the new fees for Zonky investors valid since 1 September 2017;[18] the expected yield of the individual rating was adjusted further by new fees and a sales fee on the secondary market).

Table 5 shows that the sale of loans on the secondary market is very disadvantageous for the investor, as a fixed fee must be paid and the future yield on interest is lost. Table 5 also shows that it is better to sell medium-term loans in the A-C range, where it is the least disadvantageous for the investor to sell. If an investor needs capital, they should sell these ratings out of their portfolio. It is expedient to sell loans at the best rating A**, A*, A+ after a much longer period of time to be least disadvantageous to the investor. It can be assumed that these loans are not advantageous to sell as they generate stable returns.

3 Investor's portfolio valuation

In this section, the paper deals with the modelling of Zonky's investor portfolio and the investor's portfolio of investment in a structured P2P certificate. Every method of investing should have a certain strategy. Investing through P2P providers obviously has its own rules and nuances, but the principle is the same as for each investment, namely to minimise the risk and best allocate the invested money to bring the desired return. The investor must first determine what risk they want to undertake. For this purpose, they build their loan portfolio and invest in ratings that contain information on the riskiness of the debtor.

The problem of valuing the investor´s portfolio based on structured P2P certificates lies primarily in the incomplete information of the P2P foreign platforms in which it is invested. Data on defaults and delinquencies are only aggregated rather than rated. There is also a lack of at least framework information on their risk management, but data on the failure rate of these platforms indicate a lower quality of risk management. Furthermore, not all platforms provide data on loans and their creditworthiness, and it is also necessary to reflect currency risk, which is not small. Last but not least, there is a risk of regulation, when in developed countries where the P2P platforms have been in place for a long time (USA, UK), regulation might be implemented that may negatively affect the sector. For these reasons and fundamentals, it is not possible to make a valuation of an investor's portfolio of structured P2P loan certificates, as basic data is missing and the overall difference of individual foreign P2P platforms prevents high-quality valuation. From the above-described and identified risk, investing in structured P2P loan certificates is very risky.

18 DUDEK, L. (2017)

Investor's portfolio valuations can only be made for investments in Zonky, where all the parameters that can be entered into the model are known.

The valuation is based on the Markowitz portfolio concept. This valuation approach starts with the assumption that the investor currently has a certain amount of money that will be invested over a certain period of time, called the holding period of the portfolio. At the end of this period, the investor sells the securities that were purchased. The beginning of the period is t = 0 and the end of the period is t = 1. In the period t = 0, the investor must make a decision on which of the securities to include in the portfolio. When decision-making, however, the investor does not know the return on securities in the portfolio, but can try to estimate it and invest in securities with the highest expected return. At the same time, however, a typical investor requires the risk of change in return to be minimised. This means that the investor actually follows two conflicting goals, which must balance each other. The Markowitz model takes both objectives fully into account. The method used to select the most desirable portfolio uses indifference curves that represent investor preferences for risk and return.[19]

3.1 Modified Markowitz Portfolio Model for valuation purposes at Zonky

This model needs to be adjusted for this investment segment. This modified model assumes that the investor has a certain amount of funds, which, however, are invested in the instruments (individual loans) gradually, not at once, because it is limited by an investment of Czech koruna 5,000 per loan. When investing in loans, the investor precisely knows the maturity of the loan, which, for example, they know when investing in bonds, but does not know the extraordinary situations, i.e. early repayment, default and related failures. This knowledge of repayment time is very important as the investor can choose whether to include short, medium or long-term loans in the portfolio. The condition is that the longer the maturity, the greater the risk that the loan will "ruin" over time. This may be mainly due to macroeconomic variables (GDP development, unemployment, drop in demand, etc.). It is necessary to keep in mind that the economy cycles and credit risk accumulates in the good times of a boom and bursts during a recession. Compared to the original version of Markowitz's portfolio theory, this modified version is very likely to predict the expected return, since for loans and for each rating, the investor fee (transaction cost), annual return and risk expense are fixed, which may change in the long term as, for example, the rate of credit failures grows. The expected return on a stock portfolio cannot be accurately estimated as no one knows how the shares will move on the stock market and whether the company will generate profit that will be distributed to investors in the form of a dividend. The expected yield for a bond portfolio can be determined if the yield on the bond is fixed. With a variable rate, or at a rate that is based on the price of other assets or benchmark rates, it is again difficult to determine the expected return.

19 ČIŽINSKÁ, R and M. REŽŇÁKOVÁ (2007), pp. 56–63

Table 6: Calculation of the annual volatility (σn) of the portfolio

Rating	A**	A*	A++	A+	A	B	C	D
Interest p.a. in %	3.99	4.99	5.99	8.49	10.99	13.49	15.49	19.99
Risk costs in %	0.49	0.59	0.79	1.69	2.59	3.59	4.59	7.10
Investor´s fee in %	0.20	0.50	1.00	2.50	3.00	3.50	4.00	5.00
Expected revenue in %[20]	3.30	3.90	4.20	4.30	5.40	6.40	6.90	7.89
Annual volatility (σ_n) in %	0.25	0.30	0.40	0.85	1.30	1.80	2.30	3.55

Source: Authors' calculations, some data taken from[21].

The expected return is calculated in Table 6 as Interest – Risk Cost – Investor's Fee. Annual volatility is calculated as half of the risk costs. Annual volatility is dependent on the risk costs that are calculated for individual ratings. If the economy went back into recession, these costs would increase and the volatility would be higher. In fact, according to this, the investors see the risk for each rating and it is up to them as to what they choose.

Annual volatility calculation formula:

$$\text{Annual volatility} = \begin{bmatrix} w_1\sigma_1 & \Lambda & w_n\sigma_n \end{bmatrix} \times \begin{bmatrix} 1 & \rho_{12} & \Lambda & \rho_{1n} \\ \rho_{21} & 1 & \Lambda & \rho_{2n} \\ \mathrm{M} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ \rho_{n1} & \Lambda & \Lambda & 1 \end{bmatrix} \times \begin{bmatrix} w_1\sigma_1 \\ \Lambda \\ w_n\sigma_n \end{bmatrix} \quad (1)$$

Table 7: Calculation of the expected return of the portfolio

	Weight (w_n)	Annual volatility (σ_n)	Expected return	$w_n\sigma_n$
A**	44.55%	0.25%	2.50%	0.001114
A*	30.94%	0.30%	3.40%	0.000928
A++	17.40%	0.40%	4.20%	0.000696
A+	3.85%	0.85%	5.80%	0.000328
A	1.65%	1.30%	7.40%	0.000214
B	0.86%	1.80%	8.90%	0.000155
C	0.53%	2.30%	9.90%	0.000121
D	0.22%	3.55%	11.89%	0.000077
Total	100%			

Source: Authors' calculations.

20 DUDEK, L. (2017)

21 ZONKY.CZ (2017 b)

Table 7 shows the modified Markowitz Portfolio Model for Zonky investor portfolio modelling. It shows the final yield (the required annual return for the investor) in the case of a conservative portfolio, where the largest weights represent the best loans (ratings A**, A*, A++). The return for the investor is calculated as the scalar product of weights and expected returns. The final return for the investor is 3.40%. The weight standard deviation wnσn is the product of the weight and annual volatility.

Table 8: Average annual return for the investor on selected P2P platforms to 31 May 2017

Return for the investor	3.40%
Annual variations	2.78443E-06
Volatility	0.17%
Risk-free premium	0.5%

Source: Authors' calculations.

The annual variation in Table 8 is used to calculate the aggregate volatility of this conservative portfolio and is calculated as the product of the matrix of weight standard deviations and correlation matrix transpositions. By way of comparison, a risk-free premium is presented in Table 8, which represents the yield of Czech government bonds with a maturity of ten years (risk-free premium = 0.5%). Such a long-term bond is chosen because the longest maturity of the loan is 8 years, and most of this maturity approximates the 10-year bond as a reference benchmark. Total volatility is counted as the square root of the annual variation – this figure shows the aggregate volatility in the composition of this investor P2P loan portfolio with Zonky. The yield with respect to the conservative nature corresponds and it is up to each investor which strategy they choose, which pays for the creation of all portfolios.

3.2 Diversification of portfolio for P2P investments

Portfolio diversification significantly reduces risk. In this case, it is in particular a credit risk. Credit risk (risk of default) greatly affects the overall return on the portfolio, and a significant reduction of this risk can be achieved by diversification. The calculation of the optimal amount of loans, following the diversification of portfolio of Zonky, which publishes the data, consists of the total amount of loans granted and invested over three months (due to higher stability of yields and payments). The data was mitigated by the expected loss (default rate). As the current default rate is significantly below expectations, the expected default rate was applied to ensure that this value was also valid in a period of economic slowdown and the associated deterioration in debtors' payment behaviours, see Table 9.

Table 9: Number of loans vs. portfolio diversification (in Czech koruna)

Investor	Number of investments	Average value of the investment	Total invested	Sum of interest income	Number of outstanding investments	Sum of outstanding principal amounts	Profit / Loss	Profitability in %
A	10	1,000	10,000	694	1	798	-104	-1.04
B	122	1,000	122,000	8,328	4	3,194.4	5,133	4.21
C	200	1,000	200,000	16,880	7	7,546	9,334	4.68
D	300	1,000	300,000	24,375	11	9,782	14,593	4.86

Source: Authors' calculations.

Table 9 clearly shows that an investor investing in a portfolio of ten loans in the case of one default credit generates a net loss. As the number of loans rises, risk is mitigated and yields in percentage and absolute numbers have a growing trend. The table also shows that, as the number of invested loans increases, the yield on the portfolio grows only slightly.

4 Stress test for the P2P loan investor's portfolio

To assess the investor's portfolio of P2P loans, it is necessary to reflect economic cycles. At a time of boom, in the presence of high-quality risk management there is no increase in default and delinquent loans, whereas in times of crisis, there are increases, because there is a positive correlation between GDP development and employment. Just growing employment generates the "spoiling" of the credit portfolios of banks and credit companies. Central banks, as regulators and macro-prudential policy-makers, conduct stress testing for banking market participants to identify risks. These tests are performed through pre-prepared model scenarios with exact variables. The outputs of these tests show the financial and capital stability of one financial institution or another at a time of economic downturn.[22]

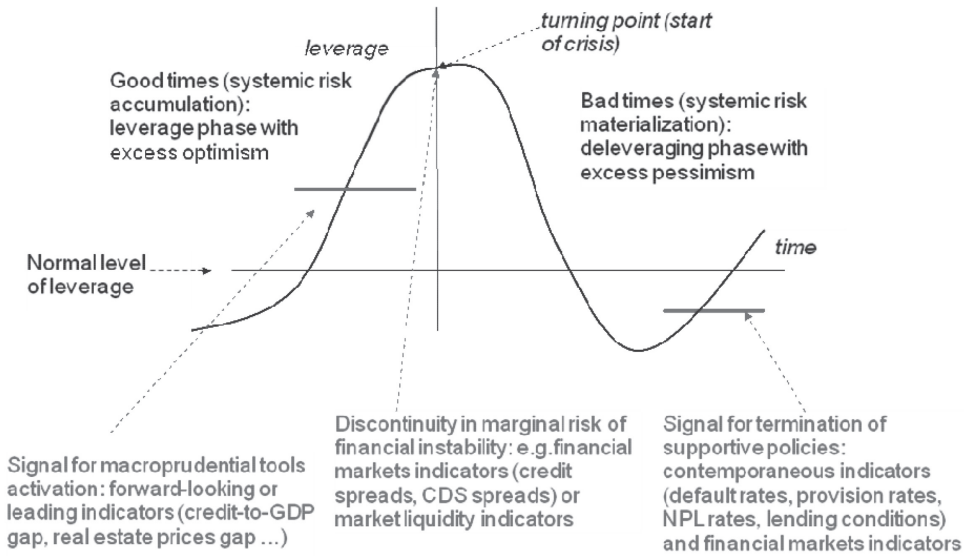
4.1 Credit risk and financial cycle in the economy

As mentioned, credit risk is the most important risk which an investor with exposure in P2P loans must take into account and understand. From the macroeconomic perspective, credit risk is an important factor in macro-prudential policy. Growth in volumes of loans in the economy, their valuation and other parameters are very important for this policy, which

22 BORIO, C. (2012)

aims to regulate the economy in its respective cycles. This paper deals with the current situation where the Czech economy is in the growth phase (GDP and export growing, consumption appetite of households growing and general positive sentiment in society), and all of this contributes to the misconception that this growth will be endless. But the economy moves in cycles which take turns, and the gradients should be the smallest. The regulator in the Czech Republic, i.e. the CNB, and its macro-prudential policy intervenes precisely at this time of upturn because they are aware of the risk, and the investor should do the same. They should count on deterioration in today's portfolio and not be subject to the illusion that the current level of delinquency and default will continue to be the same or similar in the future.

Figure 1: Financial cycle in the economy



Source: Data taken from[23].

Figure 1 shows the financial cycle in the economy and the steps that macro-prudential policies must take to mitigate pro-cyclicality. From an investor's point of view, it is interesting to note that in good times, as currently, credit risks accumulate (illustrated under the generic title "systemic risks," which are distributed through transmission and other channels to the entire financial sector). Investments are beginning to deteriorate in times of boom, and in times of economic downturn there is so-called materialisation, which for the investor means that the loans created in good times manifest in the form of higher delinquencies and especially defaults. The investor, in their expectations of future earnings forecasts, should respect this and count on a much worse prognosis of the return on loans in the portfolio. The investor should execute the so-called stress test of the portfolio, i.e. what the yield will be in a certain simulated situation that may occur in the future.

23 FRAIT, J., A. GERSL and J. SEIDLER (2011)

4.2 A single-factor model of the stress test for the P2P loan portfolio

The last financial crisis from 2008–2013 is used as the default variable. This period covers the stage of the rise (accumulation) and materialisation of credit risk in the Czech Republic. The main indicator is the share of consumer credits with default of the total volume of consumer credits. This model is applied to the P2P loan portfolio of Zonky because of the disposition of the input data that are used because of the already calculated risk costs containing the risk management premium. There is no provider of P2P loans in the Czech Republic that would get close to Zonky with the risk. As mentioned above, similar companies only act as intermediaries and not as serious P2Ps that emphasise the quality of the loan portfolio.

Model assumptions:

- Breakdown of credits into ratings by quality
- Quantified risk costs
- Fixed fees for the investor for each rating
- Share of consumer credits with default

Table 10: Current and Expected Risk of P2P Zonky Loans adjusted by new fees in %

Rating	Interest	Expected risk	Currently estimated risk	Expected gross revenue	Currently estimated gross revenue	Expected net income (original charges)	Estimated net income (new charges)	Difference
A**	3.99	0.49	0.10	3.50	3.89	2.52	3.69	1.19
A*	4.99	0.59	0.15	4.40	4.84	3.40	4.34	0.94
A++	5.99	0.79	0.32	5.20	5.67	4.20	4.67	0.47
A+	8.49	1.69	0.68	6.80	7.81	5.80	5.31	-0.49
A	10.99	2.59	1.55	8.40	9.44	7.40	6.44	-0.96
B	13.49	3.59	1.08	9.90	12.41	8.90	8.91	0.01
C	15.49	4.59	4.13	10.90	11.36	9.90	7.36	-2.54
D	19.99	7.10	5.96	12.89	14.03	11.89	9.03	-2.86

Source: Authors' calculations.

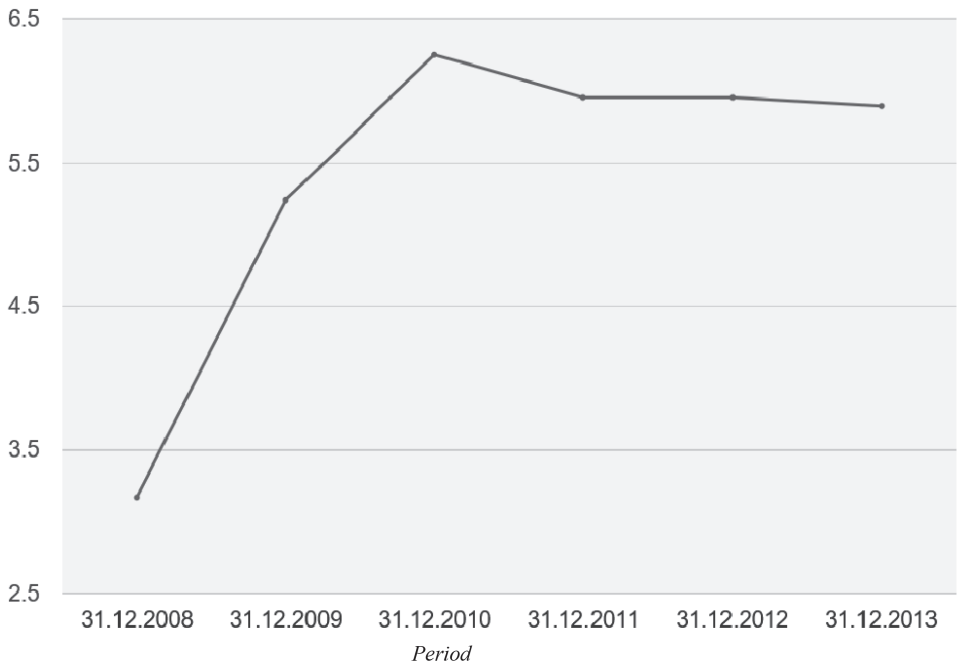
Table 10 shows that the currently estimated risk is significantly better than the expected risk. This estimate is the estimated risk from Zonky (their estimate was not the current state because it is more conservative). Multipliers are arbitrarily chosen to progress from A** to D so that the arithmetic average of the risk rises as the defaults have risen in 2008–2013 (so on average × 1.9). In addition, Table 10 shows a change in the fee policy for investors.

At present, the fee is fixed at 1% of the invested amount. Since 1 September 2017, there are changes for new loans. According to Table 10, the best ratings are favoured, i.e. from A** – A++. This decision is good for investors who are more conservative and have a similarly built portfolio.

The benefits of reducing this rating are twofold:

- At a time of economic growth, a higher yield pillar for investors is emerging.
- At a time of economic downturn, the pillow again comes in the form of lower costs.

Figure 2: Share of consumer credits with default 31 December 2008 – 31 December 2013



Source: Data from[24].

Figure 2 covers the entire period of crisis that began with the fall of Lehman Brothers in September 2008. In Europe, through capital and other mechanisms, it came in 2009 in the form of a debt and banking crisis. For the application of the single-factor model of stress test for the investor portfolio in Zonky, the figure for 31 December 2008, when the default value of consumer loans with default was around 3.12%[25] was used. The final value of this indicator was used as of 31 December 2013, when the share of consumer credits with default was around 5.89%. These values are needed to calculate the so-called total crisis coefficient, which is calculated as the share of these two data (5.89/3.17) and is 1.9%.

24 CZECH NATIONAL BANK (2017a)

25 Note: According to the UK P2P loan provider Zopa, the highest default rate was recorded in 2008 (at the time of the financial crisis) when it reached 4.21%. Source: ZOPA (2017).

This overall crisis rate indicates an increase in loan default in the portfolio. This figure is important for the quantification of net income if a similar crisis occurred in the Czech Republic as in 2008–2013.

Table 11: Application of the single-factor model of stress tests on three model portfolios of Zonky P2P loans in %

Rating	Weights for a conservative portfolio	Weights for a balanced portfolio	Weights for a dynamic portfolio	Crisis coefficient	Crisis net income
A**	24	1	0	0.56	3.2
A*	30	3	2	0.76	3.7
A++	30	17	13	1.13	3.9
A+	10	20	15	2.65	3.3
A	4	25	20	4.44	3.6
B	2	20	25	6.66	3.3
C	0	12	20	9.17	2.3
D	0	2	5	15.20	-0.2
Impact against original expectations	0.62	-0.58	-0.83		
Impact against estimate	0.06	-1.72	-2.04		
Impact of re-investment	-0.01	-0.02	-0.02		
Expected revenue	4.54	6.46	6.91		
Estimated revenue during the crisis of 2008–2013	**3.58**	**3.28**	**3.05**		

Source: Authors' calculations.

Table 11 shows that a change in the fee policy for investors has a positive impact on the portfolio of the investor investing in conservative portfolios, where the majority weights are the best ratings, while investors looking for risky loans have a relatively large yield drop. This model also reflects the impact of re-investments, as there are investors who invest their incoming instalments again in order to maintain and, if possible, increase the interest income. The impact of these re-investments is estimated based on the reference rate of 1.7%, which is the average amount that returns to the investor within the repayment per month. This is, of course, only the reference rate on which it was based, since the return of the annuity payment is individual and depends on the total volume of the invested amount, the structure of the portfolio in terms of the maturity of the loans,

and early repayments, which also play a significant role. In this case, the model shows that the impact of re-investments is slightly negative. From the investor decision-making point of view, the decision between choosing a balanced or dynamic portfolio is irrelevant in this case, since the difference in the return on balanced and dynamic portfolios is only 0.45 percentage points. The final outcome of this single-factor stress test model is estimated yields for the crisis years 2008–2013 when applied to three model portfolios. The results of this model show that the investor investing funds in a conservative portfolio containing the above-mentioned rating weights has the highest yield even with the rise of default credits, i.e. 3.58%. Overall, the difference between these three portfolios is not very significant, given that the crisis of 2008–2013 did not hit the banking sector hard: from 2008 to 2013, default bank loans have almost doubled, which is an annualised rate of growth (CAGR) of 13.19%. In addition, the return came as a result of high-quality risk management, where current credit models can be expected to reflect and include a "crisis surcharge" in their calculations.

It would be best to track the development of defaults over time according to the portfolio's maturity and to calculate the real percentage of loans in the bundle of all Zonky loans with conversion to the weights of the portfolio, but that would be a more demanding process, while this is a "good enough" one. The results of a careful calculation should vary by approximately ± 1% (a 33% scattering), but that is not currently interesting for us.

Another way of calculating the estimated return for the crisis in 2008–2013 would be through the time evolution of defaults according to portfolio maturity and calculation according to the real representation of loans of all Zonky loans with the calculation of portfolio weights. The result of this calculation would vary by ± 1%, which is approximately a 33% scattering.

Conclusions

The goal of the paper was to evaluate the profitability of a given investor strategy that allocates its finances to Zonky P2P loans by the modified Markowitz portfolio model and to evaluate the investment in structured P2P certificates to determine whether an investment by a chosen strategy can be profitable.

The profitability of investors investing funds into individual loans at Zonky is demonstrated by:

- The applied model of the modified Markowitz portfolio which showed decent returns while maintaining conservative investment.
- The current Zonky charging policy, which may change prospectively.

The paper concludes that the concept of P2P loans has a perspective. It is conditioned by the low interest banks apply to citizens' deposits and the reluctance of banks to lower interest rates on credit cards and consumer and overdraft loans. The fact is that the sale of loans on the secondary market is very disadvantageous for the investor, because a fixed

fee must be paid and the future yield on interest are lost: it is better to sell medium-term loans. The investor must account for credit risk in today's portfolio (at a time of boom) and account for the deterioration of the degree of delinquency and default.

The investment in the structured P2P Loan Certificate from SymCredit could not be assessed in this paper due to the lack of information about the basic parameters and due to the absolute distinction of individual foreign P2P platforms. In the Czech Republic, there is no P2P loans provider which would approach the risk level of Zonky. As mentioned above, similar companies only act as intermediaries and not as serious P2Ps that emphasise the quality of the loan portfolio.

A single-factor model of the stress test on the P2P loans portfolio showed that the impact of re-investments is slightly negative. From the point of view of investor decision-making, the decision between choosing a balanced or dynamic portfolio is in this case irrelevant, because the difference in the return on balanced and dynamic portfolios is only 0.45 percentage points. It can be assumed that current credit models reflect and include in their calculations a "crisis surcharge".

The result of the single-factor stress test is the estimated return as in the years of crisis 2008–2013, which shows that an investor investing funds in a conservative portfolio containing the above-mentioned rating weights has the highest yield even with the rise in default credits, i.e. 3.58%.

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