

A Reassessment of Competition in the Credit Card Market by Introducing Liquidity Cost Measures: Evidence from an Emerging Economy

Abstract

This paper investigates the competitive environment among 21 credit card issuers in Turkey, covering the time period between 2002 and 2008. Analysis is made by using an estimation methodology designed by Panzar and Rosse (1982, 1987), where the degree of competition is found as the sum of elasticities of total revenue with respect to input prices. Accounting for total revenue rather than the price of credit cards fills the gap of previous studies, which look at only one side of the credit card market. Controlling for liquidity management cost, which was firstly shown to be important for evaluating the degree of competition in the credit card industry in the United States, emerges as an important cost variable, supporting Shaffer and Thomas (2007) for an emerging market economy. The estimated Panzar-Rosse statistics are consistent with product differentiation implying that Turkish credit card issuers are characterized by monopolistic competition.

Keywords: Credit Cards, Monopolistic Competition, Product Differentiation, Bank Pricing Behavior, Regulation, Panzar-Rosse

JEL classification: G21, G28, O16

Acknowledgement: Authors acknowledge the financial support of the Bogazici University Research Fund (Project # 08C103).

G. Gulsun Akin

Department of Economics, Bogazici University, Bebek, Istanbul, Turkey
e-mail: gulsun.akin@boun.edu.tr

Ahmet Faruk Aysan

Department of Economics, Bogazici University, Bebek, Istanbul, Turkey
e-mail: ahmet.aysan@boun.edu.tr

Denada Borici

Department of Economics, Bogazici University, Bebek, Istanbul, Turkey
e-mail: denada.borici@boun.edu.tr

Levent Yildiran

Department of Economics, Bogazici University, Bebek, Istanbul, Turkey
e-mail: levent.yildiran@boun.edu.tr

A Reassessment of Competition in the Credit Card Market by Introducing Liquidity Cost Measures: Evidence from an Emerging Economy

1. Introduction

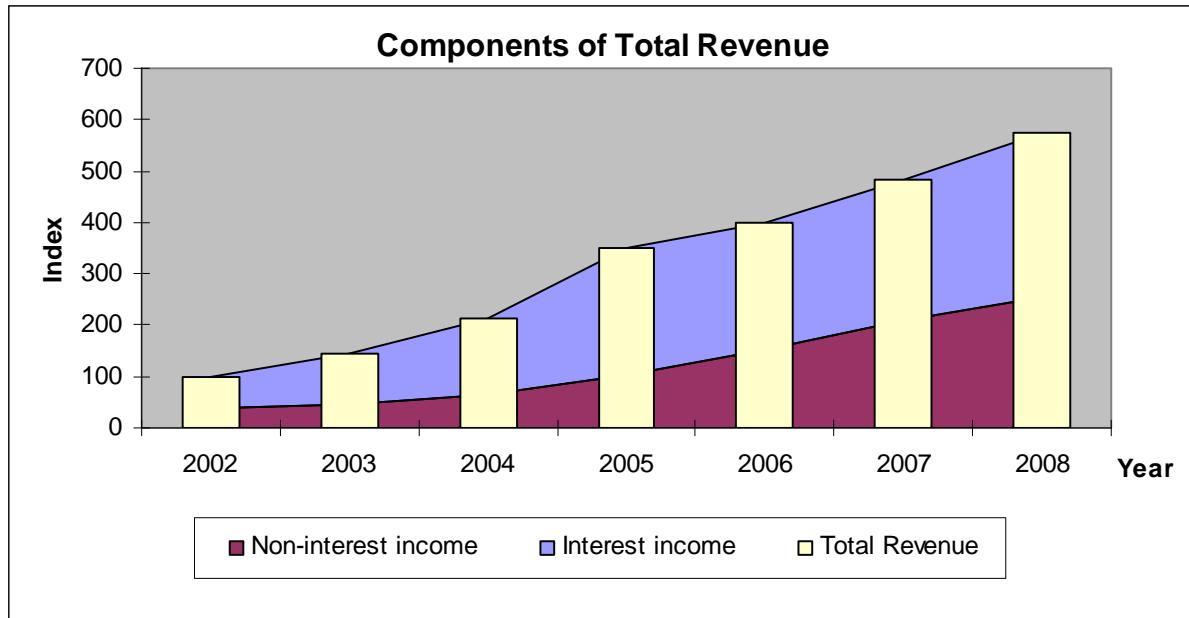
Rapidly growing volume of credit card transactions all over the world and the high interest rates associated with credit card lending have been an issue of interest for many researchers during the last decades. In this respect, the Turkish credit card market has been drawn considerable attention and regulatory measures have been the focus of the Central Bank for many years.

The aim of this paper is to analyze the degree of competition in the Turkish credit card market by using an estimation methodology proposed by Panzar and Rosse (1982 , 1987). It is the first time that this methodology is used for the credit card market of an emerging economy and it contributes to the previous literature on Turkish credit card market by looking at the total revenue earned by credit card issuers, rather than the interest revenue alone. Shaffer (1999) was the first study to use the total revenues as a sum of interest and non-interest revenues, and Shaffer and Thomas (2007) was the first work that used the reduced-form revenue equation of Panzar and Rosse in order to measure the degree of competition in the credit card industry of the United States.

The credit card market in Turkey has been analyzed in many previous studies, but only one side of the credit card market, which is the price of credit cards, has been taken into account. Recently, the revenues earned from fees and commissions have become a very important component of total revenue, and failure to account for them would lead to an incomplete analysis of credit card market. As illustrated in Graph 1, around 35 percent of total

revenue came from the interest component before 2005. After this period, although the interest component is still more important than the non-interest component, the growth rate of the former is less than the growth rate of the revenue coming from fees and commissions.

Graph1. Components of Total Revenue Index



Indexes are calculated from BRSA, CBRT and BAT

Another aim of this paper is to account for measures of liquidity management costs that credit card issuers face. The revenues earned by them may have been overstated in previous studies by neglecting this cost variable. Shaffer and Thomas (2007) were the first to account for the liquidity management costs while analyzing competition in the credit card market of the United States. According to them, in order to have appropriate regulatory rules, not only credit card pricing, but also risk management and liquidity management should be paid attention. They show that the inclusion of liquidity management costs to the model may move the degree of competition towards perfect competition and improve the fit of the model.

In order to be able to talk about the Turkish credit card market and make suggestions for improving it, one has to consider its underlying structure. The credit card market in Turkey has experienced extremely high interest rates, which have been far from being compared with the interest rates of other types of credits. Moreover, credit card interest rates have shown to be unresponsive to the decline in the cost of funds (Aysan and Muslim, 2006 ; Aysan and Yıldız, 2007). The reason behind these lies in the fact that the Turkish credit card market is highly concentrated. Among a total of 21 issuers of credit cards in Turkey, the six largest ones (Yapi Kredi, Garanti, Isbank, Akbank, Finansbank and HSBC) are the main agents, which control 86 percent of the market in outstanding credit card balances and they have a 77 percent market share in terms of the number of customers.

Since credit cards are rather homogenous products, these six banks compete with each other in terms of the number of ATMs, number of branches and the number of POS (Point of Sale) machines in order to differentiate these products and increase their individual market share, which in turn gives them market power. This behavior is an indicator of non-price competition and one of the reasons why credit card interest rates remain rather high.

The complaints of credit card holders about the high interest rates paved the way for certain regulations, which took place in 2003 and 2006. In the first one, credit cards were taken into the scope of the Consumer Protection Law, but this was just a temporary solution. There was a need for stronger regulations. In March 2006, Turkish government gave the Central Bank the right to put a ceiling on the credit card interest rates. This regulation inhibited banks from offering new cards or increasing card limits without the formal request of the cardholder. Again the problems associated with high credit card interest rates are not fully resolved.

This study contributes to previous works by analyzing competition in the credit card market without looking at the structure of banks. Different from previous literature on credit

cards, which focused on the high concentration of the credit card market and the resulting high interest rates, competition here is analyzed by looking at the effect of input prices on total revenue. The Panzar and Rosse method, which makes this possible, also considers some variables associated with the structure of the credit card market, but the degree of competition is measured by looking only at the input price elasticities.

This paper makes a similar analysis as Shaffer and Thomas (2007) for an emerging economy like Turkey by measuring the degree of competition in the Turkish credit card market and it attempts to answer the question of whether liquidity management costs are also important for emerging economies or not. The technique that will be used in this paper is the reduced form revenue equation of Panzar and Rosse. The sample includes 21 issuers of credit cards in Turkey. Quarterly data have been collected from the Central Bank of the Republic of Turkey, Bank Regulation and Supervision Agency and Banks Association of Turkey for the period beginning from the last quarter of 2002 to the last quarter of 2008. The model is estimated on a panel data framework with fixed-effect estimators.

Our results reject the hypothesis of the existence of perfect competition and show that there is monopolistic competition among credit card issuers in Turkey, which are consistent with the results of Shaffer and Thomas (2007). Accounting for liquidity costs improved the model, which shows that a failure to consider it may lead to an improperly estimated model of credit card lending. The estimation results give a significant coefficient of -0.018 for the liquidity cost, meaning that a 1 percent increase in the standard error of liquidity cost leads to a 0.084 percent decrease in the total revenue.

The paper is organized as follows: The second section gives a theoretical background. Section 3 introduces the model to be estimated and the data. Section 4 proceeds with the results and lastly, after some robustness check in section 5, section 6 concludes the paper.

2. Theoretical Background

The credit card market has attracted the attention of many economists in the recent years. Both developed and emerging economies have suffered the extremely high credit card interest rates and their unresponsiveness to the decline in the cost of funds.

The Turkish credit card market is no exception in this respect. It is highly concentrated with 6 largest issuers controlling around 80 percent of the credit card market. This high concentration gives them market power, making it difficult for interest rates to decrease, despite of the decline in the cost of funds.

Many previous studies for the credit card markets of developed countries have shown the failure of price competition in these markets. There has not been much research of this type for the emerging economies. Among the few, Aysan and Muslim (2006), Aysan and Yildiz (2007) and Akin, Aysan, Kara and Yildiran (2008) have shown the same results for the Turkish credit card market. In order to show the existence of non-price competition in credit card markets, most of the studies are based on the fact that there is a sluggish adjustment of interest rates to the decrease in the costs of funds due to high switching costs (Ausubel, 1991; Calem, 1992; Calem and Mester, 1995 and Stango, 2002). They have focused on the high profitability that the credit card interest rates yield. However, they have often failed to consider the costs that the credit card issuers face.

Shaffer and Thomas (2007) have used an alternative technique, called as the Panzar-Rosse test, in order to assess the degree of competition in the credit card market of the United States. They analyze competition by looking at the elasticity of revenue with respect to the

factor input prices. In agreement with previous works on credit card market, their results are consistent with monopolistic competition. In addition, they include the previously neglected measures of liquidity management costs, which proved to be very important in analysing the credit card market.

In the past years, different techniques were used to examine the degree of competition for the banking industry. These techniques have evolved in two directions, which can be categorized as structural and non-structural.

The traditional approach, which is the structural one, is the Structure-Conduct-Performance Paradigm (SCP Paradigm). Market structure, which is reflected in the concentration ratios of the largest firms and the Herfindahl index, is observed and is related to the conduct and performance of the firms. Conduct refers to the behavior of firms, which may be competitive or collusive depending on their pricing, advertising, R&D, choice of technology, entry barriers, etc, whereas performance is mainly defined by the firms' profits (ROA, ROE). The SCP Paradigm supports the idea that in highly concentrated markets, the largest firms can easily collude and raise their profits, which can be higher than competitive ones. Papers that use this approach look at the effect of concentration on profitability and they usually find a positive relationship between them (Bain, 1951; Smirlock, 1985; Evanoff and Fortier, 1988). Yet, this technique can be criticized because the causality between concentration and profitability is not clear and it requires a specific definition of the market.

The modern techniques are non-structural approaches and they are part of the New Empirical Industrial Organization (NEIO) literature . They intend to examine competition without considering market structures. The most commonly used approaches of this type are the Conjectural Variation (Bresnahan, 1982) approach and the Panzar and Rosse (1987) approach.

Conjectural Variation is a conjecture by one firm in a duopoly about how the other firm will adjust its actions to maximize its profits depending on potential adjustments in the

first firm's actions. Market conduct is analysed by estimating a static, homogenous good in a Cournot model. This approach is criticized by Corts (1999) in terms of the irrationality of conjectured reactions and the estimation methodology.

The Panzar-Rosse approach tests whether the market behavior is in accordance with perfect competition, monopolistic competition or monopoly, by looking at the impact of variations in factor input prices on the revenues of the banks. The Panzar-Rosse statistic, denoted as the H-statistic, is the sum of the elasticities of a firm's total revenue with respect to the factor input prices. H is nonpositive if the firm's pricing policies are consistent with monopoly or a perfectly colluding oligopoly. It takes a value between zero and one in the case of monopolistic competition and it is equal to unity under perfect competition. Table 1 summarizes the Panzar-Rosse statistic.

Table 1. A Description of Panzar-Rosse H-Statistic

H-statistic	Degree of Competition
$H \leq 0$	Monopoly or Perfectly Colluding Oligopoly
$0 < H < 1$	Monopolistic Competition
$H = 1$	Perfect Competition

The intuition behind the Panzar-Rosse statistic for the monopoly case comes from the fact that marginal revenue is equal to the marginal cost, as a condition for profit-maximizing. In equilibrium, marginal revenue will be positive, because of the positive marginal cost. As a result, an increase in the factor input prices will lead to a decrease in the equilibrium output, which will in turn lower the total revenue.

A characteristic of monopolistic competition is product differentiation, which leads to non-price competition in the market. A monopolistically competitive firm can raise its prices without losing all the customers, because of brand loyalty. As a result, an increase in the

factor input prices will lead to an increase in the total revenue, but this increase will be less than the increase in the price of inputs.

Lastly, under perfect competition, the products are homogenous for all the firms and prices increase in proportion to the increase in costs. Since a competitive firm must have non-negative economic profits in the long run, total revenue must increase with the same percentage as the increase in costs, without changing the equilibrium output level.

The Panzar-Rosse technique has many advantages over the other methods that measure competition. In contrast to the SCP Paradigm, which focuses on the market structure in order to observe the market behavior, the Panzar-Rosse technique does not do so, because there are other factors rather than market structure and concentration which may affect the competitive behavior of the firms, such as entry/exit barriers and the general contestability of the market (Baumol et al. 1982; Bresnahan, 1989; Panzar and Rosse, 1987).

Another feature makes the Panzar-Rosse technique superior to the structural approaches. In Panzar-Rosse approach there is no need to specify a geographic market, because the behavior of individual firms gives an indication of their market power. Eventhough other control variables may include some firm-specific or macroeconomic elements, the main variables in the Panzar-Rosse technique, which are input prices and total revenue, only include firm specific data.

Among all the methods that aim to measure competition, the Panzar-Rosse test is the most appropriate in some of the cases when firms exhibit expense preference behavior (Edwards, 1977; Berger and Hannan, 1998). Firms having a high market power may want to pursue some goals, such as hiring excess staff, excess quantities of inputs, or pay excessive input prices. The advantage of Panzar-Rosse test can be seen depending on the form that expense preference behavior takes. If a firm happens to pay excessive input prices, it must adjust its output prices and generate an increase in revenue by the same percentage as the

increase in the input prices, which resembles a perfectly competitive firm and distorts the Panzar-Rosse test. On the contrary, when firms exhibit expense preference behavior by employing excessive quantities of inputs or hiring excess staff, Panzar-Rosse test is superior to other approaches. The reason lies in the fact that this technique measures competition by looking at the factor input prices and not their quantities.

Most of the works that have analyzed the competition in credit card market have found a degree of market power, which has mostly been explained by consumer switching costs (Calem, 1992; Calem and Mester, 1995 and Stango, 2002), search costs (Ausubel, 1991; Calem, 1992) or tacit collusion (Knittel and Stango, 2003). Being focused on the high profitability associated with credit card lending, they have not considered the possibility that their results may change after controlling for some measures of liquidity management costs, which are faced by credit card lenders.

Different from other loans, in the credit card lending banks commit to lend up to a specific amount to the credit card users. Whether this amount is fully utilized or not is a decision of the credit card holder. For this reason, banks are obliged to keep some liquid amount of money in order to be prepared for any unexpected withdrawal by the customers. This amount should be equal to the difference between the credit card limits and the outstanding credit card balances. Banks can generate this additional liquidity by keeping excess cash reserves or highly liquid securities, or by borrowing short term loans in the interbank money market. All these sources of producing liquidity come with a cost, which may be a direct cost in the case of expensive short term borrowing from the Central Bank or other banks, or an opportunity cost in the case of holding excess cash reserves or liquid securities. Another feature of the credit card lending, which allows customers to revolve their credit card balances without giving them a time limit to repay their balances together with the interest charged on them, augments the liquidity management cost. Shaffer and Thomas

(2007) criticize the previous papers for neglecting the liquidity management costs that credit card issuers face. They show that failing to account for these costs overstates the economic profits and the market power in the credit card market. Moreover, it is possible that anticompetitive results are a consequence of not considering the liquidity management costs.

3. Model and data

Competition in the credit card market has been analysed by many previous studies. Their attention has focused mostly on the high interest rates of credit cards. By looking at the response of interest rates to the cost of funds, only one side of the revenues generated by the interest on credit cards is captured. Moreover, the risk and costs that the credit card lending faces, are not taken into account at all. Akin, Aysan, Kara and Yildiran (2008) have investigated the nature of competition in the Turkish credit card market and have shown that credit card issuers compete in terms of non-price benefits, rather than interest rates. In this way, they increase switching costs and make interest rates unresponsive to the decline in cost of funds.

Apart from the revenue generated from interest rates, the total revenue earned from credit cards also comprises revenues earned from fees that cardholders and merchants pay. Failing to account for this component of revenue may underestimate the total revenue earned on credit card lending (Humphrey et al., 1996). Another disadvantage of using the response of interest rates for analyzing competition in the credit card market is the fact that the majority of Turkish cardholders are convenience users. They fully pay their bill within the grace period each month, so they do not borrow from their credit cards, they just use it as a plastic means of payment. The revenue earned from these users is only the non-interest revenue coming from the annual fees. Hence, it does not reflect all the competition in the credit card market. Lastly, the cost of funds is only a part of the costs associated with credit card lending. There

are also costs associated with labor and physical capital. For all these reasons, looking at the competition by analyzing the sluggishness of interest rates and the spread between interest rates and cost of funds is not satisfactory.

Shaffer (1999) was the first study to use the total revenues as a sum of interest and non-interest revenues, and Shaffer and Thomas (2007) were the first to use the reduced-form revenue equation of Panzar and Rosse for analyzing competition in the United States credit card market. Several papers for developed and developing countries, have used the Panzar and Rosse statistic to analyze the competition in the banking sector, but Shaffer and Thomas (2007) were the first to implement it to the credit card industry. Moreover, they also made a further contribution to the previous studies that analyze competition in the credit card market by introducing the liquidity management costs.

In order to analyze the competition among credit card issuers in Turkey, we have followed Shaffer and Thomas's work. In this regard, this paper is the first study of this type for an emerging market economy.

The sample of our analysis includes 21 issuers of credit cards in Turkey. Quarterly data have been collected from the Banking Regulation and Supervision Agency (BRS), the Central Bank of the Republic of Turkey (TCMB) and the Banks Association of Turkey (BAT) for the period beginning from the last quarter of 2002 to the last quarter of 2008. The observations in which the ratio of the non-interest revenue to the total revenue was less than 10 percent and greater than 90 percent were deleted from the dataset to exclude outliers. The model is estimated on a panel data framework with fixed-effect estimators to control for unobserved heterogeneity.

To implement the Panzar-Rosse (P-R) test to the Turkish credit card industry, the following model is used:

$$TR_{i,t} = c_i + \alpha_1 CF_{i,t} + \alpha_2 W_{i,t} + \alpha_3 PK_{i,t} + \beta_1 AGE_{i,t} + \beta_2 CQ_{i,t} + \beta_3 YS_t + \beta_4 LC_{i,t} \\ + \beta_5 \text{Trend}_t + \xi_{i,t} \quad (1)$$

The variables are defined as follows: $TR_{i,t}$ (Total revenue) is the quarterly sum of interest revenue and non-interest revenue (annual fees, interchange fees and merchant discounts) for bank i at time t . $CF_{i,t}$ is the average quarterly price of funds, which is measured by dividing the sum of interest expenses on deposits, funds borrowed and money market transactions by the sum of the value of deposits, funds borrowed and money market takings. $W_{i,t}$ is the average quarterly wage rate, obtained by dividing quarterly personnel expenses by the number of employees. $PK_{i,t}$ is the average quarterly price of physical capital, which is measured as the depreciation of fixed assets over the value of property and equipments. Positive coefficients are expected for the last three variables, because higher input prices are associated with higher quality services, which help the banks earn higher revenues. The factor input prices are the key variables in a Panzar-Rosse model. The Panzar-Rosse H-statistic is calculated as the sum of elasticities of total revenue with respect to cost of funds, wage and price of physical capital. These three input prices are standard variables in every study that uses the Panzar-Rosse technique.

The remaining variables are other control variables, which may have an impact on the total revenue. $AGE_{i,t}$ is a variable that indicates the structure of banks. It captures the longevity and reliability of a bank and a positive coefficient is expected for this variable. In the case of Turkey small banks are the newest ones, and the largest issuers are older, which is consistent with the hypothesis that older banks are more likely to earn larger revenues. $CQ_{i,t}$ (Credit quality/default) is proxied with the ratio obtained by dividing non-performing credit card balances by outstanding credit card balances. The coefficient of this variable depends on whether banks successfully price credit risk. If this is the case, a positive coefficient is expected. On the contrary, if losses that result from not paying back the credit card balances

decrease the total revenue earned on credit cards, then the coefficient should be negative. YS_t (Yield spread) is defined as the difference between 1 year deposit interest rate and 1 month deposit interest rate. It does not change across banks, it only changes in time. It is included in the model to control for expectations of borrowers and lenders for future interest rate movements and also the opportunity cost of short-term vs. long term borrowing. A negative coefficient is expected for the yield spread variable. When consumers expect higher interest rates in the future, meaning that YS is high, they would demand more long-term loans. Consequently credit card loans would be substituted with long term-loans. Hence, total revenue earned from credit card lending will decrease.

$LC_{i,t}$ is a measure of liquidity management cost, and it is an important variable, which was firstly used by Shaffer and Thomas (2007) in analysing the credit card market. It is measured as the ratio of the value of interbank money market takings over outstanding credit card balances and a negative coefficient is expected for this variable, because short-term borrowing from the interbank money market is very expensive and it negatively affects total revenues.

Lastly, $\xi_{i,t}$ is a random error term. In addition to cost and bank-specific factors we also included a time trend to control for miscellaneous intertemporal effects. All the variables except yield spread are expressed in natural logarithm, because in this way the input price elasticities will be directly given by the coefficients. YS is not expressed in natural logarithm, because it may take negative values.

The paper by Shaffer and Thomas (2007) and many other papers using the Panzar-Rosse technique, also use the total assets (TA) of banks as a control variable in order to control for any scale effects. Since larger banks tend to earn more revenue, a positive coefficient is found for this scale variable. The reason why we have not done the same thing is the recent criticism of Bikker et al. (2007). He has shown that the Panzar-Rosse tests on

monopoly and perfect competition are misspecified when total revenues divided by total assets is used as dependent variable. The same thing happens when scale variables are included in the model as control variables, in which case the revenue equation is transformed into a price equation. In general, the scale variables are highly correlated with the control variables, which may yield non-significant coefficients for the other explanatory variables.

Table 2 describes the summary statistics of the data. The banks included in the sample exhibit credit card balances ranging from 13 million TRY to 7.1 billion TRY. Most of the total revenue comes from the revenue generated from interest on credit cards but non-interest revenue is also very important, making almost 40 percent of the total revenue.

Table 3 gives the pairwise correlations between the variables. Most of the variables have an important effect on the dependent variable (TR). Total Assets (TA) is highly correlated with AGE. It is also very correlated with Off-Balance Items (OFB) and Funds borrowed (FB), which are later used in the robustness check. This is one of the reasons why TA is not included in the model.

Following the work of Shaffer and Thomas (2007), equation (1) will be estimated in six different forms. The first form is given in equation (1). Apart from that, we reestimate the equation by using the lagged input prices instead of original ones. The reason for doing this is to extenuate the effects of monopsony power or imperfectly elastic supply of inputs (Shaffer, 2004). Lastly we estimate a short-run revenue equation by omitting the price of physical capital. All these forms are additionally estimated by omitting the liquidity management cost, in order to observe the importance of this variable in analyzing competition in the credit card market.

Table2. Summary Statistics

Variables	Observations	Mean	Std. Dev	Minimum	Maximum
Interest Expenses on Deposits*	220	590,922.3	516,845.8	22,217.6	2,488,739
Interest Expenses on Interbank Money Market*	220	53,457.9	65,832.5	-2,056	434,596
Interest Expenses on Funds Borrowed*	220	52,586	56,802.1	-9,535	241,695
Deposits*	220	22,800,000	18,600,000	1,068,463	83,900,000
Money Market Takings*	220	1,758,997	2,186,738	178	10,700,000
Fixed Assets*	220	764,814	1,240,696	16,503	16,800,000
Number of Employees	220	10,038	5,697.2	1,036	22,219
Number of Branches	220	497.5545	323.8	49	1,269
Credit Card Customer Number	220	1,733,922	1,572,627	58,340	6,601,755
Outstanding Credit Card Balances*	220	1,569,595	1,838,169	13,159	7,139,693
Non-Performing Credit Card Balances*	220	105,109.3	126,965.2	657	526,114
Interest Revenue*	220	84,962	94,301	139	432,990
Non-Interest Revenue*	220	56,979.1	66,600.1	631	297,244
<i>Total Revenue*</i>	220	141,941.1	151,249	1,126	620,146
<i>Cost of Funds</i>	220	0.0246096	0.0057265	0.0040755	0.055077
<i>Price of Physical Capital</i>	220	0.0342864	0.0220304	0.0005311	0.1616695
<i>Wage</i>	220	11.66385	2.540795	4.308863	22.69988
<i>Age</i>	220	56.22045	29.14569	6.5	120
<i>Credit Quality</i>	220	0.0774704	0.0519516	0.010494	0.3022179
<i>Liquidity Cost</i>	220	2.877805	4.801833	0.0000804	33.72809
<i>Yield Spread</i>	220	0.0669849	0.6065473	-0.48	4.013333
<i>Off-Balance Sheet Items*</i>	220	18,300,000	15,000,000	1,352,266	81,000,000
<i>Funds Borrowed*</i>	220	3,332,275	3,324,432	5,167	11,800,000
<i>Total Assets*</i>	220	33,900,000	26,100,000	1,563,184	104,000,000

(*) indicates values in thousand TRY.

The variables in italics are used in our estimation.

Table3. Pairwise Correlations

PWCORR	TR	CF	PK	W	AGE	CQ	LC	YS	OFB	FB	TA
TR	1										
CF	-0.1207	1									
PK	-0.1991	-0.2979	1								
W	0.4072	-0.1594	-0.0818	1							
AGE	0.1977	0.1792	-0.5596	0.0339	1						
CQ	-0.0736	-0.1522	0.193	0.2398	-0.1594	1					
LC	-0.1871	-0.0963	0.0897	0.1454	-0.1584	-0.117	1				
YS	-0.2413	0.3776	0.0991	-0.4994	-0.1182	-0.204	-0.0249	1			
OFB	0.7515	-0.1224	-0.1356	0.4534	0.1143	-0.008	-0.2187	-0.3196	1		
FB	0.7025	-0.2262	-0.2039	0.4591	0.1865	0.0324	-0.1738	-0.2649	0.6615	1	
TA	0.5599	0.0404	-0.5051	0.3343	0.7366	-0.2197	-0.1717	-0.273	0.5129	0.6468	1

4. Results

The regression results are shown in Table 4. Adjusted R-squares indicate that there is a good fit of the model, and the majority of the slope coefficients are significant.

Cost of funds (CF) and wage (W) have positive coefficients as expected, reflecting the services quality of the banks. These coefficients are significant for most of the estimation forms. Different from the studies where the focus was on the responsiveness of cost of funds on credit card interest rates, when total revenue is taken into account, CF results to be sensitive. A standard deviation increase in CF leads to a 2.24 percent increase in TR, whereas a standard deviation increase in W increases the total revenue by 4 percent. Price of physical capital (PK) reveals a negative sign, but it is not significant. This negative sign is explained by the fact that the largest credit card issuers in Turkey are old banks and depreciation expenses are smaller for these banks.

The sum of the elasticities of total revenue with respect to factor input prices, which is the Panzar-Rosse H-statistic, is 0.491 for equation (1). The H-statistic is significantly different from zero and one for the six forms of regression estimations, indicating that the credit card market in Turkey is characterized with monopolistic competition structure.

The effect of AGE on the total revenue is positive and significant for all forms of revenue equation, which is consistent with the hypothesis that an old bank is more reliable and thus makes more revenue than a new bank. The negative slope coefficients on credit quality (CQ) tell that the losses resulting from the default of credit card balances decrease the total revenue earned on credit cards. The coefficient on YS is negative for all the equation forms, but it is not significantly so. The reason why it is not significant is the fact that in Turkey long term bonds are rather limited. Hence, there is relatively less variation in the yield spread.

Table4. Regression Results

Variables	Benchmark estimation				Lagged Input Prices				Short - Run Revenue Equation			
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Total Revenue												
Cost of Funds	0.2315	[2.45]***	0.249	[2.73]***	0.1805	[2.09]**	0.173	[2.09]**	0.23015	[2.44]***	0.246	[2.7]***
Price of Phys. Capital	-0.01	[-0.2]	-0.02	[-0.48]	-0.044	[-0.9]	-0.053	[-1.11]				
Wage	0.1778	[1.12]	0.266	[1.73]*	0.3212	[1.99]**	0.343	[2.21]**	0.17423	[1.11]	0.257	[1.68]*
Age	1.9129	[3.4]***	1.759	[3.24]***	3.6689	[5.68]***	3.483	[5.59]***	1.9418	[3.58]***	1.827	[3.49]***
Credit Quality (Default)	-0.201	[-3.96]***	-0.19	[-3.83]***	-0.163	[-3.15]***	-0.162	[-3.27]***	-0.2027	[-4.05]***	-0.192	[-3.97]***
Yield Spread	-0.027	[-0.98]	-0.04	[-1.48]	-0.016	[-0.58]	-0.026	[-1]	-0.0264	[-0.96]	-0.038	[-1.42]
Liquidity Cost												
Trend	0.0508	[8.07]***	0.048	[7.91]***	0.0368	[5.33]***	0.037	[5.5]***	0.0507	[8.09]***	0.048	[7.91]***
Constant	2.7148	[1.27]	3.19	[1.55]	-4.156	[-1.75]*	-3.554	[-1.55]	2.64372	[1.26]	3.022	[1.49]
H:estimate	0.399		0.491		0.4572		0.463		0.40438		0.503	
P-value:H=0	0.025		0.005		0.0111		0.008		0.0212		0.003	
P-value:H=1	0.0008		0.003		0.0026		0.002		0.0007		0.004	
Adjusted R-sq	0.9699		0.974		0.9699		0.972		0.97		0.972	
F-statistic	85.33		82.92		89.55		87.19		99.92		95.02	
Number of Obs.	286		286		264		264		286		286	

(*), (**) and (***) correspond to significance at the 10%, 5% and 1% levels, respectively

When LC is included in the model, the estimation results yield a negative coefficient for LC, which is significant for all the regression forms. According to the results of equation (1), if LC increases by a standard deviation, TR increases by 0.15%. It shows the adverse effect of short term borrowing on the total revenue. With the presence of LC, adjusted R-squares increase and H-statistics also increase for all the estimation forms. In the benchmark, lagged input prices and the short run revenue model, when liquidity management cost is included, the H-statistic increases from 0.399 to 0.491, from 0.4572 to 0.463 and from 0.4044 to 0.503, respectively. This means that the inclusion of this variable makes the credit card market more competitive, in contrast to the cases when it is neglected. Hence, this shows that the total revenues earned by credit card issuers are overestimated when the liquidity management cost is neglected. Since it increases the goodness of fit of the model and the precision of the estimates, it is very crucial that we account for the cost of liquidity management, when analyzing competition among credit card issuers. Lastly the time trend is significantly positive, which shows that the total revenue from credit cards has increased over time. As time has passed, credit cards have become more widespread and the number of credit card customers has increased, which has had a positive impact on total revenues.

5. Robustness check

The correct identification of Panzar-Rosse statistic relies on the assumption that the market is in long run equilibrium during the whole period of interest (Shaffer, 1982). In order to test whether the sample is in long run equilibrium or not, return on assets or return on equity should be used as a dependent variable instead of the total revenue. The intuition behind this is the fact that in the long run, risk adjusted rates of return are equalized across banks. We reestimate our model by using the return on assets (ROA) as the dependent

variable, instead of total revenue. Since ROA can take negative values, we compute the dependent variable as $\text{ROA}' = \ln(1 + \text{ROA})$. If the market is in long run equilibrium, the sum of the coefficients of input prices should be equal to zero. Table 5 in Appendix shows the results of long run equilibrium test. According to the results, the sum of input price coefficients is approximately 0.005, but not significantly different from zero, which shows that we fail to reject the hypothesis that the sample is in long run equilibrium. Hence the Panzar-Rosse test is correctly identified.

In order to check for the robustness of our model, we analyze the effect of including two other control variables in addition to the variables used in our benchmark model. Firstly, we include off-balance sheet items (OFB), which are composed of guarantees and warranties, commitments, and derivative financial instruments. Off-balance sheet items are important because they reflect the technology, creativity and product diversity of the banks, which positively affect credit card borrowing, and consequently the revenue earned from credit cards. As expected, the coefficient for OFB is positive and significant.

Second, we include funds borrowed (FB) as a variable that indicates risk. Banks with large amounts of borrowed funds are more reliable banks. Its coefficient is positive, indicating that the soundness of the bank also helps to attract more credit card customers. The higher the funds borrowed, the more revenue banks earn. The results of including these additional variables are given in Table 6 of Appendix.

Looking back at the results of Table 4, a non-significant coefficient is obtained for the yield spread variable. For this reason, we reestimate the equation by omitting this variable and see whether the results change. As given in Table 7, the results from both including and omitting YS are similar, showing the robustness of the model.

Another measure for the price of physical capital could be the ratio of the sum of depreciation of fixed assets and amortization of intangible assets to the sum of the value of

property and equipment and intangible assets. Our results are robust to using this variable (PK1) instead of PK and are shown in Table 8 of Appendix.

6. Conclusion

The nature of competition in the credit card industry has been the focus of many researches for both developed and developing countries, and most of these studies, regardless of the methods they have used, have found that credit card market has certain characteristics of monopolistically competitive markets.

The Panzar-Rosse technique is a non-structural approach, which is widely used to test competition in the banking industry, and for the first time was applied by Shaffer and Thomas (2007) for analyzing the competition in the U.S. credit card industry. This is the second work of this type, which studies competition in the credit card market of an emerging economy and the results show that the credit card market in Turkey is a monopolistically competitive structure.

With the increasing weight of non-interest revenues to the total revenue earned by credit card issuers in the recent years, the need to include them to the total revenue has emerged. In this way, we fill the gap created by previous studies, which consider only the revenues earned from interest on credit cards.

Accounting for liquidity management cost, which was also a novelty of Shaffer and Thomas (2007), proved to be very important for a properly estimated model of competition in Turkish credit card lending. When it is included in the model, it has an adverse effect on total revenue, which shows that neglecting the liquidity management costs would lead to an overestimation of the total revenue.

Our findings are consistent with monopolistically competitive behavior and the precision of the test is proved by the fact that our sample is in long run equilibrium for the whole period in question. The results indicate that credit card issuers in Turkey do not compete in terms of credit card pricing, but they differentiate their products in order to increase their market power. This behavior is mostly related with the credit card market structure, where the largest issuers are the main determinants of the competitive behavior in Turkish credit card market. They focus on strategies to increase consumer loyalty, such as increasing the number of branches, ATMs, POS machines and the number of installments, and also giving bonus points, flyer miles, etc.

Our findings, together with the importance of liquidity management cost, are very crucial factors that should incite further regulatory measures, which are not just focused on credit card pricing and ceilings, but which deal with credit risk management.

APPENDIX

Table 5. Long-Run Equilibrium Test

Variables	Test for Long Run Equilibrium	
Return on Assets	Coefficient	t-statistic
Cost of Funds	-0.0002146	-0.08
Price of Phys. Capital	-0.0015248	-0.97
Wage	0.0065571	1.37
Age	-0.0068001	-0.4
Credit Quality (Default)	0.000208	0.14
Yield Spread	0.0009812	1.16
Liquidity Cost	-0.0008292	-1.45
Trend	-3.73E-06	-0.02
Constant	0.0081417	0.13
H:estimate	0.0048177	
P-value:H=0	0.3678 *	
P-value:H=1	0	
Adjusted R-sq	0.0854	
F-statistic	0.82	
Number of Obs.	286	

(*) , (**) and (***) correspond to significance at the 10% , 5% and 1% levels, respectively.

Table 6. Inclusion of Other Control Variables to the Model

Variables	Benchmark		OFB		FB	
	Coeff	t	Coeff	t	Coeff	t
Total Revenue						
Cost of Funds	0.2490111	[2.73]***	0.2758197	[3.12]***	0.2354739	[2.67]***
Price of Phys. Capital	-0.0239924	[-0.48]	-0.0386388	[-0.79]	-0.0221978	[-0.46]
Wage	0.2662474	[1.73]*	0.2946199	[1.98]**	0.1609361	[1.08]
Age	1.759218	[3.24]***	1.060393	[1.94]**	0.8946062	[1.63]
Credit Quality (Default)	-0.1878411	[-3.83]***	-0.1483147	[-3.08]***	-0.2691928	[-5.41]***
Yield Spread	-0.0402749	[-1.48]	-0.0479142	[-1.83]*	-0.0396622	[-1.52]
Liquidity Cost	-0.0840856	[-4.56]***	-0.0899079	[-5.04]***	-0.0798526	[-4.48]***
trend	0.0482285	[7.91]***	0.0288619	[3.96]***	0.0438118	[7.42]***
Constant	3.18989	[1.55]	1.270441	[0.62]	3.848464	[1.93]**
Off-Balance Sheet Items			0.3020401	[4.5]***		
Funds Borrowed					0.1887802	[4.98]***
H:estimate	0.4912661		0.5318008		0.3742122	
P-value:H=0	0.0046		0.0015		0.0253	
P-value:H=1	0.0033		0.0052		0.0002	
Adj R-sq	0.9744		0.974		0.9732	
F-statistic	82.92		81.39		81.54	
Number of Observations	286		286		285	
(LR)P-value:H=0	0.3678		0.3208		0.3198	
(*) , (**) and (***) correspond to significance at the 10%, 5% and 1% levels, respectively.						

Table7. The Effect of Omitting Yield Spread

Variables	Including YS		Omitting YS	
Total Revenue	Coeff	t	Coeff	t
Cost of Funds	0.2490111	[2.73]***	0.1776788	[2.28]***
Price of Phys. Capital	-0.0239924	[-0.48]	-0.0089924	[-0.18]
Wage	0.2662474	[1.73]*	0.2995267	[1.96]**
Age	1.759218	[3.24]***	1.990329	[3.81]***
Credit Quality (Default)	-0.1878411	[-3.83]***	-0.1987331	[-4.09]***
Yield Spread	-0.0402749	[-1.48]		
Liquidity Cost	-0.0840856	[-4.56]***	-0.0812588	[-4.42]***
Trend	0.0482285	[7.91]***	0.0498894	[8.3]***
Constant	3.18989	[1.55]	1.965414	[1.04]
H:estimate	0.4912661		0.4682131	
P-value:H=0	0.0046		0.0068	
P-value:H=1	0.0033		0.0021	
Adj R-sq	0.9744		0.9719	
F-statistic	82.92		94.02	
Number of Observations	286		286	
(LR)P-value:H=0	0.3678		0.3131	

(*), (**) and(***) correspond to significance at the 10%, 5% and 1% levels, respectively

Table8. Alternative Measure for PK

Variables	Using PK		Using PK 1	
	Coeff	t	Coeff	t
Total Revenue				
Cost of Funds	0.2490111	[2.73]***	0.2460748	[2.7]***
Price of Phys. Capital	-0.0239924	[-0.48]		
Price of Phys. Capital 1			-0.0030869	[-0.06]
Wage	0.2662474	[1.73]*	0.2581102	[1.68]*
Age	1.759218	[3.24]***	1.820426	[3.39]***
Credit Quality (Default)	-0.1878411	[-3.83]***	-0.1910487	[-3.88]***
Yield Spread	-0.0402749	[-1.48]	-0.038092	[-1.39]
Liquidity Cost	-0.0840856	[-4.56]***	-0.0835651	[-4.54]***
trend	0.0482285	[7.91]***	0.0480271	[7.88]***
Constant	3.18989	[1.55]	3.037089	[1.48]
H:estimate	0.4912661		0.5010981	
P-value:H=0	0.0046		0.0042	
P-value:H=1	0.0033		0.0044	
Adj R-sq	0.9744		0.972	
F-statistic	82.92		82.82	
Number of Observations	286		286	
(LR)P-value:H=0	0.3678		0.4605	
<i>(*), (**) and(***) correspond to significance at the 10%, 5% and 1% levels, respectively</i>				

References

Akin, G. G., Aysan, A. F., Kara, G. I. and Yıldırın, L. (2008). “The Failure of Price Competition in the Turkish Credit Card Market.”

Ausubel, L.M. (1991) “The Failure of Competition in the Credit Card Market”, American Economic Review, 81: 50-81.

Aysan, A.F., and Müslim, N.A. (2006) “Assessing the Competition in the Credit Card Market in Turkey: A New Empirical Evidence”, International Management Development Research Yearbook. K.Erdener and H. Talha (eds.), Vol.15:147-154, Hummelstown, Pennsylvania: International Management Development Press.

Aysan, A.F., and Yıldız, L. (2007) “The Regulation of the Credit Card Market in Turkey” , The International Research Journal of Finance and Economics, 2, no.11: 141-154.

Bain, J.S. (1951) “Relation of Profit Rate to Industry Concentration”, Quarterly Journal of Economics, 65, August, 293–324.

Baumol, W. J., Panzar J. C. and R.D. Willig (1982) “Contestable Markets and the Theory of Industry Structure” San Diego: Harcourt Brace Jovanovich.

Bikker, J.A., Spierdijk, L. and Finnie, P. (2007) “Misspecification of the Panzar-Rosse Model: Assessing Competition in the Banking Industry”, Netherlands Central Bank, DNB Working paper.

Bresnahan, T. F. (1982) “The Oligopoly Solution Concept is Identified” Economics Letters, 10, 7-92.

Bresnahan, T.F. (1989) “Empirical Studies of Industries with Market Power In: Schmalensee, R.,Willig, R.D. (Eds.), Handbook of Industrial Organisation, vol. II. Elsevier, Amsterdam, 1012–1055.

Calem, P. S. (1992) "The Strange Behaviour of the Credit Card Market" Federal Reserve Bank of Philadelphia, Business Review, 3–14.

Calem, P. S. and Mester, L. J. (1995) "Search, Switching Costs, and the Stickiness of Credit Card Interest Rates" American Economic Review, 85, 1327–36.

Corts, K.S. (1999) "Conduct Parameters and the Measurement of Market Power" Journal of Econometrics, 88, 227-225.

Evanoff D.D. and D.L. Fortier (1988) "Re-evaluation of the Structure-Conduct-Performance Paradigm in Banking", Journal of Financial Services Research, 1, 277-294.

Humphrey, D. B., Pulley, L. B. and Vesala, J. M. (1996) "Cash, Paper, and Electronic Payments: A Cross-Country Analysis" Journal of Money, Credit, and Banking, 28, 914–39.

Knittel, C. R. and Stango, V. (2003) "Price Ceilings as Focal Points for Tacit Collusion: Evidence from Credit Cards" American Economic Review, 93, 1703–29.

Panzar, J.C. and J.N. Rosse (1987) "Testing for Monopoly Equilibrium" Journal of Industrial Economics, 35, 443-456.

Shaffer, S. (1982) "A Nonstructural Test for Competition in Financial Markets" Proceedings of a Conference on Bank Structure and Competition (Federal Reserve Bank of Chicago, Chicago, IL), 225–43.

Shaffer, S. (2004) "Patterns of competition in banking" Journal of Economics and Business, 56, 287–313.

Shaffer, S. and Thomas, L. (2007) "A Reassessment of Market Power among Credit Card Banks" Applied Financial Economics, 17:9, 755-767.

Smirlock M. (1985) "Evidence on the (Non) Relationship Between Concentration and Profitability", Journal of Money, Credit and Banking, 17 (1), 69-83.

Stango, V. (2002) “Pricing with Consumer Switching Costs: Evidence from the Credit Card Market” Journal of Industrial Economics, 50, 475–92.