The Role of Simultaneous Regulations of Credit Services and Payment Services on Competition

Abstract.

In credit card markets, banks earn revenue from both credit services and payment services of credit cards. Existing literature concentrates either on credit services and investigates whether credit card rates should be regulated, or on payment services and examines whether merchant discounts or interchange fees should be regulated. Correct identification of banks' market power requires the analysis of banks' total revenues. By employing the well-known Panzar and Rosse (1982, 1987) method, and taking revenues from both credit and payment services into account, we find that the Turkish credit card market typifies monopolistic competition. We also conclude that the recent interest rate regulations have increased the overall competitiveness of the market. Lastly, contrary to expectations, we observe that both interest and non-interest revenues of banks increased after the regulations.

Keywords: Credit Cards, Regulation, Panzar-Rosse Method, Monopolistic Competition, Credit Services, Payment Services, Merchant Discounts, Credit Card Rates.

JEL classification: G21, G28, O16

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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 the mounting profitability make competition and regulation in 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 ten years, the number of credit cards increased by 500 percent and reached 43 million in 2008,[1] making Turkey the second 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. The 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 (which make about 130 percent effective annual rate) by the end of 2005. Due to the rising concerns over the high concentration, high and sticky credit card rates, and high profitability, credit card regulations were enacted in March 2006. With the mandate to regulate credit card rates, the Central Bank imposed a monthly interest rate cap of 5.75 percent on banks in May 2006, and gradually lowered that cap to 4.39 percent by the end of 2008. The regulations, however, had no stipulations for annual fees, merchant discounts and interchange fees. Consequently, banks responded to those regulations so as to increase their non-interest revenues. They started to charge annual fees to card holders, and although data is unavailable there is anecdotal evidence that they increased merchant discounts.[2]

Credit cards combine credit services with payment services. 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 record keeping facility. Moreover, consumers benefit from the interest free grace period

[1] Interbank Card Center (http://www.bkm.com.tr/yillara-gore-istatistiki-bilgiler.aspx)
[2] See (Akin et al. 2010a) for more on Turkish credit card market.

and merchants enjoy the boosted sales. In requital for these payment services, banks charge annual fees to consumers, and merchant discounts to merchants.

There are many explanations proposed as to why credit card rates and merchant discounts may be very high, and many arguments made about whether their regulation is warranted. To be able to correctly identify banks' market power in credit card markets, both their interest revenues from credit services and non-interest revenues from payment services should be included in the analysis. Taking both parts into account is also essential to be able to design effective regulations, because regulating one part may have implications for the other part. As the Turkish case clearly demonstrates, banks can easily increase prices on the unregulated part. Shaffer and Thomas (2007) present the only study that examines competition in credit card markets by considering banks' revenues from both credit services and payment services. Applying the well-known Panzar-Rosse method for the first time to credit card markets, they find 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) show the failure of price competition in the Turkish credit card market, further evidence substantiates that banks are fiercely engaged in monopolistic competition (Akin et al. 2010b). They bundle credit cards with general banking services, and differentiate themselves by providing both bank-level and card-level non-price benefits. In this study, we follow Shaffer and Thomas (2007) to corroborate our previous findings. By considering banks' total revenues from both credit services and payment services, and using the Panzar and Rosse (1982, 1987) method, we explore the nature and degree of competition in the Turkish credit card market. Moreover, using the same framework we investigate the effects on the overall competition of the interest rate caps imposed after 2006 which only aimed to regulate the credit services of credit cards.

Our analysis is based on a bank specific panel data set which was previously unavailable. The sample includes all 21 banks in the market. Quarterly data have been 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 from the last quarter of 2002 to the last quarter of 2008. Fixed effect regression results show that the credit card market in Turkey has a monopolistically competitive structure. The results also reveal that the interest rate regulations have increased the overall competiveness of the market. Moreover, contrary to expectations, both non-interest and interest revenues of banks from their credit card operations increased after the regulation.

The organization of the paper is as follows: The next section 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 5 concludes.

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 converge to competitive levels by themselves. The primary explanation is that the credit services of credit cards are inherently more costly and risky 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. Another justification is that 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, both of which are costly.

Mester (1994) and Park (2004) argue that sticky rates might be an 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 are.

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. In the first group, 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. 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 customers 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 in the third group[3]. This theory presents one of the fundamental

[3] The well-known Stiglitz and Weiss (1981) adverse selection theory predicts an opposite outcome. Only high-risk consumers respond if a bank unilaterally increases its interest rates. Hence, this bank's risk position worsens

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 arguments, 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.

Merchant discounts 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 be able to create value, banks must simultaneously provide these payment services to both consumers and merchants (i.e., "they must get both sides on board"), hence such payment systems are called *two-sided markets*.[4] Banks must *issue* credit cards to consumers so that they make their payments via credit cards, and at the same time banks must *acquire* merchants so that they accept credit cards for payments. Moreover, for these two sides to remain on 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 these skewed prices, the literature on two-sided markets cites externalities and the discrepancies in the cost of serving to, benefits obtained by, and price elasticities of demands of the two sides. The 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

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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.

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

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 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, for each transaction acquiring banks pay a variable interchange fee to issuing banks. Acquiring banks, in turn, charge a merchant discount fee 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 became a significant portion of their costs, retailer associations in some countries filed lawsuits, contending that banks were illegally engaged in fixing the interchange fees (Weiner and Wright, 2005).

Even though credit cards provide two types of services, namely payment and credit services, existing research often concentrates on analyzing the competition in only one part of the business while ignoring the other. This paper attempts to analyze the market structure of the credit card industry by jointly considering these two aspects with the Panzar-Rosse method.

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

[5] About 60-70 percent of banks' non-interest revenues come from the merchants' side (Evans and Schamalensee, 2005a).
[6] Consumers sometimes also pay fixed amount of annual membership fees.
[7] Merchant discounts charged by acquirers on Visa and Mastercard transactions in the U.S. average 2.1 percent, of which about 0.4 percent is retained by acquirers (Evans and Schamalensee, 2005a).

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, and ε_{it} is the error term. In accordance with the intermediation approach where banks are assumed to employ borrowed funds, labor and physical capital to generate income-earning assets, in most studies three factor prices are considered: 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.

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 method 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 method 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 increases.

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

3. Data and Model

Our sample initially includes all 21 banks which are both issuers and acquirers. Quarterly data have been 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. The observations with missing values for some variables are not included in the estimations.

[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.

The observations in which the ratio of the non-interest revenues to the total revenues is less than 10 percent and greater than 90 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:

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

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 equipment.

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 about future

[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.

interest rates and also for the opportunity cost of short-term vs. long term borrowing. A negative coefficient is expected for this 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 to outstanding credit card balances.[11] Unlike other loans, in credit card lending banks commit 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 in the interbank money market. Both alternatives come with 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 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 their estimations to control for any

[11] The other 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.

scale effect. Since larger banks tend to earn more revenues, they found positive coefficients for this variable. The reason why we do not follow 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, (*Regulation Dummy)* and three interaction dummies *(Reg*CF, Reg*W* and *Reg*PK)* in the following model:

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

In this way we are able to see whether the factor price elasticities of total revenue are affected by the regulation after 2006. *Regulation Dummy* is equal to one after the regulation and zero before the regulation. We fix 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. The banks included in the sample exhibit credit card balances ranging from 13 million TL to 7.1 billion TL. Most of the total

[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.

revenue comes from the credit services but non-interest revenue is also very important, accounting for almost 40 percent of the total revenue.

INSERT TABLE 1 ABOUT HERE

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 estimates 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 *Liquidity Cost* shows the adverse effect of short term borrowing on total revenue. According to the results of the benchmark regression presented in column 2 of Table 2, if *Liquidity Cost* increases by one percent, Total Revenue decreases almost by 0.9 percent. 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.

INSERT TABLE 2 ABOUT HERE

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 to 2008, it

is possible that the regulation 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, showing that the total credit card revenues of banks increased after the regulation even after controlling for T*rend* and other factors. One explanation can be that credit card interest rate cuts increased the quantity demanded for borrowing. Graph 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 revolving credit card balances contributes to the 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 undesirable customers. Collective reduction in interest rates, however, can be welfare improving.

INSERT GRAPH 1 ABOUT HERE

Another explanation for the positive impact of regulation on total revenue could be that banks increased merchant discounts and annual fees 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. Graph 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 also 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.

INSERT GRAPH 2 ABOUT HERE

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 either reputational effects or 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 coefficient of *Trend* is significantly positive, showing that the total revenue from credit cards has increased over time. This is consistent with the picture in Graph 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 to account for non-linearity, 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* is composed of guarantees and warranties, commitments, and derivative financial instruments, reflecting the technology, creativity and product diversity of banks. As product diversity is expected to increase their customer bases, banks tend to bundle their services to make their product packages more attractive. Hence, this variable is likely to positively affect consumers' credit card choices and consequently banks' revenues from credit cards. *Funds Borrowed* conveys information about banks' riskiness. Banks which are able to borrow large amounts of funds are more reliable, and this property may attract customers and bring about higher revenues. The results are given in Table A2 in the appendix. 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 at 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 A3 in the appendix 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

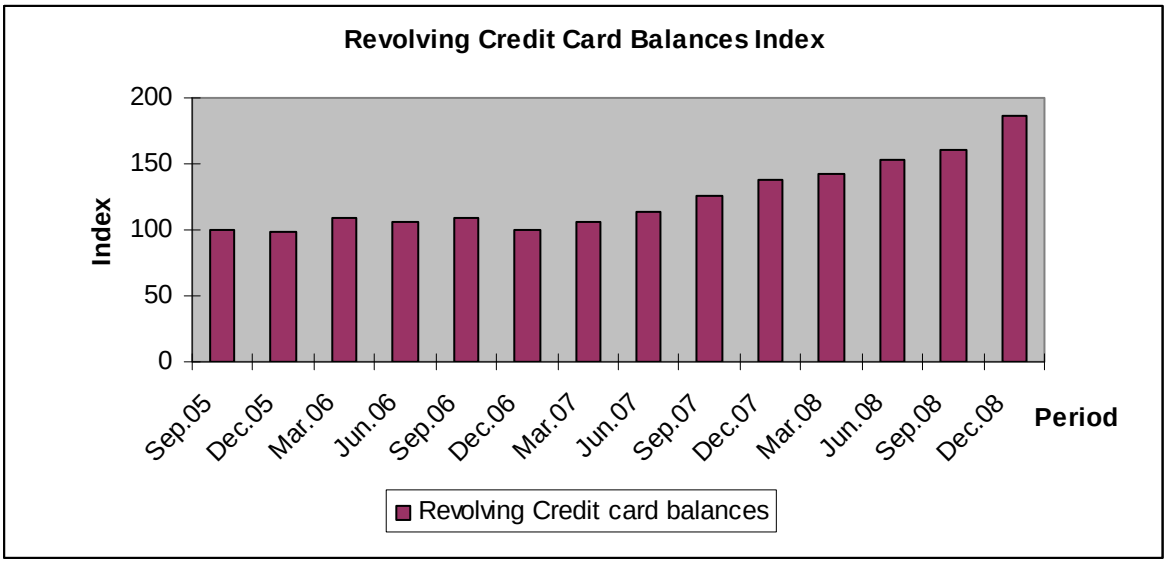
Regulation of credit card markets is an important issue for both academics and policy makers all over the world. Among the government involvements in many countries are the credit card regulations that were enacted in Turkey in 2006, and the bill that has been recently passed in the US congress to protect credit card customers. These regulations appear to be motivated by the concerns about the market structure and competition in credit card markets. There also seems to be a justified lack of confidence in credit card markets to correct themselves without regulation. In Turkey, the primary motive for the credit card regulation was to protect customers from excessive interest rates. Hence, the CBRT was authorized to regulate the interest rates. In credit card markets banks earn not only interest revenues from their credit services but also non-interest revenues in the form of annual membership fees, merchant discounts and interchange fees from their payment services. Ignoring any of these revenues will lead to the incorrect identification of banks' market power. In this paper, our

objectives are, first to unravel the nature of competition in the Turkish credit card market, and second to analyze the effects of interest rate regulations on the overall competitiveness of the market. To this end, we employ the Panzar-Rosse method which is widely used in evaluating the market structure in banking. This method is used only by Schaffer and Thomas (2007) to analyze the competition in credit card markets. The scarcity of research in this regard is mainly due to the difficulty of finding bank specific data on both interest and non-interest incomes from credit card operations.

Our unique panel data set covers all 21 banks in the market for the period between the last quarter of 2002 and the last quarter of 2008. Fixed effect panel regressions reveal two important results. First, consistent with Schaffer and Thomas (2007), the competition in the Turkish credit card market turns out to be monopolistic. This is also in line with the previous results in Akin et al. (2010b) where banks are found to compete with non-price benefits. Second, when the effects of interest rate regulations are examined, we observe that the competition has significantly increased after the regulation and approached perfect competition. Moreover, our results show that regulation caused an increase in total revenues earned by banks. Not only banks increased merchant discounts and annual fees in order to offset the decrease in interest rates, but also did declining interest rates increase the volume of revolving balances. The latter result confirms the *New Adverse Selection Theory* of Ausubel (19991). This theory explains why a bank will not unilaterally lower its credit card rate: if it does it will disproportionately attract risky consumers. Our results imply that an interest rate cap that will lead to a collective reduction in interest rates may be welfare improving. When we look at the other players in the market, we can say that revolvers became better off, while convenience users and merchants were adversely affected after the regulation. Revolvers pay lower interest rates. Convenience users and merchants, on the other hand, bear the cost by paying higher annual fees and merchant discounts.

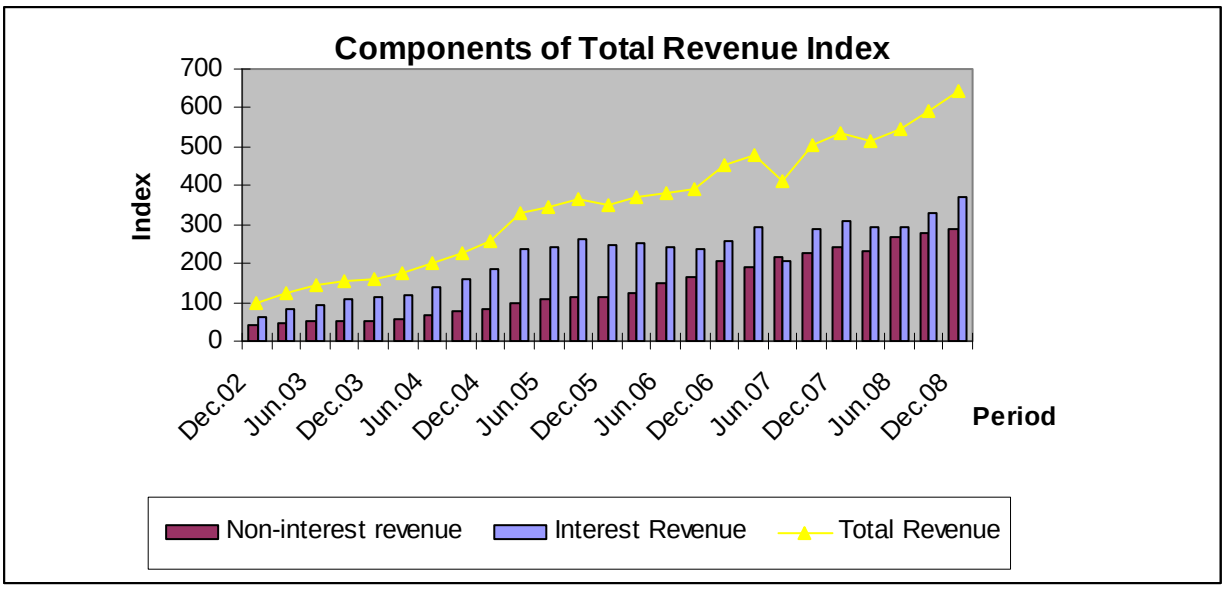
The bottom line is that even though the credit card regulations were designed to regulate the interest revenues of banks, it turns out to be instrumental in increasing the overall competition in the market.

Graph 1: Revolving credit card balances



Indexes were calculated from CBRT, BRSA and BAT.

Graph 2: Components of total revenue from credit cards



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

(*) indicates values in thousand TL.

Table 2: Regression results

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.

	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

APPENDIX

Table A1: 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 A2: Robustness checks

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.

	With *Liquidity Cost*		With regulation controls	
Cost of Funds	0.3086 (3.48)***	0.2747 (3.02)***	0.1972 (2.27)**	0.1543 (1.73)*
Price of Physical Capital	-0.0466 (-0.96)	-0.0341 (-0.69)	-0.1063 (-2.29)**	-0.0880 (-1.86)*
Wage	0.2903 (1.96)*	0.1881 (1.23)	0.3423 (2.16)**	0.1680 (1.02)
Age	0.8522 (1.55)	1.1277 (2.02)*	-0.3984 (-0.72)	-0.0911 (-0.16)
Credit Quality	-0.1649 (-3.42)***	-0.2586 (-4.98)***	-0.1023 (-2.17)**	-0.1993 (-3.93)***
Yield Spread	0.0076 (0.21)	-0.0041 (-0.11)	0.0041 (0.12)	-0.0111 (-0.32)
Liquidity Cost	-0.0925 (-5.22)***	-0.0830 (-4.55)***	-0.0880 (-5.15)***	-0.0728 (-4.17)***
Trend	0.0759 (3.49)***	0.0858 (3.85)***	0.0744 (3.51)***	0.0896 (4.10)***
Trend squared	-0.0015 (-2.29)**	-0.0010 (-1.55)	-0.0013 (-1.96)*	-0.0011 (-1.58)
Off-Balance Sheet Items	0.3266 (4.84)***		0.3725 (5.58)***	
Funds Borrowed		0.1319 (3.34)***		0.1468 (3.91)***
Regulation dummy			4.1249 (4.24)***	3.6691 (3.44)***
Regulation × Cost of Funds			0.4985 (2.16)**	0.3759 (1.55)
Regulation × Price of Physical Capital			0.4444 (6.24)***	0.4588 (6.24)***
Regulation × Wage			-0.2906 (-1.30)	-0.2307 (-0.98)
Constant	1.3853 (0.69)	5.6231 (2.65)***	4.7199 (2.36)**	9.7204 (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

Table A3: Long-Run Equilibrium Tests

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.

	With *Liquidity Cost*	With regulation controls
Cost of Funds	0.0008 (0.26)	0.0011 (0.38)
Price of Physical Capital	-0.0017 (-1.11)	-0.0012 (-0.76)
Wage	0.0063 (1.33)	0.0030 (0.55)
Age	-0.0116 (-0.69)	-0.0032 (-0.17)
Credit Quality	-0.0004 (-0.27)	-0.0010 (-0.64)
Yield Spread	0.0028 (2.41)**	0.0029 (2.50)**
Liquidity Cost	-0.0009 (-1.57)	-0.0008 (-1.34)
Trend	0.0015 (2.19)**	0.0018 (2.40)**
Trend squared	0.0000 (-2.27)**	-0.0001 (-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 (0.26)	-0.0065 (-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

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