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The Effect of Asymmetric Information on Turkish Banking Sector and Credit Markets

H. Aydın Okuyan*

Asymmetric information is a factor that decreases the efficiency of markets. The aim of the study is to expose whether asymmetric information causes problems in credit markets. The monthly data between 1986:01–2010:12 is analyzed with the causality tests (Toda ve Yamamoto [1995]) to examine the relationship between the bad credits ratio and total credits ratio. According to the causality tests a unidirectional causality which is explained by the existence of credit rationing problems.

LES EFFETS DE L'ASYMÉTRIE D'INFORMATION SUR LE SECTEUR BANCAIRE ET LES MARCHÉS DU CRÉDIT TURCS

L'asymétrie d'information est un facteur qui diminue l'efficacité des marchés. L'objectif de l'article est d'étudier si l'asymétrie d'information provoque des problèmes sur les marchés du crédit. Les données mensuelles pour la période 1986:01–2010:12 sont analysées à partir de tests de causalité (Toda ve Yamamoto [1995]) pour considérer la relation entre le ratio de mauvais crédits et le ratio du total des crédits. À partir des tests de causalité, une causalité unidirectionnelle est trouvée qui peut être expliquée par l'existence de problème de rationnement du crédit.

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INTRODUCTION

The finance theory is based on the assumption that markets are perfect. Accordingly, information prevailing in the market reaches all investors at no cost, and is immediately reflected in prices. In such a market, the government applies no restrictive rules in either trade and conveyance of funds, and the rules applicable to the trade are determined by the competition and relationships between buyers and sellers. Prices of financial instruments in an excellent market reflect the actual values of such instruments as well as all data in the market. In addition, new data reaching the market are immediately reflected in the prices (Rose [1992], 20). However, financial markets are quite far from excellence indeed. The parties in the market cannot reach the same information simultaneously. In other words, there is an asymmetry between them in terms of the level of information. At times, such information asymmetry between the parties may come to impair the running order of the market.

Information asymmetry may be described with Akerlof's [1970] "Lemon Problem". Lemon is used to describe cars in poor condition in English. In a car market, difference of information between the buyer and seller as to the product quality may impair the flow of the market, and sometimes fully prevent car trade. As potential buyers are uncertain about the quality of the product offered, they would abstain from paying a high price for such product. And also in such a case, the seller would not agree to offer the product in hand at a price lower than its real value. Buyer facing the risk of buying the car asks for discount in the price, and such request might discourage the seller to sell. Hence, the flow of the market is impaired. Although there are markets where repeat sales and reputation may resolve the problem, Akerlof observed that in many markets these problems are not easily resolved, including in insurance, labor, and credit (Rosser [2003], 10).

Credit markets are commonly affected by imperfections due to the presence of asymmetric information. Lenders might lack the necessary information to set the price of loans, which should reflect the borrowers' riskiness, that is to say their probability of default. Hence, lenders would face costs for screening safe applicants from risky applicants and for monitoring borrowers' actions, and consequently they might require additional fees, that is to say they would transfer their transaction costs to borrowers. Alternatively, they might add a premium on the interest rate, and hence high interest rates may reflect the high costs of these activities (Hoff and Stiglitz [1990]). However, increasing the interest rate might have an opposite effect on the banks' profit, as it might induce self-selection of risky borrowers. Safe borrowers might indeed be discouraged from applying as they might not consider that their (low) probability of failure would justify such a high interest rate (Stiglitz and Weiss [1981]). For this reason lenders might simply prefer to refuse loans, that is to say to apply non-price rationing.

We can talk about two major concepts in relation to information asymmetry in credit markets. These are "adverse selection" and "moral hazard". The adverse selection problem in credit markets arises when the creditor does not know full details of the borrower before the loan contract is concluded between the parties. Creditor's lack of sufficient information on the borrower's risk rating and capability of repayment leads to adverse selection. Accordingly, those with lower probability of repayment requesting for risky funds would lead off potential borrowers with higher probability of repayment requesting for less risky

funds. Because a creditor not equipped with detailed information on each of those requesting for funds would, taking into account the existence of borrowers with less probability of repayment, increase the interest rate and/or aggravate loan conditions. And in this case, borrowers with higher strength of repayment would draw away from the market as they would not prefer such borrowing conditions. Therefore, the probability of granting loan to an investor not eligible in creditors' eye, namely the probability of adverse selection, would rise.

Mortgage problems observed in US markets recently are what the adverse selection problem has culminated in. First, housing loans were granted to investors with lower strength of repayment, and applicants were asked to disclose only their income, yet no proof was requested for such disclosures. In addition, it is recorded that borrowers requesting for loans called as adaptable interest rate loans or alternative A loans were asked to provide fewer documents of disclosure relating to their financial status. As a result, financial institutions experienced troubles for non-repaid loans, culminating in severe financial demotions, and funds started to make losses one by one. This led to the loss of confidence between financial institutions, and shrinkage of loan offerings. This trend caused increase in the number of poor quality loan applicants in the market, and led creditors make adverse selections.

Moral hazard can be described as the misuse of funds borrowed. As moral hazard refers to the situation where the creditor cannot monitor the actions of the borrower, this situation is also called as the hidden action. The borrower may get engaged in some risky projects that the creditor does not approve, yet has no way whatsoever discretion in. Indeed, loan applicants would tend to prefer high-risk projects during the periods of higher interests. Because the return to the borrower in case the project achieves would be the portion after the principal and interest. On the other hand, the creditor's return is the pre-defined interest irrespective of the project achievement. Therefore, while the borrower's expected return is an increasing function of the project risk, the creditor's return is a decreasing function of this risk (Stiglitz [1981], 14). Therefore, while the borrower demonstrates tendency to take risks, the creditor shows the tendency to make sure that the fund lent is employed in safe investments. However, due to the presence of the moral hazard, the creditor would not know where the funds it lends are to be employed, and attempt to remove such risk by seeking additional mortgages and/or compounding the lending conditions.

CREDIT RATIONING

The yield expected by creditors is contingent upon the probability that loans are returned. In other words, creditors prefer to grant loans returnable to them rather than high-yield loans (Stiglitz [1981], 10). Therefore, creditors head towards credit rationing due to the presence of adverse selection and moral hazard problems. Credit rationing can be described as the imposition of limits by the banks upon the amount of loans to be granted. Credit rationing occurs when some of the loan applicants are granted with loans while others are rejected. Decline in tendency of the banks to grant loans during the periods of increased doubtful receivables is an outcome of credit rationing.

Economists arguing the necessity of financial liberalization, especially Shaw [1973] and McKinnon [1973], suggest state intervention and pressure upon the market are the responsible of credit rationing. However, in myriad of liberalized countries, the credit rationing trouble prevails. Despite major reforms and legal regulations introduced in banking sector particularly after the devastating 2001 crisis in Turkey, irregularities in loan granting process could not fully be corrected.

Stiglitz and Weiss [1981] noted that sometimes banks rejected to grant loans to applicants due to adverse selection, and put forward the underlying causes as the fact that loan applicants with high-risk investments would apply for loans at high interest rates. Bester [1985] agreed with this opinion provided that low-risk loan applicants walk off the market.

Credit rationing can be classified in two groups as weak rationing and limited rationing. While banks applying weak credit rationing diversify the amount of loan granted based on the interest rate they designate, banks applying limited credit rationing would designate interest rate to the extent of a particular loan amount and would strictly not extend any loan beyond such amount irrespective of the interest rate (Fremier and Gordon [1965], 399).

In their studies, Kutlar and Sarıkaya [2003] researched for correlation between credit rationing and interest rate within the context of asymmetric information theory and marginal cost pricing model. These studies have revealed findings partially supporting the fact that credit rationing process prevails in Turkey. In their studies, Muslumov and Aras [2004] researched for the impact of asymmetric information on the Turkish banking sector. In the study, quarterly data between 1992 and 2001 were analysed with the Sims [1972] test based on the Granger [1969] definition. The study has suggested that asymmetric information led to the credit rationing trouble in the Turkish banking sector, and thereby consolidated the findings of Kutlar and Sarıkaya [2003]. This study seems to be differing from the study of Muslumov and Aras [2004] in terms of model, method, data set and processing the data set.

The aim of this study is to reveal whether asymmetric information is influential in the credit markets of the Turkish banking sector, and whether a resultant credit rationing trouble is experienced or not. For this purpose, a brief introduction is presented in the first part of the study, and the credit rationing concept together with previous studies conducted in this field are discussed in the second part. In the third part of the study, data set and methodology are described, and in the fourth part, the econometric model and findings are discussed. The study ends with the conclusion part.

DATA SET AND METHODOLOGY

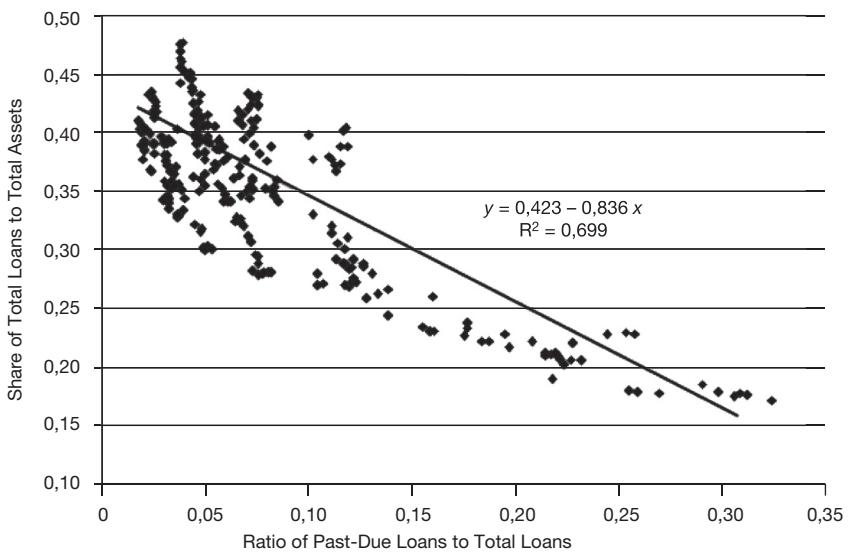
This study is aimed at identifying whether asymmetric information is influential on credit markets of the Turkish banking sector. For this purpose, it will be endeavoured to put forward whether non-performing credit rate in the banking sector induces a decrease in total credits or not. In case it is established that an increase in non-performing loans leads to the limitation of loans by the banks, we can then talk about the presence of credit rationing in the Turkish banking sector.

The monthly data have been acquired from the balance sheet of deposit money banking sector and cover the 1986:01–2010:12 period.¹ Two variables is used in the study. First one is the ratio of past-due loans to total loans in the banking sector (TK), and second is the share of total loans in total assets in the banking sector (KA). Both variables are used as ratio. Series have been seasonally adjusted by means of the Tramo Seats method. Past-due loans are loans on which payments are not being made on time and which is 90 to 180 days behind schedule, although partial payments have been made. “Past-due loans” are declared in the banks’ balance sheets.

Past due loans consist of “Loans and receivables with limited collectibility and Other Receivables” and “Doubtful Loans and Other Receivables” accounts. “Loans and receivables with limited collectibility and Other Receivables” are loans on which payments are not being made on time and which is 90 days behind schedule; “Doubtful Loans and Other Receivables” ise loans on which payments are not being made on time and which is 180 days behind schedule.

Correlation between the series is shown in Figure 1. As shown in the figure, there is a negative and significant correlation between the variables.

Figure 1. Past-Due Loans and Total Loans



Having examined the methodology employed for the dimension of causality between the variables, it is observed that the causality analysis developed by Granger [1969] is used to study the relation of causality between stationary series. In case cointegration occurs between non-stationary series that become

1. Electronic Data Distribution System of Central Bank of the Republic of Turkey <http://evds.tcmb.gov.tr/yeni/cbt-uk.html>

stationary after applying same-level differencing, the error correction model developed by Engle and Granger [1987] is used in testing causality. In the error correction model that is a limited VAR model, F test is employed to test causality, however in case the series are cointegrated, this test statistics may not be valid as it is not in line with standard distribution (see Toda and Yamamoto [1995]; Giles and Mizra [1998]; Giles Williams [1999]). In testing causality by means of the lag-increased VAR method developed by Toda and Yamamoto [1995], correlation of integration between the series is not significant, and it is sufficient to correctly identify the model and know the maximum integration level of variables in the model.

FINDINGS

Toda and Yamamoto [1995] suggested that the WALD hypothesis testing to be conducted by additionally supplementing lag to the VAR model to the extent of the maximum integration of series will have chi-square (χ^2) distribution. Toda and Yamamoto [1995] approach complies with a standard VAR model at its variable levels (instead of initial differences like in the Granger causality tests), and therefore minimizes the risks due to the probability of wrongly identifying the integration levels of series (Mavrotas and Kelly [2001]). The two-variable VAR model consisting of the series of *i*) ratio of past-due loans to total loans (TK), and *ii*) ratio of total loans to assets (KA) has been built as follows.

$$TK_t = \alpha_0 + \sum_{i=1}^k \alpha_{1i}TK_{t-i} + \sum_{j=k+1}^{d_{\max}} \alpha_{2j}TK_{t-j} + \sum_{i=1}^k \varphi_{1i}KA_{t-i} + \sum_{j=k+1}^{d_{\max}} \varphi_{2j}KA_{t-j} + \delta_1D94 + \delta_2D01 + \mu_{1t} \tag{1}$$

$$KA_t = \beta_0 + \sum_{i=1}^k \beta_{1i}KA_{t-i} + \sum_{j=k+1}^{d_{\max}} \beta_{2j}KA_{t-j} + \sum_{i=1}^k \delta_{1i}TK_{t-i} + \sum_{j=k+1}^{d_{\max}} \delta_{2j}TK_{t-j} + \delta_1D94 + \delta_2D01 + \mu_{2t} \tag{2}$$

k denotes the number of lags in the VAR model, and d_{\max} denotes maximum integration level of variables involved in the model. Key philosophy underlying this approach is to increase the number of lags in the VAR model by the maximum integration level of the variables. If in equation (1) $\phi_{1i} \neq 0$ then it is concluded that ratio of total loans in the assets is the cause of ratio of past-due loans to total loans. If in equation (2) $\delta_{1i} \neq 0$, then it may be suggested that ratio of loans under follow-up to total loans is the cause of ratio of total loans to assets. The first requirement of Toda Yamamoto [1995] causality testing is to correctly identify the maximum integration level of variables involved in the model.

Furthermore, as the Chow test revealed that breaks occurred in series in 1994 and 2001, dummy variables (δ_1D94, δ_2D01) were added to the model to eliminate

the impacts of the crises. To see the effect of the regulations made in 2001, the data set is separately examined before and after 2001. Results show that there is no difference between single data set and separate data sets.

To identify the level of maximum integration, the “Advanced Dickey-Fuller” (ADF) tests developed by Dickey and Fuller [1981], Philips and Peron (PP) test [1988] and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test [1992] have been utilized. The presence of unit root implies non-stationary time series exhibiting random walk. According to Dickey and Fuller [1981], error terms are white noise, in other words they are assumed to have sequential independence, normal distribution and constant variance. Contrary to the Dickey and Fuller [1981] test, Philips and Peron [1988] allow weak dependence and heterogeneity between the error terms. Absence of unit root indicates that the time series is stationary and doesn't follow a random walk. In all tests, the Akaike information criterion has been utilized to identify the length of lags.

Table 1. Stationary Test Results

Variables	ADF		PP		KPSS	
	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
KA	-1.360	-1.055	-1.262	-0.958	0.017	0.022
Δ KA	-7.435*	-7.499*	-18.744*	-18.763*	2.024*	2.185*
TK	-1.404	-1.421	-1.622	-1.650	0.174	0.198
Δ TK	-16.692*	-16.661*	-16.799*	-16.772*	3.425*	3.721*

Significant at *%1.

According to the results of the ADF, PP and KPSS tests, all tests became stationary after first-differencing. In this case, maximum integration level of variables involved in the model has been found as ($d_{\max} = 1$). Secondly, the number of lags to be used in the VAR model should be established. For this purpose, maximum lag length has been selected as 16 whereby it has been attempted to establish the minimum length of lag minimizing the critical values such as LR (Likelihood Ratio), FPE (Final Prediction Error), AIC (Akaike), SC (Schwarz) and HQ (Hannan Quinn).

Results in Table 2 reveal that FPE, AIC and HQ information criteria point to 3 lags. Furthermore, the graphs of error terms reveal that 3 lags suggested by FPE, AIC and HQ information criteria did not cause the autocorrelation problem. Therefore, it has been found appropriate to take the lag length of the model as 3. Hence, after having established the lag number for the VAR model and adding to it 1, which is the maximum integration level of variables involved in the model, the causality analysis has been conducted across the $k + d_{\max} = 3 + 1 = 4$ th degree VAR model. Table 3 shows the results of the causality analysis.

According to the results in Table 3, no causality has been observed from the share of total loans in assets towards the share of past-due loans in total loans, yet a causality from the share of loans under follow-up in total loans to the share of total loans in assets has been found. In other words, it may be suggested that

Table 2. Determination of Lag Length at VAR Model

Number of Lags	LR	FPE	AIC	SC	HQ
0	na	6.02e-09	- 13.25319	- 13.22557	- 13.24208
1	17.06712	5.80e-09	- 13.28925	- 13.20639	- 13.25593
2	28.45327	5.35e-09	- 13.37103	- 13.23294*	- 13.31550
3	18.83031	5.12e-09*	- 13.41523*	- 13.22189	- 13.33748*
4	1.312787	5.25e-09	- 13.38939	- 13.14082	- 13.28943
9	2.463298	5.42e-09	- 13.35709	- 12.83233	- 13.14606
10	19.37174*	5.16e-09	- 13.40805	- 12.82804	- 13.17480
11	3.426625	5.24e-09	- 13.39156	- 12.75632	- 13.13610
15	7.003359	5.43e-09	- 13.35876	- 12.50256	- 13.01444
16	7.685217	5.41e-09	- 13.36194	- 12.45051	- 12.99541

*Shows the lag length which obtains minimum information criterion.

Table 3. Results of Causality

Direction of Causality			χ^2	P value
KA	\Rightarrow	TK	1.680	0.641
TK	\Rightarrow	KA	19.282	0.000*

Significant at *%1.

share of past-due loans in total loans is the cause of banks' tendency to grant loans. Presence of a negative correlation between the variables has been put forward through the results of regression. Accordingly, if the share of past-due loans in total loans rises, a bank shows tendency to limit loan granting. And as a result, share of total loans in assets declines. These results reveal that the credit rationing process prevails in the Turkish banking sector. And this supports the findings of Muslumov and Aras [2004].

CONCLUSION

Presence of asymmetric information in the markets gives rise to wrong pricing patterns and selections. An asymmetric information-intensive market progressively draws away from being effective and fully competitive. In credit markets studied hereunder, asymmetric information avoids accurate transfer of the funds, and makes it difficult to both effectively utilize the savings and efficiently finance the investments. Proper pricing and transfer to the prospective investors of the funds is only possible if the parties have full and accurate information of each other. Otherwise, investments could not be financed at appropriate conditions, and results that would adversely impact the growth of national economy might arise.

In this study, it has been attempted to shed light on whether problems are experienced or not in the Turkish banking sector due to asymmetric information. As a result of the analysis conducted for this purpose, it has been proven that there is asymmetric information in the Turkish banking sector, which has paved the way for credit rationing by banks. It can be argued that credit rationing is a practice aggravating the harm induced by the crisis, particularly during the periods of crisis, in enterprises, therefore in the national economy. Avoiding such adverse results can be possible only by reducing asymmetric information.

There is not a single solution to decrease the problem of asymmetric information. In literature, some measures for decreasing asymmetric information such as the establishment of credit institutions in charge of collecting information about loan applicants, and securing the repayment of loan through the binding effect of guarantees and contracts are listed. Minimizing asymmetric information as much as possible is a critical measure for the banking system, credit market, and consequentially for national economy.

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