COMPETITION AND REGULATION IN THE TURKISH CREDIT CARD MARKET

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Competition and Regulation in the Turkish Credit Card Market

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Thesis Abstract

Denada Boriçi, “Competition and Regulation in the Turkish Credit Card Market”

This thesis investigates the competitive environment among twenty one credit card issuers in Turkey, covering the time period between 2002 and 2008. The analyses are made using the methodology designed by Panzar and Rosse (1987), known as the H-statistic, 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 only credit card rates fills the gap of previous studies, which look at only one side of the credit card market. 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 H-statistics are consistent with product differentiation implying that Turkish credit card issuers are characterized by monopolistic competition.

The thesis also looks at the effect of one-sided regulation on total revenues earned by credit card issuers. Results show the positive effect of regulation on both competition and total revenue, implying that for the case of Turkey, the one-sided regulation has benefited both sides of the market.

Tez Özeti

Denada Boriçi, “Türkiye’de Kredi Kartı Pazarında Rekabet ve Düzenleme”

Bu tez Türkiye'de kredi kartı işleten yirmi bir banka arasındaki, 2002 ve 2008 yılları arasını kapsayan rekabet ortamını incelemektedir. Analizler, H-istatistiği olarak bilinen Panzar ve Rosse (1987) metodolojisini kullanarak yapılmaktadır. Bu metodolojiyle, girdi maliyetlerine göre toplam gelir esneklikleri toplanarak, kredi kartı pazarında rekabet düzeyi belirlenir. Tezin amacı, kredi kartı faiz oranları yerine, toplam gelirlere bakarak, önceki çalışmaların boşluklarını doldurmaktır. Önceki çalışmalarda, kredi kartı pazarındaki sadece faizden kazanılan gelirler değerlendirilmiştir. Tezin başka bir amacı ise daha önce göz ardı edilen likidite yönetim maliyetinin kredi kartı sektöründeki rekabet düzeyine etkisisnin önemini ortaya koymaktır. Shaffer ve Thomas (2007) Amerika Birleşik Devletleri'ndeki kredi kartı sektöründe rekabetin derecesini değerlendirmek için, ilk defa bu maliyet değişkenini kullanmıştır. Bulunan H-istatistikleri, kredi kartı sektöründeki rekabet düzeyinin tekel piyasa ile tam rekabet piyasa arasında yer aldığını göstermektedir. Kredi kartı işleten Türk bankalar, ürün farklılaşması uygulayarak, birbiriyle rekabet etmektedirler.

Tez, aynı zamanda, tek-taraflı düzenlemenin, kredi kartı işleten bankalar tarafından kazanılan toplam gelirler üzerindeki etkisine bakmaktadır. Sonuçlar, kredi kartı pazarındaki düzenlemenin hem rekabet hem de toplam gelirler üzerinde olumlu etkisi olduğunu göstermektedir. Türkiye örneğinde, kredi kartı sektörünün her iki tarafı da tek-taraflı düzenlemeden faydalanmıştır.

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CHAPTER I

A REASSESSMENT OF COMPETITION IN THE TURKISH CREDIT CARD MARKET BY INTRODUCING LIQUIDITY COST MEASURES

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 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 Figure 1, around 35 percent of total revenue came from the interest component before 2005. After this period, althogh 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.

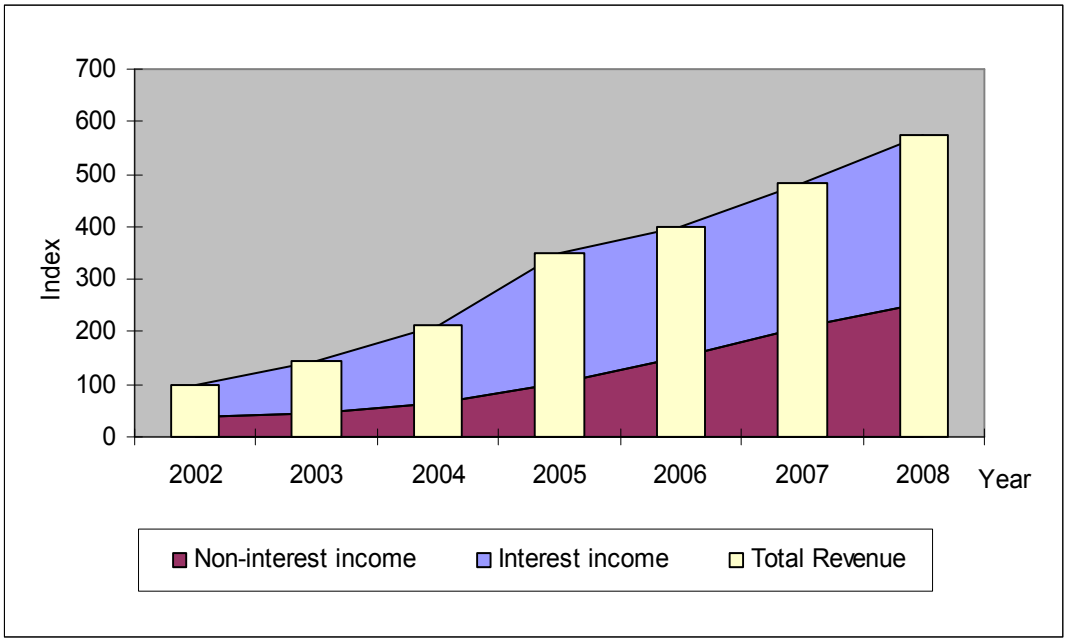

Figure 1. Index of Components of Total Revenue
Indexes are calculated from BRSA, CBRT and BAT

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 competitition 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 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 credit card market, but the degree of competition is measured by looking only at 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 next section gives a theoretical background. The third section introduces the model to be estimated and the data. Section four proceeds with the results and lastly, after some robustness check in the fifth section, the sixth section concludes the paper.

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 market, most of the studies are based on the fact that there is a sluggish adjustment of interest rates to

the decrease in the cost 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, which is called 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 analyzing 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. Because of brand loyalty, a monopolistically competitive firm can raise its prices without losing all the customers. As a result, an increase in 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 the 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, the 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 competition in the 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 tacid 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 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.

Model and data

Competition in the credit card market has been analyzed 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 from 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 understate 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 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 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 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 competition in the banking sector, but Shaffer and Thomas (2007) were the first to implement it to the credit card industry. Moreover, they made a further contribution to the previous studies that analyze competition in the credit card market by introducing 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 (BRSA), 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 non-interest revenue to the total revenue was less than 10 percent and greater than 90 percent were deleted from the datalist 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:

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

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 latter 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 the cost of funds, wage and the 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 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 analyzing 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 include a time trend to control for miscellaneous intertemporal effects. All the variables except yield spread are expressed in natural logarithm, because in this way 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 revenues, 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 sheet 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.

Table 2. 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
*Total Revenue**	220	141,941.1	151,249	1,126	620,146
Cost of Funds	220	0.0246096	0.0057265	0.0040755	0.055077
Price of Physical Capital	220	0.0342864	0.0220304	0.0005311	0.1616695
Wage	220	11.66385	2.540795	4.308863	22.69988
Age	220	56.22045	29.14569	6.5	120
Credit Quality	220	0.0774704	0.0519516	0.010494	0.3022179
Liquidity Cost	220	2.877805	4.801833	0.0000804	33.72809
Yield Spread	220	0.0669849	0.6065473	-0.48	4.013333
*Off-Balance Sheet Items**	220	18,300,000	15,000,000	1,352,266	81,000,000
*Funds Borrowed**	220	3,332,275	3,324,432	5,167	11,800,000
Total Assets*	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.

Table 3. 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

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 omittig 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.

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 total revenue is positive and significant for all forms of the revenue equation, which is consistent with the hypothesis that an old bank is more reliable and thus makes more revenues 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.

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 percent. It shows the adverse effect of short term borrowing on total revenue. With the presence of LC, adjusted R-squares increase and H-statistics also increase for all the estimation forms. In the benchmark equation, 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.

Table 4. Regression Results from Six Forms of Revenue Equation

Variables	Benchmark estimation				Lagged Input Prices				Short - Run Revenue Equation			
Total Revenue	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
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			-0.08	[-4.56]***			-0.079	[-4.5]***			-0.084	[-4.55]***
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-statistc	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												

Hence, this shows that the total revenues earned by credit card issuers are overestimated when 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.

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 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 ROA' = ln (1+ ROA). If the market is in long-run equilibrium, the sum of the coefficients of input prices should be equal to zero. Table 9 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 is 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, committments, 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 10 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 11 of Appendix, 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 12 of Appendix.

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 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. 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 the 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 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.

CHAPTER II

REGULATION IN THE TURKISH CREDIT CARD MARKET

Introduction

Turkish credit card market is one of the fastest growing credit card markets in Europe. What has made it so popular in the last decade is not the benefit that cardholders gain from credit card usage, but the extremely high interest rates. The stickiness of credit card interest rates has caused many concerns leading to the need for government interventions.

Many complaints have arised from credit card customers about the extraordinarily high interest rates. Many cardholders dafaulted because of not being able to pay out their revolving balances, which led to depression, divorce, and even suicide.

As a consequence of the serious problems that the high interest rates caused, the Turkish government was put under pressure to regulate the credit card market. Since issuers of credit cards could not lower interest rates individually, a central authority was more than needed. In order to help the cardholders pay back their credit card balances, Turkish government put forward amnesties in 2003 and 2005. Default interest rates were decreased and the maturity dates were extended. Since banks wanted to maximize their profits, they charged the maximum default rate allowed. Not only cardholders, but also banks were dissatisfied with the regulations of 2003 and 2005. Cardholders were complaining about the persisting high rates, while banks were complaining about the forgone profits from credit card holders.

In March 2006, the enaction of the Bank and Credit Cards Law gave the Central Bank the right to put a ceiling on the credit card interest rates. With this regulation banks were not allowed to offer new cards or to increase card limits without the demand of the cardholder. This regulation was to the advantage of revolving customers, who became better off by paying lower interest rates for their balances.

Turkish government has ignored the two-sided structure of the credit card market. Since the two sides of the credit card market (customers and merchants) are very related to each other and the benefits of one side depend on the characteristics of the other side, they should be priced simultaneously. The government has tried to regulate the market by putting interest rate ceilings, but has failed to consider any regulation on merchant fees. Different from one-sided markets, two-sided markets must balance both cardholders and merchants and also the prices charged to them.

The problem of neglecting the two-sided nature of credit card market is not unique for Turkey. In the United States, Australia and many European countries, the high interchange fees, and as a consequence the high merchant fees, have paved the way to some regulations on interchange fees, while leaving interest rates on cardholders unchanged.

Although the two-sided nature of the credit card market has been disregarded by the regulators, the effect of one-sided regulation of Turkish credit card market has not had any adverse effect on the revenues earned by credit card issuers. The decreased card prices have led to a rise in the number of revolvers, generating more revenues for the issuer banks.

The aim of this paper is to look at the effect of the regulation of March 2006 on the degree of competition in the Turkish credit card market. It contributes to

previous literature by considering the elasticities of total revenue with respect to factor input prices. Earlier studies have considered the effects of regulation on either interest revenue or non-interest revenue. Giving importance to both sides of credit card market, we attempt to unravel whether the regulation on one side has regulated the credit card market as a whole.

In order to assess the degree of competition before and after the regulation, we use Panzar and Rosse (1982, 1987) approach, which is widely used for the banking industry. Shaffer and Thomas (2007) have first applied it to the credit card market. We implement this method for the first time to the Turkish credit card market. We consider the two-sided market as a whole, rather than just looking at the interest or non-interest revenue from credit cards. Our sample includes 21 issuers of credit cards in Turkey. Quarterly data have been collected from the Banks Association of Turkey (BAT), Central Bank of the Republic of Turkey (CBRT), and Bank Regulation and Supervision Agency (BRSA) for the period 2002-2008. The model is estimated on a panel data framework with fixed-effect estimators and a dummy for regulation is put in order to analyze the effect of regulation on competition among credit card issuers.

It is argued that regulating the credit card market by putting a ceiling on interest rates or by reducing merchant fees adversely affects competition. Banks also complain that regulation decreases their revenues. Yet, our results prove the opposite for the Turkish credit card market. We show that regulation has increased the degree of competition among issuers of credit cards by around 60 percent, indicating that the one-sided regulation has in fact regulated both sides. Moreover, our data show that total revenues of banks that issue credit cards have significantly increased after the regulation of March 2006. Other side effects of decreasing

interest rates might have led to an increase in the total revenues earned by credit card issuers. According to Ausubel (1991), no bank will make a unilateral deviation by decreasing credit card rates, because only high risk customers will prefer that bank, resulting in the reduction of its returns. However, if all banks reduce their card rates at the same time, which is the case with regulation, the number of revolving customers increases. Hence more revenues are earned from credit card issuers.

Another source from which banks generate revenue is the non-interest revenue coming from annual fees, interchange fees and merchant discounts. Since the regulation put a ceiling on interest rates, issuers of credit cards attempted to increase the non-interest revenue by charging more on convenience users and merchants. Although the major aim of the regulation was to benefit revolvers, two other main effects were the case for Turkey: Total revenues earned by credit card issuers increased and competition improved.

The paper is organized as follows: The next section gives a theoretical background on two-sided markets and Panzar-Rosse approach. Then we introduce the model and data. The fourth section interprets the results and a robustness check is made in the fifth section. Finally, section six concludes the paper.

Theoretical Background

The Economics of Two-Sided Markets

Two-sided markets are economic networks having two distinct user groups which benefit from each other and are connected by an intermediary. There are many examples of two-sided markets such as hospitals, where neither doctors nor

patients can exist without the presence of the other. Doctors would be of less value if the number of patients was small. Likewise, patients would not go to a hospital if there were no doctors to cure them. Other examples of two-sided markets include newspapers, internet, video games, TV channels, etc.

Credit card market is also considered as a two-sided market. Credit card transactions involve cardholders and merchants, which are the two sides of this market. There are many advantages of using credit card payment for both groups. Customers (cardholders) can better manage and record their expenses, the risk of theft is minimized, and they can spend less time for shopping. In addition, they can earn rewards that can be used for other purchases and also use credit cards as sources of credit. Merchants also benefit from accepting credit cards. A lot of time can be saved and employee errors are minimized when sales are performed by credit cards. Moreover, if customers fail to pay their credit card balances, credit card issuers bear all the risk, while merchants are always paid for their sales. While taking benefits from credit card network, customers and merchants also benefit from each other. Cardholders prefer credit cards which are accepted by more merchants, and merchants prefer cards carried by more customers.

A market can be considered as two-sided if three conditions are satisfied. Firstly, there should exist two distinct groups of agents. Second, the value obtained by one group increases with the size of the other group, which is called the network effect. Lastly, these two distinct groups should be connected by an intermediary.

In two-sided markets, each group has different needs, although they are part of a common network. In credit card networks, for example, consumers require a plastic card, customer service and a monthly bill. Merchants require terminals for authorizing transactions and procedures for submitting charges and receiving

payment. Since the requirements of each group are different, credit card providers may specialize in serving users on just one side of a two-sided network.

A key characteristic of two-sided markets is that they can not be examined in isolation. Both sides should be coordinated by the network, by setting the price structure right. In order to attract one group of users, the network sponsor may subsidize the other group of users. When the two groups are taken as isolated, the fact that one group may pay less than the product's marginal cost and the other group may pay more seems to be very irrational. The fact that coordination between the two groups is what distinguishes two-sided markets from other markets allows network providers to charge the two sides differently. The important thing is the joint surplus gained by cooperation of the two sides, which explains the synergistic behavior of two-sided markets.

In order to determine which side of the market subsidizes the other, one should consider the relative demand elasticities of the two sides of the market, and the relative importance of network effects to each side (Muris, 2006). Regarding credit card market, cardholders have a higher demand elasticity than merchants. If cardholder fees are increased, less customers are willing to use credit cards, because they have the opportunity to use other payment methods. In this case, merchants would lose many sales. On the contrary, if merchant fees are increased, it is not on the merchants' interest to reject credit cards because this would cost them many sales. For these reasons, merchants are charged higher fees than cardholders. Second, the side with less network effects is charged a higher price than the one with greater network effects. With credit card market, network effects exist, but there is no obvious difference of these effects for customers and merchants. Both of them benefit to a great extent from credit cards.

McAndrews and Wang (2008) have shown that the more payment card markets evolve, the more merchant fees increase, at a time when service costs decrease. An explanation for this phenomenon is the incentive of card networks to balance the "two-sided market effects" and the "inflation effect". In order for card transaction volume to increase, the credit card network needs to attract both cardholders and merchants, which is the "two-sided market effect". The "inflation effect" arises from the fact that the card network may want to inflate the value of card transactions in order to increase its demand. Increasing card fees to merchants and decreasing them to customers is very important for inflating the card transactions value. Hence, merchant fees increase over time, despite of the decrease in the cost of services.

Managers of two-sided markets should be very careful when pricing the two sides of the market. Charging prices equal to marginal cost is not rational. In addition, profit maximization for each side is not the strategy used by these markets, because of the existence of network effects. Failing to consider these effects may lead to serious mistakes.

The Panzar-Rosse Approach

The Panzar and Rosse (1982, 1987) test, which is part of the New Empirical Industrial Organization (NEIO), is based on observation of the effect of variations in input prices on total revenue of the firms. By looking at this effect, it tests whether market behavior is consistent with perfect competition, monopolistic competition or monopoly. The Panzar-Rosse H-statistic is the sum of the elasticities of a firm's total revenue with respect to its input prices. H is negative or zero if firms are

characterized by monopoly or a perfectly colluding oligopoly. It is positive but less than unity in the case of monopolistic competition and it is equal to one under perfect competition. The reason why H-statistic is nonpositive for the monopoly case is the fact that marginal revenue equals marginal cost, in order for profit-maximization to occur. Since marginal cost is positive in equilibrium, marginal revenue will also be positive. This means that, an increase in factor input prices will decrease equilibrium output, which will in turn reduce total revenue for the monopoly.

In monopolistic competition there are non-price differences among the competitors' products, indicating that prices can be raised without losing all the customers. Hence, if factor input prices are increased, total revenue will also increase, but with a lower percentage than the increase in the price of inputs. This shows that the Panzar-Rosse statistic is a value between zero and one under monopolistic competition.

What characterizes perfect competition is the existence of a large number of firms producing homogenous products for a large number of buyers. Under this market structure, prices increase in proportion to the increase in costs. Since a perfectly competitive firm must earn non-negative economic profits in the long-run, total revenue must increase at the same rate as the increase in costs, leaving the equilibrium output level unchanged.

Shaffer (1982) was the first study to use the Panzar-Rosse test to banking data. Shaffer came up with an H-statistic between zero and one for a sample of banks in the United States, indicating that the United States banks are characterized by a monopolistic competitive structure. Molyneux et al. (1994) applied this approach to the European banking industry and showed that banks in France,

Germany, Spain and UK performed in a monopolistically competitive environment, while the conduct of Italian banking was monopolistic for the period 1986-1989. De Bandt and Davis (2000) also found an H-statistic between zero and one for France, Germany, Italy, and the United States using data for the period between 1992 and 1996. Similar results were obtained by Nathan and Neave (1989) for Canada, Molyneux et al. (1996) for Japan, Staikouras and Koutsomanoli-Fillipaki (2006) for the European Union, and Yıldırım and Philippatos (2006) for Latin America.

Shaffer and Thomas (2007) is the first study to use the Panzar-Rosse technique for the credit card market. They obtained an H-value between zero and one for the 10 year period between 1984 and 1993 in the United States, which is similar to previous works on credit card market. In addition, they include the previously neglected measures of liquidity management costs, which proved to be very important in analyzing the credit card market.

Model and data

The aim of the paper is to look at the effect of the regulation of 2006 on total revenues earned by credit card issuers and competition among them. As a two-sided market structure, credit card market should be considered as a whole. The Bank and Credit Card Law attempted to regulate only one side of the market by decreasing credit card interest rates. However, if we want to know the overall effects of the regulation, the two sides of the market should be studied. If we focus only on the effect of regulation on the interest revenue, we could reach to biased conclusions. The two-sided nature of credit card market makes it possible that the whole market is regulated accordingly, despite of the one-sided regulation.

A Panzar-Rosse approach is used in order to analyze how competition among issuers of credit cards has changed after the 2006 regulation. The degree of competition is measured as the sum of elasticities of total revenue with respect to factor input prices.

The sample of our estimation includes 21 issuers of credit cards in Turkey. The quarterly data are collected from the Banks Association of Turkey, Central Bank of the Republic of Turkey and Bank Regulation and Supervision Agency including the period beginning from the last quarter of 2002 to the last quarter of 2008. The model is estimated on panel data with fixed-effect estimators to control for unobserved heterogeneity.

Table 5 presents the summary statistics of the variables used in our regression and in Table 6 their correlation matrix is shown. The banks included in the sample exhibit credit card balances ranging from 13 million TRY to 7.1 billion TRY. The majority of 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.

The model estimated in our regression is:

$$TR_{i,t} = c_i + \alpha_1 CF_{i,t} + \alpha_2 W_{i,t} + \alpha_3 PK_{i,t} + \beta_1 CQ_{i,t} + \beta_2 LC_{i,t} + \beta_3 OFB_{i,t} + \beta_4 (Reg*CF)_{i,t} + \beta_5 (Reg*W)_{i,t} + \beta_6 (Reg*PK)_{i,t} + \beta_7 Reg_t + \beta_8 Trend_t + \beta_9 Trend_t^2 + \xi_{i,t} \quad (1)$$

The variables are defined as follows: The dependent variable, $TR_{i,t}$,is total revenue measured as the quarterly sum of interest revenue and non-interest revenue (annual fees, interchange fees and merchant discount) for bank *i* at time *t*. The first three explanatory variables, which are the key variables in a Panzar-Rosse model, are the input prices. $CF_{i,t}$ 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.

The remaining explanatory variables are the following: $CQ_{i,t}$ (Credit quality/default) is a variable proxied with the ratio obtained by dividing non-performing credit card balances by outstanding credit card balances. $LC_{i,t}$ is a measure of liquidity management cost, which was firstly used by Shaffer and Thomas (2007) in analyzing the credit card market. We use it for the first time in analyzing competition in the Turkish credit card market. This variable is measured as the ratio of the value of interbank money market takings over outstanding credit card balances. $OFB_{i,t}$ stands for off-balance sheet items. It is composed of guarantees and warranties, committments, and derivative financial instruments. Off-balance sheet items are important because they reflect the technology, creativity and product diversity of the banks.

In order to look at the effect of regulation on total revenue, we include a regulatory change dummy, Reg_t . Moreover, three other variables *(Reg*CF, Reg*W* and *Reg*PK)* called as interaction dummies, are also included in the model to capture the interaction effect of regulation and input prices on total revenue. In this way we are able to see whether input prices and consequently competition are affected by the regulation of the year 2006. The dummy variable Reg_t is equal to one after the regulation and zero before the regulation. We have considered the first quarter of 2007 as the implementation time of regulation. The interaction variables

Table 5. 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
*Total Revenue**	220	141,941.1	151,249	1,126	620,146
Cost of Funds	220	0.0246096	0.0057265	0.0040755	0.055077
Price of Physical Capital	220	0.0342864	0.0220304	0.0005311	0.1616695
Wage	220	11.66385	2.540795	4.308863	22.69988
Age	220	56.22045	29.14569	6.5	120
Credit Quality	220	0.0774704	0.0519516	0.010494	0.3022179
Liquidity Cost	220	2.877805	4.801833	0.0000804	33.72809
Yield Spread	220	0.0669849	0.6065473	-0.48	4.013333
*Off-Balance Sheet Items**	220	18,300,000	15,000,000	1,352,266	81,000,000
Funds Borrowed*	220	3,332,275	3,324,432	5,167	11,800,000
Total Assets*	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.

Table 6. Correlation Matrix

PWCORR	TR	CF	PK	W	CQ	LC	OFB
TR	1						
CF	-0.1158	1					
PK	-0.1983	-0.2959	1				
W	0.388	-0.1731	-0.0823	1			
CQ	-0.0706	-0.1465	0.1933	0.2229	1		
LC	-0.1874	-0.0968	0.0896	0.1446	-0.1174	1	
OFB	0.7523	-0.1165	-0.1347	0.4308	-0.0046	-0.219	1

take values equal to corresponding input prices when Reg_t=1, and zero when Reg_t=0. The Panzar-Rosse H-statistic before the regulation is equal to the sum of elasticities of total revenue with respect to input prices, that is $H = \alpha_1 + \alpha_2 + \alpha_3$. The change in Panzar-Rosse statistic after the regulation is measured by $H_R = \beta_4 + \beta_5 + \beta_6$.

In addition to cost and bank-specific factors we include a time trend to control for miscellaneous intertemporal effects and also the square of this time trend in order to observe whether these intertemporal effects follow an increasing or a decreasing path. All the variables are expressed in natural logarithm, because in this way the input price elasticities will be directly given by the coefficients.

Results

The regression results are shown in Table 7. Adjusted R-square indicates that there is a good fit of the model, and almost all of the slope coefficients are significant. As expected, cost of funds (CF) and wage (W) have positive coefficients. A standard deviation increase in CF leads to a 1.58 percent increase in

TR, whereas a standard deviation increase in W increases the total revenue by 5.15 percent. Price of physical capital (PK) has a negative coefficient, which can be explained by the fact that the largest credit card issuers in Turkey are old banks and depreciation expenses are smaller for these banks.

The slope coefficient on credit quality (CQ) is negative, indicating that the losses resulting from the default of credit card balances decrease the total revenue earned on credit cards.

The effect of liquidity cost (LC) on total revenue is negative. This result was expected, since short-term borrowing from the interbank money market is very expensive, negatively affecting total revenues. A standard deviation increase in LC leads to a 0.15 percent decrease in total revenue. This finding is supported by Shaffer and Thomas (2007), who used some previously neglected measures of liquidity cost for the first time, while assessing competition in the credit card market. They argue that holding liquid assets causes an opportunity cost because of the forgone interest that could be earned by lending them. Moreover, borrowing overnight from the interbank money market is very costly. Hence, liquidity management cost emerges to be an important variable for a properly estimated model of competition.

Off-balance sheet items yield a positive and strongly significant coefficient. By reflecting the technology, creativity and product diversity of the banks, they increase the revenue earned from credit cards. According to the regression results, when OFB items increase by a standard deviation, total revenue increases by 2.23 percent.

Considering the results of Table 7, we see that cost of funds (CF) and price of physical capital (PK) are sensitive to the price cuts in the credit card market. The

interaction effect of regulation and these input prices on total revenue is positive. In contrast to the period before regulation, cost of funds (CF) in interaction with regulation, reversed its slope coefficient by positively affecting total revenue. The interaction of wage (W) with regulation does not seem to have a significant effect on total revenue.

If we consider the period before the implementation of credit card interest rate regulation, the Panzar-Rosse statistic is the sum of the coefficients of input prices. H-statistic is equal to 0.42, and the hypotheses that H=0 and H=1 are both rejected. This result shows that before regulation the credit card market in Turkey was characterized by a monopolistic competition structure.

The influence of regulation on Panzar-Rosse statistic is found by adding the interaction dummy slope coefficients of input prices. The H-statistic for this period is 0.62. The hypothesis that H=0 is rejected, but the hypothesis that H=1 fails to be rejected, meaning that regulation has increased the competition among credit card issuers, which is closer to perfect competition.

The slope coefficient on regulation itself is positive. This can be explained by the fact that credit card interest rate cuts increased the number of customers. Customers who use credit cards for borrowing and revolve their credit card balances are affected by price cuts more than customers who pay within the grace period.

Figure 2 shows the increase in the revolving credit card balances after the regulation. Before 2007, revolving balances are almost constant, but after the implementation of price cuts, we observe a continuous increase till the end of 2008. The increase in the number of revolving customers leads to an increase in total revenues earned by credit card issuers. This result is only possible with regulation, where all credit card issuers decrease their credit card interest rates at the same time.

Table 7. Regression results

Variables	Estimation Results	
Total Revenue	Coefficient	t-statistic
Cost of Funds	0.1916966	[2.33]***
Price of Physical Capital	-0.0960438	[-2.19]**
Wage	0.3285043	[2.10]**
Credit Quality (Default)	-0.1044013	[-2.29]***
Liquidity Cost	-0.087253	[-5.14]***
Off-Balance sheet items	0.3556918	[5.67]***
Reg*(Cost of Funds)	0.4749655	[2.10]**
Reg*(Price of Physical Capital)	0.4271209	[6.37]***
Reg*(Wage)	-0.2807914	[-1.27]
Trend	0.0687136	[4.75]***
Trend square	-0.0011886	[-2.40]***
Regulation	3.958666	[4.20]***
Constant	3.598091	[3.38]***
H-stat (Before Regulation)	0.4241571	
P-value: H=0	0.017	
P-value: H=1	0.0013	
H-stat (After Regulation)	0.621295	
P-value: H=0	0.0961	
P-value: H=1	0.3097	
Adjusted R-sq	0.9778	
F-statistic	75.66	
Number of Observations	286	
(*) ,(**) and (***) correspond to significance at the 10% , 5% and 1% levels, respectively.		

If the opposite is the case, convenience users would remain unaffected, whereas all the risky customers would go to the deviating issuer, thus increasing the risk for that issuer. In this way, the issuer who deviates from high rate equilibrium is adversely selected by bad customers. This idea is supported by the New Adverse Selection Theory of Ausubel (1991). According to this theory, no bank will deviate from the high interest rate equilibrium by decreasing credit card rates, because it will be adversely selected by high risk customers, which results in the reduction of its returns.

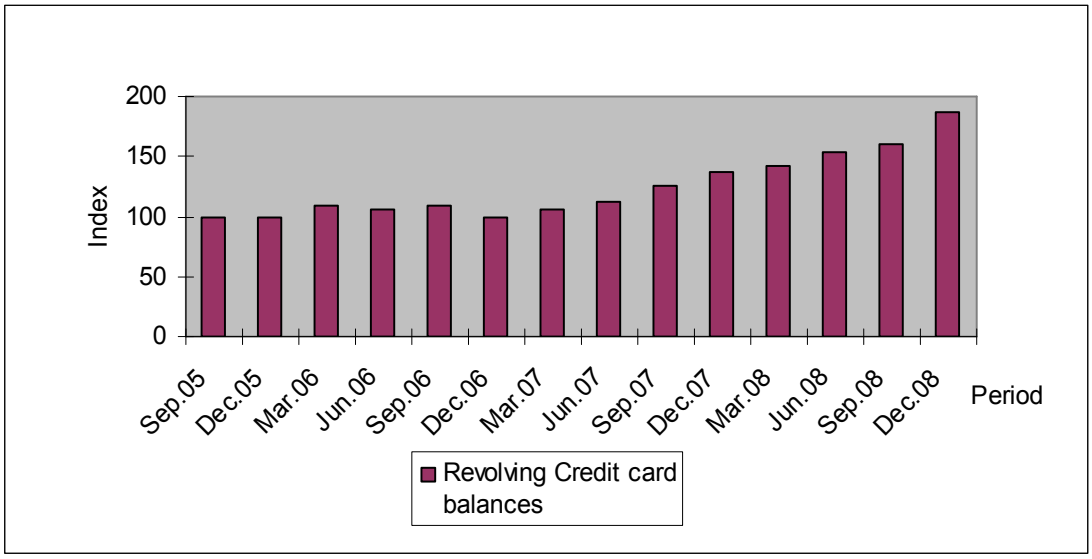

Figure 2. The path of Revolving Credit Card Balances
Indexes were calculated from CBRT, BRSA and BAT.

Another explanation for the positive impact of regulation on total revenue could be the fact that issuers of credit cards increased merchant discounts, interchange fees and annual fees on credit cards after the regulation. The fear that price cuts could decrease their revenues made them compensate the forgone interest by increasing non-interest revenues. The two-sided structure of credit card market allows credit card issuers to increase their revenues by charging higher discount

rates to merchants in order not to lose their customers. If the market is considered as one-sided, less revenue from interest rates would be generated after the regulation. What matters in a two-sided market is not which group subsidizes the other, but the joint surplus gained from their coordination. Eventhough the regulation was only on interest rates, credit card issuers made the two-sides cooperate and generate larger revenues than before.

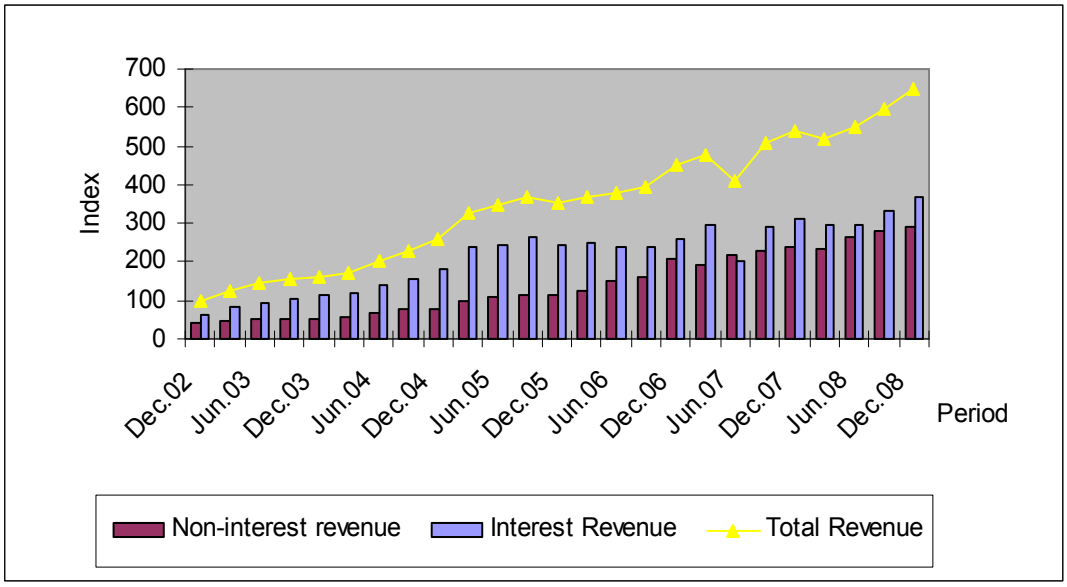

Figure 3. Components of total revenue from credit cards.
Indexes were calculated from CBRT, BRSA and BAT.

Figure 3 shows the path followed by total revenue and its components, before and after the regulation. In March 2007, which is considered as the beginning of implementation of credit card rate regulation, we observe a decrease in interest revenue earned from credit cards. At that time we see an increase in non-interest revenue, supporting the fact that initially, credit card issuers increased annual and interchange fees and merchant discounts in order not to face a decrease in total revenue. In the following months, the increase in total revenue has come by both interest and non-interest components.

Lastly the time trend is significantly positive, showing that the total revenue from credit cards has increased over time. We also included the square of trend in the model, the negative coefficient of which tells that as time has passed, total revenue has increased, but at a decreasing rate.

Robusness check

For Panzar-Rosse test to be correctly identified, the sample should be in long-run equilibrium (Shaffer, 1982). In order to test whether this is the case or not, return on assets or return on equity should be used as a dependent variable instead of total revenue. The intuition behind this is the fact that in the long-run, risk adjusted rates of returns are equalized across banks. Our model is reestimated 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 ROA' = ln (1+ROA). If the market is in long-run equilibrium, the sum of the coefficients of input prices should be equal to zero. The same applies for the period after regulation, where Panzar-Rosse statistic is equal to the sum of slope coefficients of interaction dummies.

Table 8 shows the results of long-run equilibrium test. According to the results, the sum of input price coefficients for the period before regulation is 0.0047, but not significantly different from zero, which shows that we fail to reject the hypothesis that the sample is is long-run equilibrium. The same can be concluded for the period after regulation, where the H-statistic is equal to 0.00095 and the hypothesis that H = 0 is not rejected. Hence the Panzar-Rosse test is correctly identified.

Table 8. Long-Run Equilibrium Test

Variables	Test for Long-Run Equilibrium	
Return on Assets	Coefficient	t-statistic
Cost of Funds	0.0033355	[1.16]
Price of Physical Capital	-0.001436	[-0.94]
Wage	0.0028104	[0.51]
Credit Quality (Default)	0.0002141	[0.13]
Liquidity Cost	-0.0009359	[-1.58]
Off-Balance sheet items	0.0028887	[1.32]
Reg*(Cost of Funds)	-0.0033221	[-0.42]
Reg*(Price of Physical Capital)	-0.0031595	[-1.35]
Reg*(Wage)	0.0074351	[0.96]
Trend	0.0001606	[0.32]
Trend square	-0.0000176	[-1.02]
Regulation	-0.0414655	[-1.26]
Constant	-0.0394264	[-1.06]
H-stat (Before Regulation)	0.0047	
P-value: H=0	0.4455	
H-stat (After Regulation)	0.00095	
P-value: H=0	0.9415	
Adjusted R-sq	0.085	
F-statistic	0.86	
Number of Observations	286	
(*) ,(**) and (***) correspond to significance at the 10% , 5% and 1% levels, respectively.		

Conclusion

The paper aimed at filling the gap created by previous literature, by looking at the effect of interest rate regulation on competition and total revenue, including both interest and non-interest revenue. The level of competition was measured by Panzar and Rosse (1987) statistic. It is the first time that this approach is used for the credit card market in Turkey. Our results show that regulation caused an increase in total revenues earned by credit card issuers. This can be explained by the fact that declining interest rates increased the number of revolving customers. In addition, credit card issuers increased merchant discounts, interchange fees and annual fees in order to subsidize the decrease in interest rates. Contrary to what it is often argued, the degree of competition among credit card issuers also increased after the regulation. Total revenue became more sensitive to the changes in factor input prices. As a result of the regulation, revolvers and credit card issuers became better off, while convenience users and merchants were the negatively affected. Revolvers can pay less interest on their balances, whereas convenience users and merchants are the ones to subsidize the decline in interest rates by paying higher annual fees and merchant discounts. On the other hand, banks earn more revenues from both interest and non-interest terms.

Although the dynamics of the two-sided nature of credit card market were ignored by the regulators, our results show that the one-sided regulation in Turkey has in fact affected both sides of the credit card market. The target of the regulation was to satisfy the demands and complaints of the customers, but at the same time credit card issuers benefited from this situation. The results show that sometimes a

two-sided regulation may not be obligatory. The important thing is the overall effect that a one-sided regulation causes on both interest and non-interest revenues.

APPENDIX

TABLES THAT ARE REFERRED TO IN THE TEXT

Table 9. 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 10. Inclusion of Other Control Variables to the Model

Variables	Benchmark		OFB		FB	
Total Revenue	Coeff	t	Coeff	t	Coeff	t
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.						

Table 11. 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				

Table 12. An Alternative Measure for PK

Variables	Using PK		Using PK 1	
Total Revenue	Coeff	t	Coeff	t
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	
(*) , (**) and(***) correspond to significance at the 10% , 5% and 1% levels, respectively				

REFERENCES

Akin, G. G., Aysan, A. F., Kara, G. I. and Yıldıran, 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 Yildiz, 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.

De Bandt, O. and Davis, E.P. (2000) "Competition, Contestability and Market Structure in European Banking Sectors on the eve of EMU", Journal of Banking and Finance, Elsevier, vol.24(6), 1045-1066.

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.

Goddard, J., Molyneux, P. and Wilson, J.O.S. (2004) "The Profitability of European Banks: A Cross-Sectional and Dynamic Panel Analysis", Manchester School, University of Manchester, vol.72 (3), 363-381, 06.

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.

McAndrews, J. and Wang, Z. (2008) "The Economics of Two-Sided Payment Card Markets: Pricing, Adoption and Usage", Research Working Paper RWP 08-12, Federal Reserve Bank of Kansas City.

Molyneux, P., Thornton, J. and Michael Llyod-Williams, D. (1996) "Competition and Market Contestability in Japanese Commercial Banking", Journal of Economics and Business, Elsevier, vol.48(1), 33-45.

Muris, T.J. (2006) "Payment Card Regulation and the (Mis)Application of the Economics of Two-Sided Markets", Columbia Business Law Review, Vol.2005, no.3, 515-550.

Nathan, A. and Neave, E.H. (1989) "Competition and Contestability in Canada's Financial System: Empirical Results", Canadian Journal of Economics, vol.22, 576-594.

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.

Staikouras, C and Koutsomanoli-Fillipaki, A. (2006) “Competition and Concentration in the New European Banking Landscape”, European Financial Management, vol.12, no.3, 443-482.

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

Stiglitz, J.E. and Weiss, A. M. (1981) “Credit Rationing in Markets with Imperfect Information”, American Economic Review, 71: 3, 393-410.

Yildirim, H.S. and Philippatos G.C. (2007) “Restructuring, Consolidation, and Competition in Latin American Banking Markets”, Journal of Banking and Finance, 31 (3), 629-639.