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# Gender differences in self-risk evaluation: Evidence from the Renrendai online lending platform

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# Gender differences in self-risk evaluation: evidence from the Renrendai online lending platform

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#### ARTICLE

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## Gender differences in self-risk evaluation: evidence from the **Renrendai online lending platform**

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#### ABSTRACT

Risk-related gender differences such as risk perception and risk aversion are widely discussed, whereas gender differences in self-risk evaluations are unknown. Using a sample of more than 310,000 individual loan applications from the Renrendai online lending platform, this study uses a hedonic model to examine gender differences in self-risk evaluations. We find that males are more likely than females to offer lower interest rate premiums when they have favorable attributes, such as larger loans, higher credit ratings, married status, and income level, and females tend to offer lower interest rate premiums when they have unfavorable attributes, such as longerterm loans. We conclude that males seek benefits and females avoid disadvantages when evaluating their own risk, which is supported by economic, biological and psychological research. Our findings fill this gap on gender differences in risk-related behaviors.

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**KEYWORDS** Self-risk evaluation: P2P: gender difference

#### 1. Introduction

Research has demonstrated that females and males have very different risk perceptions and degrees of risk aversion. Numerous studies in sociology and psychology have supported the hypothesis that females are more sensitive to the perception of risk attached to alcohol and drug use (Spigner, Hawkins, & Loren, 1993), the catastrophic potential of nuclear war (Silverman & Kumka, 1987), technology (Cutter, Tiefenbacher, & Solecki, 1992), radioactive waste (Macgregor et al., 1994), industrial hazards (Stallen & Tomas, 2010), environmental degradation (Flynn, Slovic, & Mertz, 2010; McStay & Dunlap, 1983), and various recreational and social activities (Boverie, Scheuffele, & Raymond, 1994). Many studies have concluded that women are more risk averse than men. For instance, women have been found to have less risky asset portfolios on average than men (Gong & Yang, 2012; Halko, Kaustia, & Alanko, 2012; Jianakoplos & Bernasek, 2010). Even after controlling for a wide range of demographic, financial, and attitudinal characteristics that could explain such allocation differences, women still tend to invest their retirement assets more conservatively than men (Bollen & Posavac, 2018; Jianakoplos & Bernasek, 2010; Sundén & Surette, 1998). A variety of laboratory tests of

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behavior, for example, in abstract gambling experiments, also indicate that women report a lower risk propensity than men (Powell & Ansic, 1997). All these gender differences may come from the different testosterone and cortisol level in men and women, which are found to be correlated to the risk aversion particularly in financial decision (Nofsinger, Patterson, & Shank, 2018).

However, the risks discussed in the literature are extrinsic, that is, either risk perception or risk aversion. For example, radioactive waste, asset portfolio allocation, and gambling are extrinsically risky. To the best of our knowledge, most studies have focused on the gender differences in extrinsic risk evaluation and have ignored the gender differences in self-risk evaluation. Self-risk evaluation occurs when an individual evaluates his or her own risk under a particular circumstance. For example, an individual evaluates his or her own symptoms when deciding whether to see a doctor. Another example is when borrowing money from an online platform, the borrower will afford an interest rate based on self-risk evaluation. In these two cases, men and women may have different self-risk evaluations. Therefore, this study identifies the gender differences in self-risk evaluation using a unique dataset from the Renrendai online lending platform.

As one of the most influential peer-to-peer online lending service companies in China, Renrendai, founded in 2010, is a Beijing-based company providing a P2P platform for financial services such as loans, debts, and investment. It is one of the AAA personal financial information service platforms approved by Chinese authorities and currently has a service network covering over 2,000 regions. It targets white-collar employees and small business owners as its customers, charging borrowers a management fee of 0.3% of the borrowed money, and a service fee of up to 5% for high-risk borrowers. The returns on Renrendai loans are between 10% and 18%, which is higher than the 3.25% offered by one-year term deposits in banks. The company also controls default risks by measuring borrowers' income, occupation, assets, and family connections.

In P2P platforms, the principal-agent problem is a major threat. Consequently, lenders require valid information, including demographic characteristics, to alleviate the problem of information asymmetry and improve credibility. When borrowing money from Renrendai, borrowers must offer to pay an interest rate based on the suggestions from the platform, which was only for reference and did not directly influence borrowers' bids, and their self-evaluation of their own risk. Therefore, to get financed, a borrower generally offers as high an interest rate premium as he/she can afford, which should be close to the preserved value if he/she really wants to succeed in this process.

Studies of P2P lending platforms generally focus on the following aspects. Some studies discuss the determinants of getting funded. For example, Pope and Sydnor (2011) show that the chances of African Americans being fully funded are 25–34% smaller than those of whites with similar credit ratings, and they have to pay between 1.39% and 1.46% higher interest rates. Barasinska and Schäfer (2014) provide evidence of the success of female borrowers at a large German peer-to-peer lending platform. Ramcharan and Crowe (2013) show that house price fluctuations can have a significant impact on credit availability. Furthermore, several studies find that facial traits and social networks are important factors in success (e.g., Duarte, Siegel, & Young, 2012; Gonzalez & Loureiro, 2014; Graham, Harvey, & Puri, 2010; Lin, Prabhala, Viswanathan, Cohen-Cole, & Hoberg, 2013; Ravina, 2012; Sonenshein, Herzenstein, & Dholakia, 2011). Additionally, text provided by the borrowers can impact leading behavior. Dorfleitner et al. (2016) find that spelling errors, text length,

and the mention of positive emotions predict funding probability. Larrimore, Li, Larrimore, Markowitz, and Gorski (2011) find that the use of extended narratives, concrete descriptions, and quantitative words that are probably related to one's financial situation have positive associations with funding success, which is considered to be an indicator of trust.

A second group of studies has investigated factors that affect loan defaults. For instance, Emekter, Tu, Jirasakuldech, and Lu (2014) find that credit grade, debt-to-income ratio, FICO score, and revolving line of credit utilization play an important role in loan defaults. Chen, Jiang, and Liu (2018) find that loans invested by female investors are more likely to default and have lower loan return in the future than loans invested by male investors. Other studies have investigated herding behavior in P2P platforms. For example, Herzenstein, Dholakia, and Andrews (2011) study herding behavior in P2P loan auctions on Prosper.com. They find a positive association between herding in the loan auction and its subsequent performance, that is, whether borrowers pay the money back on time. Zhang and Liu (2012) find evidence of rational herding among lenders. Furthermore, they find that well-funded borrower listings tend to attract more funding after controlling for unobserved listing heterogeneity and payoff externalities.

Using information from more than 310,000 individual loans on the Renrendai online lending platform, this study uses a hedonic model to examine the gender differences in self-risk evaluation.<sup>1</sup> A regression of the full sample reveals that borrowers with favorable attributes such as larger loans, higher credit ratings, married status, better education background and income level, are more likely to offer lower interest rate premiums, whereas borrowers with unfavorable attributes such as longer-term loans and older ages are more likely to offer higher interest rate premiums. More interestingly, we find that men are more likely than women to offer lower interest rate premiums when they have favorable variables, whereas women tend to offer lower interest rates when there are unfavorable variables. We conclude that men seek benefits and women avoid disadvantages, which is supported by some psychological and biological studies.

The organization of this article is as follows. Section 2 introduces the empirical strategy and data. Section 3 discusses the estimation results. Section 4 presents the results of our robustness check. Section 5 concludes this article.

#### 2. Empirical strategy

In this study, we use the following hedonic model to analyze the interest rate premiums that a borrower will accept:

$$y_{it} = \alpha_s + \alpha_t + \alpha_{it} + x \prime_{it} \beta + \varepsilon_{it} \tag{1}$$

where  $y_{it}$  is the interest rate premium, which is calculated as the borrowing interest rate for borrower *i* minus the base interest rate at that time *t*. The base interest rate is the benchmark interest rate for loan set by The People's Bank of China and we match the base and actual interest rate based on a loan's maturity and when it occurs.  $x_{it}$  represents two sets of variables. The first set is the attributes of the project, consisting of the term of the project, denoted as *term*, and the logarithm form for the amount borrowed in the project, denoted as *log(amount)*. The second set is the borrower's relevant information including *age*, *gender*, *credit grade*, *overdue*, *income*, *education*, and *marital status*, where *age* refers to the borrower's age, *gender* equals 1 if the borrower is female, and *credit grade*  488 👄 X. LI ET AL.

is a critical variable in determining the costs of borrowing. Renrendai uses seven credit grades in their credit-scoring process. Higher credit grades correspond to better creditworthiness. To further control for one's creditworthiness, we include *overdue*, which is defined by times of a borrower's overdue payments. *income* = 0 if monthly income < \$5,000; *income* = 1 if  $\$5,000 \le$  monthly income < \$10,000; *income* = 2 if  $\$10,000 \le$ monthly income < \$20,000; income = 3 if monthly income  $\ge \$20,000$ .<sup>2</sup> education equals 1 if a borrower has at least a bachelor degree. *marital status* is a binary variable with 1 denoting being married. Dummy variables for year,  $\alpha_t$ , and province,  $\alpha_s$ , are also included. Now we can rewrite Equation (1) explicitly:

interest rate premium<sub>it</sub> = 
$$\alpha_s + \alpha_t + \alpha_{it} + \beta_1 * term_{it} + \beta_2 * log(amount)_{it} + \beta_3 * age_{it}$$
  
+  $\beta_4 * credit grade_{it} + \beta_5 * marital status_{it} + \beta_6 * income_{it}$   
+  $\beta_7 * education_{it} + \beta_8 * overdue_{it} + \varepsilon_{it}$ 
(2)

What we are concerned about is whether  $\beta$ , the shadow prices of various characteristics, differs in female and male borrowers. If it is risk *per se* that results in gender differences in interest rate premiums, we would expect to see that both genders have the same change in interest rate premium, following changes in  $x_{it}$ . Only when woman and man evaluate their risk differently, will their bids respond differently to changes in  $x_{it}$ .

The dataset is obtained from Renrendai. It includes applicants who obtained financing and applicants who did not. The final sample size is 313,355 applications, including 89,914 female borrowers and 223,441 male borrowers. Figure 1 graphs the distribution of male and female interest rate premiums and provides the first hint that women are more risk averse in P2P lending. The maximum interest rate premium for women is 18.40%, whereas the maximum premium for men is 18.80%. The minimal interest rate premium is lower for males, but female borrowers are distributed more densely around the minimal level. The average interest rate premium also shows that, on average, a female borrower offers an interest rate premium of 6.04%, which is 8 basis points lower than a male borrower. Furthermore, this difference between the means is statistically significant, which serves as additional suggestive evidence.

Table 1 presents summary statistics of the samples segmented by gender, including variables such as interest rate premium, *term*, *log(amount)*, *age, credit grade, marital status, income, education*, and *overdue*. For credit grade, the value 1 denotes borrowers with the worst credit grade (recoded as HR) and 7 denotes the best credit grade (recoded as AA). We find that compared to male borrowers, female borrowers, on average, are younger, have longer terms, larger loans, higher credit grades, less default history, worse education background, are more often married, earn less, and offer lower interest rate premiums. Table 2 provides the results of the tests of differences between women and men. The differences between men and women's loan attributes and borrowers' characteristics are statistically significant.

#### 3. Empirical results

Table 3 presents the OLS regression results with different model specifications. In the first column, we don't adjust standard deviation of the estimates using clustering techniques. In the second column, we cluster on year. In the third column, we cluster on province.



Figure 1. Distribution of males' and females' interest rate premiums.

	Women					Men					
Variable	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	
interest rate premium	6.04	6.05	0.84	2	18.4	6.12	6.05	1.01	0.50	18.80	
term (month)	31.18	36	8.41	1	48	29.04	36	9.85	1	48	
log(amount)	11.07	11.16	0.63	8.01	14.91	10,88	10.97	0.72	8.01	14.91	
age	37.49	36	8.27	21	70	37.86	36	8.59	21	74	
credit grade	5.84	6	0.82	1	7	5.59	6	1.29	1	7	
marital status	0.84	1	0.37	0	1	0.80	1	0.40	0	1	
income	1.32	1	1.07	0	3	1.34	1	1.05	0	3	
education	0.30	0	0.46	0	1	0.30	0	0.46	0	1	
overdue	0.16	0	1,43	0	32	0.46	0	2.40	0	54	

Table 1. Summary statistics.

We control for both year and province fixed effects in all the three specifications. The results from the different model specifications are robust. Therefore, for simplicity, we only cluster on year or province in the subsample regressions to test for gender differences. The coefficient estimate of *gender* is negative and significant in the full sample regression, suggesting that after controlling for other demographic characteristics, male and female borrowers still differ in average interest rate premium. We find that borrowers tend to offer higher interest rate premiums when the term is longer, borrowers are older (although insignificant), and overdue payments have occurred less frequently. Although the negative relationship between *overdue* and interest rate premium is counter-intuitive, it is insignificant possibly because default history has already been taken into consideration when Renrendai gives the credit grade. Borrowers are more likely to offer lower interest premiums when the money borrowed is larger, their credit grade is higher, the borrowers are married and have at least a bachelor's degree and better income level. Therefore, based on the sign of coefficients, we call *log(amount), credit grade*.

#### Table 2. Test for gender difference.

	Diff	Difference between Means				
Variable	Difference	t-statistics	p-value			
interest rate premium	0.08	21.41	0.000***			
term (month)	-2.15	-57.43	0.000***			
log(amount)	-0.19	-69.88	0.000***			
age	0.36	10.74	0.000***			
credit grade	-0.25	-54.53	0.000***			
marital status	-0.04	-27.87	0.000***			
income	0.03	6.34	0.000***			
education	3.86e-03	2.13	0.034**			
overdue	0.30	34.89	0.000***			

diff = mean (men) - mean (women). \*, \*\*, and \*\*\* denote significance levels of 10%, 5%, and 1%, respectively.

	Table 3	. Regression	results	with	full	sample.
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Dependent Variable		Interest rate premium	
term	0.063***	0.063***	0.063***
	(1.71e-04)	(1.06e-03)	(0.004)
log(amount)	-0.047***	-0.047***	-0.047*
	(2.27e-03)	(9.09e-03)	(0.018)
age	2.31e-05	2.31e-05	2.31e-05
	(1.51e-04)	(2.67e-04)	(6.35e-04)
credit grade	-0.356***	-0.356***	-0.356***
	(1.50e-03)	(8.59e-03)	(0.024)
marital status	-9.73e-03***	-9.73e-03	-9.73e-03
	(3.22e-03)	(6.67e-03)	(0.012)
income	-0.024***	-0.024***	-0.024**
	(1.18e-03)	(5.34e-03)	(0.007)
education	-0.036***	-0.036***	-0.036**
	(2.57e-03)	(4.28e-03)	(0.013)
overdue	-1.51e-03**	-1.51e-03	-1.51e-03
	(6.75e-04)	(3.43e-03)	(0.007)
gender	-8.17e-03***	-8.17e-03**	-8.17e-03***
	(2.53e-03)	(3.10e-03)	(0.002)
constant	5.764***	5.764***	5.441***
	(0.258)	(0.053)	(0.332)
R-squared	0.631	0.631	0.570
Observations	313,355	313,355	313,355
Cluster on year	No	Yes	No
Cluster on province	No	No	Yes

\*, \*\*, and \*\*\* denote for significance level at 10%, 5% and 1% respectively. Robust standard errors are reported in the parenthesis.

income, education and marital status favorable variables, and term, age, and overdue unfavorable variables.

As our main focus is whether females and males respond differently to unfavorable and favorable variables, we segment the sample into the female and male subsamples. Table 4 presents the regression results by gender and the statistical tests of the differences between the parameters. We find that both genders offer lower interest rate premiums when faced with favorable variables and higher interest rate premiums when faced with unfavorable variables. Interestingly, we find that in subsample regressions, gender differences are significant in term, log(amount), credit grade and marital status. Men with favorable attributes offer much lower interest rate premiums, indicating that they are more demanding in this situation. For example, in terms of credit grades, women's response to a one unit increase in credit grade is -0.339, which is smaller in scale than

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the -0.358 response of males. We also find that females offer lower interest premiums than males when they experience unfavorable variables, *term*. Although *marital status* has little influence on interest rate, being married is favorable for men but unfavorable for women, which explains why the coefficient of marriage is insignificant in the full sample regression. The reason of opposite signs could be that being married introduces the other gender into a borrower's life and thus has different influence on male and female.

Figure 2 summarizes the gender differences in self-risk evaluation in terms of interest rate premiums. We see that on the side illustrating unfavorable conditions (i.e., on the right side), women are more likely to offer lower interest rate premiums, whereas on the other side, that is, favorable conditions, we see males are more likely to offer lower interest premiums. As a result, we see that the curve for males is steeper than that of females. We conclude this finding that the shadow characteristic price is larger in terms of absolute value for male as men seek benefits and women avoid disadvantages.

Our findings are consistent with research in economics, psychology and biology. For example, Harris, Jenkins, and Glaser (2006) show that women's greater perceived likelihood of negative outcomes and lesser expectation of enjoyment partially mediates their lower propensity toward risky choices in the gambling, recreation, and health domains. Barber and Odean (2001) find that in areas such as finance, men are more overconfident than women. They document that men trade 45% more than women. Jacobsen, Lee, Marquering, and Zhang (2014) show that men tend to be significantly more optimistic than women regarding a broad range of issues, including the economy and financial

Dependent Variable	Interest ra	te premium	Difference
Sample	(1) Men	(2) Women	Diff
•			(Chi-square stat)
term	0.064***	0.061***	0.003***
	(0.004)	(0.004)	(28.14)
log(amount)	-0.063***	-0.006	-0.056***
	(0.017)	(0.020)	(23.04)
age	1.67e-04	-2.18e-04	3.85e-04
	(5.43e-04)	(9.01e-04)	(0.61)
credit grade	-0.358***	-0.339***	-0.019*
	(0.023)	(0.030)	(3.35)
marital status	-0.016	0.013	-0.028***
	(0.014)	(0.009)	(12.68)
income	-0.022***	-0.028***	0.006
	(0.006)	(0.011)	(1.49)
education	-0.036***	-0.036**	1.34e-04
	(0.012)	(0.016)	(0.00)
overdue	-0.002	-0.002	5.59e-04
	(0.007)	(0.007)	(0.87)
constant	-0.789***	-1.356***	
	(0.196)	(0.118)	
R-squared	0.550	0.639	
Observations	223,441	89,914	
Year FE	Yes	Yes	
Province FE	Yes	Yes	
Cluster on year	Yes	Yes	

Table 4. Regression results by gender and test for gender difference.

Diff = coefficient (men) – coefficient (women). \*, \*\*, and \*\*\* denote for significance level at 10%, 5% and 1% respectively. Robust standard errors are reported in the parenthesis for first two columns and Chi-square statistics are reported in the third column.



Figure 2. Gender differences in self-evaluation in terms of interest rate premiums.

markets. Beyer and Bowden (1997) show that when performing a masculine task, females' self-evaluations of performance are inaccurately low, their confidence statements for individual questions are less well calibrated than males, and their response bias is more conservative than males' response bias. Petrides and Furnham (2000) find that in terms of self-estimated emotional intelligence, males' self-estimates are higher than females', indicating that the process of self-estimation is biased. These findings point to the existence of gender differences in self-risk evaluation. For instance, the overconfidence of men make them more likely to overestimate their advantages and to underestimate their disadvantages, resulting in the steeper slope displayed in Figure 2.

#### 4. Robustness check

#### 4.1. Learning behavior

In our data, there are borrowers who have obtained a loan on Renrendai more than once. These participants may have learnt from their previous loans, and thus have more information about lenders' willingness to pay. Thus, the interest rates they propose no longer exactly reflect their evaluation of self-risk and the corresponding preserved value of the premium. Instead, these users may modify the requested interest rate premium to minimize the necessary borrowing costs while ensuring they are successfully funded.

To rule out such learning behavior, we eliminate second or third loans from the sample and test gender differences as before. The results are reported in Table 5. The coefficients on *term*, *log(amount)*, *age, credit grade, marital status, income, education*, and overdue are not strongly affected. Excluding learning behavior does not change our main findings although gender differences in *credit grade* is no longer significant, indicating that borrowers' learning behavior influences the way they set interest rate premium to some extent. Male offers much lower interest rate premium when faced with favorable attributes, *log(amount)*, and female offers much lower interest premiums when experiencing unfavorable attributes, term. Results in Table 5 imply that our findings are robust.

#### 4.2. Matched regression

To further validate our conclusion, we match each female borrower with a male borrower on the basis of observable characteristics and segment the matched sample into female group and male group. Table 6 presents the regression results. The magnitude of coefficients remains roughly the same. However, when faced with an increase in *income*, a favorable attribute, female borrowers are more sensitive, which contradicts our previous findings. Our results are robust to the extent that male and female still show expected differences in self-risk evaluation when *term* and *log(amount)* changes.

#### 5. Concluding remarks

This study investigates the gender differences in self-risk evaluation. Using information about more than 300,000 individual loans from the Renrendai online lending platform, this study examines the gender differences in self-risk evaluation using a hedonic model. Regressions of the full sample reveal that borrowers with larger loans, higher credit scores, married status, better education background and income level are more likely to have lower interest rate premiums, whereas borrowers who are older and who borrow for longer terms are more likely to have higher interest rate premiums, indicating that borrowers have a consistent self-risk evaluation. Interestingly, females are willing to offer lower interest rate premiums under disadvantageous conditions such as being older or wanting longer loan terms. Males ask for lower interest rate premiums under

Dependent Variable	Interest ra	te premium	Difference
Sample	(1) Men	(2) Women	Diff
·			(Chi-square stat)
term	0.064***	0.061***	0.003***
	(0.001)	(0.001)	(29.90)
log(amount)	-0.067***	-0.006	-0.061***
	(0.008)	(0.006)	(103.59)
age	-1.38e-04	2.36e-05	-1.61e-04
	(2.40e-04)	(2.14e-04)	(0.52)
credit grade	-0.343***	-0.342***	-0.002
	(0.009)	(0.011)	(0.04)
marital status	-0.010*	0.010	-0.020***
	(0.006)	(0.007)	(10.61)
income	-0.023***	-0.028***	0.005*
	(0.005)	(0.004)	(3.39)
education	-0.029***	-0.035***	0.006
	(0.005)	(0.006)	(1.43)
overdue	-0.002	-0.004	0.002
	(0.003)	(0.005)	(0.14)
constant	1.245	7.176***	
	(0.103)	(0.063)	
R-squared	0.595	0.663	
Observations	212,882	87,504	
Year FE	Yes	Yes	
Province FE	Yes	Yes	
Cluster on province	Yes	Yes	

Table 5. Robustness check.

Diff = coefficient (men) – coefficient (women). \*, \*\*, and \*\*\* denote for significance level at 10%, 5% and 1% respectively. Robust standard errors are reported in the parenthesis for first two columns and Chi-square statistics are reported in the third column.

Dependent Variable	Interest ra	te premium	Difference
Sample	(1) Men	(2) Women	Diff
			(Chi-square stat)
term	0.064***	0.061***	0.002***
	(0.001)	(0.001)	(15.82)
log(amount)	-0.076***	-0.006	-0.069***
	(0.012)	(0.007)	(96.38)
age	1.41e-04	-2.18e-04	3.59e-04
	(2.88e-04)	(2.54e-04)	(2.26)
credit grade	-0.348***	-0.339***	-0.009
	(0.010)	(0.012)	(0.76)
marital status	-9.28e-04	0.012	-0.013*
	(0.006)	(0.008)	(2.93)
income	-0.015***	-0.028***	0.012***
	(0.005)	(0.004)	(11.95)
education	-0.029***	-0.036***	0.007
	(0.007)	(0.006)	(1.53)
overdue	0.003	-0.002	0.005
	(0.006)	(0.006)	(0.47)
constant	9.629	8.433***	
	(0.159)	(0.118)	
R-squared	0.636	0.639	
Observations	89,913	89,913	
Year FE	Yes	Yes	
Province FE	Yes	Yes	
Cluster on province	Yes	Yes	

Гab	le	6.	Matc	hed	regression	result	s by	/ gende	er and	test	for	gender	difference.
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Diff = coefficient (men) – coefficient (women). \*, \*\*, and \*\*\* denote for significance level at 10%, 5% and 1% respectively. Robust standard errors are reported in the parenthesis for first two columns and Chi-square statistics are reported in the third column.

favorable conditions such as larger loans, higher credit scores, and married status. These findings are supported by research in biology and psychology.

This research aims to fill in a gap in our understanding of gender differences in risk-related behaviors. Future research could address the following issues. First, a larger dataset with more borrowing behavior would be useful. Second, a suitable lab experiment based on auctions could also provide a clear identification of gender differences.

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