What Drives the Interest Rates in the P2P Consumer Lending Market? Empirical Evidence from Switzerland

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ABSTRACT:

Traditionally, the lending of money in a bank-based financial system is controlled by banks. The rise of online Peer-to-Peer (P2P) lending markets that unite non-institutional borrowers and lenders is challenging the classical bank loan. By using a unique data set on loan contracts between borrowers and investors from Switzerland, we analyze the determinants of the P2P consumer loan interest rates – a research question that has not yet been analyzed empirically. In addition to the loan-specific and macroeconomic factors that significantly affect the interest rates, we also find some discrimination by the lenders. Furthermore, our results reveal that borrower-specific factors such as its economic status significantly influence lender evaluations of the borrower's credit risk and thus the interest rates, especially as the market for P2P consumer loans matures.

Key Words: Peer-to-peer lending (p2p lending); crowdfunding, crowdlending, marketplace lending

JEL Classification: G21, J16, J71

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1. Introduction

In Peer-to-Peer (p2p) consumer lending, individuals post their borrowing needs and personal profiles on a p2p lending platform. Other individual and institutional investors can view and fund consumer loans directly through the platform. Investors can thus diversify their asset allocation with an additional fixed income instrument and have access to consumer loans without having to go through the asset-backed security market. Furthermore, p2p lending also opens the above-mentioned asset class to smaller investors. Therefore, p2p lending is a disintermediation of consumer finance using a crowdfunding platform as a marketplace. This model shows potential to significantly disrupt consumer finance.

P2p financing activities exhibit high growth numbers – volumes have more than quadrupled across Europe between 2012 to 2014 (Wardrop et al., 2015), but are still low compared to traditional financing schemes. In the US, p2p unsecured consumer loan issuance in 2014 was estimated at $7 billion, 7 times more than two years earlier according to research by Morgan Stanley (2015). If the industry maintains such growth rates, traditional lenders might experience a negative impact on their margins.

Online p2p lending, also referred to as crowdlending, loan based crowdfunding, or social lending can be separated into consumer and business lending. The development of the market, such as an increased involvement of institutional investors, especially in the US, has led to a broader use of the term marketplace lending. In this paper, we focus on the Swiss p2p consumer lending market.

The issue of credit costs plays a key role for households since high borrowing costs act as a credit constraint to some households. Higher cost of credit and thus higher costs of servicing

debt may also negatively impact the overall economic activity as the number of borrowers unable to repay loans increases.

Since the inception of the first p2p lending platform Zopa in 2005 (Bachmann et al. 2011), an increasing amount of academic contributions have been published in recent years (Moritz & Block, 2014 provide a literature review) even though online p2p lending is a relatively young field of research. On the other hand, in contrast to the US or UK markets, there has been no empirical research yet which can be related to the Swiss p2p lending market.

This paper focuses on p2p consumer loans and investigates the determinants of the loan rates. In particular, we examine the extent to which differences in loan rates are a function of (1) loan-specific, (2) borrower-specific and (3) macroeconomic factors.

We were able to obtain the (internal and confidential) data from the most relevant Swiss p2p platform *Cashare*. By utilizing this unique and large data set on loan contracts, we are able to analyze the determinants of the loan rates in the Swiss p2p market from 2008 to 2014. In order to make the p2p loan interest rates comparable, we focus on data for consumer loans.

Our analysis of the lending rates differs in several important ways from previous studies. First, our data set from the Swiss market is unique as the relevant loan rates are not publicly available and to the best of our knowledge, no previous study has analyzed the Swiss p2p lending market. Second, data from Switzerland offers an advantageous and interesting environment in which these issues can be analyzed. Switzerland has a bank-based financial system while most research focuses on p2p markets of market-based financial systems, for example, in England and the United States. In bank-based systems, banks play a leading role in allocating capital, overseeing the investment decisions of corporate managers, and providing risk management. In such markets, the determinants of the interest rates might be different from those

of market-based financial systems. Furthermore, the volume in the p2p lending market has increased exponentially in the past year. While the market volume was only CHF 100,000 in 2008, loans for CHF 3.5 million have been granted in 2014, up from CHF 800'000 in 2012 (Dietrich & Amrein, 2015). Third and most important, interest rates in the Swiss p2p lending market are still determined through an auctioning process. This allows us to analyze the lending behaviors of investors with respect to their subjective risk-return tradeoff. Lastly, we investigate the role of additional borrower-specific information which has not been considered before. In particular, we analyze whether factors such as living arrangements, marital status, and the number of children also affect the risk premium. The information related to these factors is public for the investors on the platform.

The remainder of this paper is structured as follows: Section 2 provides a survey of the relevant academic literature; Section 3 contains a presentation of the basic model and the determinants of the p2p interest rates; Section 4 describes the data and methodology used to test our hypotheses; Section 5 presents the results from our empirical analysis; and Section 6 provides a summary and conclusions.

2. Related Literature

The availability of comprehensive data from online p2p consumer lending platforms like *Prosper* and *Lending Club* has enabled a wide range of empirical research. Many have focused on factors affecting default rates and funding success (Emekter et al., 2015). Some other papers focused on the herding behavior (Zhang and Liu, 2012; Lee and Lee, 2012; Herzenstein et al., 2011), home bias (Lin and Viswanathan, 2014), trust (Duarte et al., 2012; Greiner and Wang, 2010), gender (Pope and Sydnor, 2011; Barasinska and Schäfer, 2014) and social networks

(Freemdan and Jin 2014). Agrawal et. al (2013) provide an economic interpretation of how transaction costs, reputation, and market design can explain the growth of crowdfunding.

An emerging issue is the interest rate setting mechanism of online p2p loans. There are currently two main regimes prevailing to determine the interest rate a borrower from a p2p lending platform has to pay: the reverse auction process and the posted prices. The reverse auction system, that works similar to the bond auctions where supply and demand determine interest rate, was widespread during the initial years of p2p lending. A potential borrower had to post his/her loan application on the platform and investors bid their investment amount with a corresponding minimal interest rate during the auction period. The Swiss p2p lending platform *Cashare*, the platform that has provided us with data for this paper, has been applying this auction procedure since its launch in 2008. Major players in the biggest p2p lending markets in the US and UK meanwhile apply the posted price process. In these models, the platform sets the interest rate for each loan listing based on the information available on the borrower. This simplifies and usually also shortens the process for borrowers and lenders. *Prosper*, the first p2p lending platform in the US changed from the reverse auction regime to the posted-price regime in 2010, not long after their competitor *Lending Club* surpassed them in market share (Chen et al., 2014).

A theoretical analysis by Chen et. al (2014) concludes that reverse auction process, in contrast to posted prices (where the platform sets the interest rate for each borrower), fails to provide the cheapest outcome to the borrower. However, this theoretical model was contradicted by empirical evidence from the regime change of the p2p platform *Prosper* in December 2010 (Wei & Lin, 2015). They argue that the "wisdom of the crowd", as practiced in open auctions, may "allocate resources in a more socially desirable fashion".

So far and to the best of our knowledge, there is no recent paper specifically analyzing the determinants of the interest rates for p2p lending. This might be due to the fact that the majority of the big platforms which are publishing their data are using the posted-price regime and therefore setting the interest rates themselves. Additionally, for many platforms, loan and borrower-specific data is not publicly available. This paper addresses this issue and analyzes the drivers of the loan rates for p2p consumer loans. We analyze the determinants of p2p loan interest rates based on a unique dataset of all 665 p2p consumer loans granted by this platform with detailed single transaction information. The p2p consumer loans are for borrowers located only in Switzerland. Our study thus also bridges a gap in the literature as no study has yet analyzed p2p interest rate determinants in Switzerland. We further divide interest rate drivers into loan-specific, borrower-specific, and macroeconomic characteristics and determinants. The empirical research provided in this paper should thus make a valuable contribution to the literature on the p2p consumer loan market and especially to the determinants of p2p loan rates.

3. Determinants of the Interest Rate

This section describes both, the dependent and the independent variables that we selected for our analysis of the p2p loan rates. Table 1 provides a summary of the variables as described below. As to our independent variables, this study focuses on three broad components to explain the interest rates of p2p consumer loans: the (i) loan-specific information, (ii) borrower-specific information and (iii) macroeconomic view.

The (i) loan-specific view analyzes elements such as loan volume and the loan period by investigating the effects of these elements on the interest rate for p2p consumer loans (see, e.g. Dietrich, 2012). The (ii) borrower-specific factors focus on aspects that affect a borrower's credit rating. In general, p2p lending is a classical principal-agent setting and faces the fundamental

economic problem of information asymmetry. Asymmetric information arises because borrowers are better informed of their ability and willingness to repay than lenders. Leland and Pyle (1977) and Campbell and Kracaw (1980) suggest that informational asymmetries are a primary reason to explain the existence of financial institutions. In p2p lending, it is not easy for an individual lender, usually not an expert in analyzing and dealing with risks, to distinguish borrowers with a high probability of default from solvent ones. Furthermore, in the p2p consumer loan market there are no screening and signaling devices such as collateral and personal guarantees to distinguish the ex-ante riskiness of the borrower (Serrano-Cinca et al., 2015). Individual lenders are thus at a disadvantage and p2p lending is a risky activity for them. This information asymmetry could lead to adverse selection. In order to mitigate adverse selection, borrowers need quality information to adjust the interest rate they ask from the borrower, according to his risk profile. The p2p lending sites thus provide potential lenders with detailed information about borrowers and their loan purpose.

On the other side, the increasing popularity of p2p lending might be explained by the existence of transactions costs (Serrano-Cinca et al., 2015). P2p lending might lower intermediation costs. Since the collection of deposits is bypassed, it is not subject to bank capital requirements and not overseen by bank regulators so far. According to Maudos and De Guevara (2004) operating costs are one of the most important factor in explaining bank interest rates and margins. Or as Demirgüç-Kunt and Huizinga (1999) formulate it, "banks pass on their operating costs to their depositors and lenders". The lower intermediation costs in the p2p lending might be transferred to clients in the form of lower interest rates for borrowers and higher revenues for lenders, compared to conventional financial institutions. In contrast to bank interest rates, operating costs are thus not a relevant driver of the interest rates for p2p consumer loans.

Therefore, in our model we focus on variables that affect a borrower's credit rating such as the debt-to-income ratio, and additionally also consider rather subjective factors such as nationality and gender that were found to play a role in the decision-making process of the lender (Pope and Sydnor, 2011).

The (iii) macroeconomic view perceives interest rates being driven by monetary policy changes and by economic cycles. An increase in the risk-free rate increases the interest rate on newly agreed loans. In addition, changes in business cycles, as measured by GDP growth or by the unemployment rate, may affect lending rates as the creditworthiness of borrowers varies over the business cycles (Bernanke and Gertler 1995; Kiyotaki and Moore 1997). We take this into account by including the seasonally adjusted unemployment rate, which according to Okun's law is strongly related to GDP (Okun, 1962). Furthermore, the labor market is highly relevant, given that we analyze consumer credits, which are not covered by collateral and thus depend on earned income.

3.1. Dependent Variable

Our dependent variable is the average interest rate paid by each borrower. It is set using reverse-auction mechanism by investors as described above. From an academic perspective, the reverse-auction regime is far more appealing than the posted-price regime, as it allows us to study the loan pricing behavior of the "crowd". On account of the wide range of variables from the dataset, we will be able to better understand key factors that play a role in lender's investment decisions, and whether the development and drivers of the p2p lending market have changed over time.

3.2. Independent Variables

This section describes the independent variables in our model. As Table 1 shows, we categorize these variables as (i) loan-specific factors, (ii) borrower-specific variables and (iii) macroeconomic factors.

Our loan-specific factors consist of three variables. First, we investigate the relationship between loan volume (*loanamount*) and interest rate. As a risk-minimizing mechanism, many lenders bid small amounts on individual loans instead of placing one large bid with one borrower. We would thus expect that the larger the amount requested by the borrower, the higher the number of lenders needed to fund the auction completely. However, by law in Switzerland, a maximum of 20 persons are allowed to bid for one loan.[3] As a result, the larger the amount requested by a borrower, the higher an average bid per borrower, and thus, higher the perceived risk of the retail investors to lose money. Therefore, we expect a positive relationship between loan volume and interest rate.

Along with the conventional assumption of a normal yield curve, the loan period (*duration*) of a loan is expected to be positively correlated to the interest rate. The third loan-specific variable implies simple supply and demand assumptions. *Nrauctions90d* is a variable that reflects the loan demand as measured by the number of loan-auctions conducted in the 90 days before the loan is granted. We expect that loans auctioned during times of higher loan demand pay a higher interest rate.

Furthermore, we test nine different borrower-specific variables. First, we analyze whether the debt-to-income ratio (*debtincome*), calculated as a borrower's monthly installment arising from the loan he seeks in relation to his gross monthly income, has an influence on the interest

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[3]Art. 6, Bundesgesetz über die Banken und Sparkassen (BankG).

rate. This value indicates the resilience of a borrower towards unexpected expenses. Since consumers seek unsecured loans through p2p platforms, we can expect that the consumer's current income is positively associated with his or her ability to pay back the loan (see, e.g. Edelberg 2006). A higher ratio is expected to negatively affect the creditworthiness of the borrower.

Additionally, we include dummy variables to control for gender (*dfemale*), nationality (*dswiss*), home ownership (*homeowner*), children (*children3plus*), and living arrangements. We have no expectations regarding the gender variable, even though Alesina et al. (2013) found evidence that women in Italy pay more for credit than men. However, we expect that the presence of children, which may indicate lower ability to pay, increases the interest rate. We use a dummy variable for a household with three or more children. Additionally, we expect homeownership to be an indicator of higher net-worth, and thus, to be inversely related to the external finance premium as stated in Bernanke et. al (1999). Similar assumptions can be drawn for borrowers living with their spouse or with an unmarried partner, as opposed to living in a shared flat or being a single parent. Swiss borrowers are also expected to pay a lower interest rate than borrowers of other nationalities. However, this might solely be based on a subjective prejudice from a lenders perspective. These so-called statistical discrimination models have been discussed in relationship with the labor market in Phelps (1972) and Arrow (1973), and empirically for the p2p credit market in Ravina (2012) as well as Pope and Sydnor (2011).

Since our dataset is spread over seven years, we control for changes in the macroeconomic environment. Including the seasonally adjusted unemployment rate (*unemployment*) allows us to control for business cycle effects. According to the empirical results of Keeton and Morris (1988), and Sinkey and Greenawalt (1991), we assume that the

	Variable	Description	Expected Sign
Dependent variable			
	interest	Average interest rate on loan (%)	
Independent variables			
Loan-specific variables	loanamount	Loan amount (in thousand CHF)	+
	duration	Term of the loan (in months)	+
	nrauctions90d	Number of other loans for auction in the last 90 days of auction period	+
Borrower-specific variables	debtincome	Recurring monthly debt divided by gross monthly income (%)	+
	dfemale	Dummy: female borrower	=
	dswiss	Dummy: Swiss borrower	-
	homeowner	Dummy: Homeowner	-
	livingarrangement:*		
	sharedflat	Dummy: Living in a shared flat	+
	singleparent	Dummy: Single Parent	+
	spouse	Dummy: Living with Spouse	-
	unmarriedpartner	Dummy: Living with unmarried partner	-
	children3plus	Dummy: Borrower with 3 or more children	+
Macro-economic variables	unemployment	Swiss unemployment rate (seasonally adjusted) at time of auction (%)	+
	govbond3y	3 year Swiss Government Bond yield	+
	SMI	3 month SMI performance (%)	-
* as opposed to living alone			

Table 1   Definition of Variables and Expected Sign

average probability of a loan default of is highly correlated with the overall economic situation, and thus the unemployment rate affects the creditworthiness of borrowers as represented in interest rates. As a result, we expect this variable to be positively correlated with the loan rates. The coefficient of the government bond yield (*govbond3y*) as a measure for the risk-free interest rate is also expected to show a positive sign. We chose the 3-year yield to match the maturity of the majority of loans in the dataset. The average credit period of a p2p loan in Switzerland is 32 months (see Table 2). Since expectations about the future matter for investment decisions, we included the three month performance of the Swiss Market Index (*SMI*) as a gauge for the

investors' sentiment. Otoo (1999) states that people use movements in equity prices as a leading indicator. We thus infer that rising stock prices lower the risk premium asked by the loan investors.

4. Data and Methodology

All of our unique loan-specific and borrower-specific data stem from *Cashare*, the biggest player in the Swiss p2p lending market with a market share of nearly 98%. Therefore, our sample can be considered as representative for the whole p2p lending market in Switzerland. The sample for this dataset consists of information on 665 loans for private individuals granted between April 7, 2008 and December 31, 2014 with the data being collected during spring 2015. Data for the monthly unemployment rate and the Swiss government bond rate are taken from the Swiss National Bank on a monthly basis, while data for the SMI on a daily basis is taken from the SIX Swiss Exchange.

In a first step, we present a set of descriptive statistics in order to explore basic relationships in our data. We then split the sample into a high (above median) and a low group (below median) based on the median of each explanatory variable, i.e., one group including observations below the median, and another group including observations that are above the median respectively. We then calculate the average interest rate for high and low groups and construct a t-test for the differences in means between the two groups. We thus analyze whether the interest rates between the two subsamples differ from each other. To the extent that differences in the means are statistically significant, these tests provide univariate evidence regarding which interest rate determinants matter. We carry out this analysis for our full sample, and then separately for our two subsamples of data for years leading up to 2012, and from year 2013 onwards.

The subsamples are defined this way based on two reasons. First, the market for p2p consumer loans has matured over time which is reflected in the higher volume and number of loans auctioned. Second, macroeconomic factors such as interest rates and unemployment had stabilized. With this reduced volatility, we expect a shift in the investors focus for determining their expected gross return, i.e., putting more focus on loan and borrower-specific factors.

In a second step, we assess the impact of the various factors on the interest rate in the p2p consumer loan market by estimating linear regressions as given by (1):

$$\text{Rate}_{it} = \alpha + \beta \times \text{Loan}_i + \gamma \times \text{Borrower}_i + \delta \times \text{Macro}_t + \varepsilon_{it} \tag{1}$$

Rate is the interest rate for loan *i* auctioned at time *t*; *Loan* is a vector of loan-specific variables for loan *i* as listed in Table 1. *Borrower* is a vector of the borrower-specific variables of loan *i*. *Macro* is a vector of macroeconomic variables at the time *t*. ε is an i.i.d error term; and α, β, γ, and δ are vectors of parameters to be estimated.

We use OLS regression with robust standard errors to estimate the coefficients in our model. To test for robustness of the coefficients, we estimate the model separately for the three explanatory variable categories using the full sample, as well as, for the period before and after end of 2012. In an additional step we also control for year and month of the loan auction to check whether there exists a time trend that is not accounted for.

5. Results

5.1. Descriptive Statistics and Univariate Results

Descriptive statistics for our full sample are shown in Table 2. The interest rate is, on average, 980 basis points, whereas the median is 970 basis points, indicating that the distribution

is not significantly skewed. The minimum interest rate is 190 basis points and the maximum is 1500 basis points, as it is capped at 15% by the Federal Act on Consumer Credit.[4] To compare: The weighted average interest rate for personal loans of the leading Swiss provider of consumer loans, Cembra Money Bank, was 11.33% in 2014 (Cembra Money Bank, 2015). The average loan amount in our sample is 12,170 CHF. The difference between the mean and median (9,250 CHF) points to the fact that there exist some differences related to the volume of granted loans (this difference can also be seen in the considerable standard deviation). The average loan term is 32 months. On average, 31.2 auctions were active during the three-month period before a loan was issued, with a maximum of 64 auctions. As to our borrower-specific variables: 25% of the borrowers are female, 71% have a Swiss passport, and 21% of the borrowers are homeowners. Regarding the living arrangements, 37% of the borrowers in our sample live with their spouse, while 21% live in a shared flat, 31% live alone, 8% live with an unmarried partner, and 2% are single parents. Only 3% of the borrowers have three or more children.

	Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent	interest	665	9.80	2.63	1.90	15.00
Loan	loanamount	665	12'171	11'995	200	149'610
	duration	665	32.14	7.56	4.00	60.00
	nrauctions90d	665	31.20	15.82	0.00	64.00
Borrower	debtincome	665	7.37	6.28	0.14	57.24
	dfemale	665	0.25	0.43	0.00	1.00
	dswiss	665	0.71	0.45	0.00	1.00
	homeowner	665	0.21	0.41	0.00	1.00
	livingarrangement					
	sharedflat	665	0.21	0.41	0.00	1.00
	singleparent	665	0.02	0.14	0.00	1.00
	spouse	665	0.37	0.48	0.00	1.00
	unmarriedpartner	665	0.08	0.27	0.00	1.00
	children3plus	665	0.03	0.16	0.00	1.00
Macro	unemployment	665	3.23	0.35	2.49	4.13
	govbond3y	665	0.33	0.54	-0.36	2.75
	SMI	665	1.98	5.85	-26.98	18.44

Table 2   Descriptive Statistics - Full Sample

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[4] Art. 1, Verordnung zum Konsumkreditgesetz (VKKG).

Among the macroeconomic explanatory variables, between 2008 and 2014, the average seasonally adjusted Swiss unemployment rate was 3.23%, the average 3-year government bond rate was 0.33% and the average three-month return of the SMI was 1.98%.

The descriptive statistics for the two subsamples from 2008-2012 and from 2013-2014 are shown in Table 3. As can be seen in this table, the mean interest rate was 1100 basis points in 2008-2012, but significantly decreased thereafter by 255 basis points to 845 basis points. At the same time, the risk free interest rate dropped, on average, by 69 basis points. The average loan issued before 2013 has to be paid back after 31 months, and 33.5 months if issued thereafter. The average number of auctions in the 90-day window before a loan is issued almost doubled to 40.5. Interestingly, the debt-to-income ratio increased from 5.9% to 9.0%. The share of female borrowers decreased from 28% to 20%, whereas Swiss nationals account for 8 percentage points less in the last two years of the sample. Additionally, there are significantly more homeowners seeking a loan in 2013-2014, rising from 16% to 27%.

	Variable	2008-2012			2013-2014			+/-
		Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean
Dependent	interest	352	11.00	2.62	313	8.45	1.89	-2.55
Loan	loanamount	352	8'802	8'760	313	15'960	13'881	7'158
	term	352	30.95	8.18	313	33.47	6.55	2.51
	nrauctions90d	352	22.89	12.58	313	40.54	13.74	17.65
Borrower	debtincome	352	5.89	0.06	313	9.03	0.06	3.14
	dfemale	352	0.28	0.45	313	0.20	0.40	-0.08
	dswiss	352	0.75	0.43	313	0.67	0.47	-0.09
	homeowner	352	0.16	0.37	313	0.27	0.44	0.11
	livingarrangement							
	sharedflat	352	0.26	0.44	313	0.16	0.37	-0.10
	singleparent	352	0.02	0.15	313	0.02	0.13	-0.01
	spouse	352	0.31	0.46	313	0.45	0.50	0.14
	unmarriedpartner	352	0.07	0.26	313	0.09	0.29	0.02
	children3plus	352	0.03	0.16	313	0.03	0.17	0.00
Macro	unemployment	352	3.29	0.47	313	3.16	0.03	-0.13
	govbond3y	352	0.65	0.57	313	-0.04	0.06	-0.69
	SMI	352	1.09	7.21	313	2.98	3.52	1.89

Table 3   Descriptive Statistics - Sub-Samples

The unemployment rate was lower in 2013-2014 (3.16%) than 2008-2012 (3.29%) while the monthly performance of the Swiss Market Index (SMI) was more positive in 2013-2014 (2.98%) than in the years before (1.09%).

In a further step, we split up the sample into two groups, based on the median of each of the explanatory variables, i.e., with one group including observations below the median and another group including observations that are above the median, respectively, of the relevant explanatory variable. In case the explanatory variable is a dummy, we define the groups depending on the value of the dummy variable, i.e. No (dummy=0) and Yes (dummy=1). Table 4 presents the results for the interest rate based on this univariate statistics.

We find that many variables included in our sample are statistically highly significant based on univariate statistics. Of the loan-specific factors, interest rates for longer durations are 993 basis points, but only 941 basis points for loans with a shorter credit period. Furthermore, based on this univariate analysis interest rates are significantly lower for larger loans amounts, indicating a better risk profile of borrowers who seek larger loans.

Of the borrower-specific factors, Swiss passport holders pay significantly lower interest rates (9.63%) than foreigners living in Switzerland (10.23%). Also we find that interest rates are significantly higher when the borrower is female and lower when the borrower owns a house.

Among the macroeconomic explanatory variables, we find that the unemployment rate has a strong influence on the interest rates with a t-value of 15.02. As expected, p2p consumer loan rates are much lower when government bonds are less attractive for investors. While the average interest rate for p2p consumer loans is 8.47% during times of a lower 3-year government

bond yields, it is 11.11% when government bond yields are above the median. This 265 basis-point difference is highly significant with a *t*-statistic of 8.64.

	(1) Variable	(2) Low (0)	(3) High (1)	(4) Difference	(5) t-statistic	
Loan	loanamount	10.01	9.59	-0.42	-2.06	**
	duration	9.41	9.93	-0.52	-2.04	**
	nrauctions90d	9.69	9.91	0.22	1.06	
Borrower	dti	10.03	9.57	-0.46	-2.26	**
	dfemale	9.70	10.10	0.40	1.71	**
	dswiss	10.23	9.63	-0.60	-2.67	***
	homeowner	10.04	8.89	-1.16	-5.50	***
	livingarrangements					
	alone	9.89	9.60	-0.30	-1.36	*
	sharedflat	9.75	9.99	0.24	0.93	
	singleparent	9.77	11.20	1.43	1.69	*
	spouse	9.81	9.79	-0.02	-0.08	
	unmarriedpartner	9.80	9.79	-0.01	-0.01	
	children3plus	9.79	10.08	0.29	0.52	
Macro	unemployment	8.95	10.61	1.66	8.64	***
	govbond3y	8.47	11.11	2.65	15.02	***
	SMI	9.86	9.74	-0.13	-0.62	

Table 4   Univariate Test: Interest Rate - Full Sample

The same analysis is also performed for the two subsamples, 2008-2012 and 2013-2014. It indicates a shift of the main influencing factors from macroeconomic variables in the first subsample, towards borrower-specific variables in the last two years of the observed period. The results are shown in Table 6 in the Appendix. Columns (4) and (8) indicate much larger differences in the interest rate due to macroeconomic variables in the subsample up to 2012, while the difference in the interest rate stemming from loan-specific variables are substantially larger for the years after.

5.2. Regression analysis

Table 5 reports the regression results. We present four columns of results based upon the (1) loan-specific variables only; (2) borrower-specific variables only; (3) macroeconomic variables only; and (4) all the variables of the model. This enables us to evaluate the relative

explanatory power of the loan-specific variables as well as of the borrower and the macroeconomic variables.

Our full model explains 54% of the variation in the interest rate of Swiss p2p consumer loans with only two coefficients (female and single parents) as not significant. However, the explanatory power varies largely across our three categories of independent variables. Macroeconomic variables (3) explain most of the variation of our dependent variable. The adjusted R-squared amounts to 44.4%. Furthermore, we are able to explain 4.2% of the interest rate variation by using the borrower-specific variables only.

The explanatory power of the three loan-specific variables is only 4%, but produces statistically as well as economically significant results when included in the full regression model. This finding indicates a significant variation in the credit quality of the borrowers, such that, only after controlling for those factors, the duration and amount of a loan matters for the interest rate.

Based on the full model (column 4), the three loan-specific variables all show the expected signs when included in the full regression model. Increasing the loan amount by CHF 10'000 leads to an expected interest rate increase of 35 basis points, compensating for the reduced diversification effect, i.e. higher notional default risk for a single investor.[5] A similar rate increase (37 basis points) is expected for loans that are auctioned during periods when the demand for loans in the past three months has been twice the average of 31. The duration of the loan is estimated to affect the interest rate positively, with its results being consistent with the

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[5] The maximum number of investors is, at this time, legally bound by 20 for each loan. For a loan of CHF 20'000 the average investment for each lender is CHF 1'000 (or more if the loan is financed by less than 20 investors).

assumptions of a normal yield curve. Each additional month in the duration can be associated

with a 4 basis point rise in the interest rate.

VARIABLES	(1) Loan-specific factors	(2) Borrower-specific factors	(3) Macro-economic factors	(4) Full model
debtincome		-0.009		0.029**
		(0.016)		(0.013)
dfemale		0.346		0.218
		(0.242)		(0.182)
dswiss		-0.505**		-0.523***
		(0.222)		(0.145)
homeowner		-1.256***		-0.732***
		(0.244)		(0.191)
sharedflat		0.328		0.456**
		(0.294)		(0.202)
singleparent		1.403*		0.798
		(0.808)		(0.512)
spouse		0.601**		0.565***
		(0.265)		(0.179)
unmarriedpartner		0.267		1.151***
		(0.413)		(0.318)
children3plus		-0.104		1.036**
		(0.540)		(0.487)
loanamount	-0.012			0.035***
	(0.008)			(0.008)
duration	0.024			0.041***
	(0.017)			(0.010)
nrauctions90d	0.007			0.012**
	(0.006)			(0.005)
unemployment			4.170***	4.357***
			(0.257)	(0.266)
govbond3y			1.719***	2.349***
			(0.156)	(0.182)
SMI			-0.062***	-0.047***
			(0.014)	(0.014)
Constant	8.949***	10.067***	-4.119***	-7.275***
	(0.593)	(0.277)	(0.821)	(0.948)
Observations	665	665	665	665
Adjusted R-squared	0.040	0.042	0.444	0.543

Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: *Full Sample Regression Results*

The nine borrower-specific variables also affect the interest rate in the expected direction.

A 10 percentage point higher debt-to-income ratio is expected to result in a 29 basis points

higher interest rate, a fairly moderate compensation for the higher default risk associated with

borrowers of lower financial strength. This effect is also considerably smaller than as estimated by Berger and Gleisner (2009) using data from the US based platform Prosper. Owning a home, on the other hand, results in a significant interest rate reduction of 73 basis points. Even though the sign is as expected, this contrasts with the findings of Ramcharan and Crowe (2013) who estimate an additional risk premium of approximately 50 basis points in association with homeownership. However, their estimations are based on a period of declining house prices in the US market (2006 to 2008) while Swiss real estate prices in our analyzed period are on the rise. The coefficient for female borrowers is positive, but not statistically significant. Swiss borrowers, on the other hand, are expected to pay 50 basis points less than foreigners. As for the living arrangements, those living alone pay the lowest interest rates, whereas borrowers living with an unmarried partner pay 115 basis points more. Those in shared flats or living with their spouse pay roughly half a percentage point more.

The macroeconomic variables have a significant impact on the interest rates for our period from 2008 to 2014. A rise in the seasonally adjusted unemployment rate by one standard deviation (0.35) transforms into an expected rise in the loan rate of 152 basis points. Similarly, the impact of one standard deviation rise in the 3-year government bond yield (0.54) is 127 basis points. The logic behind the strong responses to unemployment and the risk free interest rate can be associated with the financial accelerator mechanism as described in Bernanke et. al (1999). A rise in the three-month return of the SMI by 1% is associated with a 4.8 basis point lower interest rate.

Robust results were obtained when also correcting for month and year of a loan auctions as shown in Table 8. Coefficients for loan and borrower-specific variables were largely unchanged. For another test of whether there is a potential time trend that is not accounted for in

the regression, the actual and fitted values of the interest rates were plotted against time. As shown in Figure 1, the two series exhibit no systematic deviations.

To investigate the impact of market maturity and the changed macroeconomic environment, we split the sample into two time periods: the period from 2008-2012; and years 2013-2014. The two subsamples exhibit fairly robust results. Signs do not change, whereas the statistical and economic significance shifts among our three defined categories of explanatory variables. Table 7 in the appendix displays the estimates for the two subsample periods. Column (1) shows that our three loan-specific factors explain, if isolated, 43.3% of the variation in the interest rate for the years 2013-2014, more than double the value estimated for the subsample 2008-2012. A similar development is observed for borrower-specific factors, which explain 20.2% of the variance in the second subsample, compared to 11.9% for the years before. The macroeconomic variables on the other hand show the opposite trend. While the R-squared for the first five years amounted to 44.4%, it was a mere 4.4% for the last two years of the sample. This change might be in part attributed to two factors. First, the macroeconomic environment was more stable during the second period, and second, the p2p consumer lending market in Switzerland matured, indicated by a higher amount of loans granted. The average number of loans auctioned during three months almost doubled from 22.9 in the first subsample, to 40.5 in the years 2013 and 2014.

6. Conclusion

Peer-to-peer lending is a rather new form of market-based finance that is currently very small in comparison to traditional funding options. However, the p2p lending market has experienced exceptional growth since 2010 overall and since 2012 in Switzerland.

Given its rapid rise, the dynamics of crowdfunding have been largely unstudied. The crowdfunding literature focuses, so far, mainly on the motivations for crowdfunding, the determinants of success, and the legal restrictions of equity-based crowdfunding. This paper offers insights into the p2p consumer loan market. We use a unique dataset of 665 p2p consumer loans with detailed single transactions in Switzerland from April 2008 to December 2014 and analyze the determinants of the interest rates demanded by investors. This data reflects 98 percent of the total Swiss peer-to-peer lending market. So far, and to the best of our knowledge, there is no paper specifically analyzing the overall determinants of the interest rates for peer-to-peer consumer loans and there is no academic study focusing on the Swiss crowdfunding market. Our dataset is unique in the p2p lending literature as we have direct access to the data of the largest Swiss p2p-lending platform, including specific information about the borrowers. In particular, this dataset allows us to examine to what extent differences in loan rates are a function of (1) loan-specific, (2) borrower-specific and (3) macroeconomic factors.

Our loan-specific variables produce statistically, as well as economically significant results. We find that interest rates for loans are higher if the duration is longer, if the loan amount is larger or if there are more loan auctions in the same period and as a result, more opportunities for investors to participate in this alternative market. The signs of our coefficients are as expected and imply that the interest rate setting mechanism seems to be rather rational.

We find that borrower-specific factors, representing the credit risk of the p2p consumer loans, negatively affect the interest rates. Due to the anonymous nature of the internet based lending market, granting a loan is characterized by high risk and uncertainty. On p2p lending platforms, individuals try to differentiate themselves by providing signals of trustworthiness. Key variables, such as the borrower's economic status, significantly influence lender evaluations

of the borrower's credit risk and thus the interest rates. Our results show that interest rates are significantly higher when the debt-to-income ratio is higher, and lower when the borrower is a homeowner. Based on these results, lenders act rationally and demand for a premium if the risk of the borrower seems to be higher. Additionally, we also find some indication of discrimination by the lenders. Swiss passport holders pay significantly lower interest rates than foreigners living in Switzerland although, e.g., the debt-to-income level for Swiss is, on average, even higher. Furthermore, people with three or more children also pay higher interest rates than borrowers with less than 3 kids.

We also find that the macroeconomic environment significantly influences the interest rates for p2p consumer loans. Loan rates are higher when the general interest level and unemployment rate is high. This implies that generally small investors act rather rational and demand higher interest rates if the risk free interest rate is high. Moreover, it seems as if the interest rate determinants in the Swiss p2p lending market do not substantially differ from the bank loan rate determinants.

Additionally, our subsample analysis indicates that as the p2p lending matures, investors act increasingly rational. The discrimination decreases while the focus on hard risk-related factors such as the debt-to-income ratio and loan duration increases.

Overall, the literature on crowdfunding is still in its infancy stage. Our study adds research on p2p consumer loan rate determinants and aims to contribute to a better understanding of the interest rate mechanism. This paper represents initial evidence about important phenomena and characteristics in the alternative financing market, including the learning process by market participants.

References

Agrawal, A. K., Catalini, C., & Goldfarb, A. (2013). Some simple economics of crowdfunding (No. w19133). National Bureau of Economic Research.

Alesina, A. F., Lotti, F., & Mistrulli, P. E. (2013). Do women pay more for credit? Evidence from Italy. Journal of the European Economic Association, 11(s1), 45-66.

Arrow, K. (1973). The theory of discrimination. Discrimination in labor markets, 3(10), 3-33.

Bachmann, A., Becker, A., Buerckner, D., Hilker, M., Kock, F., Lehmann, M., & Funk, B. (2011). Online Peer-to-Peer Lending - A Literature Review. Journal of Internet Banking and Commerce, 16(2), 1-18.

Barasinska, N., & Schäfer, D. (2014). Is Crowdfunding Different? Evidence on the Relation between Gender and Funding Success from a German Peer-to-Peer Lending Platform. German Economic Review, 15(4), 436-452.

Berger, S. C., & Gleisner, F. (2009). Emergence of financial intermediaries in electronic markets: The case of online P2P lending. BuR-Business Research, 2(1), 39-65.

Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. *Handbook of macroeconomics 1*, 1341-1393.

Bernanke, B. S., & Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission (No. w5146). National bureau of economic research.

Campbell, TS & Kracaw WA (1980). Information production, market signalling, and the theory of financial intermediation. Journal of Finance, 35(4), 863-882.

Chen, N., Ghosh, A., & Lambert, N. S. (2014). Auctions for social lending: A theoretical analysis. Games and Economic Behavior, 86, 367-391.

Cembra Money Bank (2015). Annual Report 2014.

Demirgüç-Kunt, A. & Huizinga, H (1999). Determinants of commercial bank interest margins and profitability: some international evidence. World Bank Econ Rev, 13(2). 379-408.

Dietrich, A. (2012). Explaining loan rate differentials between small and large companies: evidence from Switzerland. Small Business Economics, 38(4), 481-494.

Dietrich, A., Amrein, S. (2015). Crowdfunding Monitoring Switzerland 2015, www.hslu.ch/crowdfunding

Duarte, J., Siegel, S., & Young, L. (2012). Trust and credit: the role of appearance in peer-to-peer lending. Review of Financial Studies, 25(8), 2455-2484.

Edelberg, W. (2006). Risk-based pricing of interest rates for consumer loans. Journal of Monetary Economics, 53(8), 2283-2298.

Emekter, R., Tu, Y., Jirasakuldech, B., & Lu, M. (2015). Evaluating credit risk and loan performance in online Peer-to-Peer (P2P) lending. Applied Economics, 47(1), 54-70.

Freedman, S., & Jin, G. Z. (2014). The signaling value of online social networks: lessons from peer-to-peer lending (No. w19820). National Bureau of Economic Research.

Greiner, M. & Wang, H. (2010). Building consumer-to-consumer trust in e-finance marketplaces: An empirical analysis. International Journal of Electronic Commerce, 15(2), 105-136.

Herzenstein, M., Dholakia, U. M., & Andrews, R. L. (2011). Strategic herding behavior in peer-to-peer loan auctions. Journal of Interactive Marketing, 25(1), 27-36.

Keeton, W. R., & Morris, C. S. (1988). Loan losses and bank risk-taking: is there a connection? (No. 88-04).

Kiyotaki, N., & Moore, J. (1997). Credit chains. Journal of Political Economy, 105(21), 211-248.

Lee, E., & Lee, B. (2012). Herding behavior in online P2P lending: An empirical investigation. Electronic Commerce Research and Applications, 11(5), 495-503.

Leland, HE & Pyle, DH (1977). Informational asymmetries, financial structure, and financial intermediation. Journal of Finance. 32(2), 371-387.

Lin, M., & Viswanathan, S. (2014). Home Bias in Online Investments: An Empirical Study of an Online Crowdfunding Market. Available at SSRN 2219546.

Maudos J, De Guevara JF (2004). Factors explaining the interest margin in the banking sectors of the European Union. Journal of Banking and Finance, 28(9), 2259–2281.

Morgan Stanley Research, (2015). Global Marketplace Lending: Disruptive Innovation in Financials, Morgan Stanley Blue Paper (May 19, 2015).

Moritz, A., & Block, J. H. (2014). Crowdfunding: A Literature Review and Research Directions. Available at SSRN 2554444.

Okun, A. (1962). Potential GNP: Its Measurement and Significance. Reprinted in Economics for Policymaking: Selected Essays of Arthlur M. Oklun, edited by Joseph Pechman. Cambridge, Mass.: MIT Press, 1983.

Otoo, M. W. (1999). Consumer sentiment and the stock market. FEDS Working Paper No. 99-60. Available at SSRN.

Phelps, E. (1972). The statistical theory of racism and sexism. The american economic review, 659-661.

Pope, D. G., & Sydnor, J. R. (2011). What's in a Picture? Evidence of Discrimination from Prosper.com. Journal of Human Resources, 46(1), 53-92.

Ramcharan, R., & Crowe, C. (2013). The impact of house prices on consumer credit: evidence from an internet bank. Journal of Money, Credit and Banking, 45(6), 1085-1115.

Ravina, E. (2012). Love & loans: the effect of beauty and personal characteristics in credit markets. Available at SSRN 1107307.

Serrano-Cinca C, Gutiérrez-Nieto B, López-Palacios L (2015). Determinants of Default in P2P Lending. PLoS ONE 10(10): e0139427.

Sinkey Jr, J. F., & Greenawalt, M. B. (1991). Loan-loss experience and risk-taking behavior at large commercial banks. Journal of Financial Services Research, 5(1), 43-59.

Wardrop, R., Zhang, B., Rau, R., & Gray, M. 2015. Moving Mainstream. The European Alternative Finance Benchmarking Report. London: University of Cambridge and Ernst & Young.

Wei, Z., & Lin, M. (2015). Market Mechanisms in Online Crowdfunding.

Zhang, J., & Liu, P. (2012). Rational herding in microloan markets. Management science, 58(5), 892-912.

7. Appendix

		(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)
			2008 - 2012					**2013 - 2014**			
	Variable		Low (0)	High (1)	+/-	t-statistic		Low (0)	High (1)	+/-	t-statistic
Loan	loanamount		11.35	10.65	-0.70	-2.51 ***		7.70	9.21	1.51	7.67 ***
	duration*		10.55	11.22	-0.66	-2.14 **		7.03	8.75	-1.73	-6.94 ***
	nrauctions90d		10.06	12.04	1.98	7.78 ***		7.72	9.19	1.47	7.46 ***
Borrower	debtincome		11.35	10.65	-0.70	-2.52 ***		7.81	9.10	1.29	6.43 ***
	dfemale		10.98	11.04	0.06	0.20		8.40	8.64	0.24	0.85
	dswiss		11.81	10.73	-1.08	-3.41 ***		8.90	8.23	-0.67	-3.07 ***
	homeowner		11.28	9.57	-1.70	-5.05 ***		8.46	8.43	-0.03	-0.14
	livingarrangements										
	alone		11.13	10.75	-0.38	-1.33 *		8.60	8.08	-0.51	-2.15 **
	sharedflat		11.06	10.82	-0.24	-0.73		8.44	8.48	0.04	0.11
	singleparent		10.95	13.08	2.12	3.35 ***		8.45	8.20	-0.25	-0.29
	spouse		10.85	11.33	0.47	1.59 *		8.33	8.59	0.26	1.22
	unmarriedpartner		11.02	10.75	-0.27	-0.43		8.40	8.91	0.50	1.18
	children3plus		11.01	10.77	-0.24	-0.28		8.42	9.40	0.98	1.40 *
Macro	unemployment		9.46	12.54	3.07	13.58 ***		8.63	8.28	-0.35	-1.64 *
	govbond3y		10.05	11.97	1.92	7.41 ***		8.26	8.63	0.37	1.76 **
	SMI		10.76	11.25	0.49	1.77 **		8.83	8.05	-0.78	-3.70 ***

Table 6   Difference to Median - Subsamples

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Subsample 2013 - 2014				Subsample 2008 - 2012			
	Loan-specific factors	Borrower-specific factors	Macro-economic factors	Full model	Loan-specific factors	Borrower-specific factors	Macro-economic factors	Full model
debtincome		0.124***		0.064***		-0.024		0.018
		(0.024)		(0.021)		(0.026)		(0.019)
dfemale		0.106		0.131		0.251		0.218
		(0.251)		(0.205)		(0.309)		(0.243)
dswiss		-0.694***		-0.584***		-0.805***		-0.575***
		(0.193)		(0.160)		(0.306)		(0.214)
homeowner		0.002		-0.194		-2.259***		-1.370***
		(0.241)		(0.208)		(0.386)		(0.288)
sharedflat		0.265		0.138		0.167		0.370
		(0.314)		(0.244)		(0.358)		(0.265)
singleparent		0.334		-0.149		2.138***		1.199**
		(0.658)		(0.681)		(0.611)		(0.494)
spouse		0.606***		0.169		1.431***		1.018***
		(0.229)		(0.191)		(0.352)		(0.260)
unmarriedpartner		0.758*		0.683**		0.167		1.394***
		(0.453)		(0.343)		(0.665)		(0.493)
children3plus		1.396**		1.342**		-1.599*		0.082
		(0.677)		(0.558)		(0.821)		(0.749)
loanamount	0.048***			0.031***	-0.042***			0.026**
	(0.010)			(0.011)	(0.011)			(0.013)
duration	0.074***			0.077***	0.025			0.033**
	(0.012)			(0.012)	(0.019)			(0.014)
nrauctions90d	0.057***			0.054***	0.085***			0.028***
	(0.006)			(0.007)	(0.010)			(0.009)
unemployment			-0.601	-1.555			3.809***	3.470***
			(4.706)	(3.514)			(0.256)	(0.290)
govbond3y			-0.691	0.379			1.064***	1.406***
			(1.901)	(1.400)			(0.187)	(0.182)
smi3mg			-0.127***	-0.012			-0.048***	-0.030*
			(0.034)	(0.028)			(0.016)	(0.016)
Constant	2.903***	7.348***	10.703	7.804	8.641***	11.537***	-2.192**	-3.283***
	(0.468)	(0.285)	(14.980)	(11.085)	(0.725)	(0.340)	(0.865)	(1.083)
Observations	313	313	313	313	352	352	352	352
Adjusted R-squared	0.433	0.202	0.044	0.490	0.189	0.119	0.444	0.538

Table 7   Subsample Regression Results

	Variable	(1) Full Sample		(2) 2008-2012		(3) 2013-2014	
Loan-Specific Factors	Loanamount	0.03	***	0.04	**	0.03	*
	Duration	0.05	***	0.04	**	0.08	***
	nrauctions7d	0.11	**	0.07		0.07	
Borrower-Specific Factors	Debtincome	4.16	**	2.06		6.58	**
	Dfemale	0.20		0.33		0.13	
	Dswiss	-0.59	***	-0.54	*	-0.53	**
	Homeowner	-0.63	***	-1.28	***	-0.24	
	livingarrangement						
	Sharedflat	0.24		0.29		0.15	
	singleparent	0.68		1.42	**	-0.23	
	Spouse	0.52	**	0.81	**	0.19	
	unmarriedpartner	0.96	**	1.26	**	0.62	
	children3plus	0.96	*	0.17		1.20	*
Macro Varialbes	unemployment	3.04	***	2.90	***	-7.78	*
	govbond3y	0.87		-0.29		3.02	
	SMI	-0.03	*	-0.02		-0.06	
	Month						
	February	0.41		0.71		-0.23	
	March	0.53		1.52	**	-0.34	
	April	0.31		0.94		-0.71	
	May	0.27		0.28		0.57	
	June	0.28		-0.38		0.74	
	July	0.29		-0.12		0.45	
	August	0.18		-0.42		0.34	
	September	0.62		-0.18		1.08	*
	October	-0.06		-0.64		0.14	
	November	-0.09		-0.73		0.48	
	December	0.21		-0.54		0.84	
	year						
	2009	0.58		-0.98			
	2010	0.20		-1.77			
	2011	-0.31		-2.39	*		
	2012	-1.20		-3.96	**		
	2013	-2.86	*			(base)	
	2014	-1.95				1.10	***
	Constant	-1.98		1.83		28.60	*
	Observations	665		352		313	
	Adj. R-squared	0.61		0.57		0.49	

legend: * p<0.05; ** p<0.01; *** p<0.001
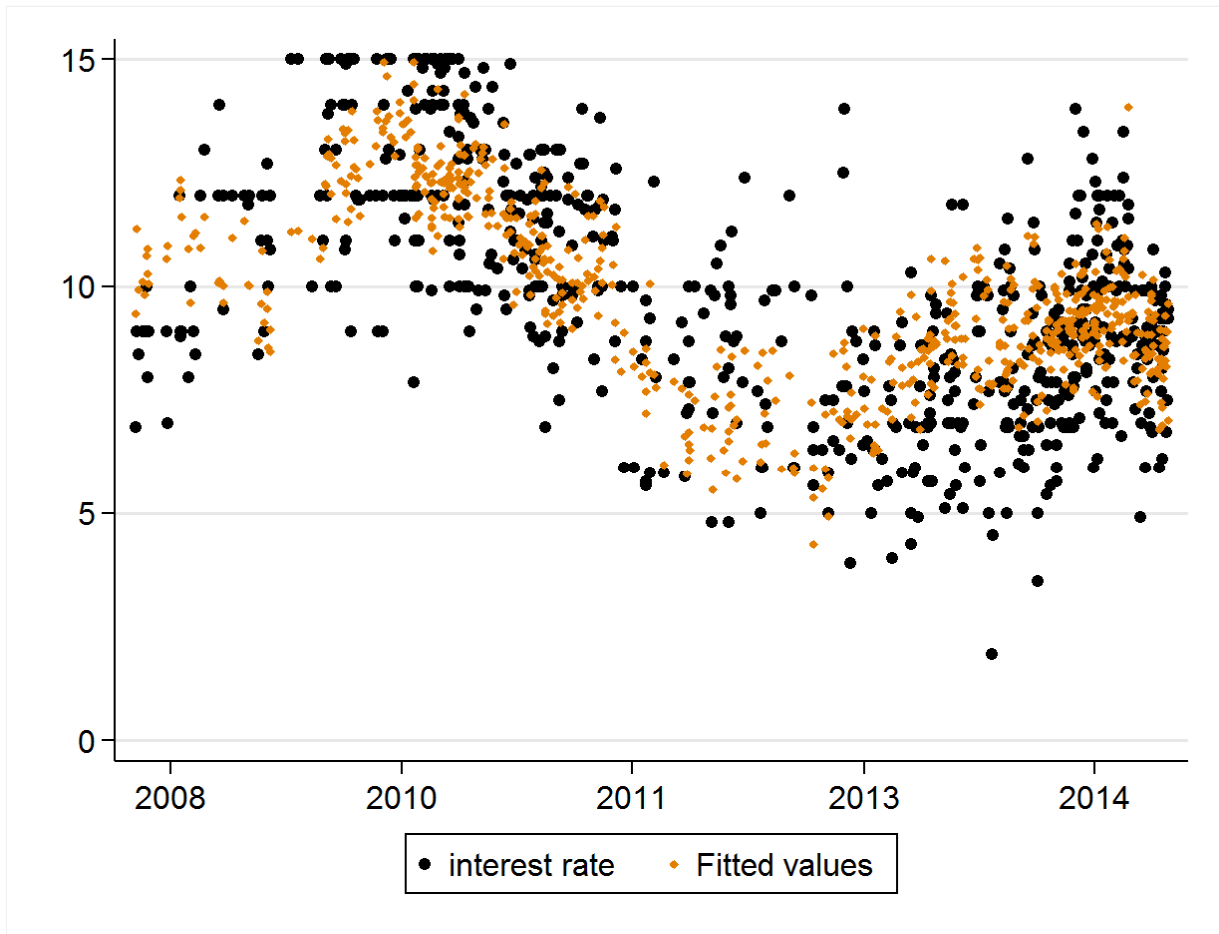
Table 8   Robustness – Regression Including Weekdays and Years

Figure 1   Actual Versus Fitted Interest Rates Over Time