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Abstract

The paper investigates the competition among 21 credit card issuers in Turkey, covering the time period between 2002 and 2008. Analysis is conducted by using an estimation methodology designed by Panzar and Rosse (1982, 1987), where the degree of competition is measured by the sum of elasticities of total revenue with respect to input prices. Accounting for the total revenue rather than interest revenue fills the gap in previous studies, which look only at one side of the credit card market. Liquidity management cost, which was first shown by Shaffer and Thomas (2007) to be important for evaluating the degree of competition in the credit card industry, emerges as an important variable. The estimated Panzar-Rosse statistics are consistent with product differentiation, implying that Turkish credit card issuers are involved in monopolistic competition.

ملخص

تحقق هذه الورقة في المنافسة بين 21 شركة من الشركات المصدرة لبطاقات الائتمان في تركيا ، والتي تغطي الفترة الزمنية بين عامي 2002 و 2008. ويجري التحليل باستخدام منهجية تقدير التصميم (1987 و 1982 Panzar Rosse،) ، حيث يتم قياس درجة المنافسة على مجموع المرونات من إجمالي الإيرادات فيما يتعلق بأسعار المدخلات. المحاسبة عن إجمالي الإيرادات بدلا من عائدات الفائدة يملأ فجوة في الدراسات السابقة، والتي تبدو في جانب واحد فقط من سوق البطاقات الائتمانية. تكلفة إدارة السيولة، والذي كان أول من أظهر شافير وتوماس (2007) إلى أنها مهمة لتقييم درجة المنافسة في صناعة بطاقات الائتمان، والذي يبرز كمتغير مهم. و تتسق إحصاءات Panzar - Rosse مع تمايز المنتجات، مما يعني ضمنا أن مصدري بطاقات الائتمان التركية يتتشاركوا في المنافسة الاحتكارية.

1. Introduction

The surge in credit card transactions and credit card debt, the high levels of credit card rates, merchant discounts and interchange fees, and mounting profitability make competition in and the regulation of credit card markets very important issues for both researchers and policy makers all over the world.

Turkey is not an exception in this respect. In just ten years, the number of credit cards has increased by 500 percent and reached 43 million in 2008,[1] making Turkey the second highest country in Europe after the UK. Although there are currently 21 card issuing banks, 87 percent of the market is controlled by the six largest banks. Credit card rates were extremely high till 2006. While the annual inflation and T-Bill rates were 10 and 19 percent, respectively, the monthly credit card rates of the two market leaders were 7.47 and 7.39 percent by the end of 2005 (which make about 130 percent effective annual rate). Due to the rising concerns over the high concentration, high and sticky credit card rates, and high profitability, the Central Bank (CBRT) was instructed to regulate the credit card rates in March 2006. The CBRT imposed a monthly interest rate cap of 5.75% in May 2006, and gradually lowered that cap to 4.39% by the end of 2008. Banks responded to those regulations by increasing their non-interest revenues. They started to charge annual fees on card holders and increased their merchant discounts. [2] Our objective, in this regard, is to explore the nature and degree of competition in the Turkish credit card market and to examine the effects of the interest rate regulations on competition.

Credit cards combine credit services with payment services. The credit services relax consumers' liquidity constraints, and thus enable them to smooth their consumption. Through their credit services, card issuers earn interest revenue from revolvers. Payment services, on the other hand, provide both customers and merchants with convenience, improved security and a record keeping facility. Moreover, consumers benefit from the interest free grace period and merchants enjoy the boosted sales. In return for these payment services, banks collect annual fees from consumers, and impose merchant discounts on merchants.

There are many explanations proposed as to why credit card rates and merchant discount rates may be very high, and many arguments made about whether their regulation is warranted. To correctly identify banks' market power in credit card markets, both their interest revenues and non-interest revenues should be included in the analysis. This is also essential to enable the authorities to design proper regulations, as regulating one side will have implications on the unregulated side. To the best of our knowledge, no study except Shaffer and Thomas (2007) examined the competition in credit card markets by considering banks' revenues from both sides: credit services and payment services. Applying the well-known Panzar-Rosse methodology for the first time to credit card markets, Shaffer and Thomas (2007) found that competition in the American credit card market is not perfect but monopolistic.

Their result also applies to the Turkish market. Although Akin et al. (2010a) shows the failure of price competition in the Turkish credit card market, evidence substantiates that banks are fiercely engaged in monopolistic competition (Akin et al. 2010b). They bundle their credit cards with general banking services, and differentiate themselves by providing both bank-level and card-level non-price benefits. In this study—following Shaffer and Thomas (2007) — we aim to corroborate our previous findings by employing a more established and reliable methodology proposed by Panzar and Rosse (1982, 1987). Moreover,

[1] Interbank Card Center(http://www.bkm.com.tr/yillara-gore-istatistiki-bilgiler.aspx).

[2] See (Akin et al. 2010a) for more on the Turkish credit card market.

using the same methodology we investigate the effects of the interest rate regulations after 2006 on competition.

The organization of the paper is as follows: Section 2 lays down the theoretical and empirical background of our model. In section 3, the data and model are explained. Section 4 presents the results and section 5concludes

2. Theoretical and Empirical Background

Explanations abound as to why credit card rates are sticky and higher than other credit rates, and why they may not themselves converge to competitive levels. The primary explanation is that the credit services of credit cards are inherently more costly and riskier than other credit types (Evans and Schmalensee 2005a). As consumers can borrow at any time in an uncollateralized manner, credit card loans lead to higher default rates. Borrowers are financed for up to about one month during the interest free grace period. Moreover, operating a credit card system entails huge investments in technology and other infrastructure, and small average balances preclude a cost-effective collection process. Shaffer and Thomas (2007) add liquidity management costs to the aforementioned inherent costs. As consumers can, at any time, borrow any amount up to their credit card limits, banks must always hold low-yield liquid assets or be ready to borrow at the interbank market.

Mester (1994) and Park (2004) argue that sticky rates might be the equilibrium response of banks to their lack of information about cardholders' future incomes. Chakravorti and Emmons (2003) relate credit card rates to the proportion of convenience users to revolvers. As banks finance convenience users during the interest free grace period and earn their interest incomes only from revolvers, the higher the ratio of convenience users, the higher the banks' costs.

In his seminal paper, Ausubel (1991) accounts for the failure of achieving competitive rates in credit card markets with asymmetric information. He categorizes credit card holders in three groups. The first, convenience users, only use the payment services of their credit cards, never borrow and hence are insensitive to interest rates. These customers are not risky for banks. However, they are costly and do not yield profit opportunities. The second group includes consumers who exhibit some sort of irrationality: they do not intend to borrow ex-ante, but somehow end up doing so ex-post. These consumers are generally low-risk and pay their debt. Hence they are the preferred consumer group for banks. Since they do not plan to use the credit option of their cards ex-ante, they are not sensitive to credit card rates either. Finally, consumers in the third group plan to use the credit option of their cards. They are illiquid and risky. Hence they are not preferred by banks. These consumers are sensitive to interest rates because they actually intend to pay their debt. According to the new adverse selection theory suggested by Ausubel (1991), in a situation where banks cannot differentiate between these three consumer types, a bank that unilaterally lowers its credit card rate will attract only the undesirable consumers of the third group[3]. This theory represents one of the fundamental explanations of banks' reluctance to compete in prices. Calem and Mester (1995) and Calem, Gordy and Mester (2006) categorize customers somewhat differently by using impatience, search costs and switch costs, and reach the same conclusion: when information is asymmetric, prices are sticky because if a bank lowers its interest rate, it merely attracts the risky and/or non-profitable customers.

[3] The well-known adverse selection theory of Stiglitz and Weiss (1981) predicts an opposite outcome. Only high-risk consumers respond if a bank unilaterally increases its interest rates. Hence, this bank's risk position worsens and its expected future profits decrease. Ausubel argues that the Stiglitz-Weiss theory fits more collateralized credits, while his own theory is better for uncollateralized credits.

Merchant discounts rates are another important issue, at least as contentious as credit card rates. Merchant discounts are paid by merchants in return for the benefits they receive from the payment services of credit cards. To create value, banks must simultaneously provide these payment services to both consumers and merchants (i.e. "they must get both sides on the board"), hence such payment systems are called *two-sided markets*.[4] Banks must issue credit cards to consumers so that they might make their payments via credit cards, and at the same time banks must acquire merchants so that they could accept credit cards for payments. Moreover, for these two sides to remain on the board, their benefits from the payment services should exceed the fees they have to pay.

In two-sided markets, it is quite customary that sides are priced asymmetrically for the services they receive. For instance, tenants pay more than landlords in real estate agencies, men contribute more than women in dating services, and while customers are sometimes offered benefits like free parking, merchants pay rents in shopping malls. As reasons for such skewed prices, the literature on two-sided markets cites externalities, discrepancies in the cost of serving, benefits obtained by and price elasticities of demand of the two sides. Payment services of credit cards are also asymmetrically priced. While merchants pay discount fees on transactions, card holders effectively pay negative fees due to free float and transaction-based reward programs. [5] [6] Baxter (1983) and Rochet (2003) propose the following justifications for these skewed prices: Issuing cards is more costly than acquiring merchants; payment services yield more benefits to merchants; consumers have a more elastic demand; and the adoption of credit cards by consumers have positive externalities on merchants.

In today's multiparty credit card payment systems, issuing and acquiring banks can be different. As the risk of fraud or nonpayment, and the cost of funding during the grace period are borne by issuing banks, acquiring banks pay a variable interchange fee to issuing banks for each transaction. Acquiring banks, in turn, charge a merchant discount which is somewhat greater than the interchange fee to recover their costs.[7] There are serious doubts that privately determined interchange fees might be inefficiently high due to the externalities among the involved parties and the imperfect competition among both issuers and acquirers. Moreover, as merchant discounts had become a significant portion of their costs, retailer associations in some countries have filed lawsuits, contending that banks were illegally engaged in fixing the interchange fees (Weiner and Wright 2005).

In a nutshell, there is widespread agreement that both banks' interest and non-interest revenues from their credit card operations should be regulated. The Panzar-Rosse methodology, which allows incorporating both types of revenues, can help in discovering the nature and degree of competition in credit card markets. Using comparative static analysis, Panzar and Rosse (1987) derive testable restrictions on the reduced form revenue equations of firms depending on the nature of competition they are involved in. In particular, the response of the equilibrium values of firms' revenues to the changes in factor input prices is investigated in the following reduced form revenue equation:

$$\ln (TR_{it}) = \alpha + \Sigma_f \beta_f \ln (P_{f,\,it}) + \Sigma_k \gamma_k X_{k,\,it} + \varepsilon_{it} \qquad (1)$$

where TR_{it} is the total revenue of firm i at time t. P_f and X_k denote the price of factor input f and control variable k, respectively. In accordance with the intermediation approach where

[4] See (Rochet and Tirole 2003) and (Evans and Schmalensee 2005b) for more on two-sided markets.

[5] About 60-70 percent of banks' non-interest revenues come from the merchants' side (Evans and Schamalensee 2005a).

[6] Consumers sometimes also pay a fixed amount for annual membership fees.

[7] Merchant discounts charged by acquirers on Visa and Masterard transactions in the U.S. average 2.1 percent, of which about 0.4 percent is retained by acquirers (Evans and Schamalensee 2005a).

banks are assumed to employ borrowed funds, labor and physical capital to generate income-earning assets, three factor prices are considered in most studies: the cost of funds, wage rate and price of fixed capital.

The Panzar-Rosse H-statistic, $H = \Sigma_f \beta_f$, is the sum of the factor price elasticities of total revenue. The comparative static analysis of the firm under alternative behavioral hypotheses indicates that for firms in long-run competitive equilibrium H=1, whereas for monopolists or colluding oligopolists $H \leq 0$. Estimates satisfying $0<H<1$ are consistent with monopolistic competition (ibid.).

The intuition behind the monopoly case comes from the fact that marginal revenue is equal to marginal cost in equilibrium, as the profit-maximization condition. Thus, an increase in factor input prices and marginal cost will lead to a fall in the equilibrium output, which will in turn lower total revenue. To put it differently, increases in factor prices will increase the marginal cost and the optimal monopoly price. Consequently, as they always operate in the elastic region of their demand, an increase in prices will reduce monopolists' revenues.

To see the reasoning for the competitive case, suppose that all factor prices rise by one percent. As the average cost function is homogenous of degree one in factor prices, any such increase will shift the AC curve upward by one percent, leaving its minimum point unchanged. Recall also that in long-run competitive equilibrium, firms pass along all increases in their costs to prices, and they always operate at an output level where their AC is minimized. Thus, in response to a one percent rise in factor prices, revenues of competitive firms will also rise by one percent.

The Panzar-Rosse methodology has certain important advantages over the other methods that measure competition.[8] It is independent of the definition of the geographic and product markets; data requirements are modest (only revenues and factor prices); and it does not entail the estimation of the cost function. Many studies have applied this methodology to the banking industry, for instance Shaffer (2002) in the US, Molyneux et al. (1994), De Bandt and Davis (2000) in Europe, and Nathan and Neave (1989) in Canada.[9] Actually, the magnitude of the H statistic is also of interest. Claessens and Laeven (2004) estimate the Panzar-Rosse H statistic for 50 countries in the period 1994–2001. Their results range between 0.6 and 0.8. They further regress these H statistics on a number of country characteristics, and find that as entry and activity restrictions decrease, competition improves.

Shaffer and Thomas (2007) is the first study which used the Panzar-Rosse technique for credit card markets. They obtain an H value between zero and one for the 10-year period between 1984 and 1993 in the United States. In addition, they included the previously neglected measures of liquidity management costs, which proved to be important in analyzing the competition in the US credit card market.

3. Data and Model

Our sample includes 21 banks which are both issuers and acquirers. Quarterly data is collected from the Banking Regulation and Supervision Agency (BRSA), the Central Bank of the Republic of Turkey (CBRT) and the Banks Association of Turkey (BAT) for the period between the last quarter of 2002 and the last quarter of 2008. Observations with missing values for some variables are not included in the estimations. Observations in which the ratio of the non-interest revenues to the total revenues was less than 10 percent and greater than 90

[8] See Degryse and Ongena (2007) for an extensive survey of the emprical literature on competition in banking.

[9] Bikker and Haaf (2002) provide a comprehensive survey of results from many countries.

percent are also dropped from the data to exclude outliers.[10] Panel fixed effect estimators are employed to control for unobserved heterogeneity.

To implement the Panzar-Rosse test to the Turkish credit card market, the following model is used:

$$TR_{i,t} = c_i + \alpha_1 CF_{i,t} + \alpha_2 W_{i,t} + \alpha_3 PK_{i,t} + \beta_1 AGE_{i,t} + \beta_2 CQ_{i,t} + \beta_3 YS_t + \beta_4 LC_{i,t}$$
$$+ \beta_5 Trend_t + \beta_6 Trend\ Squared_t + \xi_{i,t} \quad (2)$$

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. $CF_{i,t}$ (*Cost of Funds*) is the average quarterly cost of funds, which is measured by the ratio of the sum of interest expenses on deposits, funds borrowed and money market borrowings to the sum of the values of deposits, funds borrowed and money market borrowings. $W_{i,t}$ (*Wage Rate*) is the average quarterly wage rate, obtained by dividing the quarterly personnel expenses by the number of employees. $PK_{i,t}$ (*Price of Physical Capital*) is defined as the quarterly depreciation expenses divided by the value of property and equipments.

The remaining variables are control variables, which may have an impact on total revenues. $AGE_{i,t}$ reflects the longevity and reliability of a bank and is expected to positively affect revenues. $CQ_{i,t}$ (*Credit Quality*) is proxied by the ratio of non-performing credit card balances to outstanding credit card balances. The coefficient of this variable depends on whether banks successfully price credit risk. If they fail to do this then the coefficient is expected to be negative. YS_t (*Yield Spread*) is defined as the difference between one year and one month deposit rates. It does not change across banks, it only changes in time. It is included in the model to control for the expectations of borrowers and lenders of future interest rate rates and also for 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 *Yield Spread* is high, they would demand more long-term loans. Consequently credit card loans would be substituted with long term-loans, and total revenues earned from credit card lending would decrease.

$LC_{i,t}$ (*Liquidity Cost*) is a measure of liquidity management cost, which was firstly used by Shaffer and Thomas (2007) in the analysis of credit card markets. It is defined as the ratio of the value of interbank money market borrowings over the outstanding credit card balances.[11] Unlike other loans, banks commit, in credit card lending, to lend up to the credit limit of a card holder. Whether, when and how much will be borrowed is solely at the discretion of the card holder. For this reason, banks are obliged to keep some liquid assets or be ready to borrow from the interbank money market. Both alternatives come at a cost, which may be a direct cost in the case of expensive short term borrowing from the interbank market, or an opportunity cost in the case of holding excess reserves or liquid securities. Shaffer and Thomas (2007) criticize the previous studies 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 market power in the US credit card market.

All variables except yield spread are expressed in natural logarithm, because in this way the input price elasticities will be directly given by the coefficients. *Yield Spread* is not expressed

[10] There are 49 such observations, half of which are from Anadolu Bank. These observations are either from very small players which had no regular operations in the market, or from banks which underwent some structural changes in certain periods.

[11] The alternative measure used by Shaffer and Thomas (2007) for liquidity management cost is the ratio of liquid assets to outstanding credit card balances. This measure is highly correlated with ours and does not give better results.

in natural logarithm, because it may take negative values. Lastly, to detect possible time patterns in the data we also include *Trend* and *Trend Squared* variables. $\xi_{i,t}$ is the random error term.

The paper by Shaffer and Thomas (2007) and many other papers using the Panzar-Rosse technique, also include the total assets of banks in order to control for any scale effect. Since larger banks tend to earn more revenues, a positive coefficient is found for this variable. The reason why we have not followed them is the recent criticism of Bikker et al. (2007). They show that the Panzar-Rosse tests on monopoly and perfect competition are misspecified when total revenues divided by total assets is used as the 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. Moreover, as scale variables are generally highly correlated with other control variables, estimations may yield insignificant coefficients.[12]

To investigate the effect of the interest rate regulations on banks' revenues and competition, we include a regulatory change dummy, Reg_t , and three interaction dummies *(Reg*CF, Reg*W* and *Reg*PK)* in the following model:

$$TR_{i,t} = c_i + \alpha_1 CF_{i,t} + \alpha_2 W_{i,t} + \alpha_3 PK_{i,t} + \beta_1 AGE_{i,t} + \beta_2 CQ_{i,t} + \beta_3 YS_t + \beta_4 LC_{i,t} + \beta_5 OFB_{i,t} + \beta_6 (Reg*CF)_{i,t} + \beta_7 (Reg*W)_{i,t} + \beta_8 (Reg*PK)_{i,t} + \beta_9 Reg_t + \beta_{10} Trend_t + \beta_{11} Trend\ Squared_t + \xi_{i,t} \quad (3)$$

In this way we are able to see whether the factor price elasticities of total revenue are affected by the regulation after 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.[13] 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 the Panzar-Rosse statistic after the regulation is measured by $H_R = \beta_4 + \beta_5 + \beta_6$.

Table 1 describes the summary statistics of the data. Banks included in the sample exhibit credit card balances ranging from TL13 million to TL7.1 billion. Most of the total revenue comes from the credit services but non-interest revenue is also very important, making almost 40 percent of the total revenue.

4. Results

The results of the regressions based on equation (2) are given in the first two columns of Table 2. The first column presents the model without controlling for liquidity cost. Since the tests for this specification reject that the H-statistic is equal to 0 or 1, we have evidence that the credit card industry is monopolistically competitive. However, according to Shaffer and Thomas (2007), failing to account for costs of liquidity would understate competition in this market. The second column of the table displays regression results including *Liquidity Cost* among the explanatory variables, and the results are in accordance with their prediction. Even though the results still indicate a monopolistically competitive structure, the H-statistics goes up in value from 0.4281 to 0.5027. The inclusion of this variable makes the credit card market more competitive, in contrast to the cases when it is excluded. The negative sign of this variable shows the adverse effect of short term borrowing on total revenue. According to the results of benchmark equation, if *Liquidity Cost* increases by one standard deviation,

[12] Total Assets are found to be highly correlated with AGE, Off-Balance Sheet Items and Funds Borrowed in our data.

[13] Even though credit card regulations took effect in March 2006, interest rate caps were not binding till the first quarter of 2007.

Total Revenue decreases by 0.15%. Due to its importance in making a correct assessment of market structure, all the regressions will include the *Liquidity Cost* variable from this point on.

Column 3 shows the results of the regressions based on equation (3). Here, the level of competition in the Turkish credit card market can be assessed separately for the periods before and after the regulation of credit card interest rates. While the first two columns of Table 2 present an overall measure of competition for the entire period from 2002 and 2008, it is possible that the regulation had caused a structural change which altered the mode of competition in the industry.

In the period before the effective implementation of the regulation, the Panzar-Rosse H-statistic is equal to 0.3259. The hypotheses that H=0 and H=1 are both rejected, implying that the credit card market in Turkey was characterized by a monopolistic competition structure at the time. The influence of regulation on the H-statistic is found by adding the interaction dummy slope coefficients of input prices to the pre-regulation statistic. The H-statistic for the post-regulation period is 0.7378, showing a significant increase. The hypothesis that H=0 is rejected, but the hypothesis that H=1 fails to be rejected. This result is rather illustrative: It implies that the monopolistically competitive credit card industry has approached a perfectly competitive structure with the implementation of a price ceiling on interest rates. The insensitivity to input prices seems to have ceased with the intervention. If the aim of the regulatory agency was to achieve competitive behavior among banks, there is evidence that the intervention was successful.

The coefficient of the *Regulation dummy* is positive. This can be explained by credit card interest rate cuts increasing the number of borrowing consumers. Figure 1 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 simultaneously. If the decrease is unilateral, as the new adverse selection theory of Ausubel (1991) states, convenience users remain unaffected whereas all the risky customers go to the deviating issuer, increasing the risk for that issuer. In this way, the issuer who deviates from the high rate equilibrium is adversely selected by bad customers. Collective reduction in interest rates, however, can be welfare improving.

Another explanation for the positive impact of regulation on total revenue could be the fact that issuers of credit cards increased merchant fees and annual fees on credit cards after the regulation. The fear that price cuts could decrease their revenues made them compensate for the lost interest income by increasing non-interest revenues. Since the regulation was only on interest rates, credit card issuers could generate larger revenues than before. Figure 2 depicts the composition and evolution of Turkish banks' interest and non-interest revenues from their credit card operations. Before 2005, around 65 percent of their total revenue came from the interest component. After this period, although the interest component is still more important than the non-interest component, the growth rate of the latter is greater. In March 2007, which marks the beginning of the effective 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 from both interest and non-interest components as revolving on credit card debts became more viable due to the decreased rates.

As for the control variables, we see that the effect of *Age* on total credit card revenue is positive and mostly significant. It may be that older banks have larger customer bases due to a first mover's advantage. The negative slope coefficients on *Credit Quality* show that the losses resulting from credit card debt defaulting decrease the total revenue earned on credit cards. The coefficient on *Yield Spread* is negative for all the equation forms, but it is not significant. The reason is attributable to the fact that, in Turkey, long term bonds are rather limited. Hence, there is relatively less variation in the yield spread. Lastly the time trend is significantly positive, showing that the total revenue from credit cards has increased over time. This is consistent with the picture in Figure 2. Credit card usage has become more widespread in time and the number of credit card customers has increased, which has had a positive impact on total revenues. We also included the square of trend in the model, but it did not turn out to be significant.

In order to check the robustness of these results, *Off-Balance Sheet Items* and *Funds Borrowed* were added to the explanatory variables separately for the specifications with and without regulation controls. *Off-Balance Sheet Items* are composed of guarantees and warranties, commitments, and derivative financial instruments, reflecting the technology, creativity and product diversity of banks. They are likely to positively affect consumers' credit card choices and thus banks' revenues from credit cards. As product diversity is expected to increase their customer bases, banks tend to bundle their services to make their product packages more attractive. *Funds Borrowed* conveys information about banks' risk. Banks with large amounts of borrowed funds are more reliable banks, and this characteristic may attract customers and bring about higher revenues. The results are given in Table A.2 in the annex. Both variables are found to have significant positive impacts on credit card revenues. Since these two variables are highly correlated, they are not included in the model together. The results attained in these regressions do not significantly differ from the regressions presented in Table 2.

Panzar and Rosse (1982, 1987) highlight an important caveat: The results for the perfect and monopolistic competition models depend crucially on the assumption that firms are observed in long-run equilibrium. In this regard, Shaffer (1982) shows that $H<0$ can also be the result of short-run competitive equilibrium if industry is not in structural equilibrium. He proposes an empirical test for long-run equilibrium by replacing the dependent variable *Total Revenue* with *Return on Assets* and running the above regressions. The rationale is that *Return on Assets* should be stable in the long-run and be independent of input prices. Thus the sum of elasticities of *Return on Assets* with respect to input prices should be equal to zero in long-run equilibrium. This test has been previously applied by Molyneux et al. (1996), Hondroyiannis et al. (1999), and De Bandt and Davis (2000). When carrying out these tests, the dependent variable was computed as the natural logarithm of the sum of 1 and the return on assets since the return on assets can take on negative values. Table A.3 in the annex shows the results of these long run equilibrium tests. We fail to reject the null hypothesis that the H-statistic is equal to zero for both specifications and for the pre and post-regulation periods. These results conform to the hypothesis that the sample is in long run equilibrium. Hence the Panzar-Rosse test is correctly identified.

5. 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 the 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 under study. 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 to the credit card market structure, where the largest issuers are the main determinants of the competitive behavior in the 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.

This paper has aimed to fill 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 and annual fees from customers 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 negatively affected. Revolvers can pay less interest on their balances, whereas convenience users and merchants 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 the 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.

References

Akin, G. G., A.F. Aysan, G. I. Kara, and, L. Yıldıran. 2010a. The failure of price competition in the Turkish credit card market. *Emerging Markets, Finance and Trade*, 46: 23-35

Akin, G. G., A.F. Aysan, G. I. Kara, and, L. Yıldıran. 2011. Non-price competition in the Turkish credit card market. *Contemporary Economic Policy,* Forthcoming

Ausubel, L.M. 1991. The failure of competition in the credit card market. *American Economic Review* 81, 50–81.

Baxter, W. F. 1983. Bank exchange of transactional paper: Legal and economic perspectives. *Journal of Law and Economics* 26 (3): 541-588

Bikker, J.A., and K. Haaf. 2002. Competition, concentration and their relationship: An empirical analysis of the banking industry. *Journal of Banking and Finance*, 26 (11): 2191-22

Bikker, J.A., L. Spierdijk, and P. Finnie. 2007. Misspecification of the Panzar-Rosse model: Assessing competition in the banking industry. DNB Working Paper, Netherlands Central Bank.

Calem, P. S., and L. J. Mester. 1995 .Search, switching costs, and the stickiness of credit card interest rates. *American Economic Review* 85, 1327–36.

Calem, P., M. Gordy and L. Mester. 2006, Switching costs and adverse selection in the market for credit cards: New evidence. *Journal of Banking & Finance* 30, 1653–85.

Chakravorti, S., and W.R. Emmons. 2003. Who pays for credit cards? *Journal of Consumer Affairs* 372, 208–30.

Claessens, S and L. Laeven. 2004. What drives bank competition? Some international evidence. *Journal of Money, Credit and Banking* 36 (3): 563-583

De Bandt, O. and, E.P. Davis. 2000. Competition, contestability and market structure in European banking sectors on the eve of EMU. *Journal of Banking and Finance,* 24 (2000), 1045–1066

Degryse, H. and S. Ongena. 2007. Competition and regulation in the banking sector: A review of the empirical evidence on the sources of bank rents in A.W.A. Boot and A.V. Thakor (eds.) *Handbook of financial ıntermediation and banking*. North Holland.

Evans, D. S., and R. Schmalensee. 2005a. *Paying with plastic.* 2nd edt., Cambridge, Massachusetts: MIT Press.

Evans, D. S., and R. Schmalensee. 2005b. The economics of interchange fees and their regulation: An overview. MIT Sloan Working Paper 4548–05.

Mester, L.J. 1994. Why are credit card rates sticky? *Economic Theory* 4, 505–30.

Molyneux, P., D.M. Lloyd-Williams, and J. Thornton.1994. Competitive conditions in European banking. *Journal of Banking and Finance*, 18 (1994), 445-459

Molyneux, P., D.M. Lloyd-Williams, and J. Thornton.1996. Competition and market contestability in Japanese commercial banking. *Journal of Economics and Business,* Elsevier, 481, 33–45.

Nathan, A., and Neave, E.H. 1989. Competition and contestability in Canada's financial system: Empirical results. *Canadian Journal of Economics* 22, 576–94.

Panzar, J.C., and J.N. Rosse. 1982. Structure, conduct and comparative statics. Bell Laboratories Economic Discussion Paper

Panzar, J.C., and J.N. Rosse. 1987. Testing for monopoly equilibrium. *Journal of Industrial Economics* 35, 443–56.

Park, S. 2004. Consumer rationality and credit card pricing: An explanation based on the option value of credit cards lines. *Managerial and Decision Economics* 25 (5), 243–254

Rochet, Jean-Charles. 2003. The theory of interchange fees: A synthesis of recent contributions. *Review of Network Economics* 2 (2), Article 4.

Rochet, Jean-Charles, and J. Tirole. 2003. Platform competition in two sided markets. *Journal of European Economic Association* 1, (4)

Shaffer, S. 1982. A nonstructural test for competition in financial markets. Proceedings of Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, Chicago, IL, 225–43.

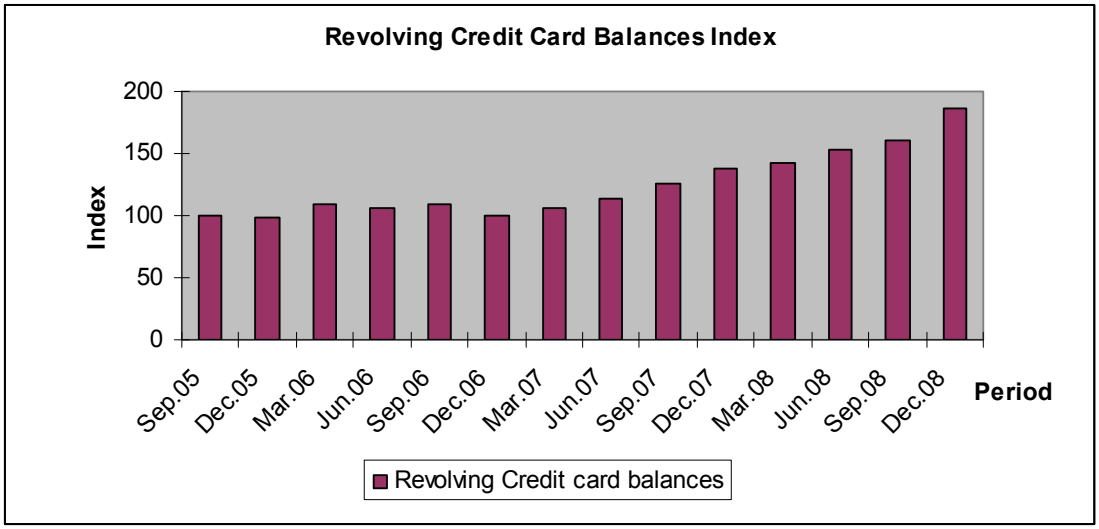
Shaffer, S. 2002. Conduct in banking monopoly. *Review of Industrial Organization,* 20, 221-238.

Shaffer, S. and L. Thomas. 2007. A reassessment of market power among credit card banks. *Applied Financial Economics* 17(9):755–67.

Stiglitz, J.E. and, A. M. Weiss. 1981. Credit rationing in markets with imperfect information. *American Economic Review* 71(3): 393–410.

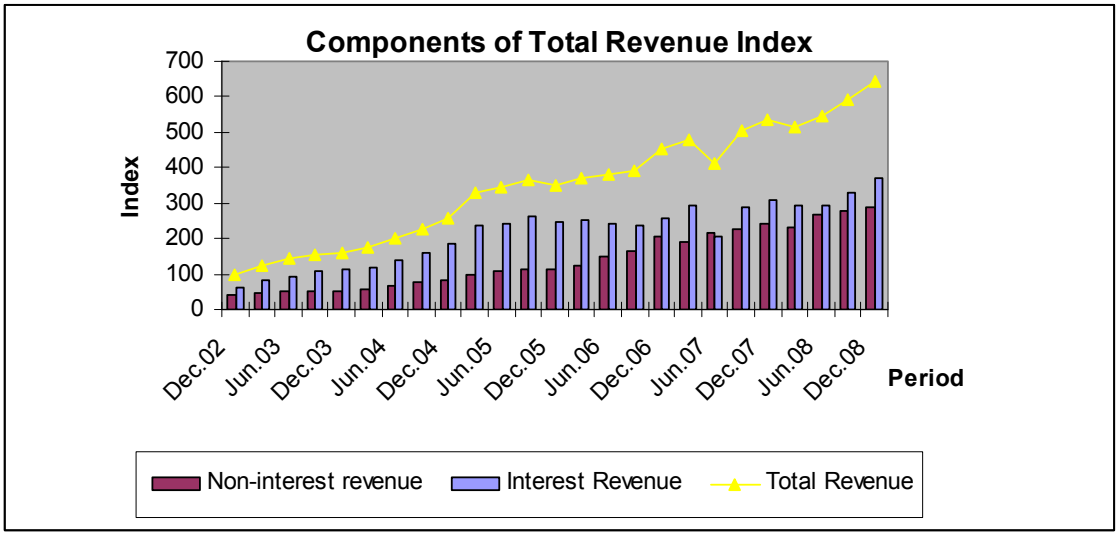
Weiner, S. E., and J. Wright. 2005. Interchange fees in various countries: Developments and determinants. Federal Reserve Bank of Kansas City Working Paper 05-01.

Figure 1: Revolving credit card balances



Notes: Indexes were calculated from CBRT, BRSA and BAT.

Figure 2: Components of total revenue from credit cards



Notes: Indexes are calculated using data from BRSA, CBRT and BAT.

Table 1: Summary statistics

Variables	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
Total revenue*	286	118,683.3	141,570.8	15	620,146
Cost of funds	286	0.0254	0.0079	0.0041	0.0676
Price of physical capital	286	0.0364	0.0242	0.0005	0.1617
Wage	286	11.1449	2.7235	4.3089	22.6999
Age	286	51.3925	30.2580	5.5	120
Credit quality	286	0.0695	0.0488	0.0105	0.3022
Liquidity cost	286	4.1517	13.2917	0.0001	153.4854
Yield spread	286	0.4220	1.1319	-0.4800	4.0133
Off-balance sheet items*	286	16,400,000	14,100,000	76,131	81,000,000
Funds borrowed*	285	2,823,396	3,124,684	1,473	11,800,000

Notes: (*) indicates values in thousand TL.

Table 2: Regression results

	Without *liquidity cost*	With *liquidity cost*	With regulation controls
Cost of funds	0.3005 (3.14)***	0.2694 (2.92)***	0.1646 (1.79)*
Price of physical capital	-0.329 (-0.64)	-0.0285 (-0.56)	-0.0757 (-1.55)
Wage	0.1605 (1.01)	0.2619 (1.70)*	0.2370 (1.43)
Age	1.4621 (2.69)***	1.6585 (3.03)***	0.5831 (1.05)
Credit quality	-0.1392 (-2.83)***	-0.2010 (-4.04)***	-0.1397 (-2.83)***
Yield spread	-0.0149 (-0.38)	-0.0030 (-0.08)	-0.0097 (-0.27)
Liquidity cost		-0.0855 (-4.64)***	-0.0769 (-4.29)***
Trend	0.0797 (3.35)***	0.0805 (3.56)***	0.0828 (3.71)***
Trend squared	-0.0010 (-1.37)	-0.0010 (-1.48)	-0.0010 (-1.35)
Regulation dummy			2.6859 (2.71)***
Regulation × Cost of funds			0.1725 (0.73)
Regulation × Price of physical capital			0.4305 (5.72)***
Regulation × Wage			-0.1910 (-0.81)
Constant	4.6515 (2.0496)**	3.3699 (1.63)	7.0005 (3.38)***
Adjusted R-squared	0.68	0.72	0.75
F-statistic	73.33***	74.29***	60.03***
Number of observations	302	286	286
H estimate	0.4281	0.5027	
p-value to test H=0	0.0177	0.0037	
p-value to test H=1	0.0016	0.0041	
H estimate before regulation			0.3259
p-value to test H=0			0.0828
p-value to test H=1			0.0004
H estimate after regulation			0.7378
p-value to test H=0			0.0447
p-value to test H=1			0.4742

Notes: Dependent variable: Total Revenue. All variables except for Yield Spread and Trend are in natural logarithmic form. t-statistics are shown in parentheses. (*), (**) and (***) correspond to significance at the 10%, 5% and 1% levels, respectively.

Annex

Table A.1: Correlation coefficients

	Total revenue	Cost of funds	Price of physical capital	Wage	Age	Credit quality	Liquidity cost	Yield spread	Off-balance sheet items
Total revenue	1.0000								
Cost of funds	-0.1158	1.0000							
Price of physical capital	-0.1983	-0.2959	1.0000						
Wage	0.3880	-0.1731	-0.0823	1.0000					
Age	0.2000	0.1833	-0.5580	0.0212	1.0000				
Credit quality	-0.0706	-0.1465	0.1933	0.2229	-0.1556	1.0000			
Liquidity cost	-0.1874	-0.0968	0.0896	0.1446	-0.1587	-0.1174	1.0000		
Yield spread	-0.2396	0.3784	0.0994	-0.4942	-0.1164	-0.2021	-0.0252	1.0000	
Off-balance sheet items	0.7523	-0.1165	-0.1347	0.4308	0.1174	-0.0046	-0.2190	-0.3173	1.0000
Funds borrowed	0.7025	-0.2262	-0.2039	0.4591	0.1865	0.0324	-0.1738	-0.2649	0.6615

Table A.2: Long-run equilibrium tests

	With *liquidity cost*	With regulation controls	
Cost of funds	0.0008	0.0011	
	(0.26)	(0.38)	
Price of physical capital	-0.0017	-0.0012	
	(-1.11)	(-0.76)	
Wage	0.0063	0.0030	
	(1.33)	(0.55)	
Age	-0.0116	-0.0032	
	(-0.69)	(-0.17)	
Credit quality	-0.0004	-0.0010	
	(-0.27)	(-0.64)	
Yield spread	0.0028	0.0029	
	(2.41)**	(2.50)**	
Liquidity cost	-0.0009	-0.0008	
	(-1.57)	(-1.34)	
Trend	0.0015	0.0018	
	(2.19)**	(2.40)**	
Trend squared	0.0000	-0.0001	
	(-2.27)**	(-2.47)**	
Regulation dummy		-0.0451	
		(-1.39)	
Regulation × Cost of funds		-0.0033	
		(-0.43)	
Regulation × Price of physical capital		-0.0026	
		(-1.06)	
Regulation × Wage		0.0099	
		(1.29)	
Constant	0.0167	-0.0065	
	(0.26)	(-0.10)	
Adjusted R-squared	0.04	0.06	
F-statistic	1.31	1.17	
Number of observations	286	286	
H estimate	0.0054		
p-value to test H=0	0.3130		
p-value to test H=1	0.0000		
H estimate before regulation			0.0029
p-value to test H=0			0.6357
p-value to test H=1			0.0000
H estimate after regulation			0.0069
p-value to test H=0			0.5658
p-value to test H=1			0.0000

Notes: Dependent variable: Return on Assets; All variables except for Yield Spread and Trend are in natural logarithmic form. t-statistics are shown in parentheses. (*), (**) and (***) correspond to significance at the 10%, 5% and 1% levels, respectively.

Table A.3: Robustness checks

	With *liquidity cost*		With regulation controls	
Cost of funds	0.3086	0.2747	0.1972	0.1543
	(3.48)***	(3.02)***	(2.27)**	(1.73)*
Price of physical capital	-0.0466	-0.0341	-0.1063	-0.0880
	(-0.96)	(-0.69)	(-2.29)**	(-1.86)*
Wage	0.2903	0.1881	0.3423	0.1680
	(1.96)*	(1.23)	(2.16)**	(1.02)
Age	0.8522	1.1277	-0.3984	-0.0911
	(1.55)	(2.02)*	(-0.72)	(-0.16)
Credit quality	-0.1649	-0.2586	-0.1023	-0.1993
	(-3.42)***	(-4.98)***	(-2.17)**	(-3.93)***
Yield spread	0.0076	-0.0041	0.0041	-0.0111
	(0.21)	(-0.11)	(0.12)	(-0.32)
Liquidity cost	-0.0925	-0.0830	-0.0880	-0.0728
	(-5.22)***	(-4.55)***	(-5.15)***	(-4.17)***
Trend	0.0759	0.0858	0.0744	0.0896
	(3.49)***	(3.85)***	(3.51)***	(4.10)***
Trend squared	-0.0015	-0.0010	-0.0013	-0.0011
	(-2.29)**	(-1.55)	(-1.96)*	(-1.58)
Off-balance sheet items	0.3266		0.3725	
	(4.84)***		(5.58)***	
Funds borrowed		0.1319		0.1468
		(3.34)***		(3.91)***
Regulation dummy			4.1249	3.6691
			(4.24)***	(3.44)***
Regulation × Cost of funds			0.4985	0.3759
			(2.16)**	(1.55)
Regulation × Price of physical capital			0.4444	0.4588
			(6.24)***	(6.24)***
Regulation × Wage			-0.2906	-0.2307
			(-1.30)	(-0.98)
Constant	1.3853	5.6231	4.7199	9.7204
	(0.69)	(2.65)***	(2.36)**	(4.63)***
Adjusted R-squared	0.74	0.73	0.78	0.77
F-statistic	74.98***	69.11***	64.52***	59.50***
Number of observations	286	285	286	285
H estimate	0.5523	0.4287		
p-value to test H=0	0.0009	0.0123		
p-value to test H=1	0.0071	0.0009		
H estimate before regulation			0.4332	0.2344
p-value to test H=0			0.0157	0.2079
p-value to test H=1			0.0016	0.0001
H estimate after regulation			1.0854	0.8384
p-value to test H=0			0.0022	0.0204
p-value to test H=1			0.8082	0.6532

Notes: Dependent variable: Total Revenue; All variables except for Yield Spread and Trend are in natural logarithmic form. t-statistics are shown in parentheses. (*), (**) and (***) correspond to significance at the 10%, 5% and 1% levels, respectively.