

**Research Unit for Statistical
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**Rationality, Market and Rural Credit:
Case of Fude Association**

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Abstract: Researches about traditional rural credit always claimed it was composed by reciprocal credit between villagers and usury from outside societies. Contrarily, the credit operation of Fude Association in a village of Taiwan shows that there is no clear classification between reciprocal credit and usury, and the divergence in interest rates and loan sizes can be explained by selections in an optimizing model. Meanwhile, this paper finds some special deviations from rational decision, mainly according to the calculation cost. However, such deviations decreased when marketization developed and the benefit of rational calculation increased, which illustrates the internal consistency between market economy and rationality.

JEL: D01, G23, N25

I. Introduction

In literatures about traditional rural credit, there also exist different traditions of study. In fact, as rural credit has history much older than the development of modern market economy, kinds of documents different from market records are left and illustrate the complex character of it. Thus, it's not surprising that, in the mainstream view, rural credit is guided by customs or non-economic relationships at least before modernization. In a classic research about south-east Asian rural society, Scott (1976, p.13-29) argues that surviving is the fundamental subject of traditional presents, which leads to the rural reciprocal relationship, while usury is left to despairing credit just at lean years. Furthermore, while surviving desire is not in accordance with profit maximization, marketization or capitalization will destroy traditional reciprocal relationship and result in the more miserable situation of peasants.

For researches about rural credit in traditional Chinese society which this paper will focus on, echoes of Scott (1976) are obvious. For example, Huang Zhongzhi (1992, p.111) classifies rural credit into two types: one is reciprocal interest free credit between villagers without weighing gains and losses,³ and the other is loans from outside societies, always coming to be usuries to the miserable peasants. However, there are some subtle differences too. Although Scott (1976, p.58-90) regards commercialization or marketization as a destruction factor together with colonialism, Huang Zhongzhi (1992, p.305-310) tries to explain it by involution within family, which contributes to the small peasant production persistent in the long history of China. Kishimoto Mio (2010, p.61-81) holds some similar viewpoint with Huang Zhongzhi (1992) as she pays attention to the instability of traditional China caused more by market fluctuations than by natural disasters, though she was obviously affected by Tawney's describing of Chinese peasants' struggle for surviving cited in Scott (1976, p. 13-29). However, if market institution is active in the economic relationship between families, there shouldn't be natural division between reciprocal credit and usury, and, on the contrary, both of them should be the results of economic conditions. In fact,

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³ Obviously, we need other conditions, including extremely low marginal return of capital and symmetry of credit demand, to reach the point that surviving economics means interest free. However, such economic reasoning is scarce in Scott (1976) and Huang (1992).

Scott (1976, p. 13-25) has tried to provide an economic explanation for surviving economics, but, at the same time, it always tends to be neglected and there seems to have an independent moral principle when he argues about the functions of surviving economics. It goes further in Huang Zhongzhi (1992, p.309), where small peasant rationality is stressed to be in contradiction to optimizing principle, and hence, marketization is thought to occur without market rationality in traditional China.

However, Peng, Chen and Yuan (2008) try to explain China's rural credit by optimizing activities in a competitive market. They show that credit, either usury or reciprocal low interest rate loans, can be analyzed in a united model where usury is just a result of the higher average cost of micro loans. They also find that there is no significant interest rate difference between loans from villagers and other sources including professional moneylenders, if other conditions controlled. This is quite in accordance with surveys of 555 MFIs (Microfinance Institutions) in 2006 held by CGAP, which confirmed the inverse relationship between loan's individual size and operating expenses while scale benefits had been mostly captured by MFIs (Rosenberg et al., 2009). In addition, Peng, Chen and Yuan (2008) classified interest rate as implied and noted in credit contracts. For the latter type which looks quite regulated, customs or some similar rules rather than economic force might have stronger effect, although economic force could still work by other ways except interest rates, including loan screening, payment method and so on. Although such regulation of noted interest rate leads to some deviation from normal market mechanism, it is quite different to the description of Huang Zhongzhi (1992). If we turn to the microfinance case introduced in this paper, more interesting deviations will be found. Then, why they happened? How did they interact with market institution if it still played the main role?

For biases from idealized rationality or market equilibrium, researches about bounded rationality or behavioral economics provide another angle. A famous example of Kahneman (1984) is loss aversion, which can explain the conservative attitude to a bet even if it is fair. This is quite similar with the conservative impression about traditional peasant. It may also play a role in the generally depreciating attitude toward usury even when it satisfies economic rationality or what called "small peasant rationality". Meanwhile, behavioral economists regard the pattern of decision making as psychological, which has little relation with social background. For example, M. Keith Chen, et al. (2006) suggests that that loss aversion even extends beyond humans and may be innate rather than acquired by learning. However, all above cited literatures about traditional credit care about the social background deeply, which implies that the importance of biases from economic rationality should not be same under different situations and it should be better to be estimated empirically. Another related point is the bounded rationality. Restriction of information and calculation ability could affect credit decision greatly in traditional rural society as there were no statistic publications and modern mathematical or financial theory was not available. Since there are so many possible explanations about bounded rationality, it's clear that once we want to testify the real importance of some specific bound, the problem also becomes empirical as Rubinstein (1998, p.16) noted.

Therefore, the purpose of this paper is not to discuss the rationality behind rural credit by definitions or theories but to study it through an historical case. We will research the credit relationship of the Fude Zhengshen Association (FDA) in Rinan Village, belonged to Tachia Township, Taizhong County of Taiwan, mainly through its account books from 1915 to 1943, which is kept in the Institute of Taiwan History, Academia Sinica. The FDA was set up to sacrifice

the fortunate (*Fu*) and moral (*De*) god (*Zhengshen*) whose formal identity was the village god with thousands years tradition in China. In its operation, a fund was gathered and lent to its members who were also the villagers. By this way, villagers got a source of credit and the interest provided funds for FDA's running expenses at the same time. Though it's a too inconspicuous example to reach a general conclusion about traditional rural credit, there are reasons to select it as a research object. First, we can get the nearly complete record of FDA's credit operation from the account books which show FDA's interest rate rules and the reaction of its members. Second, the borrowers' names were recorded in the books and they always borrowed repeatedly which make us could control their personal characters. Combined with the detailed chorographic materials, we can get even more important personal information. The last and most important reason is there has changes in the credit operation of the FDA which happened in the background of Taiwan's modernization. This provides us a chance to test different hypothesis about relationships between rationality, traditional economy and market.

In the next section, the material and its background will be described in more details. Then, we will explore the interest rate of FDA, including its different forms and rules. In the fourth section, the rationality behind the interest rate rules of FDA and the reactions of its members is discussed and different hypothesis are tested. The last is a conclusion.

II. Material and Background

The account books of FDA have two volumes, containing eighties loan records from 1915 to 1943. For every year, the records were updated at the night of Chinese calendar's Jan. 15. As the birthday of the village god is Feb.2 in Chinese calendar and Jan. 15 is an important festival just before it, villagers would gather at the night of Jan. 15 for celebration and take this opportunity to arrange the forthcoming sacrifice. Because the head of FDA, called censer head (*Luzhu*), is rotational, new head will be decided at this night too. Then the last head settled accounts of last year and turned the fund and account books to the new head. In order to settle accounts, every lending, including its borrower's name and its interest rate, would be recorded. During this annual gathering, interest rate rule claimed by the FDA would be discussed too, and there was once that the members agreed to change the interest rate quotation by consensus at 1923.

Most of the loans were recorded in the money unit, Yuan. It's the legal money in Taiwan after the monetary reform carried out by Japanese colonial government at 1910s. Before 1930s the legal money was on the gold standard, but it turned to fiat money step by step after then. (Su Zhen, 1954, pp.9) The value of one Yuan during 1920s and 1930s was about 0.7 silver tael of Shanghai and could buy about 10 kg. rice in Taizhong⁴. (Statistics Department of Taiwan Chief Executive Office, 1946, Tab. 320, Tab. 402) As Taiwan had finished monetary reform before mainland China, money unit in FDA's account books is much simpler. But there still has exceptions. Fractional money in silver appeared several times and some of them were recorded in their unit inherited from currencies before monetary reform without converting to Yuan. Their conversion would be very complex according to the monetary institution before monetary reform,⁵ but, fortunately, there were cases in the account books to show that the conversion between fractional money and Yuan for our sample had simplified to decimalism directly. We apply this principle to do conversion when needed.

⁴ We change the unit from Dou to kilogram using the ratio 1: 7.8, which is documented in Chuan Hansheng, et al. (1975).

⁵ Refer to Su (1954, pp.4).

Thus, we get 83 loan records according to 37 borrowers for research in this paper. Most of the borrowers were personal, but a few of them may be families which were entitled by house (*Wu*) or clan. Despite the fact that Rinan was a normal village with about only one thousand people, from the local chronicles, we can find relatively numerous biographies referring to kinds of local elite who had affected the local society. For the 37 borrowers in our sample, two were recorded in the chronicles. One was surnamed Guo and had the family seniority as Mu, which means it belonged to the richest family of Rinan village and even Tachia Township during the early 20th century. They leased land in the township and established a rice factory near the rail station when it was constructed in 1922. Guo Murong, the representative of his family, was active in Taizhong's industrial society and became one of the managers of local cooperatives promoted by Japanese colonial government. Another was Ye Qingjiang who was a landlord of Rinan village and famous for his activity in charity. (Liao Ruiming et al., 2007, p.1520, p.1562) In the borrowers, ten surnames were found, but 80% of the 83 loans were lent to the four main surnames including Chen, Guo, Lin and Ye. This is in accordance with the surname distribution of residents (Liao Ruiming et al., 2007, p.1438).

Apparently, the credit of FDA was restricted to villagers and should be classified to reciprocal relationship if we accept definition of Huang Zhongzhi (1992, p.111) in his description about mainland China. Of course, there were many similarities in the popular organizations and practices of mainland China and the Chinese immigrant society of Taiwan. In fact, except for residents surnamed Guo who might source from the aboriginal, all other main surnames cited above immigrated from Fujian and Guangdong of mainland China. (Liao Ruiming et al., 2007, p.1430) Hence, it's not surprising that the FDA kept typical Chinese tradition in its religion and operation. However, the traditional form itself does not provide support for reciprocity, as it's obvious that the primary function of FDA's loan is to fund its operation. Although the FDA could act as an institution for local charity if it could be sustained, market method may be more efficient before this situation reached. Especially, when the development process of Taiwan is considered, we would be more conscious about reciprocity. It's known that immigrants of Taiwan's west coast, where Rinan located, were composed of croppers and merchants from southeast China, who were not only for surviving but also for profit. That would destroy the symmetry of credit demand between residents while it is crucial for the reciprocal relationship to last. Another related point is that more definite institutions, including land ownership registration, are believed to be founded when the exploitation of Taiwan started in Qing Dynasty (David Faure, 2010, p.14), which would not only promote kinds of immigrants but also make market institution play a more important role in the immigrant society.

Meanwhile, as the discussion about account money has shown, the colonial government by Japanese shouldn't be neglected. In the view of Scott (1976, p.58-90), colonial government tended to destroy the traditional surviving economics by normalized institutions, such as stiff taxation and modern legal systems. As to Taiwan's situation, some similarities can be found, including requisition of common land and clarifying land ownership. At the same time, colonial government seems to be more success in Taiwan which is supported by the evidences of per capita income and welfare status (Wu and Lu, 2008). Modernization started in this period with the improvement of transportation, water conservancy, financial institutions and so on. (Zhang Hanyu, 1955, p.74-79) One most important change to Rinan village during our researched period was that the coast railway went into operation and a station was set at Rinan in 1922. The convenience caused by

this traffic improvement would provide more economic opportunities as proved by the increase of population (Zhang Qingzhong, et al., 2004, p.195-198).⁶ Although traditional handicraft industry and seaport economy faced more competing after the railway operated (Chen Yanzheng, et al., 1989, p.213), these side effects seemed much weaker for Tachia Township. Except for the improvement of traffic condition, cooperative was set up at Tachia in 1915 and Guo Murong from Rinan was entitled as a director (Liao Ruiming et al., 2007, p.1562). However, there is no material to show its effects on local society, and we will discuss it in next section. As a whole, economic status was more likely to be improved during this period and threaten to survive should be weakened, which was on the contrary to Scott (1976, p.58-90). Although the FDA kept its traditional appearance, its substance would have been changing in the modernization process.

On the other hand, as the FDA was a traditional Chinese organization, conflicts between its practice and the colonial legal system happened inescapably. For example, law of 1923 claimed that the property of god association was not owned by the association but by its members, which challenged the traditional operation (Lin and Huang, 2001, p.268). Further, the “Japanesizing” (皇民化) movement began in 1941 gave the heaviest beat to the god associations, and Chinese belief and culture was restrained greatly in this movement (Lin and Huang, 2001, p.268). From the account book of FDA, we can see that the cash credit disappeared after 1941. It seems that movement had much greater effect than law to local society, as the relationships in local society were reshaped more dramatically by forces in the movement. Since what we will research is the relationships besides politics, the period from 1915 to 1938 is suitable for there was no great movement happened.

III. Exploring interest rates of the FDA

In the FDA's interest rate rules, the key point is that two stages were divided by the size of loans. For loans less than one Yuan, annual rate was 100%, while, for loans above one Yuan, it was just 50% before 1923, then adjusted to 30% and further dropped to 20% after 1933. These were the claimed interest rate, but exceptions existed in practice. For example, for loans exceeding 10 Yuan or with long-term, interest rate would be discussed specially and always reach a favorable level below 15%, considering such loans could save transaction costs compared to tiny and temporary lending. Measured by the interest rate level, especially for the micro loans, the reciprocity suggested by Huang Zhongzhi (1992) can't hold. Moreover, even compared with other god associations whose interest rate was always 20% or even lower⁷, the FDA's credit seems not only close to usury but also illegal. However, we should notice that normal god associations loan their fund to the head in lump sum, and then, their interest rate should be correspond to the most favorite type of FDA. Therefore, the FDA didn't require higher interest rate in fact. On the contrary, it was more flexible to the members as the association met micro demand directly and provided more selections for related borrowers. Since the difference of interest rate cannot be attributed to social relationships, the classification between usury and reciprocal credit argued by Scott (1976) or Huang Zhongzhi (1992) also can't be valid, while size affect shown by Peng, Chen and Yuan (2008) would work. An additional question is that why the FDA made interest rate rules

⁶ See also Wu and Lu (2008).

⁷ A collection of Taiwan's materials can refer to Lin Zhen (1961, p.260-302). As the tradition of god association could be formed before the exploitation of Taiwan, situation of Fujian is comparable too. From Yang Guozhen, et al. (1990), we can even find loans from associations whose sacred god was the same as FDA. Their interest rates were about 10% to 20% which was much lower than FDA, while their loan sizes were large compared to loans of FDA.

different to other similar associations. It's perhaps that the interest rate regulation was weaker in this obscure village, or, there were fewer villagers who involved in great business and could absorb a large sum at one time. Any way, it's fortunate for our research because the seemingly trivial status of Rinan village made interest rate more flexible, which means more could be discovered in the interest rate.

Besides cash loans, there were special loans of sacrifices, such as orange and dishes, whose annual interest rate was 100% in kind and this rate was kept until 1943 when the account book ended.⁸ Such loan in kind was always as tiny as one or two oranges, one bowl of dishes, and so on. Its interest rate was the same as small cash loans too. Meanwhile, there may be special meanings in the sacrifice loans or we have to suggest that demand about such ordinary food is as urgent as cash. Actually, similar customs could be found extensively in the Qing Dynasty. For example, in Beijing, people borrowed the paper ingot which was a special sacrifice to the god of wealth, and paid back doubled to win the god's blessing (Li Hongruo, 1886, pp.3; Chong Yi, 1982, p.87). Same practice in Shanghai was recorded, but it was under the name of a god governing the underworld (Gu Bingquan, 2001, p.33). It's more exaggerated in Guangzhou, where people borrowed several *wen* from the Kwan-yin Bodhisattva and paid back tens and hundreds times in the next year (Chen Kun, 1996, p.2801). These ritualized activities could be ascribed to Frazer's "Homoeopathic Magic" (Frazer, 1922, p.12) perfectly. As orange and dish were homophonic with propitiousness and treasure separately in Chinese, borrowers paid back double symbolizing their propitiousness and treasure would be doubled too. In this operation, the 100% or higher interest rate is more like a special bribe to the god than usury under the name of god. Of course, the incentive behind related activities also exposed that exorbitant repayment, including interest rate as high as 100%, could be accepted by the popular moral, which is contradictory to the critiques of usury since Aristotle in the Western history.

The interest rate of sacrifice loans kept constant according to the mental or religious implication in such ritual operations. As a custom, it is important and interesting for a traditional society, but the sacrifice loans are very tiny in amount and their economic meaning is limited actually. More importantly, the benefit of these loans lies in the "Homoeopathic Magic", which is quite different to normal credit we care about in this paper. For these reasons, we will turn to cash loans below. From fig.1, where the interest rates of settled transactions are plot point by point, it's clear that they drop significantly. As described above, the quoted interest rate for loans exceeding 1 Yuan decreased step by step, but, the more important reason is that there were much fewer micro loans after 1923. This expanding of loan size will be discussed in next section, because it may be tactical reaction to the adjustment of interest rate rules, which need special analysis. Now, let's look at other exogenous factors which might work directly to the decrease of interest rate quotations for loans above 1 Yuan.

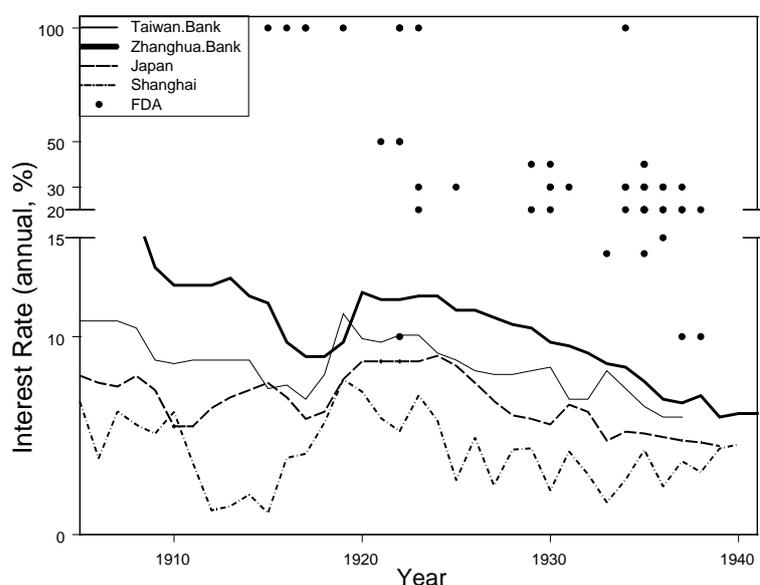
From fig.1, the interest rates of banks, including the Taiwan, Zhanghua, Japan and Shanghai series, dropped during 1920s too, but their time point was not in coherence with the FDA, as far-east finance market was still in crisis and bank interest rate kept high when the FDA cut down its interest rate in 1923. In fact, far-east industry and financial market flourished during the First World War which foreshadowed depression after the war. (Chen, 1953, p.146) Meanwhile, the market turbulence of world around didn't affect FDA, and, even the interest rate of Zhanghua Bank, a modern financial institution relatively near to Rinan, kept a remarkable gap with market

⁸ There was only one exception in 1938 where meat pie was borrowed with 50% interest rate.

centers at Taipei, Tokyo or Shanghai. If we confess the financial integration between Rinan and the institutional financial market was still very weak, had it improved during 1920s? It's true to some extent as the interest rate gap between the FDA and banks decreased, and some similarity in their trends after 1920s, which will be tested further, appeared. However, judged from their change order, this is mainly the result of FDA's interest rate cut, and there was also little direct evidence that institutional finance contributed to it. A difficulty in estimating the role of institutional finance is that Tachia cooperative, the first modern financial institute near Rinan, was set up in 1915, while we have no material about the interest rate of FDA before then to discuss the function of this cooperative directly. However, comparing to the normal situation of Taiwan and Fujian since Qing Dynasty⁹, the interest rate of FDA before 1923 was still quite high, closely to the upper limit of popular private interest rate. It's nearly impossible that the interest rate of FDA would be higher before 1915 and decrease after the cooperative founded.

If we turn away from development of institutional finance, the most coincident events are the completeness of lengthwise railway and the foundation of Rinan Station at 1922. As we have discussed, traffic improvement provided more opportunity which would increase credit demand and decrease transaction cost. When villagers could get loans at lower price by other ways and had more demand for loans exceeding one Yuan, they would have incentive to cut down the interest rate for larger loans and related suggestions would also have more opportunities to reach a consensus in the meetings of FDA.

Fig. 1 Trend of Interest Rate: Taiwan and around



Source: Taiwan and Zhanghua Bank, Chen Rongfu (1953); Japan, Homer and Sylla (1996); Shanghai, Shanghai Branch of PBC (1960).

In order to explore the interest rate of FDA formally, we next regress interest rate against related factors to discriminate their effects. Our basic regression function is specified as below:

$$rate = \beta_0 + \sum_{i=1}^3 \beta_i D_i + \beta_2 \log(prin) + \beta_3 term + \beta_4 bankr + \beta_5 train + \theta \cdot debtor + \mu (*)$$

⁹ Related discussion can be found in Wang Siqing (1994) and Peng, Chen and Yuan (2008).

In (*), D_i is a dummy variable, valued one if principle exceeds one Yuan in period i , used to control the quotations of three periods: 1915-1922; 1923-1933; 1934-1938. Though scale economy is embedded clearly in the quotation of FDA, it's not captured completely as the quotation was still too regulated and there were cases that the interest rate was decided specially. We add the logarithm of principal, $\log(\text{prin})$, to represent this further effect. A related item is *term*, for the effect of longer term is similar to larger scale. Bank interest rate and the foundation of Rinan station are included by *bankr* and *train*. For *bankr*, we use the lending rate of Taiwan Bank lagged one year,¹⁰ and *train* is a dummy variable valued one after 1922. In order to control personal characters whose importance in personal credit is often claimed, dummies represent different debtors are included in (*) by the dummy vector named *debtor*.

Table 1 reports the main regression results. In result (1) and (2), we control personal character by 35 debtor dummies, and only scale economy represented by the quotation rule and principle is significant steadily. Since debtor dummies are too many compared to the number of observations, which makes their coefficients bewildering and stochastic even if some of them are significant, we drop the dummies except those according to Guo and Ye whose personal character are outstanding as introduced above. Then, we get the result (3). It's strange that *Guo*'s coefficient is significantly negative while that of *Ye* is very insignificant, though they should both have good credit. Check of the data shows that this is due to an outlier where Guo borrowed 50.59 Yuan at the minimum rate of 10%. If this observation is omitted, result (4) shows that both *Guo* and *Ye* become very insignificant, while bank rate and train are significant when *Guo* and *Ye* are dropped in (5). It's not surprising to find that personal character has no significant effect on interest rate, considering games of the FDA members were repeated, their information was nearly transparent and they have the same belief of Fude God. Meanwhile, it should be noted that *bankr* could only explain a small part of the change of FDA's interest rate as the coefficient of period is in much greater scale. On the contrary, the importance of *train* is more than it appeared since not only its main effect has captured by period dummies, but also integration between interest rate of bank and FDA after mid 1920s should be attributed to it as discussed.

A possible problem for the regression is the endogeneity of principle. As we will discuss later, if the quotation is known ex ante and there is breakpoint at one Yuan, chance for arbitrage will appear, which makes loan size endogenous. This means the scale effect represented by principal or loan size in (*) may be endogenous, but this is quite weakened when interest rate rule, which is the main source of endogeneity, is included in regression. Meanwhile, for loans whose interest rate deviate from quotation and decided by consensus specially, principal is decided firstly, and interest rate, which becomes ex post now, is very difficult to expect by information out of (*). In either situation, the endogenous problem is nearly excluded in fact. However, in order to weaken the endogeneity further and understand the scale effect better, in specification (6), the effect of principle for loans below 1 Yuan and exceeding 1 Yuan is discriminated. The result shows that the negative relationship just comes from loans exceeding 1 Yuan. Actually, if the scale economy lies in some fixed cost as Peng, Chen and Yuan (2008) suggested, it is easy to understand that even double interest of micro loans can't pay the cost and the 100% interest rate of FDA is still restrained, which explains why the scale economy doesn't work below one Yuan. We will touch upon the interest rate limit problem again in discussion about the decision of FDA.

¹⁰ In fact, we have tried the contemporary interest rate of Taiwan Bank and Zhanghua Bank, but they are not as significant as lagged interest rate. Hence, we drop them for collinearity through a stepwise procedure.

Table 1

Variable	(1)	(2)	(3)	(4)	(5)	(6)
C	117.53 (15.87) ^{***}	100.11 (7.98) ^{***}	87.06 (7.22) ^{***}	83.95 (6.27) ^{***}	83.95 (7.17) ^{***}	85.56 (8.20) ^{***}
I(prin \geq 1)						
Period1	-52.39 (10.04) ^{***}	-60.80 (6.17) ^{***}	-49.10 (4.55) ^{***}	-46.17 (3.98) ^{***}	-44.60 (3.99) ^{***}	-46.76 (6.60) ^{***}
Period2	-70.46 (12.17) ^{***}	-75.90 (6.57) ^{***}	-64.09 (4.86) ^{***}	-64.80 (4.20) ^{***}	-58.27 (4.02) ^{***}	-60.57 (6.89) ^{***}
Period3	-72.84 (11.13) ^{***}	-76.68 (6.08) ^{***}	-66.47 (4.54) ^{***}	-66.83 (3.92) ^{***}	-61.13 (3.76) ^{***}	-63.43 (6.74) ^{***}
log(prin)	-4.73 (2.01) ^{**}	-2.49 (1.02) ^{**}	-2.69 (0.77) ^{***}	-2.24 (0.67) ^{***}	-3.54 (0.65) ^{***}	
prin<1						-2.24 (3.22)
prin \geq 1						-3.58 (0.66) ^{***}
term	-6.28 (6.56)	-5.69 (3.26) [*]	-5.51 (3.31)	-6.03 (2.86) ^{**}	-3.86 (3.26)	-3.79 (3.28)
bankr	-0.65 (0.61)	0.20 (0.31)	0.57 (0.30) [*]	0.64 (0.26) ^{**}	0.61 (0.30) ^{**}	0.61 (0.30) ^{**}
train	-3.98 (7.65)	-2.01 (5.42)	-5.76 (3.79)	-4.33 (3.28)	-8.27 (3.35) ^{**}	-7.64 (3.70) ^{**}
guom			-6.87 (3.40) ^{**}	-1.83 (3.11)		
yeq			2.68 (6.89)	-0.26 (5.98)		
F stat. of debtor	2.03 ^{**}	2.16 ^{**}				
R ²	0.93	0.98	0.95	0.96	0.94	0.94

Note: standard errors are provided in “()”; superscript ^{***}, ^{**} and ^{*} mean significant at 1%, 5% and 10% separately.

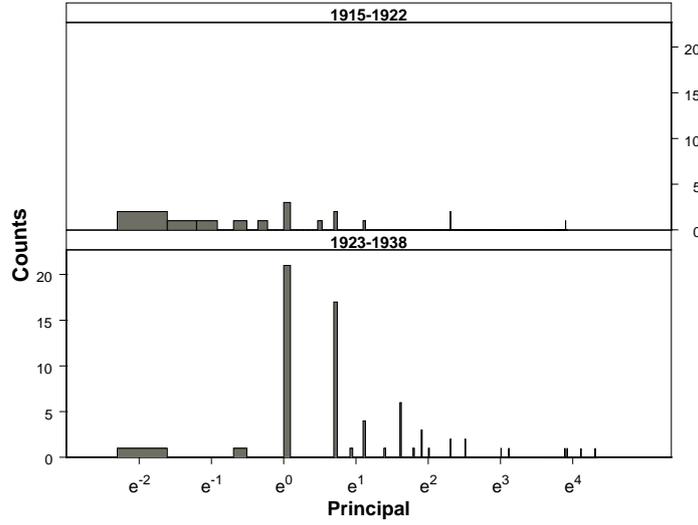
IV. Arbitrage about the interest rate quotation

As shown by the regression analysis of equation (*), the interest rate arrangement of FDA is mainly impersonal and members could decide their credit amount according to it. This forms a typical game in economic terms. Then, will the association and its member act in a rational way as the optimizing theory expects? Or, if there was deviation from the theory in some situations, did it change with the modernization progress? Answers about these questions will be helpful for understanding the marketization and the essence of economic rationality.

It's useful to look at the distribution of loan size at first. From fig.2, we can find that principal concentrates at one Yuan (e^0) with a sharp left drop, which is different from normal micro credit distribution with its peak close to zero. An apparent explanation is to avoid exchange cost by loaning integer amount, but this can't explain why the proportion of small change loans decreased

greatly and concentrating at one Yuan strengthened after 1923, when the interest rate for loans exceeding one Yuan was lowered. On the contrary, the endogeneity of credit size to the interest rate gap illustrates that we should pay more attention to the arbitrage about one Yuan loans, as larger gap means more room for arbitrage. However, when members acted in this way, it may be not optimal for FDA to leave a so great gap in the interest rate quotation. Then, how should we understand the reaction between FDA and its members?

Fig.2 Histogram of loan sizes



In order to detect what questioned above, we'd better start from a standard optimizing problem of the FDA and its members. At first, the FDA decides its interest rate quotation by maximizing its object, e.g., profit. Suppose the quotation is required to take a two stage form to save menu cost and negotiating cost.¹¹ Then, the profit maximization could be defined as below.

$$(1) \max_{r^a, r^b, \omega} \Pi = r^a \int_0^{q^*} q dF(q) + r^b \omega \int_{q^*}^{\omega} q dF(q) + r^b \int_{\omega}^{\infty} q dF(q) - E(C(q))$$

In (1), the two stage quotation is defined as r^a for principle lower than ω , and r^b elsewhere. Borrowing reserve price function as q is known to the FDA, and the status of members is supposed to be stochastic whose distribution is defined as $F(q)$. However, according to the quotation rule, the reserve price function will not equal to the real demand function, because borrowers, whose demand is lower than ω but exceed some level, e.g., q^* , would borrow ω to arbitrage as will be discussed below. The minus item in (1) is the expected cost which may depend not only on the total loan scale but also on the distribution of every loan size. For the main problem of FDA is scarce of demand as discussed in section III, we don't add credit amount constraint to the solution of (1).

In addition, we suppose the reserve price function of borrowers has a quasi log-linear form for convenience, which is defined in (2).

$$(2) \ln q = \beta_0 + \beta_1 r + \varepsilon$$

¹¹ Actually, the FDA's quotation was not complete since members would discuss interest rate for extra large or long term loans specifically as we pointed out in section III. This also illustrates that the simple form of quotation is selected mainly to save menu cost and negotiating cost. If such costs are great enough and there is no substitution between extra large loans and one Yuan loans, we can suppose the quotation form is given for convenience.

Of cause, profit should not be the exact object of FDA, but it's a useful start point and we will discuss how it might be deviated through empirical analysis. An actual obstacle for the FDA's optimization is the strategy of members, which will make the problem difficult to solve since the quotation will affect the lend size in the pattern shown in fig.2. Under the rationality assumption, the FDA should take the reaction of members into consideration and get first derivative condition as (3.1)~(3.3). Meanwhile, if its rationality is bounded for constraint of calculation ability, terms mixed with reaction of members in (3.1)~(3.3) might be omitted.

$$(3.1) \quad \frac{\partial \Pi}{\partial r^a} = (1 + r^a \beta_1) \int_{-\infty}^{\Delta_a} e^{\beta_0 + \beta_1 r^a + \varepsilon} dF(\varepsilon) + (r^a q^* - r^b \omega f(\Delta_a)) \left(\frac{q_a^*}{q} - \beta_1 \right) - EC_a$$

$$(3.2) \quad \frac{\partial \Pi}{\partial r^b} = (1 + r^b \beta_1) \int_{\Delta_b}^{\infty} e^{\beta_0 + \beta_1 r^b + \varepsilon} dF(\varepsilon) + (1 - f(\Delta_b)) \beta_1 r^b \omega + \omega (F(\Delta_b) - F(\Delta_a)) \\ + (r^a q^* - r^b \omega f(\Delta_a)) \frac{q_b^*}{q} - EC_b$$

$$(3.3) \quad \frac{\partial \Pi}{\partial \omega} = r^b (F(\Delta_a) - F(\Delta_b)) + (r^a q^* - r^b \omega f(\Delta_a)) \frac{q_\omega^*}{q} + (f(\Delta_b) - 1) r^b - EC_\omega$$

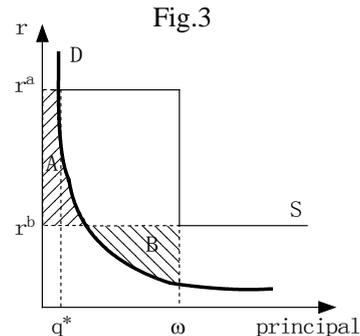
In (3), $\Delta_a = \ln q^* - \beta_0 - \beta_1 r^a$, $\Delta_b = \ln \omega - \beta_0 - \beta_1 r^b$. $F(\bullet)$ and $f(\bullet)$ represent distribution and density function of ε separately. EC and q^* with lower subscript means related partial derivatives, through which the strategy of members are taken into FDA's consideration.

As making exchange is relatively expensive for micro loans, it seems quite reasonable to set ω at one Yuan and (3.3) has little need to refer in fact. In addition, since the fund of FDA didn't come from outside credit but gathered through contribution, its cost, EC , mainly consisted of the management cost and exchange cost, and only the latter would relate to the controlled variables. Moreover, because the need of exchange is decided by the proportion of micro loans below one Yuan, the marginal cost of interest rate adjustment will mainly come from its affect on the loan size distribution.

Once the interest rate quotation is decided, members will decide their amounts to borrow. For arbitrage, they will tend to borrow one Yuan even if the needed amount is smaller than it. Thus, the breakpoint in the interest rate quotation causes nonlinearity in the borrower's strategy. Given the marginal utility or reserve price function of borrower, tradeoff between the decrease of reserve price and interest rate when borrowing more decides the one Yuan arbitrage as shown by fig.3 or equation (4). From fig.3, it is easy to see that if shadowed area A is greater than B, members would borrow ω though the reserve price curve intersects supply curve at q^* . This arbitrage gives (4).

$$(4) \quad \ln q = \begin{cases} \beta_0 + \beta_1 r^a + \varepsilon, & q \leq q^* \\ \omega, & q^* < q \leq \omega \\ \beta_0 + \beta_1 r^b + \varepsilon, & q \geq \omega \end{cases}$$

In theory, q^* should be derived from $S_A = S_B$, where



$$S_A = \int_{r^b}^{r^a} e^{\ln q^* - \beta_1(r^a - r)} dr, S_B = \int_{(\ln q^* - \ln \omega + \beta_1 r^a) / \beta_1}^{r^b} (\omega - e^{\ln q^* - \beta_1(r^a - r)}) dr$$

The equation, $S_A = S_B$, can be simplified into (5), which shows the equilibrium relationship between interest rate quotation and q^* .

$$(5) \quad 1 + \ln(q^* / \omega) - \beta_1(r^a - r^b) - q^* / \omega = 0$$

Obviously, q^* tends to increase if the gap between r^a and r^b shortened. Since increase of q^* or the threshold for arbitrage means some loans will retreat from ω to q^* , exchange cost will increase accordingly. Then, for the items in (3), there are

$$q_a^* \leq 0, q_b^* \geq 0, EC_a \propto f(\Delta_a) \cdot q_a^* \leq 0, EC_b \propto f(\Delta_a) \cdot q_b^* \geq 0.$$

(4) also provides conditions for empirical analysis through the data introduced in section II, where r^a , r^b and q are known. As (4) is highly nonlinear, we will use methods of moment to estimate the reserve price function and the threshold q^* . The moment conditions can be derived from (4), which are listed below.

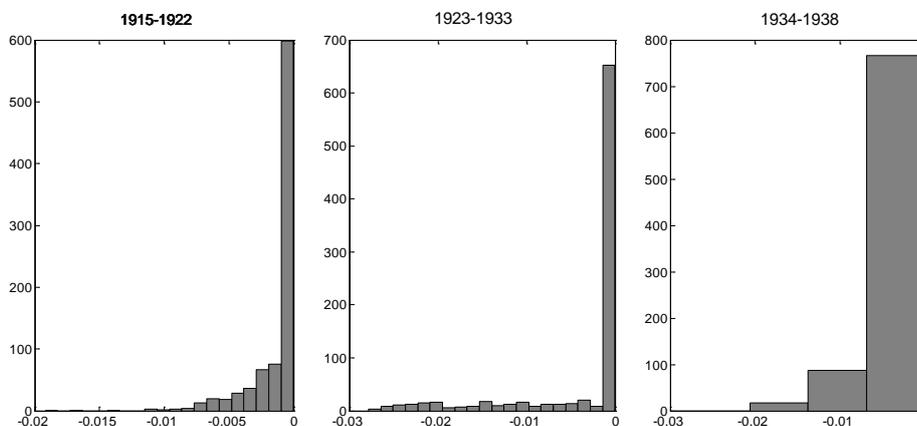
$$(6) \quad \left\{ \begin{array}{l} E(\varepsilon | q \leq q^*) = \int_{-\infty}^{\ln q^* - \beta_0 - \beta_1 r^a} \varepsilon dF(\varepsilon) \\ E(\varepsilon | q \geq \omega) = \int_{\ln \omega - \beta_0 - \beta_1 r^b}^{\infty} \varepsilon dF(\varepsilon) \\ E\left(\frac{N_a}{N}\right) = F(\Delta_a) \\ E\left(\frac{N_\omega}{N}\right) = F(\Delta_b) - F(\Delta_a) \end{array} \right.$$

It should be noted that we don't use $S_A = S_B$ or (5) to get (6), because the equilibrium condition under perfect rationality might not hold empirically. Then, q^* will not be derived from (5) directly, but be estimated from (6) together with β_0 and β_1 , which means we could test the theoretical relation (5) by the estimated results. Since it's difficult to get analytic solution from the moment condition (6) and the sample is small, we apply bootstrap method to get distributions of the estimations, while ε is supposed to be normally distributed. Fig.4 plots the bootstrap distribution of β_1 's MM estimation. As fig.2 have shown that the debt sum concentrates on one to two Yuan heavily, it's not surprising that the credit demand is quite inelastic and the empirical distributions of different periods all peak near zero. However, the more important point is the extension of left tail or the increase of elasticity after 1922. Compared with fig.2, this is in accordance with increase of larger sum loans and more arbitrage on one Yuan. The later point needs more explanation. As shown in fig.3, more elasticity means increase of S_A 's area relative to S_B , which will lead to the decrease of threshold q^* and more loans of one Yuan.

Especially, the largest lend below one Yuan is 0.75 before 1923 and this is also the MM estimation of q^* for the first period. It happens to be an exactly "right" calculation for a vertical reserve price curve, as loan of 0.75 Yuan with 100% interest rate will pay the same as loan of 1 Yuan with 50% interest rate. However, it's quite impossible for the elasticity to be zero exactly or for the surplus 0.25 Yuan to be in vain absolutely. Another more reasonable explanation is that calculation with a zero elasticity hypothesis is much simpler. Thus, elasticity or preference might not change in fact, but the opportunity cost of a simplified calculation was increased when the Rinan station was founded and more market opportunity appeared. Of course, elasticity may also

change in other ways not related to preference. For example, when market opportunity is scarce, most debt may be caused by emergent, inelastic and scattered need. In both cases, market development provides more reasonable explanations for the increase of elasticity and proportion of larger loans.

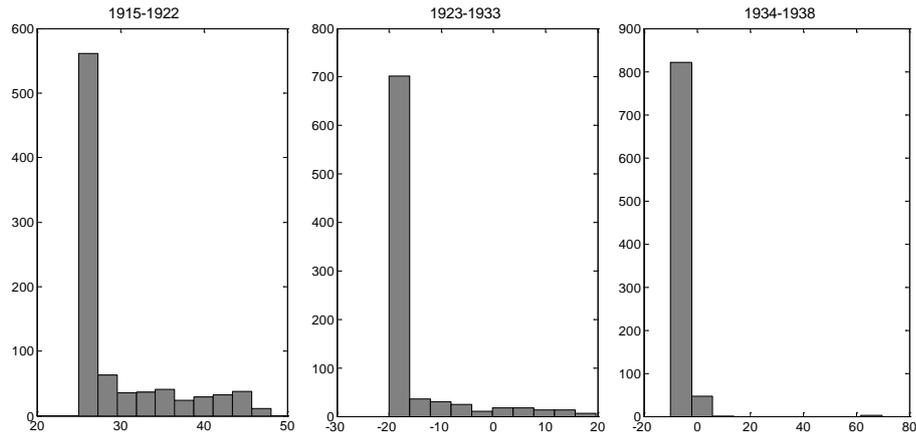
Fig.4 Histogram of β_1 's MM estimation by bootstrap



Note: The histogram composed by 1000 times bootstrap resampling, where the singular samples are dropped.

Above explanation means optimization isn't realized perfectly. In fact, fig.2 has led us to doubt whether it was too progressive after 1922 while it might be too conservative before then. This can be solved by testing the rationality of FDA's members represented by the optimizing condition $S_A=S_B$ or (5). Fig. 5 plots the bootstrap histograms of S_A-S_B in different periods. Similarly to the zero peak of β_1 's histogram, there is left peak for S_A-S_B . Meanwhile, fig.5 shows that the optimizing condition can be rejected just for the first period, which means people became more "rational" from being too "conservative" as credit had been more elastic after 1922. However, it may be not exact to say the change of rationality. As our discussion about fig.4 has shown, $S_A=S_B$ will hold for the first period, if the elasticity was set zero or if the calculation cost and market status are considered. Fig.5 supports our argument further, because the optimizing condition became acceptable after 1922, when market condition was improved and calculation cost became insignificant compared with related benefit. So, it's fairer to suggest bounded rationality than some natural pattern different from rationality as behavioral economists would argue. Furthermore, the bound of rationality is not fixed, and marketization tends to relax it, which means market economy and economic rationality could enforce each other and construct an internal consistent hypothesis. It's a positive support for analysis market economy with rationality assumption.

Fig.5 Histogram of S_A-S_B



Note: The histogram composed by 1000 times bootstrap resampling, where the singular samples are dropped.

As members arbitrated with the interest rate quotation rather rational, how did the FDA react to it? When we turn to the test of (3), things become quite different. Our method is similar to the test of (5) and the bootstrap histogram of (3) is plotted in fig.6.¹² However, the optimizing condition that the first derivative equals to zero is rejected generally. The partial derivative is negative to r^a while it is positive to r^b for all periods, which verifies the intuition that optimized interest rate quotation shouldn't have so dramatic shift from 100% to 50% or 30% at one Yuan. In fact, deviation from (3.2) is not difficult to understand since there was competing private credit market for larger loans and its popular interest rate was just about 20% to 30%. When the entrance obstacle of credit market was weakened and borrowing elasticity increased after 1922, derivative to r^b also increased. Deviation from (3.2) thus reflects the competitive market pressure, which isn't included in our model explicitly, rather than rejects the optimization of FDA.

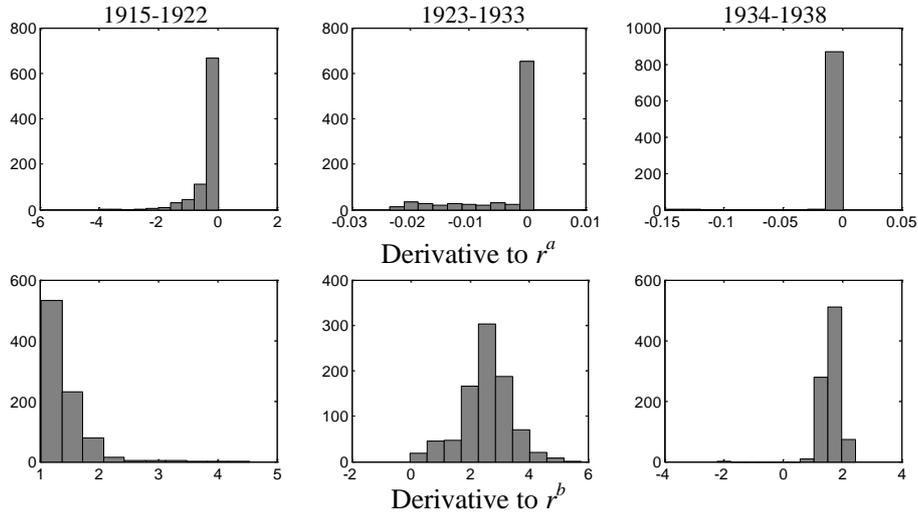
Meanwhile, the negative derivative to r^a seems quite unreasonable, since decreasing r^a from 100% would gain Pareto improvement even if the FDA looked for other subjects such as charity. Exchange cost, omitted in fig.6, might provide some explanation, for exorbitant r^a will push more small change borrowers to borrow one Yuan. However, exchange cost can't explain why deviation from (3.1) was weakened greatly after 1922, while EC_a would increase with more elastic demand curve¹³. Therefore, exchange cost should not be the key point for the decision of r^a , once monetary reform had succeeded in uniting fractional money. Another possibility lies in calculation cost. As we have noted, omitting the strategy of members could make the problem much simpler and save the calculation cost greatly. This gives fig.7, where the items related to partial derivatives of q^* in (3) are omitted. It's clear that partial derivative of r^a shifts to be positive for all periods, which becomes in accordance with interest rate regulation and easy to understand, considering 100% interest rate had long been regarded as the upper limit of tolerance in traditional literatures. Thus, the departure from (3.1) should be explained by calculation cost, combining with a customary interest rate limit at 100%, which is also consistent with the ritualized interest rate in loan of sacrifices. In contrast to the test of member's rationality through fig.5, the calculation cost of FDA worked for all periods, although the scale decreased after 1922. However, it's not surprising if we

¹² Because exchange cost is very difficult to be included explicitly in our model, it is omitted in computation, which is acceptable as EC_a and EC_b are relative small in (3.1) and (3.2), according to our discussion about the monetary institution.

¹³ In our computation results, not only q_a^* for the latter periods increased, but also $f(\Delta_a)$ increased slightly too. Both of them tend to increase the effect of r^a to exchange cost.

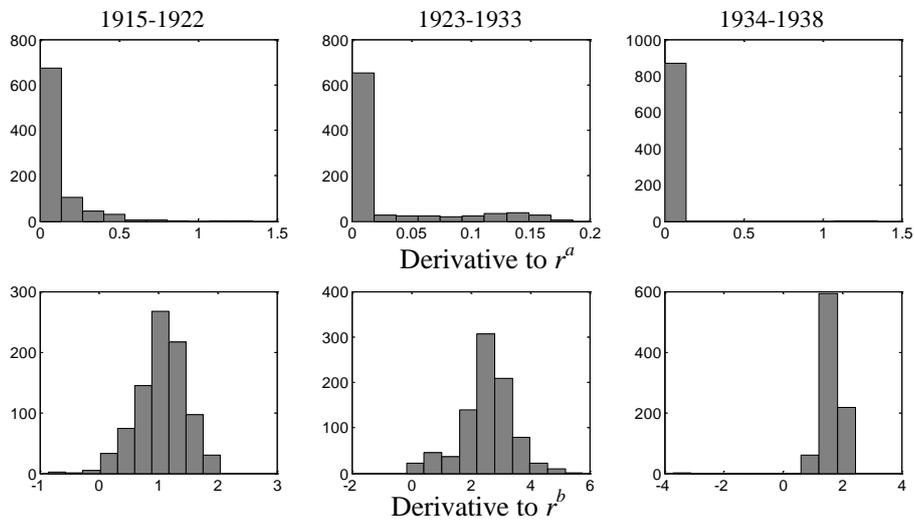
notice that the optimization problem of FDA is much more complex and it has to be solved by collective decision. As introduced in section II, the decision process was some colligation of ideas from members with different situations and subjects, and further, the more powerful members would pay more attention to lower r^b which had more correlation with their own interests. So, the rejection of (3.1) means more likely to suggest the agent problem tangled with difficulties in calculation than reject personal rationality simply.

Fig.6 Histogram of (3)



Note: The histogram composed by 1000 times bootstrap resampling, where the singular samples are dropped.

Fig.7 Histogram of (3): omitting the indirect effects



Note: The histogram composed by 1000 times bootstrap resampling, where the singular samples are dropped.

V. Conclusion

Traditional rural economy is often believed to have some special pattern, such as surviving economy or small peasant economy, where rural credit is divided into reciprocal lending between villagers and the usury from market. However, we find this can't hold in the case of FDA. The FDA provided credit for villagers, but its interest rate for micro loans was set to be as high as usury by consensus of its members, according to the scale diseconomy of those loans. At the same time, though the FDA is a local religious institution, its interest rate is comparable to other private

credit in fact and adapts to competing from credit market. Furthermore, marketization didn't aggravate usury as Scott (1976) argued. On the contrary, the interest rate was lowered and there even appeared integration between rural credit and institutional financial market when market condition was improved by railway. It should also be noted that institutional factors, including the land ownership and modern cooperatives which were more often cited, could explain little about the variation of interest rates.

Meanwhile, in the argument about small peasant economy before modernization, the rationality of peasant was thought to be not according to calculation about benefits and costs. We do find deviations from optimal solution given the FDA's interest rate rule, but it just reflects that the calculation cost shouldn't be neglected and the calculation process tends to be simplified for cost saving. In our findings, the calculation problem leads to some special calculation procedures which could be attributed to bounded rationality or mental accounting, rather than the small peasant rationality. More importantly, when more market opportunities appeared and the benefit of calculation increased, deviations from optimal equilibrium also decreased. This shows that the importance of deviations from complete rationality is more depending on social institutions than physiological elements, which proves the internal consistent between market economy and economic rationality.

According to our findings, the arbitrage of FDA members was more extended in micro loans after 1922, which could reflect the effects of marketization on the daily life at the micro level. It seemingly supports the usual attack on marketization, but, when the cause is that the benefit of calculation increased, the meaning of daily rationalization becomes not so negative certainly. In the FDA's operation, something kept unchanged during the marketization is the ritual sacrifice loan. Ironically, ritualization actually restricts this kind of loan to a tiny scale, even if the FDA is a religious organization. In addition, in Rinan village where formal interest rate regulation was weak, the customary limit as high as 100% was really worked. However, it's much higher than the legal limit and only affects very little loans, e.g., those much less than one Yuan. Thus, religion or custom also can't constitute a significant rational pattern in the traditional economic life we explored. Nevertheless, the aim of this paper isn't to claim the universality of economic rationality, but, when we understand the deviation from rationality more clearly, we can use the theories based on rationality hypothesis better even in analyzing the traditional economy.

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