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Study on the Mitigating Effect of Financial Literacy on Formal Credit Constraints of Farmers

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Abstract: *In view of the farmers being restricted by the strong formal credit, this paper analyzes the financial literacy from the perspective of whether the financial literacy can effectively alleviate this constraint. Then, based on the sample data of China Household Financial Survey database (CHFS) in 2015, and on the basis of measuring farmers' financial literacy, the Probit model and Tobit model are used respectively. From the two angles of formal credit availability and loan amount unsatisfied, this paper verifies the existence of mitigation effect: financial literacy has a significant mitigation effect on farmers' formal credit constraints; The unmet amount of formal credit will decrease as the level of financial literacy increases. This paper attempts a new research breakthrough from the angle of financial literacy, which has certain theoretical and policy significance.*

Keywords: *Financial literacy; Formal credit constraints; Farmers*

1. Introduction

At the October 2023 financial work conference of the CPC Central Committee, the Party Central Committee listed inclusive finance as one of the five strategic chapters for our country to become a strong financial country once again. It focuses on the persistent ailments of rural household credit constraints that have long constrained the development of our rural areas.

The research on this problem has been going on for many years, and the predecessors have established the research framework of joint analysis from supply and demand. On the other hand, it is difficult for farmers to evaluate the transaction cost and risk cost of formal credit, and there are obvious cognitive biases on loan products and application procedures. Farmers tend to give up the initiative to apply for loans, forming a"Demand-based credit constraints"[1].

Logically, financial literacy, as the embodiment of financial cognitive ability (including financial knowledge, financial behavior, financial skills, financial attitudes), directly affects farmers' financial decision-making[2]. Households with high financial literacy are more likely to hold debt and borrow through formal channels[3]. But the farmers in our country lack of general financial knowledge, low cognitive level, poor application ability, insufficient risk cognitive ability, and thus inhibit their effective participation in formal financial services.

This article is from the perspective of financial literacy to analyze and verify it can effectively alleviate the persistent problem of credit constraints of farmers, in order to seek a breakthrough in this field.

2. Literature review and the value of this study

2.1 Both the supply side and the demand side are important reasons for credit constraints

The study of the reasons of credit constraint started from the supply side in the early stage. In the theory of credit rationing, Stiglitz argues that the existence of credit rationing is based on the fact that lenders tend to adopt rationing in the absence of discernible information, and make the allocation of formal credit resources by lending money to well-informed borrowers at below-market clearing rates [4]; Rural financial markets in developing countries (including our country) operate more inefficiently and the credit allocation problem of farmers is more prominent [5][6](Kochar, 1997; Liu Xichuan et al. , 2009). In the theory of credit rationing, it is believed that the reason of credit rationing problem is the

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adverse selection and moral risk caused by information asymmetry between the lender and the borrower. Information asymmetry is the main cause of the problem. With regard to the theory of financial exclusion, which holds that certain social groups are unable to obtain the necessary financial services from the formal financial system. High unemployment, poor skills, low income, poor housing, high crime, poor health, poverty and family division are all important reasons for financial exclusion. Financial institutions tend to segregate disadvantaged groups. Thus financial exclusion of rural households is particularly pronounced [7].

The theoretical consequences of supply-side mitigation are not fully supported in practice. For example, our early inclusive financial reform has been trying to change the supply structure from the point of view of breakthrough, but the effect is very modest. So in recent years, scholars have begun to try to make new breakthroughs from the perspective of demand. The study of demand-based credit rationing shows that there are a large number of farmers who do not apply for loans from financial institutions or give up voluntarily because of some reasons. Only if the borrower does not suffer from the demand-type rationing, can it be observed whether the borrower suffers from the supply-type rationing. That is, demand is the cause and supply is the cause behind the demand. Li Qinghai et al (2016) established a double sample selection model based on the survey data of farmers in the two provinces of Sulu, and found that the demand-based credit rationing is an important factor in the formation of formal credit rationing. The education level of the head of household and whether he has ever obtained formal loans are also important factors to form demand-oriented rationing [8].

2.2 Information asymmetry may be an important factor in credit rationing

2.2.1 Information asymmetry on the demand side

The research of Liu Xichuan et al. (2009) found that the low coverage rate of farmers in formal financial institutions in our country is not only related to the credit supply of rural credit cooperatives and other formal financial institutions, but also related to the demand of farmers for formal finance. There are a large number of potential and hidden formal credit needs in the surveyed areas. Only 17.3% of farmers with formal credit needs applied for loans from rural credit cooperatives and it is easier for farmers to understand the loan products and express their needs more effectively [9]. Wu Yu et al. (2016) found that the improvement of farmers' financial knowledge and education significantly reduces the likelihood of farmers having formal credit needs but not applying for loans. It also significantly reduced the likelihood that farmers had a preference for informal credit. The improvement of the level of financial knowledge and education is beneficial to the promotion of farmers' access to formal credit and the reduction of informal credit preference [10].

2.2.2 Information asymmetry on the supply side

From the perspective of information asymmetry between lenders and borrowers, the classical model deduces that formal finance has to realize market clearing through credit rationing under the circumstance of information disadvantage through the competition model between formal and informal financial sectors, and create credit rationing for farmers. The same analytical framework applies in our country. Wang et al. (2023), based on survey data from Jiangsu, Anhui and Heilongjiang provinces, found that 81.81% of the total variance that can not be explained is caused by the information asymmetry between the supply and demand sides of the fund. In the determination of the loan amount, the supplier has information advantage over the demander, which makes the decision-making power mainly in the supplier [11].

2.2.3 Information asymmetry can effectively ease credit constraints

Social capital theory advocates the use of social capital to alleviate the problem of information asymmetry. Liang Yan (2016) believes that there is a dual credit structure between urban and rural areas under the dual economic structure in our country. So both the supply and demand sides should make use of the rural-specific social capital (geographical, kinship, birth, religious, etc.) to improve the ability of sending, screening and using information[12]. The theory of financial connection tries to alleviate the problem of information asymmetry through the credit mechanism of connected transaction. Information asymmetry can be effectively mitigated by interconnected transactions with financial connectivity. The research of Meng Ying et al. (2022) holds that financial linkage is an innovation of micro-financial structure on the basis of inter-connected transaction, which combines credit market and product market into related market, and forms the credit constraint that restricts both sides of transaction. Civil society organizations in product markets (often economic organizations of some kind) act as intermediaries linking borrowers with formal financial institutions and forming mechanisms for

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generating and transmitting credit. Thus it replaces collateral and acts as intangible assets and ease credit rationing due to information asymmetry [13].

Summing up the progressive theoretical research above, we find that no matter from the perspective of the formation of credit constraints, or from the perspective of looking for ways to ease credit constraints, information asymmetry should be at the heart of the problem. According to the theory of information asymmetry, financial literacy itself is the core of the signal sent by the demand side and the signal screened by the supply side. Thus promoting financial literacy and establishing signalling and screening mechanisms based on it may be the key to effectively ease credit constraints. Such a study opens up a new perspective, and it is possible to achieve a certain breakthrough in the theoretical and policy level. Although this must be a series of in-depth studies, this article first from the theoretical and empirical point of view study the existence of causality as the first step in a series of studies.

3. Theoretical analysis and research hypotheses

In the financial market, information asymmetry is the unequal information mastery between two parties, which may lead to the reduction of market efficiency and the increase of financial risk. As an individual's ability to understand and manage financial affairs, financial literacy plays an important role in alleviating information asymmetry. The improvement of financial literacy can not only enhance the individual's ability to identify and process financial information, reduce misunderstanding, reduce adverse selection and moral hazard, improve market efficiency, but also enhance the individual's risk awareness and management ability. It encourages individuals to evaluate investments rationally, reduces irrational behavior, and reduces systemic risk. In addition, financial literacy is essential for inclusive financial development by improving access to financial services for marginalized groups through education, reducing service gaps and achieving efficient resource allocation. In today's digital financial era, financial literacy is more important. It can help consumers identify the authenticity of information, avoid financial fraud and protect the safety of individual property.

Previous studies have shown that because of information asymmetry, a large number of farmers have cognitive biases, the subjective belief that they do not have the ability to obtain credit or have the willingness to apply for credit but do not understand the formal credit procedures and give up. Therefore, in the study of the impact of financial literacy on the willingness to apply for credit, it is often considered that the higher the financial literacy of farmers, the more they can release this willingness, thus increasing the possibility of applying for formal credit. Wu Yu et al. (2016) found that families with higher levels of financial knowledge are more active in choosing formal credit. And higher levels of financial knowledge can improve residents' ability to apply for credit. Thus it also increases the probability of loan success. Liu Ziqiang et al. (2019) found that the improvement of farmers' financial literacy level can promote farmers to transform potential formal credit demand into effective formal credit demand, thus improving the constraint of farmers to carry out formal credit, improving farmers' access to formal credit. This paper proposes hypothesis 1:

H1: financial literacy is an important factor affecting farmers' credit behavior. The higher the level of financial literacy of farmers, the stronger their willingness to apply for formal credit.

Taking into account the living standards of rural households and their ability to repay loans, when farmers choose to apply for formal financial loans, the supply side will make decisions based on such factors as their own assets, liabilities and income, whether to meet the loan demand of farmers in full. So there will be differences in the allocation of credit quota. In general, farmers with higher financial literacy are better able to manage household income and expenditure, repay loans as much as possible and reduce household debt. Their formal credit needs are more easily met. Thus, this paper proposes hypothesis 2:

H2: financial literacy can affect the amount of loans for farmers, the higher the financial literacy of farmers, the easier it is to be met in full.

4. Study design

4.1 Data source and sample basic situation

The data used in this study are from the questionnaire data of China Household Finance Survey (CHFS) in 2015, which covers a wide area with high accuracy and has comprehensive content and

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strong data representation. Because the part of micro-data about agriculture in CHFS2017 and CHFS2019 have low coincidence with the index of this paper, so we choose CHFS2015 data. The questionnaire clearly subdivides the production and operation items of the respondents into agriculture and industry and commerce. Considering that the subjects of this study are farmers, we first screened the data of 10614 families, and got 3231 samples after eliminating extreme points and missing values.

4.2 Variable selection and descriptive statistics

Dependent variables: willingness to apply for formal credit, failure of formal credit to meet loan amount. The specific definition is as follows: regarding farmers' willingness to apply for formal credit. According to the questionnaire, “At present, does your family have any outstanding bank/credit union loans due to agricultural operation activities?” If the answer is “Yes”, farmers are considered to have the intention to apply for formal credit; if the answer is “No”, farmers are considered to have no intention to apply for formal credit. According to the farmers' questionnaire, “What is the amount of unsatisfied agricultural loan demand in your family?” as the data of unsatisfied loan amount.

Core independent variable: Financial Literacy. From previous studies, when it comes to the comprehensive assessment of multiple indicators, when considering the weight of indicators, it can be evaluated synthetically by subjective weighting method, objective weighting method or analytic hierarchy process combining subjective and objective methods. Because there are many items in the evaluation of financial literacy, and the subjective weighting method will reduce the credibility because of the strong subjective preference, this paper adopts the objective weighting method. That is, the comprehensive evaluation of financial literacy through the factor analysis method, and the factors are extracted by principal component analysis.

As shown in Table 1, the financial literacy of rural households was assessed on the basis of the questionnaire and scored by factor analysis. When farmers answered the questions, the choice of the wrong option and the direct answer ‘unknown’ represent the different levels of financial literacy of the farmers respectively. A wrong answer means that the farmer may have some financial knowledge, while ‘unknown’ answer means that the farmer has no knowledge of such problems at all. Therefore, for the answer of the third and fourth measurement questions of farmers' financial literacy, the correct answer assignment is 1, the wrong answer assignment is 2, and it can not be calculated that the assignment is 3.

Table 1: The financial literacy measurement framework for rural households.

A4002a	How concerned are you with economic and financial information? Very much. 4. Very little Very much. Never 3. General	According to the degree of attention score, 1-5 points of attention gradually decreased
A4002b	Have you taken any courses in Economics or finance? Yes and no	The answer is assignment 1 and the answer is No 2
A4004a	Suppose the annual interest rate of the bank is 4% , if the 100 yuan deposit for 1 year, 1 year after the principal and interest? 1. Less than 104 yuan 3. More than 104 yuan 2. It's 104.4. I can't figure it out	Answer correctly assignment 1, error 2, can't figure out assignment 3
A4005a	Suppose the annual interest rate of the bank is 5% and the inflation rate is 3%,what you can buy after a year of putting $100 in the bank will? 1. More than a year ago 3. Less than a year ago 2. As much as a year ago 4. Can't figure it out	Answer correctly assignment 1, error 2, can't figure out assignment 3
A4007aa	Do you think stocks or funds are riskier in general? 1. Stocks 4. Never heard of a fund 2. Funds 5. Never heard of either 3. Never heard of stocks	Option 1 is correct and assigned a value of 1; option 2 is incorrect and assigned a value of 2; options 3 and 4 are assigned a value of 3; and option 5 is assigned a value of 4

In order to test whether the data are suitable for factor analysis, KMO test and Bartlett spherical test were performed on the data of factor analysis using STATA17.0 software. The value of KMO statistic was 0.651, the statistic of Bartlett's spherical test reaches 1% significance level, which indicates that there is correlation between original variables and it is suitable for factor analysis. In this paper, three common factors were extracted with eigenvalues greater than 1. The cumulative variance contribution of three common factors was 74.04%. Finally, the financial literacy score was calculated by taking the proportion of each factor's contribution rate of variance to the cumulative contribution rate of variance as the weight of each factor's score. The minimum value of financial literacy of 3231 survey samples was -2.12, and the maximum value was 2.48, the overall mean was 0, and the standard deviation was

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0.756. To better interpret the results of the empirical tests, they were reversed.

The age, sex, education level, party membership, village cadres, marital status, physical health status, family size, total assets, total output value and total gross income of the farmers were selected as control variables, the assignment, definition and descriptive statistics of the variables are shown in Table 2.

Table 2: Descriptive statistics for variables.

Variable	Variable description	Mean	Standard deviation	Min	Max
Formal credit rationing	There is a formal credit rationing = 1; there is no formal credit rationing = 0	0.08	0.27	0	1
Failing to meet the loan amount	Take the logarithm of the amount of the loan that the farmer's family has failed to meet for agricultural production and operation	1.44 E + 06	1.17 E + 07	1000	1.00E + 08
Financial literacy	Farmers' financial literacy score	0	0.76	-2.12	2.48
Sex	Male = 1; female = 2	1.08	0.27	1	2
Age	Survey Farmers' ages	62.48	10.67	14	98
Education level	Not attending school = 1; primary school = 2; junior high school = 3; senior high school = 4; university and above = 5	2.61	0.85	1	5
Party member	YES = 1; NO = 2	1.88	0.32	1	2
Village cadres	YES = 1; NO = 2	1.26	0.44	1	2
Marital status	Unmarried = 1; married = 2	0.13	1.00	1	2
Health condition	Very good = 1; Good = 2; General = 3; Bad = 4; very bad = 5	2.78	0.98	1	5
Family size	Number of people living together	2.41	1.55	0	13
Total assets	The sum of non-financial and financial assets	1.01E + 05	3.25 E + 05	0	8.01 E + 06
Total output value	The value of farm produce produced by farmers	2.42 E + 04	56058.18	0.75	1.50 E + 06
Gross income	The gross income of farmers from their produce	1.98E + 04	44891.98	4	1.50 E + 06

4.3 Model settings

4.3.1 Whether financial literacy can ease credit rationing

In the impact of financial literacy on farmers' access to formal credit rationing, because "Whether there is formal credit rationing" is a binary virtual variable, the Probit model is used to analyze the possibility of financial literacy easing credit rationing. The binary Probit model assumes that the event Y is an unobserved potential variable, and the variable X_i has a linear relationship with it:

$$\text{Probit}(Y = 1) = \alpha + \beta_1 \text{Comscore}_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

Among them, the explanatory variable Y indicates whether there is a formal credit rationing. If there is, it is recorded as 1; if there is not, it is 0. α is a constant term. Comscore_i denotes financial literacy. X_i is a control variable, including farmer household characteristic variable and family characteristic variable. The information of head of household involves gender, age, marital status, education degree, etc. The household information included total household assets, total household output value and household income. ε_i is a random perturbation term.

4.3.2 The alleviation degree of financial literacy to credit rationing

To analyze the impact of financial literacy on the amount of credit applied by rural households, given that many rural households in this questionnaire have all been met with their credit needs, the data on the amount of unmet formal loans are continuous, however, there are a large number of observed data for 0 with obvious cut-off characteristics. It is appropriate to use the Tobit regression model. Among them, the Tobit model assumes $y^*$is an unobserved potential variable, it has a linear relationship with X_i, namely:

$$\text{Tobit} \quad y^* = \alpha + \beta_1 \text{Comscore}_i + \beta_2 X_i + u_i \quad (2)$$

Among them, y^* is expressed as the logarithm of the amount that can not meet the household loan requirement. α is a constant term. Comscore_i is expressed as financial literacy. X_i is a control variable and ε_i is a random perturbation term.

ISSN 2616-5902 Vol. 6, Issue 11: 88-95, DOI: 10.25236/AJBM.2024.061113

5. Empirical results analysis

5.1 An empirical test of the impact of financial literacy on farmers' access to formal credit

The first two columns of Table 3 present the results of regression analysis using the Probit model. Column (1) shows the results of regression with the addition of only the explained and control variables. Column (2) shows the results of regression for adding financial literacy variables without changing the original control variables. From the empirical results, we can find that adding financial literacy variables does not affect the impact of the original control variables on farmers applying for formal loans. At the same time, we find that financial literacy has a significant positive effect on farmers' formal credit application. That is, the higher the financial literacy, the higher the willingness of farmers' families to apply for formal credit. Hypothesis 1 is verified.

5.2 The empirical test shows that financial literacy has a positive effect on farmers' unsatisfied loan amount

Table 3: The empirical test results.

	(1) Probit	(2) Tobit	(3) Probit	(4) Tobit
main				
Fina~y		0.102***		-0.173**
		(0.034)		(0.085)
Sex	-0.120	-0.121	0.345	0.231
	(0.134)	(0.134)	(0.507)	(0.500)
Age	-0.018***	-0.017***	-0.000	0.000
	(0.003)	(0.003)	(0.011)	(0.010)
Educatio~l	-0.001	-0.019	0.136	0.159
	(0.043)	(0.043)	(0.156)	(0.153)
Partymem~r	-0.151	-0.139	-0.205	-0.275
	(0.104)	(0.105)	(0.290)	(0.287)
Maritals~s	0.147	0.126	-0.264	-0.202
	(0.258)	(0.257)	(0.687)	(0.674)
Healthco~n	0.032	0.038	-0.126	-0.098
	(0.036)	(0.036)	(0.105)	(0.104)
Familysize	0.071***	0.071***	0.067	0.070
	(0.021)	(0.021)	(0.069)	(0.068)
Villagec~s	-0.157*	-0.154*	0.132	0.222
	(0.080)	(0.081)	(0.233)	(0.233)
Total_as~t	-0.011	-0.022	0.378*	0.315*
	(0.036)	(0.038)	(0.279)	(0.275)
Totalout~e	0.060	0.058	-0.101	-0.034
	(0.042)	(0.042)	(0.241)	(0.238)
Grossinc~e	0.149***	0.141***	0.192	0.146
	(0.047)	(0.047)	(0.230)	(0.227)
_cons	-0.393	-0.369	0.023	-0.069
	(0.621)	(0.623)	(1.903)	(1.867)
var..ze~1)		0.869***		0.835***
		(0.121)		(0.116)
N	3231	3231	103	103

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01

The results of the regression analysis using the Tobit model are presented in the last two columns of

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Table 3. Column (3) shows the results of the regression with the addition of only the explained and control variables. Column (4) shows the results of adding financial literacy variables without changing the original control variables. The results show that financial literacy has a significant negative effect on the unmet amount of formal credit of farmers. That is, the higher the financial literacy of farmers, the smaller the unmet amount of formal credit will be. Hypothesis 2 is verified.

5.3 Robustness test

In this study, we test the robustness of the above empirical results by using the measure method of substituting core explanatory variables and the method of eliminating partial samples. The measure method of replacing the core explanatory variable is to assign a value to the question according to the farmer's answer option, then add it directly and simply, and finally take the sum of the total of the scores and take it back as the score of financial literacy to measure farmers' financial literacy and to test their robustness. The empirical results show that financial literacy still has a positive correlation with farmers' willingness to apply for formal credit at 1% confidence level and a negative correlation with the unmet amount of formal credit at 10% confidence level, as shown in column (1)(2) of Table 4.

Table 4: The robustness test.

	(1) Probit	(2) Tobit	(3) Probit	(4) Tobit
main				
Fina~y	0.097***	-0.154*	0.035***	-0.056*
	(0.035)	(0.088)	(0.013)	(0.032)
Sex	-0.127	0.258	-0.013	-0.384
	(0.134)	(0.502)	(0.156)	(0.631)
Age	-0.017***	-0.001	-0.006	-0.011
	(0.003)	(0.010)	(0.006)	(0.018)
Educatio~l	-0.021	0.183	-0.077	0.131
	(0.043)	(0.156)	(0.053)	(0.209)
Partymem~r	-0.132	-0.240	-0.309**	-0.076
	(0.105)	(0.287)	(0.126)	(0.392)
Maritals~s	0.127	-0.166	0.217	-0.098
	(0.257)	(0.679)	(0.297)	(0.694)
Healthco~n	0.038	-0.093	-0.021	-0.024
	(0.036)	(0.106)	(0.043)	(0.140)
Familysize	0.072***	0.064	0.037	0.082
	(0.021)	(0.068)	(0.028)	(0.081)
Villagec~s	-0.152*	0.181*	-0.100	0.048
	(0.081)	(0.231)	(0.093)	(0.276)
Total_as~t	-0.021	-0.034	0.326*	0.319*
	(0.037)	(0.043)	(0.254)	(0.269)
Totalout~e	0.047	0.048	-0.097	-0.032
	(0.056)	(0.039)	(0.244)	(0.235)
Grossinc~e	0.148***	0.137***	0.177	0.152
	(0.044)	(0.050)	(0.228)	(0.220)
_cons	-0.377	-0.219	-0.621	0.639
	(0.622)	(1.880)	(0.737)	(2.257)
var..ze~l)		0.843***		0.858***
		(0.118)		(0.138)
N	3231	103	1933	77

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.00

Considering the difference in lending behaviour between farmers over 65 years of age who are

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unable to take out loans from formal financial institutions due to age restrictions and those under 65 years of age, therefore, the sample of farmers over 65 years old is excluded in order to reduce the model estimation error. The robustness test is performed. The results show that the influence of financial literacy on whether farmers apply for formal credit is still significantly positive after excluding the sample of farmers who are over 65 years old and the impact on the amount of unmet loans remained the same,as shown in column (3)(4) of Table 4.

6. Conclusions and recommendations

Based on the data of Chinese Household Finance Survey (CHFS) in 2015, this paper uses Probit model and Tobit model to measure farmers' financial literacy, from the two aspects of formal credit availability and unsatisfied loan amount. This paper verifies the easing effect of farmers' financial literacy on their formal credit constraints. The results show that financial literacy has a significant easing effect on farmers' formal credit constraints, and the unmet amount of formal credit will decrease with the increase of financial literacy level.

According to the empirical results, it can be seen that financial literacy has a significant easing effect on farmers' formal credit constraints. So improving farmers' financial literacy is the key to easing credit constraints. The following are some feasible suggestions. Government Departments should improve farmers' financial literacy, increase rural capital input, support farmers' production and management, improve lending policies, and provide guarantee services for farmers. It is necessary for financial institutions to establish rural credit evaluation system, develop credit products suitable for farmers, reduce risks and improve farmers' financing ability. Farmers should learn financial knowledge, improve their creditworthiness, abide by loan agreements, conduct business through formal financial institutions, reduce information asymmetry, and improve their ability to finance.

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