THE DIFFUSION OF FINANCIAL INNOVATION IN TURKEY: THE CASE OF ATM

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ABSTRACT

THE DIFFUSION OF FINANCIAL INNOVATION IN TURKEY:

THE CASE OF ATM

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This study investigates the indicators of the number of ATMs (automated teller machines) in the provinces of Turkey by examining two banks: T.C. Ziraat Bankası and T. İş Bankası. The study depends on annual panel data from 1990 to 2004 for seventy-three provinces of Turkey. The information about the number of ATMs of the two banks is gathered after a study in the archives of the banks. In this study it is concluded that the number of ATMs of T. İş Bankası and T. C. Ziraat Bankası in the previous year and the total number of branches of the banks in Turkey are the indicators of ATM adoption for both of the banks concerned. However, population has a negative sign for T. C. Ziraat Bankası which is a state bank whereas it has a positive sign for T. İş Bankası which is a quasi-private bank. The findings also indicate that the ATM number of T. İş Bankası is more sensitive to the number of total bank branches.

Key Words: financial innovation, technology diffusion, ATM (automated teller machines), Turkish banking system

ÖZ

TÜRKİYE'DE FİNANSAL YENİLİĞİN YAYGINLAŞMASI:

ATM ÖRNEĞİ

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Yüksek Lisans, İktisat Bölümü

Tez Yöneticisi: Prof. Dr. Erol Taymaz

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Bu çalışmada Türkiye'nin il bazındaki ATM sayısının belirleyicileri, T.C. Ziraat Bankası ve T. İş Bankası odaklı olarak incelenmiştir. Çalışmada Türkiye'nin yetmiş üç ili için 1990-2004 yılları arasını kapsayan yıllık panel veri seti kullanılmıştır. Çalışmaya konu olan iki bankanın ATM sayılarına ilişkin bilgi bankaların arşivlerinden çalışma sonucu edinilmiştir. T. İş Bankası ve T. C. Ziraat Bankası'nın bir önceki dönem ATM sayılarının ve Türkiye'deki toplam şube sayısının ATM sayısını olumlu yönde etkilediği sonucuna varılmıştır. Nüfus değişkeni T. C. Ziraat Bankası için negatifken, T. İş Bankası için pozitif bulunmuştur. Bulgular, İş Bankası'nın ATM sayısının, Türkiye'deki toplam şube sayısına T. C. Ziraat Bankası'na kıyasla daha duyarlı oldugunu da göstermektedir.

Anahtar Kelimeler: finansal yenilik, teknoloji yaygınlaşması, ATM, Türk Bankacılık Sistemi

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CHAPTER 1

INTRODUCTION

History shows that financial innovation has been a key influence on the world economy in providing a solid base for the growth of financial systems. Since finance is a facilitator of virtually all production activity, improvements in the financial sector will have direct positive ramifications throughout an economy. (Frame and White, 2004) The centrality of finance in an economy raises the importance of financial innovations. Over the past few decades there has been a serious increase in the development of new financial instruments. The world revolution is entirely appropriate for describing the changes in financial institutions and instruments that have occurred in the past twenty years. (Miller, 1986) Innovations help us perform the following functions according to Merton's (1992) functional decomposition: (1) moving funds across time and space; (2) the pooling of funds; (3) managing risk; (4) extracting information to support decision-making; (5) addressing moral hazard and asymmetric information problems; and (6) facilitating the sale of purchase of goods and services through a payment system. Although a broad descriptive literature concerning recent financial innovations has proliferated[1], there are only a few empirical studies about the subject.

[1] Examples: William Silber (1983); James Van Horne (1985); Miller (1986, 1992); Colin Mayer(1986); Ian Cooper (1986); BIS (1986); Gerald Faulhaber and William Baumol (1988); Richard Levich (1988); Tim Campbell (1988); Daniel Siegel (1990); Henry Cavanna (1992); John Finnerty (1992); Robert Merton (1992, 1995); Richard Kopcke (1995); Peter Tufano (1995, 2003); Michael Lea (1996); Mervyn Lewis and Paul Mizen (2000); Finnerty and Douglas Emery (2002)

Technology includes "hard" technologies (such as computer-controlled machine tools) and "soft" technologies (for example, improved manufacturing, quality, or training methods). (Shapira and Rosenfeld, 1996) Banks as profit-seeking enterprises try to use both kinds of new technologies in their systems that will reduce their cost of production and yield more profits. However, banks usually adopt technological improvements later than securities firms as one example of this can be observed in the field of on-line services. ATMs, early video banking, internet banking, transactional internet websites are some kinds of services supported by new technology in the banking sector. However, the rate at which innovations diffuse through an economy is crucial. With the help of technology diffusion, the adoption of new technologies and techniques became possible all over the world at different rates. The positive effects of the size of an enterprise (especially a bank) on its likelihood of innovating or of adopting innovations or of adopting them earlier is the common point concluded by many of the articles (Frame and White, 2004) Also, profitability or proxies for (or components of) it also tend to be positive influences on earlier adoption. (Molyneux and Shamroukh, 1996) and (Akhavein, Frame, and White 2005).

As Frame and White (2004) stated, despite the recognized importance of financial innovations and an extensive descriptive literature, there have been surprisingly few empirical studies that test hypotheses concerning the economic/environmental conditions that encourage financial innovation. The reasons may be: (1) The research and development tradition: Outside of finance much of the empirical testing has linked innovation with formal research and development efforts by companies. Financial services are not in this R&D tradition. (2) The Patent Count Tradition: Patents for financial products and services are not common, and financial services firms are unlikely to be boasting in advertisements about their patenting proclivities. (3) The Data: The data that are commonly used for research about financial services yield no directly useful information about financial innovation. (4) Summing Up: The data and research environments have not been conducive to empirical work on financial innovation. For a number of empirical financial innovation studies, the crucial data have come from special surveys as in this thesis.

This study focuses on the automated teller machine (ATM) which enables a bank customer to conduct banking transactions from almost every other ATM in the world. The first examples of automated teller machines are cash dispensers (CDs) that had been adopted in 1960s. Cash dispensers were used as machines that supply certain amount of cash. With the technologic improvement automated teller machines replaced with cash dispensers. Automated teller machines have been widely adopted by retail banks and building societies since their commercialization in 1972. (Gourlay and Pentecost, 2000) Hannan and McDowell (1987) found a significant and positive relationship between the number of previous adopters at the state level (as a proxy for the stock effect) and the probability of ATM adoption in the US banking sector. Since its introduction into test markets in 1974, ATM's have become as common place as banks, shopping malls, and supermarkets. ATMs provide access to banking services at virtually any hour of the day or night and, with the introduction of inter-bank networks, at almost any location. The main shared systems of ATMs all over the world are: Visa International, Plus System, CIRRUS System, The Exchange, NATIONET, Master Teller and Express Cash (served by American Express).

Turkish banking system uses advanced information technology. In the system technology-intensive services as ATM (Automatic Teller Machine), POS (Point of Sale terminal), telephone banking and internet banking are available. Having an important place in the vision of banks, electronic banking activities have been growing rapidly for the purpose of improving quality of services and saving costs. Within this context, the banks put new services into practice such as “Call Center”, “Internet Banking”, and “Management of Customer Relations”. Besides customer-oriented procedures of banks, information technology has been used extensively in the internal operations of banks as well. As of the end of 2004 the number of ATMs reached 13,544. (BAT, 2004)

In the literature there are only six empirical studies examining the diffusion of ATMs[2]. As a result of bank regulations, data set of ATMs is more available compared to the data set concerning information about other financial innovation implementations. However in Turkey, there is not an official source publishing the annual improvement of the ATM number. It is more difficult to reach data concerning the number of automated teller machines in the provinces of Turkey. Although banking firms and ATM suppliers have information about the number and the location of automated teller machines, they do not give any access to their archives because of security reasons. This may be one of the main reasons that there is no published empirical study about the number of ATMs in Turkey taking into account panel data including years and provinces.

In Turkey the adoption of ATM was started by T. İş Bankası in December, 1987. The number of ATMs increased rapidly after 1987 in Turkey especially in the more developed provinces. The automated teller machines in Turkey have the similar technological qualities compared with the automated teller machines in Europe and in the United States. Moreover, the cash dispensers that are still used in some countries have never been used in Turkey. Instead the recent technology used in automated teller machines has been adopted. (Aksoy, 1998)

The aim of this thesis is to investigate the determinants of the number of ATMs in the provinces of Turkey empirically by focusing on two important banks of the Turkish banking system which are T.C. Ziraat Bankası and T. İş Bankası. There are many descriptive attempts to reveal the increase in the number of ATMs in Turkey. However, the situation of provinces is beyond the scope of these papers. Moreover an empirical approach to reveal the determinants of the number of ATMs in the provinces of Turkey is a subject that has never been studied on before.

For this study panel data on eighty-one provinces of Turkey are gathered. The districts that became provinces after 1990 are evaluated as they were still districts for the sake of the study as there exists no data for the new provinces before the date

[2] Hannan and McDowell (1984); Hannan and McDowell (1987); Sinha and Chandrashekaran (1992); Saloner and Shepherd (1995); Ingham and Thompson (1993); Gourlay and Pentecost (2002)

they became province. Thus, the number of provinces used in this paper is seventy-three. The data set covers the years between 1990 and 2004. It was impossible to access the data of total number of ATMs in Turkey according to provinces because of the reasons mentioned above. Data on T.C. Ziraat Bankası and T. İş Bankası are gathered from the archives of the banks after some study for this thesis. T.C. Ziraat Bankası and T. İş Bankası are chosen not only because I was allowed to access their archives but also T. C. Ziraat Bankası ranked as number one and T. İş Bankası as number two by total assets, as of September 30, 2004 according to The Banks Association of Turkey. The rest of the data in this study are either used as how they were officially published or used after some calculations.

This study makes a couple of contributions to the literature. First, different from the existing literature this study is an empirical study in the field of financial innovations. Second, it tries to reveal the determinants of the number of ATMs in the provinces of Turkey empirically. Moreover, the information of ATMs gathered for this study is not published. In this study after the model estimation, it is concluded that the number of ATMs of T. İş Bankası and T. C. Ziraat Bankası in the previous year, the total number of branches of banks in Turkey and the population are the indicators of ATM adoption for both of the banks concerned. The findings also indicate that the number of ATMs is higher in more developed provinces of Turkey.

The rest of the paper is organized as follows: Second chapter gives a brief summary of financial innovation and technology diffusion literature survey mainly focusing on ATM diffusion literature. Third chapter gives general information about the Turkish banking system, then about the financial innovations in the Turkish Banking system and finally about the situation of T.C. Ziraat Bankası and T. İş Bankası in this system. Chapter four presents data used in the analysis. Chapter four also consists the model, estimation results and comments on the results. Chapter five concludes.

CHAPTER 2

FINANCIAL INNOVATIONS AND TECHNOLOGY DIFFUSION: A BRIEF LITERATURE SURVEY

"The primary function of the financial system is to facilitate the allocation and deployment of economic resources, both spatially and across time, in an uncertain environment" (Merton 1992, p.12) To facilitate the allocation and deployment of economic resources, new financial services, products and instruments are necessary to better satisfy the needs of financial sector agents. Viewed in this context, financial innovation is the act of creating and then popularizing new financial services/products/instruments that better satisfy the needs of the participants of the financial sector.

As Tufano (2002) mentioned, financial innovation—like innovation elsewhere in business—is an *ongoing* process whereby private parties experiment to try to differentiate their products and services, responding to both sudden and gradual changes in the economy. The literature on financial innovation attempts to catalog some of this variety, describe the reasons why we observe an ever-increasing diversity of practice, and assess the private and social implications of this activity.

"One of the bedrocks of our financial system is financial innovation, the life blood of efficient and responsive capital markets." Van Horne (1985) There is

general recognition of the particular importance of financial innovation.[3] However, there are only a few empirical studies about financial innovation in the literature and they are relatively new compared with the descriptive studies.[4]

As Tufana (2002) discussed, a small literature on the history of financial innovation demonstrates that the creation of new financial products and processes has been an ongoing part of economies for at least the past four centuries, if not longer. One sub-branch of the literature on financial innovation has created lists or taxonomies of innovations. However, different lists of innovations demonstrate the difficulty of categorizing new products. Organizing the innovation lists by product name tend to be informative, as firms use names to differentiate similar products. Lists by "traditional labels" (e.g., legal or regulatory definitions of debt or equity, etc.) tend to be problematic, as innovations often intentionally span across different traditional labels. Lists organized by product feature (e.g., maturity, redemption provisions, etc.) provide a great deal of information and highlight the component parts of each innovation, but do so at creating a classification system that has so many dimensions as to be unmanageable.

An alternative way of categorizing the innovations preferred by most academics is due to the functions they serve. [5] Innovations help us perform the following functions according to Merton's (1992) functional decomposition: (1) moving funds across time and space; (2) the pooling of funds; (3) managing risk; (4) extracting information to support decision-making; (5) addressing moral hazard and asymmetric information problems; and (6) facilitating the sale of purchase of goods and services through a payment system. Finnerty (1992) identifies a set of functions similar with the identification of Merton's. Reallocating risk and reducing agency

[3] Silber 1975; Van Horne 1985; Miller 1986, 1992; Faulhaber and Baumol 1988; Campbell 1988, ch. 16; Siegel 1990; Finnerty 1992; Merton 1992.

[4] Garbade and Silber 1978; Hannan and McDowell 1984, 1987; Saloner and Shephard 1995; Lea 1996; Lerner 2000; Furst, et al. 2000; and Frame, et al. 2001).

[5] While various authors have proposed functional classification schemes, the broader notion of using "function" as the critical unit in understanding financial systems has been advanced strongly by Merton (1992) according to Tufano (2000).

costs correspond closely to Merton's functions whereas increasing liquidity is defined as the composition of Merton's movement of funds and pooling functions. With a slight difference the Bank for International Settlements (1986) identifies the functions of innovations focusing on the transfer of risks (both price and credit), the enhancement of liquidity, and the generation of funds to support enterprises (through credit and equity). It worths noting that as a single innovation is likely to address multiple functions, each of the schemes is probable to have complications.

Duffie and Rahi (1995) concluded that while there are several results providing conditions for the existence of equilibrium with innovation, the available theory has relatively few normative or predictive results. From a spanning point of view, it can be guessed that there are incentives to set up markets for securities for which there are no close substitutes, and which may be used to hedge substantive risks.

As cited in Tufana (2000), Ross (1989) invokes agency issues to explain some financial innovations. He notes that agency considerations make borrowing costly or limited and, as a result, individuals contract with opaque financial institutions. When a shock (such as a change in taxes or regulation) occurs, financial intermediaries may find it efficient to sell off low-grade assets. Because outside investors cannot easily assess the value of these assets, the institutions turn to investment banks to place these securities with their network of clients. These investment banks innovate, creating new pools of these low-grade assets. Agency considerations interact with marketing costs to produce innovation.

In the literature some studies search for a link between innovations and taxes, regulations, and innovation regimes. Miller (1986) emphasized the link between taxes and innovation: "The major impulses to successful innovations over the past twenty years have come, I am saddened to have to say, from regulation and taxes." According to Kane (1986) "regulatory dialectic" is the major source of innovation. The link between the regulation and innovation has been an academic debate in

different forms.[6] Moshe Ben-Horim and Silber (1977) employ a linear programming model and find that regulatory constraints induce innovation by linking the difference between estimated shadow prices of commercial bank liabilities and equity relative to regulatory thresholds to some of the major innovations of the 1960s, such as the negotiable CD. Franks and Sussman (1999) argue that the nature of the "innovation regime" (whether driven by lenders and borrowers, or by judges and legislators) affects the nature of subsequent contract evolution and the amount of innovation. McLaughlin (2000) discusses the relationship between legal engineering and financial innovation from the perspective of a practicing member of the legal bar.

Most financial innovation studies state that innovation helps the economic agents manage the new kinds of risks sourcing from globalization. Thus, globalization and economic volatility are drivers for financial innovation. Smith, Smithson, and Wilford (1990) explain the link between risk and financial innovations as follows:

> Uncertainty in the global financial environment has caused many economic problems and disruptions, but it has also provided the impetus for financial innovation. Through financial innovation, the financial intermediaries were soon able to offer their customers products to manage or even exploit the new risks. Through this same innovation, financial institutions became even better able to evaluate and manage their own asset and liability processes.

In the literature there are studies concerning the timing of the innovation as a result of the changes in the environment as well as studies in which no attempt occurs to explain the timing of the innovation. Tufano (2000) summarizes the key points as follows: (1) Innovation exists to complete inherently incomplete markets. (2) Innovation persists to address inherent agency concerns and information asymmetries. (3) Innovation exists so parties can minimize transaction, search or marketing costs. (4) Innovation is a response to taxes and regulation. (5) Increasing globalization and risk motivate innovation. (6) Technological shocks stimulate innovation.

[6] White (2000), Hu (1989), Pouncy (1998), and Russo and Vinciguerra (1991)

Frame and White (2004) claim that if the search-and-success were a relatively constant phenomenon, innovations would tend to appear in a roughly continuous stream. However, since the observed streams of innovations do not appear to be uniform across all enterprises, across all industries, or across all time periods, the general innovation literature has sought to uncover the environmental conditions that may encourage greater (or lesser search) efforts and a larger (or smaller) stream of innovations. They add that literature has focused on hypotheses concerning roughly five structural conditions: (1) the market power of enterprises; (2) the size of enterprises; (3) technological opportunity; (4) appropriability; (5) product market demand conditions.

The broadest list of economic/environmental factors that have encouraged financial innovation is provided by Campbell (1988): underlying technologies, macroeconomic conditions, regulation and taxes are mentioned among these factors. However, appropriability is not included in this list. Frame and White (2004) include appropriability in the list with such an explanation: in the absence of some protection or frictions, a productive new idea would be rapidly copied by rivals (who, in a competitive marketplace, will price their output at marginal cost), thereby depriving the originator of a return on his original investment in the innovation.

The intellectual-property protection system (i.e., patent, copyright, trademark) has not been considered important for financial innovation; patents for financial innovations were a rare phenomenon before 1980 and only became noticeable and significant in the late 1990s. (Josh Lerner, 2002) Lerner (2002) documents financial patenting activity in the late twentieth century and finds that although the rate of patenting activity has been modest, it increased markedly after a 1998 judicial decision (the State Street Bank case) that allowed for business method patents. Lerner also studies the patenting activity of investment banks and finds that it was positively related to the size of the investment banks and to the extent of their indirect academic ties. The direct involvement of academic institutions or of academics themselves in financial patenting was not related to finance-related research productivity of the institutions or the individuals. (Frame and White, 2004) Also, neither the general innovation literature nor the financial innovation literature

has satisfactorily addressed the issue of how the presence of network externalities effects (Fejjrey Rohls, 1974) influences the type and pace of innovation.

The advantages of being a member of a network increase as the number of the members increases. Within a network, the economies of scale and compatibility are important features. According to Frame and White (2004), incremental innovations within the compatibility confines of a network are clearly possible. But the scale-related problems of creating new networks may discourage such "large" innovations. In some academic models, parties most constrained or inconvenienced by imperfections would be the most likely to innovate, as the shadow costs of releasing these constraints would be greatest for these firms. Silber (1975, 1983) articulates this constraint-based notion of innovation.

The literature on financial innovations dealt with the customers for and users of innovations as well. Ross (1989) points out that investment banks come up with innovative bundles of securities in order to reduce their search or marketing costs. Boot and Thakor (1997) show how different levels of innovations occur in different institutional structures. They concluded that innovation would be higher in a banking system in which commercial and investment banking were functionally separated than a universal banking system—especially one with substantial market concentration—. It can be concluded that greater competition among these private parties leads to increased innovation. Bhattacharyya and Nanda (2000) model what leads innovation within the investment banking industry. They find that banks with larger market shares will tend to innovate, as will banks whose clients are stickier. Heinonen (1992) studies game-theoretic models of innovation, focusing on benefits on the costs of production (economies of scope) or on the costs of distribution (marketing) as cited in Tufano (2002).

Despite the numerous studies about financial innovations, there are only a few empirical studies. When the empirical studies in the literature on financial innovations are examined, it is observed that the size of an enterprise has a positive effect on the probability of innovating or adopting innovations. The enterprise size also plays an important role for the probability of adopting the innovations earlier.

As Frame and White (2004) state, empirical investigations of the relationship between general economic/environmental conditions and financial innovation-the topic that is at the center of the economics research on innovation generally- sum to only two studies which are discussed above: Moshe Ben-Horim and Silber (1977) and Lerner (2002).

Innovation includes the diffusion (adoption) of new products/services/ideas as well as the invention. In this context, technology includes "hard" technologies (such as computer-controlled machine tools) and "soft" technologies (for example, improved manufacturing, quality, or training methods). Shapira, Roessner, and Barke (1992) contrast technology diffusion with technological innovation which emphasizes the development of new knowledge, products, or processes, and government-oriented technology transfer, which frequently seeks to shift advanced technology out of laboratories into commercial use. Unlike the invention of a new technology, which often appears to occur as a single event or jump, the diffusion of that technology usually appears as a continuous and rather slow process. Yet it is diffusion rather than invention or innovation that ultimately determines the pace of economic growth and the rate of change of productivity. (Hall and Khan, 2002) Technology can diffuse in multiple ways and with significant variations, depending on the particular technology, across time, over space, and between different industries and enterprise types. (Shapira and Rosenfeld, 1996) Technology also diffuses through the internal "catch-up" efforts of firms, the transfer and mobility of skilled labor, the activities of professional societies and the trade and scientific press, varied forms of informal knowledge trading, and such practices as reverse engineering. (Shapira and Rosenfeld, 1996)

For diffusion, one of the most common approaches is applying social leader concept as cited in Chang (2004). Becker (1970) finds substantial correlation between an individual's adoption timing of an innovation and both his/her relative position in sociometric network and his/her most valued source of information and suggests that early adopters are opinion leaders. Rogers (1995) overviewed a vast amount of publications related to innovation diffusion and summarizes socio-

economic characteristics of adopter categories: early adopters to laggards. He also claims that opinion leaders are at the core of respective networks.

Taking into account that the adoption proceeds slowly at first, accelerates as it is recognized by the potential adopters, and then slows down when the population of potential adopters saturates, an S-shaped curve plotting a new invention versus time is obtained. Zvi Griliches in his study of the economic determinants of the diffusion of hybrid corn in 1957 and Edwin Mansfield in his study on the diffusion of major innovations in the coal, iron and steel, brewing, and railroad industries pointed out this fact. According to Hall and Khan (2002), the heterogeneity model assumes that different individuals place different values on the innovation. The following set of assumptions will generate an S-curve for adoption: (1) The distribution of values placed on the new product by potential adopters is normal (or approximately normal); (2) the cost of the new product is constant or declines monotonically over time; (3) individuals adopt when the valuation they have for the product is greater than the cost of the product. An alternative way mentioned by Hall and Khan(2002) is a learning or epidemic model which also generates an S-shaped curve for diffusion. In this model, as all the consumers are not informed about the new technology at the same time, as time passes more and more people adopt the technology during any period, leading to an increasing rate of adoption. However, eventually the market becomes saturated, and the rate decreases again and as a result an S-shaped curve occurs.

Commercial banks' adoption of new technologies has never been as rapid as the adoption of securities firms. According to Frame and White (2004) banks generally do not have a reputation for rapid adoption of innovative technologies. Nevertheless, new technologies eventually enter the banking sector, as banking firms are profit maximizers. Schumpeter (1939) argues that firms' basic objective to innovate is to maximize their profits. Kotler (1972, pp. 464) emphasizes this incentive as follows: " ...businesses are increasingly recognizing that the key to their survival and growth may lie in the continuous development of new and improved products." Although the positive effect of bank size on the likelihood of adoption is a common theme for empirical studies, Frame and White pointed out that the other

influences on adoption appear to be an eclectic mixture of the predispositions that the researches bring to their studies, rather than being driven by a common theoretical base. According to the paper by Pennings and Harianto (1992) bank's size, accumulated technological experience, and inter firm technological linkages are positively related with the adoption of technology. Mantel (2000) searched which consumers use electronic bill-payment services in his study and founded that income, age, education, homeownership status, gender (women), and holding a credit card are positive influences on consumers' use of electronic bill-payment services.

The diffusion of innovations has long been studied in the industrial organization field. Empirical studies of the adoption of financial innovations have focused on the introduction of automated teller machines (Hannan and McDowell (1984, 1987) and Saloner and Shepherd (1995)), small business credit scoring (Akhavein, Frame and White (2001)), patents (Lerner (2002)), off-balance sheet activities of banks (Molyneux and Shamroukh (1996), Obay (2000)), junk bond issuance (Molyneux and Shamroukh (1999)) and corporate security innovations (Tufano (1989)). From Tufana (2002)'s point of view, the central question in much of this literature is to determine which organizations adopt innovations and how quickly they do so. While this literature is rich, much of it plays off of the question of whether larger firms or smaller firms lead innovation, a long-standing debate. In many of these studies, it has been the larger firms that have innovated more rapidly, for example, with larger banks more quick to adopt credit scoring or larger investment banks are faster to underwrite new securities.

Philip Molyneux and Nidal Shamroukh (1996) examined the underwriting of junk bonds and of note issuance facilities (NIFs)[7] and find that exogenous factors, such as regulatory or demand changes, played a significant role in the diffusion of junk bond underwriting while the diffusion of NIF underwriting appeared to be motivated by bandwagon effects (i.e., the adoption by one bank makes it more desirable for other banks to follow suit) as cited in Frame and White (2004). Frame

[7] An NIF is an arrangement by which a bank or group of banks agrees to act as managers for the underwriting of a borrower's issue of short-term paper as and when required and to back the facility with medium-term credit should the note not find a market (Molyneux and Shamroukh 1996, p. 513)

and White (2004) criticizes their study by explaining that the opaque exposition of their methods makes it impossible for readers to ascertain basic attributes of their study, such as the unit of observation and the number of observations in their diffusion equations. Another diffusion study investigates the expansion of the use of small business credit scoring by large banking organizations in the mid-1990s. (Akhavein, Frame, and White, 2005). This study suggests that larger banking organizations, those with more branches, and those located in the New York Federal Reserve district adopted this technology sooner. Frame and White (2004) sum up diffusion studies and conclude that, the size of institution is a strong positive influence on earlier adoption of an innovation, with only the split hazard model of Sinha and Chandrashekaran (1992) yielding a contrary result. Also, they state that profitability or proxies for (or components of) it also tend to be positive influences on earlier adoption.

Internet banking is one of the recent financial innovations. Sullivan (2000) investigated the characteristics of banks in the 10th Federal Reserve District that offer internet services and concluded that bank size, educated population, the population between the ages 18 and 64, non interest expenses, and noninterest income are positively related to offering internet banking. Another study examining the characteristics of banks that offer internet banking is the study by Furst, Lang and Nolle (2002). They found that holding company affiliation, size, urban location, fixed expenses, and non interest income are positively related to offering internet banking services. Chang (2004) characterized the determinants of consumer adoption of internet banking using survey data from Korea[8] in both static and dynamic framework and found evidence that adoption of internet banking is influenced by sex, age, marital status, and degree of exposure to internet banking as well as the characteristics of the banks. Another finding of the study is that the adoption is dominated by social norm effects. Using a duration analysis, Chang found no evidence of first mover advantage *(order effect*s) in internet banking whilst the largest bank *(rank effect*s) in commercial banking remains dominant in internet banking.

[8] According to the Bank of Korea report (using quotes from Wall Street Journal Report), Korea has the highest internet banking penetration ratio per head.

This paper focuses on the automated teller machine that is accepted as one of the most important financial innovations that attracted the attention of many authors. An automated teller machine (ATM) is an electronic device that allows a bank's customers to make cash withdrawals and check their account balances at any time without the need for a human teller. The first examples of automated teller machines had been adopted in 1960s and commercialized in 1967. As noted by Kirkman (1987), these were not strictly ATMs but, rather, cash dispensers. Cash dispensers were used as machines that supply certain amount of cash. By the mid-1970s these machines had been phased-out (British Bankers' Association, 1986). With the technologic improvement automated teller machines replaced with cash dispensers. Don Wetzel invented the first successful and modern ATM in the USA. The other two inventors listed on the patent were Tom Barnes, the chief mechanical engineer and George Chastain, the electrical engineer. The concept of the modern ATM first began in 1968, a working prototype came about in 1969 and Docutel was issued a patent in 1973. Automated teller machine (ATM) has been widely adopted by retail banks and building societies since their commercialization in 1972. (Gourlay and Pentecost, 2000) The first working ATM was installed in a New York based Chemical Bank according to Don Wetzel's reference.[9] Wetzel, Barnes and Chastain developed the first real ATM cards, cards with a magnetic strip and a personal ID number to get cash. ATM cards had to be different from credit cards (then without magnetic strips) so account information could be included.

Since its introduction into test markets in 1974, ATMs have become as common places as banks, shopping malls, and supermarkets. ATMs provide access to banking services at virtually any hour of the day or night and, with the introduction of inter-bank networks, at almost any location. The main shared systems of ATMs all over the world are: Visa International, Plus System, CIRRUS System, The Exchange, NATIONET, Master Teller and Express Cash (served by American Express). Most ATMs are connected to interbank networks, enabling people to withdraw and deposit money from machines not belonging to the bank where they have their account. Although ATMs were originally developed as cash

[9] Mary Belis, www. inventors. about. com library

dispensers, they have evolved to include many other bank-related functions. In some countries, especially those which benefit from a fully integrated cross-bank ATM network ATMs include many functions which are not directly related to the management of one's own bank account, such as:

- Paying routine bills, fees, and taxes (utilities, phone bills, social security, legal fees, taxes, etc.)
- Loading monetary value into pre-paid cards (cell phones, tolls)
- Ticket purchases (train, concert, etc.).

According to Haynes and Thompson (2000), the ATM clearly has both process and product innovation characteristics. As a process innovation, it substitutes the automated delivery of services for those previously offered at a bank counter. However, the ATM additionally offers services not previously available; for example 24 hours-a-day access, foreign currency provision abroad and cash provision in locations remote from bank branches. As a consequence the ATM is also a product innovation, with implications for consumer demand. For example, as Griliches (1994) points out, improved access generates unmeasured but presumably not unvalued time saving for the users.

Sharma (1991) lists the reasons of the introduction of ATMs by banks as follows: (1) to increase their share of the retail banking market and to attract new customers by offering more flexible and convenient services; (2) it was envisaged that these machines could perform many deposit, withdrawal and transfer operations at lower cost than human tellers. Further, they could act as surrogate branches and decrease the number of hours the regular branches needed to be open; (3) they could be used for marketing purposes to test the demand for services in a particular area before a regular branch was established. On the cost side, beside the expense of setting up and maintaining an ATM system (or obtaining access to one), the banks have to deal with problems of malfunction, fraud, robbery and vandalism (Baker and Brandel, 1988). According to Baker and Brandel (1988), ATM systems typically require high fixed costs. To a large extent such investment expenditure is a sunk

cost and hence irreversible; further these expenditures can be delayed allowing the firm to accumulate more information about costs, benefits and market conditions before committing resources.

Despite the widely recognition of the importance of ATM diffusion in financial economy, there are only six empirical studies in the literature. Frame and White (2004) sum up the probable reasons of such few studies in six categories: (1) The research and development tradition: Outside of finance much of the empirical testing has linked innovation with formal research and development efforts by companies. Financial services are not in this R&D tradition. (2) The Patent Count Tradition: Patents for financial products and services are not common, and financial services firms are unlikely to be boasting in advertisements about their patenting proclivities. (3) The Data: The data that are commonly used for research about financial services yield no directly useful information about financial innovation. (4) Summing Up: The data and research environments have not been conducive to empirical work on financial innovation. For a number of empirical financial innovation studies, the crucial data have come from special surveys as in this thesis.

Nevertheless, it is possible to state that among the empirical studies, ATM diffusion studies have the greatest share. They think that it is no surprise that ATMs have been prominent in diffusion studies, since the banks that install the ATMs represent narrowly defined enterprises for which there is extensive firm and market data availability. However, in Turkey there is no official source publishing the data concerning the ATM numbers of the banks. Almost none of the Turkish banks reveal the numbers of ATMs for claiming that giving information about the ATMs damages their security.

As cited in Frame and White (2004), Hannan and McDowell (1984) examine ATM diffusion in the United States over the 1971-79 period using data for almost 4 000 banking firms. The data set used in the study was gathered from the survey of banks use of ATMs during 1971-79. The authors find that- consistent with the Schumpeterian hypotheses- larger banks and those operating in more concentrated local banking markets registered a higher conditional probability of ATM adoption.

This study also finds that bank product mix, bank holding company affiliation, urban location, branch-banking restrictions, and the area wage rate were all positively related to ATM adoption. In a subsequent study, Hannan and McDowell (1987), while confirming their earlier results, also find that ATM adoption is positively related to a rival's adoption and that firms in less-concentrated markets react more strongly to rival precedence than do their counterparts in concentrated markets. However, despite their use of the sama data, the authors fail to include the product mix and location variables that were significant in their initial paper.

The data set used in Hannan and McDowell's studies have been used in two more studies.[10] This may be an indicator of the difficulty of gathering data in this field of research. Sinha and Chandrashekaran (1992) using the same data set find that a bank's growth, income and its presence in a unit banking or limited-branching sate have positive influences on its probability of adoption. They also concluded that a bank's income, its proportion of deposits that were in the form of demand deposits, its ownership by a bank holding company, and its presence in a unit banking or limited-branching state were positive influences on earlier adoption. Although they used the data set of Hannan and McDowell's, one of their findings differ from the findings of the former study. According to Sinha and Chandrashekaran (1992), after other influences mentioned above controlled, bank's size has a negative effect on earlier adoption. This conclusion is unique to this study.[11]

Another study using the same data set is by Saloner and Shephard (1995). They are also the only researchers explicitly to investigate network externalities. As Frame and White (2004) mention, they find that the expected time to adoption of ATMs declines (i.e., adoption speed increases) with both a bank's number of customer-users (as proxied by deposits) and its number of locations (branches). The

[10] Sinha and Murali Chandrashekaran (1992), Saloner and Shepherd (1995)

[11] "However, for calibration purposes Sinha and Chandrashekaran also estimate a standard single equation hazard model in which size has a negative effect on earlier adoption, which is contrary to every other ATM diffusion study, even those that use the Hannan-McDowell data set. Thus, the reason for their negative effect of size is somewhat of a mystery." (Frame and White, 2004)

deposits variable may just be indicating the effects of size (similar to its use in all of the other ATM studies), but it could also be indicating the presence of network externalities; the branches variable is more clearly an indicator of network effects. Also, a higher average wage rate in a banks geographic area tends to hasten the adoption of ATMs. For limited-branching states, market concentration is positively related to ATM adoption speed (consistent with Hannan and McDowell's [1984, 1987] findings), while depositor growth is negatively related. According to Saloner and Shephard (1995), in the case of ATM machines, the network effect emerges in the following way: if ATM's are largely available over geographically dispersed areas, the benefit from using an ATM will increase since customers will be able to access their bank accounts from any geographic location they want. This implies that the value of an ATM network increases with the number of available ATM locations, and the value of a bank's network to a customer will be determined in part by the final network size of the bank. As a result, assuming that a bank can extract part of the consumer surplus, a bank will adopt ATM more rapidly if it expects to have a larger number of ATM locations in equilibrium, which implies that its network will have more value for its consumers.

Ingham and Thompson (1993) investigating the adoption of ATM in the United Kingdom in their study, point out a positive relationship between the probability and timing of adoption and the institution size, advertising costs, and labor costs and a negative relationship with the number of retail outlets. Firm size plays a prominent role in rank models of diffusion and has traditionally been found to have a positive effect on the probability of adoption. Evidence provided by Humphrey (1994) suggests the existence of significant (positive) scale and scope economies for ATM technology. This suggests that adopting ATMs, *ceteris paribus*, is likely to be more profitable for relatively larger institutions. (Gaurlay and Pentecost, 2000)

The essence of the stock effects models (Reinganum, 1981a, 1981b, 1989; Quirmbach, 1986) is that benefits to the marginal adopter from acquisition decreases as the number of previous adopter's increases. As firms acquire new technology, their production costs fall. This leads to changes in the output of firms and the

industry, thereby affecting industry prices and the profitability of further adoption. Order effect models are similar to the rank effect models in that the gross returns to a firm adopting new technology depends upon its position in the order of adoption, with higher order adopting firms achieving a greater return than low-adopters. As noted by Baptista (2000), however, the stock and order effects models will have opposite effects on the probability of adoption. The stock effects focus on the equilibrium number of adopters and the subsequent lower profitability of adoption, whilst the order effects focus on the anticipation of subsequent adoptions. Hence, the stock effect has a negative effect on the probability of adoption, and the order effect a positive effect. (Gourlay and Pentecost, 2000)

Although Hannan and McDowell (1987) find a significant and positive relationship between the number of previous adopters at the state level (as a proxy for the stock effect) and the probability of ATM adoption in the US banking sector as discussed above, Gourlay and Pentecost (2000) state that empirical testing of stock and order effects has been predominately on the diffusion of technologies in the industrial sector.

Gourlay and Pentecost (2000) treated ATM technology as being embodied in a specific capital good supplied by a capital producing industry in their study. The empirical contribution of this paper has been to estimate a number of duration models for a panel data set of adoption histories in the UK financial sector. The methodology allowed for the explicit incorporation of time and time-varying covariates. The empirical results indicate that rank effects have played an extremely significant role in the diffusion of ATMs, thus supporting probit-type theoretical models. Institution size, growth in deposits and profitability were all found to have a positive and significant effect on the conditional probability of adoption. Moreover, the results suggest that early adoption of previous vintage technologies (resulting in learning-by-doing effects) play a significant role in fostering faster diffusion. Consequently, the former technology history of the firm affects current adoption decisions. No significant role was found, however, for the labor saving potential of ATMs. Reassuringly, the results were found to be robust across different specifications of the baseline hazard. There was no support given to the existence of

stock effects, although order effects entered the empirical model with the correct sign and was found to be statistically significant. The empirical results lend support to the existence of epidemic effects in the diffusion of ATMs and it was illustrated that this was not due to the potential problem of distinguishing between stock effects and the time-varying nature of the baseline hazard. It was further found that expectations formed on the number of adopters and the price of technology have a significant role to play in the diffusion process, although the real quality-adjusted price of technology fails to register a significant effect. The decision of whether or not to impose a structure on the baseline hazard does not appear to radically alter estimates and inferences. With these outputs, it can be concluded that this study is consistent with previous diffusion studies.

CHAPTER 3

TURKISH BANKING SYSTEM AND FINANCIAL INNOVATION

3.1 Turkish Banking System

Turkey has a deep-rooted banking tradition that goes back to the 19th century. During the last two or three decades, the banking sector has played a prominent role in the Turkish financial system, and has made considerable progress, aided to some extent by structural changes, towards making the Turkish economy more financially liberalized. In response to the restructuring of the Turkish economy and to the need to integrate Turkey into the modern world of finance, Turkish banks have made major changes both in their institutional structures, and in the quality of services and products they offer. (Erçel, 1999)

The most important feature of the Turkish banking system can be characterized by the very strong interrelationship between the state, the banking sector and the industrial and commercial conglomerates. This has been the legacy of the historical developments of the Turkish economy since the beginning of the Republican era in 1923. (Akçaoğlu, 1998)

As Isik and Hassan (2002) argued, in the early 1980s Turkey has began to follow financial liberalization policies and undergone a number of major policy changes in bank regulation. For example, elimination of controls on interest rates, a significant reduction in directed credit programs, and the relaxation of entry barriers into the banking systems have been the key elements of the banking related policy changes. Akçaoğlu (1998) emphasizes that although after 1980 the capital markets and non-bank financial institutions such as insurance companies have developed to some extent, the banking sector still keeps its dominant position. Turkish financial system is characterized by: (1) significantly strong networks linking the state to the banking sector and the banking sector to non-financial companies; and (2) the market is dominated by just a few banks.

Banks in the Turkish banking system can be classified under two main groups: (1) banks with the permission to collect deposits (commercial banks) and (2) banks that do not accept deposits (non-depository banks). These two groups can be divided into three sub-groups: (i) state-owned, (ii) privately owned, and (iii) foreign banks according to the source of their respective capitals. (Table 3.1)

Table 3. 1 Number of Banks

	2001	**2002**	**2003**	**2004**
Number of banks	**61**	**54**	**50**	**48**
Commercial banks	46	40	36	35
-State-owned	3	3	3	3
-Privately owned	22	20	18	18
-Banks in the Fund	6	2	2	1
-Foreign banks	15	15	13	13
Non-depository banks	15	14	14	13
-State-owned	3	3	3	3
-Privately owned	9	8	8	8
-Foreign banks	3	3	3	2

Source: BAT, 2005

The recent situations of the banks shown in the table 3.1 can be summarized as follows[12]: Commercial banks operate as universal banks offering a wide range of products and services using developing technology today. Besides traditional depository and lending services, they operate in the field of investment banking as well as engaging in capital market transactions. Considering the commercial banks group; state-owned banks have wide networks of branches throughout the country. Besides commercial banking transactions, they are specialized in the financing of agricultural sector and SMEs. (Table 3.2) Among privately owned banks there are large-scale commercial banks, which have nation-wide net works of branches and provide all kinds of banking services, and there are small-and middle-scale commercial banks with activities more concentrated in main populated cities and engaging more in wholesale banking. Foreign banks are divided into two groups; those have opened branch in Turkey and those are founded in Turkey. These banks are subject to the same regulations as the other commercial banks.

Table 3.2 Number of Branches

	2001	**2002**	**2003**	**2004**
Number of branches	**6,908**	**6,106**	**5,966**	**6,106**
Commercial banks	6,889	6,087	5,949	6,088
-State-owned	2,725	2,019	1,971	2,149
-Privately owned	3,523	3,659	3,594	3,729
-Banks in the Fund	408	203	175	1
-Foreign banks	233	206	209	209
Non-depository banks	19	19	17	18
-State-owned	4	4	4	4
-Privately owned	12	12	10	12
-Foreign banks	3	3	3	2

Source: BAT, 2005

[12] See The Banks Association of Turkey, 2005 "Financial Sector and Banking System in Turkey"

State-owned banks make up a large segment of the Turkish banking sector (about 42% of total deposits and some 20% of total loans). Though state banks have arguably a few strengths (such as the franchise with SMEs and farmers or loyal depositors), Steinherr, Tükel and Üçer (2004) claim that weaknesses such as infrastructure, staff quality and ability to compete with private banks in terms of service quality and innovation seem to overpower the strengths by far.[13]

Table 3-3 reveals information about the employees of the Turkish banking system according to the classification mentioned above.

Table 3.3 Number of Employees

	2001	**2002**	**2003**	**2004**
Number of employees	**137,495**	**123,271**	**123,249**	**127,163**
Commercial banks	132,274	118,329	118,607	122,630
-State-owned	56,108	40,158	37,994	39,467
-Privately owned	64,380	66,869	70,614	76,880
-Banks in the Fund	6,391	5,886	4,518	403
-Foreign banks	5,395	5,416	5,481	5,880
Non-depository banks	5,221	4,942	4,642	4,533
-State-owned	4,322	4,174	3,882	3,800
-Privately owned	822	691	683	681
-Foreign banks	77	77	77	52

Source: BAT, 2005

[13] In fact, McKinsey (2003) finds that state banks are a key drag on productivity in the sector (see p. 212).

The average number of people per bank in Turkey is approximately 1,500,000, that of people per branch is about 12,000, and per bank employee is 565. The average amount of assets per capita is around USD 3,200.

According to Delikanlı (2001), the dominance of commercial banks in Turkish Banking System has been continuing despite a series of financial liberalization measures that were introduced during the 80s although the deregulations considerably affected the banking conditions in Turkey. As a result of the financial liberalization, many foreign banks entered into Turkish banking system and commercial banking market structure changed from tight oligopoly to loose oligopoly.[14] After 1998, degree of oligopolistic competition in commercial banking started to increase again.

Turkish banking system is already open to the outside world. As a result of the greater freedom of that comes with market-oriented policies and a liberalized financial environment, many entrepreneurs, foreign as well as domestic, have been attracted by the potentially profitable Turkish banking system. (Erçel, 1999) Foreign banks are formally welcomed and there are no capital controls. The fact that foreign banks are not assuming a very important role in Turkish banking system is less the result of a "protective policy" than the result of strong competition that makes it difficult for foreign banks to capture easily market shares.

Denizer (1997), on the other hand examined the impact of the new entries following the deregulation on the competition of the banking market in Turkey. He concluded that regulatory and non-regulatory barriers should be removed to promote competition because the entry of small-scale firms alone seems not to have succeeded to increase the competition in banking.

[14]In Turkey there are a large number of licensed, foreign-owned banks: 13 of the 37 commercial banks are either fully-owned subsidiaries or branches of foreign banks. Their operations are, however, mostly limited to a single branch and to corporate banking. Only three of them – Kocbank, (where Credito Italiano has a 50% stake), HSBC and Citibank – have a multi-branch retail presence. A fourth one, Bank Europa (a subsidiary of Banco Comercial Portugues), has started to build a network. (Bruges European Economic Policy Briefings, 2004)

Some important notes can be concluded from the annual reports of the Bank Association of Turkey about the present structure of the Turkish Banking System. By early 2004, 21 domestic private banks had been taken over (19 of these between the onset of the disinflation program in late 1999 and mid-2003) and the number of domestic private commercial banks in the system had declined to 18. The capital base of the remaining private banks had largely been replenished, and the state banks had been operationally restructured under new management and ceased to be a major source of 'liquidity risk' for the markets. With 21 private banks having been taken over or outright dissolved by the SDIF, (Savings and Deposits Insurance Fund) the number of private banks is now much reduced and it is hard to talk of the Turkish Banking System as being 'over-banked'. All liabilities of these banks were taken over by the Savings and Deposits Insurance Fund. On the other hand, the banking licenses of 8 banks were terminated and liquidated. In the same period, 11 bank mergers took place in the banking sector including the buying of some of the banks under the Savings and Deposits Insurance Fund management.

Compared to the size of the economy, the Turkish banking system is still relatively small: total assets stood at some 60% of GDP at the end of 2003, which is less than EU averages. (Steinherr, Tükel and Üçer, 2004) Meanwhile, total assets of *private* banks only stood at 40% of GDP. As for concentration, the industry is dominated by seven large banks (three state-owned banks and four private ones), which account for 75% of the sector. The share of the five largest banks – a common indicator of concentration – stands at some 60% (as of September, 2003), which is higher than the EU average of 50% and lower than the average of newly acceded EU countries of 75% (Pazarbasioğlu, 2003). This is a fair ratio in that the level of competition in the sector is sufficiently high to prevent the development of a monopolistic service provider with a price-setting capability, but also, the sector is not too fragmented to preclude reaping the benefit of economies of scale. According to BAT reports, in the last years, the shares of the first five and the first ten banks increased considerably. The share of the five largest banks increased to 60 percent in 2003 as mentioned above from 46 percent in 1999. And the share of the first ten

banks increased from 68 percent to 82 percent in the same period. The similar trend was observed in total deposits and loans as well.

3.2 Financial Innovation in the Turkish Banking System

Akçaoğlu, (1998) classifies the determinants of financial innovation in Turkish banking at two different levels as (1) the macroeconomic level with the factors leading to financial innovation are characterized in terms of the interaction of the financial sector and the aggregate economy, and (2) the microeconomic level with the factors leading to financial innovation are described in terms of an individual financial institution. There is general consensus in the literature that financial innovation has taken place in financial markets in developed countries due to macroeconomic changes, changes in regulations, increasing competitive pressures, and technological developments. While macroeconomic level explains these forces, the microeconomic level explains how they have induced financial institutions to create new products or processes. After analyzing the macroeconomic and microeconomic determinants of financial innovation, Akçaoğlu concluded that before 1980, neither macroeconomic features of the financial system nor microeconomic conditions of the aggregate economy were suitable to produce financial innovation as it was in developed countries. Financial repression and the protectionist nature of general economic policy had created an environment where the conditions for financial innovation did not quite exist.

The situation changed after 1980 as a consequence of the stabilization program. Financial liberalization has been a component of the program. New entries into the banking sector have increased competition. The banks have realized the increasing importance of customers' portfolio requirements. In other words, determinants of financial innovation began to appear in the Turkish financial system after the 1980 stabilization program.

By the end of 1980s, foreign exchange deposits started to surpass the volume of the TL denominated deposits in the sector as pointed out by Işık, Gündüz, Kılıç, Uysal (2002). During this period, Turkish banks also took an interest in doing

business abroad whether by purchasing banks in foreign countries or by opening branches and representative offices, and began increasingly operating in international markets dealing with extensive off-balance sheet activities such as swaps and forward agreements. In this new business conditions, traditional banks have found themselves in a stern competition not only with recently opened domestic banks but also with foreign banks. Celasun et al. (1999) note, "The arrival of foreign banks raised the overall standards in the banking sector, especially in terms of human capital, and information technology, which was low prior to reforms". Işık, Gündüz, Kılıç, Uysal (2002) claim that although domestic firms were able to capture productivity changes which arose from the adoption of new technology and practices introduced by the foreign banks, Turkish banking sector could benefit more from the presence of foreign banks if foreign banks' activities were not restricted.

During the last two decades, the Turkish banking sector has achieved significant progress in implementing structural changes towards a more financially liberalized Turkish economy. During the last two decades combined with the effects of restructuring Turkish economy and the efforts for the integration to the modern world of finance, the Turkish banks achieved important changes in their institutional structures on the one hand, and in the quality of services and products on the other hand.

The increase in the number of banks and qualified personnel, in turn, enhanced competition and contributed to broad utilization of new financial instruments and techniques. Intense competition and a desire to integrate with global financial markets has driven banks to improve the quality and the variety of services through information technology and international payment systems. According to Işık, Gündüz, Kılıç, Uysal (2002) those established banks have concentrated on computerization and automation projects to level with the state of art technology of the new foreign and domestic banks. In addition, they have undertaken continuous restructuring and downsizing projects to reduce the size of their branch networks and operations in rural and unprofitable regions.

Turkish banking system uses advanced information technology. Such technology-intensive services as ATM (Automatic Teller Machine), POS (Point of Sale terminal), telephone banking and internet banking are available. Having an important place in the vision of banks, electronic banking activities have been growing rapidly for the purpose of improving quality of services and saving costs. Within this context, the banks put new services into practice such as “Call Center ”, “Internet Banking ”, and “Management of Customer Relations ”. Besides customer-oriented procedures of banks, information technology has been used extensively in the internal operations of banks as well.

In Turkey the adoption of ATM was started by T. İş Bankası in December 1987. The number of ATMs increased rapidly after 1987 in Turkey especially in the more developed provinces. The automated teller machines in Turkey have the similar technological qualities compared with the automated teller machines in Europe and in the United States. Moreover, the cash dispensers that are still used in some countries have never been used in Turkey. Instead the recent technology used in automated teller machines has been adopted. (Aksoy, 1998)

As of the end of 2004 the number of credit cards in Turkey is 26,681,128. The number of ATMs and POS machines reached 13,544 and 912,118 respectively. (Table 3.4, 3.5 and 3.6) In addition to their own operations, banks in Turkey engage in technology- aided practices in interbank transactions as well. In this context, the electronic cheque exchange system, the direct indebtedness system and the EFT system have an important place in interbank transactions. Furthermore, the SWIFT system which is an important international payment system, has also been used by the banks for many years. (BAT, 2005)

Table 3.4 Number of Credit Cards

	2001	2002	2003	2004
Visa	7.829.906	7.947.302	9.572.460	13.202.147
MasterCard	6.102.024	7.718.049	10.255.667	13.450.664
Others	64.876	40.019	35.040	28.317
Total	**13.996.806**	**15.705.370**	**19.863.167**	**26.681.128**

Source: Interbank Card Centre, 2005

Table 3.5 Number of ATMs and POS Terminals

	2001	2002	2003	2004
ATM	12.127	12.069	12.857	13.544
POS	364.636	495.718	662.429	912.118

Source: Interbank Card Centre, 2005

Table 3.6 Number of Debit Cards

	2001	2002	2003	2004
Electron (Visa)	6.721.452	7.801.830	9.424.197	11.942.762
Plus (Visa)	57.672	50.766	45.069	39.915
Electron and Plus (Visa)	2.711.896	3.080.776	3.613.896	3.058.946
Cirrus and Maestro (MasterCard)	14.628.251	16.966.124	20.601.196	24.506.797
Private Label	7.537.673	7.157.812	5.879.099	3.536.574
Total	**31.656.944**	**35.057.308**	**39.563.457**	**43.084.994**

Source: Interbank Card Centre, 2005

3.3 The Cases of T. İş Bankası and T.C. Ziraat Bankası

3.3.1 T. İş Bankası

Mr. Celal Bayar, the minister of economic affairs in 1924, was personally called by Mustafa Kemal Atatürk, the founder of modern Turkey, to discuss the setting up of T. İş Bankası. Atatürk provided the sum of TL 250,000 as the only paid

up capital of the bank. The opening date of 26th August of 1924 commemorates the anniversary date of the independence victory. (Kaplan, 1997)

Ökçün (1971) states that T. İş Bankası was opened with a nominal capital of TL 1.000.000, one quarter paid and two branches in Ankara and İstanbul. At the end of 1924, T. İş Bankası had recorded a deposit total of TL 2.469.235. Its capital was also paid in full towards the end of 1925.

The philosophy of the founders of T. İş Bankası clearly was a residual of the strategy for the economic development of the country. (Bayar, 1938):

- To demonstrate that Turkish financed and managed banks are effective.
- To increase national savings.
- To promote the industrialization and development of the country either by actively investing in commercial and industrial enterprises or acting as an intermediary for their establishment.
- To supply any sort of machinery, equipment or to establish firms in order to produce that equipment.
- To engage in any type of banking transactions. However, it cannot be involved in real estate buying and selling and con not make mortgage loans but may take them as collateral.

With a strong presence of state interest, T. İş Bankası can be classified as a "quasi-private" rather than a full private bank. It is not regarded as a private bank due to the fact that its shares are not fully dispersed among the members of the public with the exception of 19 percent of its shares traded in the İstanbul Stock Exchange market. Since its foundation, T. İş Bankası played a significant role in the development of certain sectors of the economy targeting the development of certain primary industries and economically backward areas of the country. As cited in Kaplan (1997), T. İş Bankası provided 68% of the capital of the first sugar plant in 1926, and subsequently financed 13 more plants. Similarly it established glass manufacturing, the largest Turkish glass manufacturer. T. İş Bankası was also the first enterprise in the republic to have a joint venture with foreign capital. Lately, there was a refocus on the core business of commercial banking with three major

investments made in 1980s in the areas of “leasing”, “insurance” and “glass”. Those investments also represented new product areas that were seen as a necessary feature of an innovatory organization. In Turkey the adoption of ATM was also started by T. İş Bankası in December 1987.

Kaplan (1997) pointed out that T. İş Bankası, is keen on the educational qualifications of its personnel. In this regard, promotions are conducted based on “examinations” and the “seniority” gained at different positions over years. The established tradition of the bank was to recruit “from within” for the upper levels of hierarchy. These points imply that T. İş Bankası is open to change and has undertaken a number of new procedures as a result of the changes occurring in the industry. In responding to those environmental changes, T. İş Bankası appears to be keen on its institutional control practices and would not readily allow its procedures to be altered. This, however, might imply a conscious attempt and a reliance on its tight controls for a high organizational performance.

3.3.2 T. C. Ziraat Bankası

Mithat Paşa, appointed as governor of Niş in 1861 established a local “cash savings scheme” for the credit needs of farmers, later known as “Memleket Sandığı”. In 1883 this saving scheme was reorganized under the name of Menafi Sandıkları and a secure inflow of one percent of the state income tax-known as aşar-collected from farmers, was made available as bank capital. (Aral, 1964)

According to Gökbilgin (1964) the intention was to create the procedures for a centralized funds administration by the Topkapı Palace in order to finance its credit needs. As a consequence, the bank was founded under its present name on the 15th of August 1888. Although there is a recording of an initial nominal capital of 2 million liras, only 20 percent of it was fully paid. It is estimated that the bank had about 250 branches at that time.

The arrival of the republic in 1923 caused a dramatic change in the structure of the organization. Although the main purpose of its existence, increasing the wealth of farmers, was kept untouched, its services were extended to include every type of banking transactions. Kaplan (1997) points out that the budget law which was promulgated on the 19 of March 1924, established T. C. Ziraat Bankası as a mutual corporation with its owners being the farmers of the country. But in practice no shares were sold to farmers and it remained as a state organization. Re-shuffling the organization in 1937, two alternatives were considered: The first full privatization was rejected and T. C. Ziraat Bankası retained its status as a state credit organization. In relation to the cooperatives belonging to the bank, it was accepted by Parliament that T. C. Ziraat Bankası was the parent bank for establishing and developing agricultural co-operatives in the country.

T. C. Ziraat Bankası has the highest number of branches all over Turkey. In addition to this, Kaplan (1997) states that when he was searching the branches of Turkish banks during his study about the openness to change and budgetary control, the branches of T. C. Ziraat Bankası were relatively bigger in size, and in the amount of transactions that the other branches in small cities. Kaplan concluded that although T. C. Ziraat Bankası responded to its environment by installing some changes, it would be difficult to establish a general direct association with its managerial and financial performances. On the other hand from the limited information reported in his case study, it can be noted that the relatively high levels of "centralization", "job related tension" and "the influence of general manager" would hinder the inclination to change for the overall organization.

According to the regular report of the European Commission (2001) the establishment of the Banking Surveillance and Regulatory Agency (BRSA) in 2000 has significantly improved banking surveillance and the adherence to prudential rules. However, the consolidation process is far from being completed. So far, only the smallest state-controlled bank, *Emlak Bankasi,* has been dissolved. The two largest state banks, the agricultural bank, *Ziraat bankas*i, and a bank providing credits to SME's, *Halk bankas*i, have been put under joint professional management and will be prepared for privatization.

Steinherr, Tükel, Üçer (2004) evaluates the state banks as the the main contributor to the latest crisis. Subsequent to the crisis, the state banks (Ziraat, Halk and Emlak) have gone through successful operational restructuring as part of the banking sector reform programme (e.g., the merger of Emlak with Ziraat and the appointment of a joint management board; the downsizing of branches and employment; and the passing of legislation preventing 'duty loses'). But now the next phase of reform is marred by uncertainties, and the government (at least until now) has provided mixed signals regarding its intentions. One reason could be that Turkey privatized a number of state banks in the mid-1990s, but experience has not been particularly encouraging as most of these banks were among the first to be taken over by the SDIF during the crises years (e.g., Sümerbank).

Consequently, there is currently discussion on the possible strategy for state banks and the government's intentions. Banking sources (mainly representing private banks) sound pessimistic that state banks can be privatized – and they propose instead that state banks be reduced in size and stick to their original public functions. This strategy, in their view, would prevent the state banks from distorting the market. In order to continue with their function of agricultural- and SME-lending, they need not continue as universal banks with a deposit-taking license. The counter argument to privatization, expressed by the current management of Ziraat and Halk, asserts that no potential buyers would be interested in the state banks as they are and therefore they must first improve their results as commercial banks and then be put up for sale. The recent forays of these banks into consumer products, especially into the credit card business should be interpreted in this context. (Steinherr, Tükel, Üçer, 2004)

Financial data on T. C. Ziraat Bankası and T. İş Bankası are given below. The indicators of the number of ATMs that this paper focuses on are given in separate tables and figures.

Table 3.7 Financial Data on T. İş Bankası and T. C. Ziraat Bankası, September 2004

r: the rank of the bank in the Turkish banking system in the field that the indicator concerns

	T. İş Bankası	**T. C. Ziraat Bankası**
Total Assets (YTL Thousand)	37.491.937 (r: 1)	54.966.148 (r: 2)
Total Loans (YTL Thousand)	11.894.735 (r: 1)	7.387.992 (r: 5)
Total Deposits (YTL Thousand)	23.106.317 (r: 2)	43.500.413 (r:1)
Total Equity (YTL Thousand)	7.196.399 (r: 1)	4.557.526 (r: 3)
Paid in Capital (YTL Thousand)	1.640.757 (r: 2)	2.221.978 (r: 1)
Net Income/Loss (YTL Thousand)	538.382 (r: 3)	1.250.199 (r: 1)
Off Balance Sheet Commit. (YTL Thousand)	50.723.952 (r: 3)	22.752.073 (r: 7)
Number of Branch	848 (r: 2)	1.146 (r: 1)
Number of Employees	15.802 (r: 2)	21.763 (r: 1)

Source: BAT , 2005

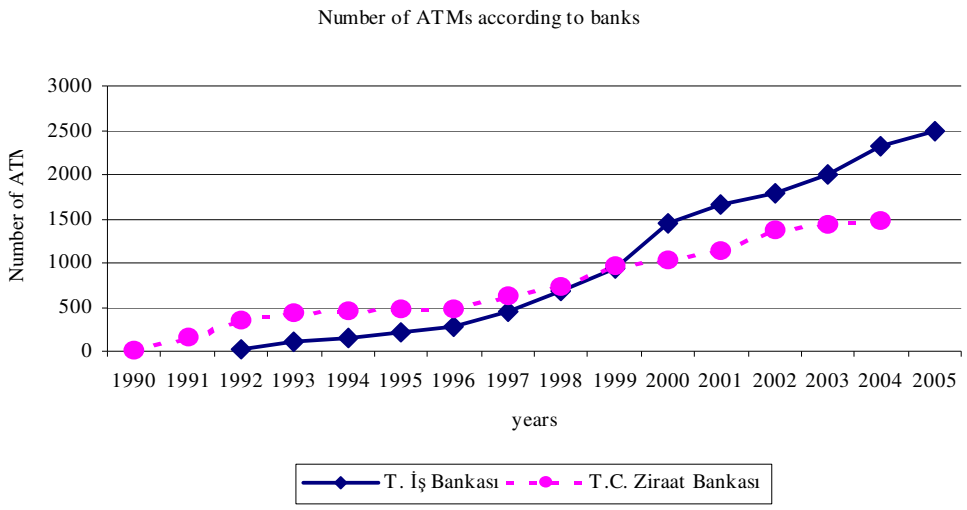

Figure 3.1 Number of ATMs, Comparison[15]

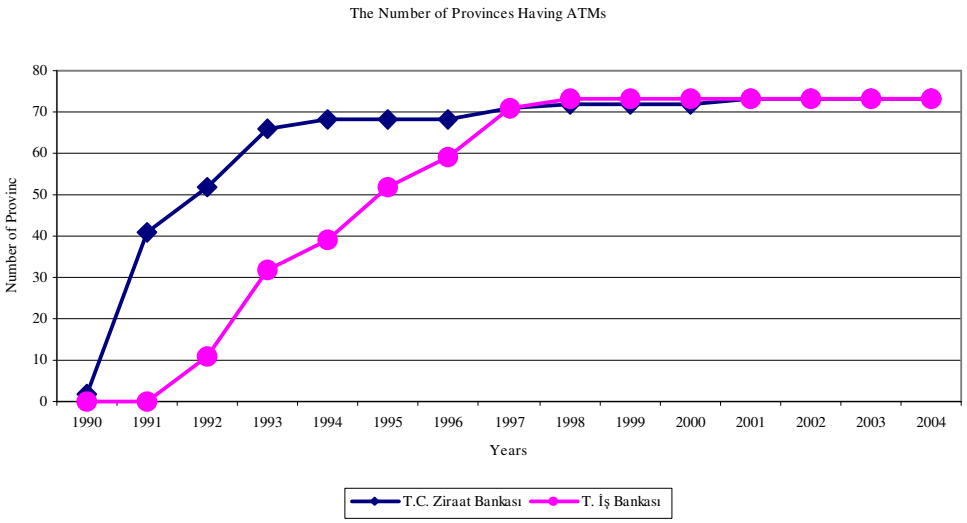

Figure 3.2 Number of Provinces Having ATM, Comparison

[15] The data used for the figures are obtained by research in the archives of the two banks, and became available after calculation.

CHAPTER 4

DATA, MODEL AND ESTIMATION RESULTS

This research is based on dynamic panel data. One group of data covers information for each of the 81 provinces of Turkey between the years 1990 and 2004. I tried to collect data for fifteen years. But in some cases the research depends on data for less than fifteen years because of the insufficient data problem.

Not to lead a measurement problem, the districts that became provinces after 1990 have been treated as they remained districts. Since data have not been collected for the new provinces until the date they became provinces, I sum up the data set of the province and the data set of the province's old district/districts for the sake of the study.

The districts that became provinces after 1990 are Ardahan, Bartın, Düzce, Iğdır, Karabük, Kilis, Osmaniye and Yalova. Thus, I added the data of Ardahan and Iğdır to Kars, Bartın and Karabük to Zonguldak, Yalova to İzmit, Kilis to Gaziantep, Osmaniye to Adana and Düzce to Bolu. After organizing the data set, the list of provinces used is: Adana, Adıyaman, Afyon, Ağrı, Aksaray, Amasya, Ankara, Antalya, Artvin, Aydın, Balıkesir, Batman, Bayburt, Bilecik, Bingöl, Bitlis, Bolu, Burdur, Bursa, Çanakkale, Çankırı, Çorum, Denizli, Diyarbakır, Edirne, Elazığ, Erzincan, Erzurum, Eskişehir, Gaziantep, Giresun, Gümüşhane, Hakkari, Hatay, Isparta, İçel, İstanbul, İzmir, Kahramanmaraş, Karaman, Kars, Kastamonu, Kayseri, Kırıkkale, Kırklareli, Kırşehir, Kocaeli, Konya, Kütahya, Malatya, Manisa, Mardin, Muğla, Muş, Nevşehir, Niğde, Ordu, Rize, Sakarya, Samsun, Siirt, Sinop, Sivas, Şanlıurfa, Şırnak, Tekirdağ, Tokat, Trabzon, Tunceli, Uşak, Van, Yozgat and

Zonguldak. As a result, this thesis includes 73 provinces instead of 81 as cross-section identifiers.

I was given access to the archives of T.C. Ziraat Bankası and T. İş Bankası to collect data about the number of ATMs of the banks. The other banks had to be deleted from the variable list because of insufficient data, as their archives were not accessible because of secrecy as they express. To be given access to the archives of T.C. Ziraat Bankası and T. İş Bankası, I had a chance to use the information of these two banks. These two banks are chosen for this study not only because I was given access to their archives, but also T.C. Ziraat Bankası is the first and T. İş Bankası is the second biggest banking firms of the Turkish banking system according to their assets. Furthermore, these two banks are ranked as the two biggest banks of the Turkish banking system in many fields according to financial data published by The Banks Association of Turkey.

Data of the banks except the ATMs were collected from The Banks Association of Turkey while the remaining missing data were furnished by the Central Bank of the Republic of Turkey, State Institute of Statistics, State Planning Organization and Interbank Card Centre.

The criteria for selecting the information were:

(1) the information must contain data according to provinces of Turkey for multiple years of observation
(2) the information must contain data from official sources relevant for banks.

The only database that met these criteria was the database of The Banks Association of Turkey. I found, however, that this database was not enough for the research. I tried to combine the accessible data with the database of The Bank Association of Turkey.

4.1 Notes About Data

The two equations estimated for this study are as follows:

$$\textbf{Log } (N_{i,t}^{\ is} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ is} + 1) + \beta_2 \log (N_{i,t-1}^{\ iz} + 1) + \beta_3 \log (B_{i,t} + 1) + \beta_4 \log (P_{i,t}) + \beta_5 \ (Year_{i,t})$$

$$\textbf{Log } (N_{i,t}^{\ iz} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ iz} + 1) + \beta_2 \log (N_{i,t-1}^{\ is} + 1) + \beta_3 \log (B_{i,t} + 1) + \beta_4 \log (P_{i,t}) + \beta_5 \ (Year_{i,t})$$

Where,

NIS t: The number of ATMs of T. İş Bankası in period t (according to provinces)

NIS (-1): The number of ATMs of T. İş Bankası in period t-1 (according to provinces)

NIZ t: The number of ATMs of T. C. Ziraat Bankası in period t (according to provinces)

NIZ (-1): The number of ATMs of T. C. Ziraat Bankası in period t-1 (according to provinces)

B: Total number of branches of the banks in the Turkish Banking System (according to provinces)

P: Population (according to provinces)

YEAR: Time variable

4.1.1 Annual Data

The observation on the number of employees in the banking sector includes the years between 1990 and 2002. A decrease was observed in the total number of employees of the banking sector from 1990 to 1994. Between 1995 and 2000, the total number of employees of the banking sector increased each year. In 1997, the employee number nearly reached to the level of 1990. However, this increase turned

to be a deep decrease in 2001, from 170.401 employees to 137.495 employees. The decrease continued in 2002, too. In 2002 the total number of employees of the banking sector was 123.271 and this number is nearly 20.000 employee less that the level in 1990. Between 1990 and 2002 the highest employee was observed in 1999 whereas the least in 2002, even less than the initial year of the research which is 1990.

A decrease was observed in the number of employees of T. İş Bankası from 1990 to the end of 1996. A slight increase occurred in 1997. In 1998 a decrease was observed. In 1999 and 2000 an increase occurred. In 2001 and 2002 the number of employees of T. İş Bankası decreased. Among the observation years, the number of employees was highest in 1990 and least in 1996.

The number of employees of T.C. Ziraat Bankası decreased from 1990 to the end of 1997 each year. Slight increases were observed for the years 1998 and 1999. After 1999, the employee number decreased each year. The highest number of employees was observed in 1990 and the least in 2002.

The observation on the number of branches of T. İş Bankası includes the years between 1991 and 2003. T. İş Bankası is one of the two banks that have the largest number of branches all over Turkey. In 1991, the number of branches was 900. A decrease occurred until 1994. An increase followed the decrease until the end of 2000. In 2003 the number of branches was observed as 844 with an increase after two years of decrease. The maximum number observed belongs to 1991 and the minimum to 1993. The maximum decrease occurred in 1992 (-57). The maximum increase occurred in 1998 (15).

The largest number of branches all over Turkey belongs to T.C. Ziraat Bankası. The number of branches almost did not change until 1994. After a decrease in 1994, the number of branches increased until the end of 1999. Between 2000 and 2003 the only increase was observed in 2001. The maximum number observed belongs to 2001 and the minimum to 2003. The maximum decrease occurred in 2002 (-340). The maximum increase occurred in 2001 (201).

The observation on the total number of branches covers the years between 1991-2003. The total number of bank branches was 6.477 in 1991, and 5.966 in 2003. Decreases occurred in 1992, 1994 and continuous decreases were observed after 2000. The maximum branch number was reported as 7.837 and this number belongs to 2000. The least number of branches was observed as 5.966 in 2003. The total decrease was observed in 2001 (-929). The maximum increase was observed in 1998 (551).

Another data used in this study is CPI (1987=100) was 454,47 in 1990 and 402.783,06 in 2004. The maximum increase in CPI (1987=100) occurred in 2002 (902,79%) and the minimum increase in 2004 (375,04).

4.1.2 Data for Provinces

The observation period is 1992-2005 for the number of ATMs of T. İş Bankası. The ATM number of T. İş Bankası increased or stayed at the same level for all the provinces of Turkey. In less developed or small provinces, the change in the number of ATM is not very obvious. But in developed provinces it can be easily observed that, the maximum increases occurred in 2000. With a calculation such as: (the ATM number in 2005-the ATM number in 1992)/100, the maximum results were obtained for İstanbul (4,66), for Ankara (3,14) and for İzmir (2,25). With the same calculation the minimum results obtained were for Kilis (0,01) and for Iğdır (0,02).

The observation period for the number of ATMs of T. C. Ziraat Bankası is between 1991-2004. The ATM number of T. İş Bankası increased or stayed at the same level for all the provinces of Turkey. The result concluded for T. İş Bankası that although in less developed or small provinces the change in the number of ATM is not very obvious, in developed provinces it can be easily observed that the maximum increases occurred in 2000, can be concluded for T.C. Ziraat Bankası, too. The result of the formula which is (the ATM number in 2004-the ATM number

in 1991)/100 revealed that the maximum increases were in İstanbul (1,75), Ankara (1,72) and in İzmir (1,02) whereas the minimum increases were in Bayburt (0,01), Hakkari (0,02) and in Kilis (0,02).

The data on total deposit (billion TL) /CPI are for the years between 1990 and 2003. The data were not proper to make generalizations about all the provinces of Turkey. With an overgeneralization, the deposits decreased in 2000 in most of the provinces. The result of the formula, (the value of deposit/CPI in 2003 – the value of deposit/CPI in 1990)/100 showed that the maximum results were for İstanbul (1,0390), for Ankara (0,3251) and for İzmir (0,1156). With the same formula the minimum results were for Kırıkkale (-0,0017), for Bayburt (-0,0003) and for Bolu (0,0000).

The total credit (billion TL) /CPI data covers the years between 1990-2003. An obvious decrease in credit/CPI was observed in most of the provinces in 2001. Using the formula, (the value of credit/CPI in 2003 – the value of credit/CPI in 1990)/100 it can be concluded that the maximum results are for İstanbul (0,2722), for Kocaeli (0,0467) and for Denizli (0,0073) and the minimum ones are for Ankara (-0,2149), for İzmir (-0,0893) and for Adana (-0,0602).

The observation period is between 1991 and 2003 for the information concerning the total number of bank branches. In most of the provinces it is impossible to observe a steady increase in the number of bank branches. The deep decrease in the number of branches in 2001 and 2002 is common for all of the provinces. 2001 and 2002 are the years in which the deepest decreases occurred in most of the provinces. Also, 2001, 2002 and 2003 ended with either a decrease in the number of bank branches or with no change.

The data on population is drawn from the census in 1990 and the census in 2000 for each of the provinces. According to this information three provinces that had the highest population in 1990 were as follows: İstanbul (7.195.773), Ankara (3.236.378), İzmir (2.694.770). Three provinces that had the least population in 1990 were, Bayburt (107.330), Kilis (130.198) and Tunceli (133.584). In 2000 the

provinces with the highest populations did nor change: İstanbul (10.018.735), Ankara (4.007.860), İzmir (3.370.866) whereas the provinces with the least populations occurred to be Tunceli (93.584), Bayburt (97.358), Kilis (114.724). Data were calculated to reveal the percent increase in the population comparing the population in 1990 and in 2000. According to this calculation, the population increased most in Antalya (41,79%), in Şanlıurfa (36,55%) and in İstanbul (33,09%). The population decreased most in Tunceli (-35,58), in Ardahan (-20,22) and in Sinop (-16,16).

Table 4.1 reveals the descriptive statistics of the key variables used in this study.

Table 4.1 Descriptive Statistics Table

	NIS	NIZ	B	P	YEAR
Mean	11.04110	10.67123	90.80023	327.8901	1997.500
Median	4.000000	6.000000	45.50000	329.2072	1997.500
Maximum	347.0000	179.0000	2214.000	841.2103	2003.000
Minimum	0.000000	0.000000	7.000000	43.88117	1992.000
Std. Dev.	28.15517	18.96587	215.9272	198.6563	3.454025
Sum	9672.000	9348.000	79541.00	287231.7	1749810.
Sum Sq. Dev.	693624.5	314741.3	40796486	34531280	10439.00
Observations	876	876	876	876	876

Data set examines the situations of 73 provinces. Broadly speaking, when the total values for the variables are taken into account, the number of ATMs of T.C. Ziraat Bankası is more than the number of ATMs of T. İş Bankası until 1999. This is directly related with the number of branches. Because when the bank establishes a branch, it establishes an ATM at the same time.

According to the regular report of the European Commission (2001) the establishment of the Banking Surveillance and Regulatory Agency (BRSA) in 2000 has significantly improved banking surveillance and the adherence to prudential rules. Subsequent to the crisis, the state banks (Ziraat, Halk and Emlak) have gone through successful operational restructuring as part of the banking sector reform programme (e.g., the merger of Emlak with Ziraat and the appointment of a joint management board; the downsizing of branches and employment; and the passing of legislation preventing 'duty loses').

During 2000, increasing tensions in the financial markets revealed major systemic weaknesses. Profitability declined as a result of the December 1999 programme's success in reducing interest rates and public-sector borrowing requirements. Unexpected liquidity bottlenecks in November 2000 and February 2001 drove these overexposed banks close to bankruptcy. Profitability of the banking sector improved after the 2001 crisis. Since autumn 2002, domestic currency lending spreads have remained at around 11%, while foreign exchange lending spreads have declined from 4.7% in September 2002 to 3.6% in April 2003.[16]

The number of branches and the number of banking sector employees decreased as a result of the tension in the financial market. The decrease is more obvious in 2000, 2001 and 2002. Although the number of ATMs of T. İş Bankası did not decline, T.C. Ziraat Bankası decreased its ATMs in some cities as a part of the banking sector reform programme that includes the merger of Emlak Bankası with T.C. Ziraat Bankası.

In the cities with more population, the number of ATMs of each of the banks is higher. It is also obvious that, the changes in the Turkish economy did not affect the number of ATMs in the provinces with less population as much as they affected the number of ATMs in the provinces with more population.

[16] Steinherr, A. , Tükel, A. and Üçer, M. 2004. "The Turkish Banking Sector Challenges and Outlook in Transition to EU Membership", BEEP briefing no. 9.

4.2 Estimation

The two equations that this study tries to estimate are as follows:

$$\textbf{Log } (N_{i,t}^{\ \textbf{is}} \textbf{ +1}) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ is} +1) + \beta_2 \log (N_{i,t-1}^{\ iz} +1) + \beta_3 \log (B_{i,t} +1) + \beta_4 \log (P_{i,t}) + \beta_5 \ (Year_{i,t})$$

$$\textbf{Log } (N_{i,t}^{\ \textbf{iz}} \textbf{ +1}) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ iz} +1) + \beta_2 \log (N_{i,t-1}^{\ is} +1) + \beta_3 \log (B_{i,t} +1) + \beta_4 \log (P_{i,t}) + \beta_5 \ (Year_{i,t})$$

Where, **i** indicates the province and **t** indicates the year. $\mathbf{N}^{\mathbf{is}}$ is used for the number of ATMs of T. İş Bankası and $\mathbf{N}^{\mathbf{iz}}$ for the number of ATMs of T. C. Ziraat Bankası. **NIS (-1)** is used for the number of ATMs of T. İş Bankası in period t-1 (according to provinces) and **NIZ (-1)** is used for the number of ATMs of T. C. Ziraat Bankası in period t-1 (according to provinces). **B** shows the total number of branches of the banks in the Turkish Banking System (according to provinces). **P** shows the population (according to provinces). Finally, **YEAR** is used as time variable.

Before conducting the Hausman (1978) specification test, the estimation results for both “fixed effects” and for “random effects” for both of the banks are shown in the tables below.

Table 4.2 Fixed Effects for T. İş Bankası

Dependent Variable: LOG(NIS+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 09:34
Sample (adjusted): 1994 2003
Cross-sections included: 73
Total panel (balanced) observations: 730
Identity instrument weighting matrix
Instrument list: C LOG(NIS(-2)+1) LOG(NIZ(-1)+1) LOG(P) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-233.2167	26.61339	-8.763134	0.0000
LOG(NIS(-1)+1)	0.432133	0.044345	9.744904	0.0000
LOG(NIZ(-1)+1)	-0.050013	0.042456	-1.177988	0.2392
LOG(P)	0.266877	0.035726	7.470064	0.0000
LOG(B+1)	0.332760	0.103526	3.214275	0.0014
YEAR	0.115909	0.013312	8.706838	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.959205	Mean dependent var	1.888538
Adjusted R-squared	0.954388	S.D. dependent var	1.126463
S.E. of regression	0.240580	Sum squared resid	37.73683
Durbin-Watson stat	1.509344	J-statistic	9.17E-06
Instrument rank	78.00000		

Table 4.3 Random Effects for T. İş Bankası

Dependent Variable: LOG(NIS+1)
Method: Panel GMM EGLS (Cross-section random effects)
Date: 06/22/05 Time: 09:56
Sample (adjusted): 1994 2003
Cross-sections included: 73
Total panel (balanced) observations: 730
Identity instrument weighting matrix
Swamy and Arora estimator of component variances
Instrument list: C LOG(NIS(-2)+1) LOG(NIZ(-1)+1) LOG(P) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-87.69741	18.29284	-4.794085	0.0000
LOG(NIS(-1)+1)	0.705022	0.025244	27.92852	0.0000
LOG(NIZ(-1)+1)	-0.030970	0.025308	-1.223738	0.2214
LOG(P)	0.231955	0.028213	8.221636	0.0000
LOG(B+1)	0.288516	0.029981	9.623135	0.0000
YEAR	0.043036	0.009167	4.694885	0.0000

Effects Specification

Cross-section random S.D. / Rho	0.000000	0.0000
Idiosyncratic random S.D. / Rho	0.240267	1.0000

Weighted Statistics

R-squared	0.955199	Mean dependent var	1.888538
Adjusted R-squared	0.954890	S.D. dependent var	1.126463
S.E. of regression	0.239251	Sum squared resid	41.44266
Durbin-Watson stat	1.739981	J-statistic	0.000365
Instrument rank	6.000000		

Unweighted Statistics

R-squared	0.955199	Mean dependent var	1.888538
Sum squared resid	41.44266	Durbin-Watson stat	1.739981

Table 4.4 Fixed Effects for T.C. Ziraat Bankası

Dependent Variable: LOG(NIZ+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 09:54
Sample (adjusted): 1993 2003
Cross-sections included: 73
Total panel (balanced) observations: 803
Identity instrument weighting matrix
Instrument list: C LOG(NIZ(-2)+1) LOG(NIS(-1)+1) LOG(P) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-114.2048	16.67805	-6.847611	0.0000
LOG(NIS(-1)+1)	0.064099	0.017815	3.598003	0.0003
LOG(NIZ(-1)+1)	0.408315	0.053436	7.641180	0.0000
LOG(P)	-0.066361	0.023955	-2.770309	0.0057
LOG(B+1)	0.110932	0.070915	1.564306	0.1182
YEAR	0.057702	0.008370	6.893825	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.968246	Mean dependent var	1.995495
Adjusted R-squared	0.964874	S.D. dependent var	0.937984
S.E. of regression	0.175796	Sum squared resid	22.40561
Durbin-Watson stat	1.218513	J-statistic	1.31E-06
Instrument rank	78.00000		

Table 4.5 Random Effects for T.C. Ziraat Bankası

Dependent Variable: LOG(NIZ+1)
Method: Panel GMM EGLS (Cross-section random effects)
Date: 06/22/05 Time: 09:58
Sample (adjusted): 1993 2003
Cross-sections included: 73
Total panel (balanced) observations: 803
Identity instrument weighting matrix
Swamy and Arora estimator of component variances
Instrument list: C LOG(NIZ(-2)+1) LOG(NIS(-1)+1) LOG(P) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-56.06467	12.14744	-4.615347	0.0000
LOG(NIS(-1)+1)	0.028594	0.013621	2.099182	0.0361
LOG(NIZ(-1)+1)	0.761366	0.022471	33.88210	0.0000
LOG(P)	-0.075038	0.019464	-3.855129	0.0001
LOG(B+1)	0.182575	0.022680	8.050135	0.0000
YEAR	0.028185	0.006094	4.625339	0.0000

Effects Specification

Cross-section random S.D. / Rho	0.000000	0.0000
Idiosyncratic random S.D. / Rho	0.175416	1.0000

Weighted Statistics

R-squared	0.962680	Mean dependent var	1.995495
Adjusted R-squared	0.962446	S.D. dependent var	0.937984
S.E. of regression	0.181770	Sum squared resid	26.33321
Durbin-Watson stat	1.553827	J-statistic	6.77E-05
Instrument rank	6.000000		

Unweighted Statistics

R-squared	0.962680	Mean dependent var	1.995495
Sum squared resid	26.33321	Durbin-Watson stat	1.553827

The fixed vs. Random effects issue has generated a hot debate in the biometrics and statistics literature which has spilled over into the panel data econometrics literature.[17] Mundlak (1961) and Wallace and Hussain (1969) were early proponents of the fixed effects model and Balestra and Nelove (1966) were advocates of the random error component model. As cited in Greene (2003), the specification test devised by Hausman (1978) is used to test for orthagonality of the random effects and the regressors. The test is based on the idea that under the hypothesis of no correlation, both OLS in the LSDV model and GLS are consistent, but OLS is inefficient whereas under the alternative, OLS is consistent, but GLS is not. Therefore, under the null hypothesis, the two estimates should not differ systematically, and a test can be based on the difference.

Hausman test for T. İş Bankası and T. C. Ziraat Bankası is shown in Table 4.6 and 4.7 respectively.

Table 4.6 Hausman Test for T. İş Bankası

Hausman test for fixed versus random effects	
chi-sqr(2) =	65.1367

Table 4.7 Hausman Test for T. C. Ziraat Bankası

Hausman test for fixed versus random effects	
chi-sqr(2) =	74.9746

[17] See Baltagi, Badi H. 2002. "Econometric Analysis of Panel Data", John Wiley & Sons. Ltd

The critical value from the chi-squared table with five degrees of freedom is 11.0705, which is far smaller than the test values for both of the banks. The hypothesis that the individual effects are uncorrelated with the other regressors in the model is rejected. Thus, it is concluded that of the two alternatives we have considered, the fixed effects model is the better choice.

For T. İş Bankası, the number of ATM of itself in the previous period affects the number of ATMs of the current period positively. The number of the ATM of T. C. Ziraat Bankası does not seem to be meaningful for the explanation of the number of ATMs of T. İş Bankası. It is probable that T. İş Bankası do not prefer to establish the ATMs to the provinces where the ATMs have been established by T.C. Ziraat Bankası. Another possible explanation is as follows: T. İş Bankası is not a state bank. So profit maximization is more important for this bank. So it reacts with an opposite behavior. The number of branches and the population affect the number of ATM positively. Also, the time variable has a positive sign. T.C Ziraat Bankası as being a state bank conducts some services as a duty given by government. As establishing bank branches in the less developed provinces is not possible, ATMs were used instead of branches in districts of the less developed provinces as a duty. Thus, profit maximization is not the main point for T.C Ziraat Bankası.

For T. C. Ziraat Bankası, the number of ATMs of T. İş Bankası and the number of ATMs of itself in the previous period affect the number of ATMs of the current period positively. T.C. Ziraat Bankası is a state bank. Profit maximization may not have a priority as described above. So, the ATM number of the other bank does not affect its ATM number negatively. The signs of the number of branches and the time variable are both positive. However, it seems interesting that the population variable has a negative sign. As a state bank T. C. Ziraat Bankası experienced a series of changes. Subsequent to the crisis, the state banks (Ziraat, Halk and Emlak) have gone through successful operational restructuring as part of the banking sector reform program (e.g., the merger of Emlak with Ziraat and the appointment of a joint management board; the downsizing of branches and employment; and the passing of legislation preventing ‘duty loses’). Despite the

increasing population, as the number of branches and accordingly ATMs decreased, the population sign is negative. Moreover, establishing ATMs was a part of duties of this bank as the government wanted to conduct the banking services in the less developed districts of Turkey by the intermediacy of T.C. Ziraat Bankası.

The coefficients of the two banks also may give an idea about their ATM adoptions. The coefficients concerning the effect of the banks' own ATM number in the previous period to the current number of ATM for T. İş Bankası and T. C. Ziraat Bankası are 0.432133 and 0.408315 respectively. Thus, it can be concluded that the effect of the previous period's ATM number to the current period's ATM number is similar for both of the banks.

Although there is a similarity about the previous period's ATM numbers for T. İş Bankası and T. C. Ziraat Bankası, the coefficient of total branch number differs seriously. The total branch number coefficient is 0.332760 for T. İş Bankası whereas the same coefficient is 0.110932 for T. C. Ziraat Bankası. It means the ATM number of T. İş Bankası is more sensitive to the number of branches. The increase in the number of bank branches leads to a greater increase in the number of ATMs for T. İş Bankası, nearly three times of the increase for T. C. Ziraat Bankası in the short run. In the long run, the coefficients for T. İş Bankası and T. C. Ziraat Bankası becomes 0.498711 and 0.12477 respectively. The difference between the sensitivity of the banks to the number of branches becomes larger in the long run. These explanations also presents the difference in the sensitivity of a state bank and a quasi-private bank.

Different versions of the estimation can be seen in Appendix B to evaluate the effect of the variables in different situations.

CHAPTER 5

CONCLUSION

Financial innovation has been a key influence on the world economy in providing a solid base for the growth of financial systems. The centrality of finance in an economy raises the importance of financial innovations. Over the past few decades there has been a serious increase in the development of new financial instruments. The improvements in the technology enabled the financial sector, especially banks, to introduce new financial instruments to the market. Banks as profit-seeking enterprises benefit new technologies in their systems that will reduce their cost of production and yield more profits. ATMs, early video banking, internet banking, transactional internet websites are some kinds of services supported by new technology in the banking sector.

The rate at which innovations diffuse through an economy is crucial. With the help of technology diffusion, the adoption of new technologies and techniques became possible all over the world at different rates. As Frame and White (2004) stated, despite the recognized importance of financial innovations and an extensive descriptive literature, there have been surprisingly few empirical studies that test hypotheses concerning the economic/environmental conditions that encourage financial innovation.

This study focuses on the Automated Teller Machnine (ATM) that is known to be one of the most important financial innovations. (ATM) enables a bank customer to conduct banking transactions from almost every other ATM in the

world. The first examples of automated teller machines are cash dispensers (CDs) that had been adopted in 1960s that were used as machines that supply certain amount of cash. With the technologic improvement automated teller machines replaced with cash dispensers. Automated teller machines were widely commercialized in 1970s. After their commercialization, ATMs have become as common places as banks, shopping malls, and supermarkets.

As a result of bank regulations, data set of ATMs is more available compared to the data set concerning information about other financial innovation implementations. Thus, the empirical studies concerning the automated teller machines have the greatest share among the surprisingly few empirical studies about financial innovations.

After analyzing the macroeconomic and microeconomic determinants of financial innovation, Akçaoğlu concluded that before 1980, neither macroeconomic features of the financial system nor microeconomic conditions of the aggregate economy were not suitable to produce financial innovation as it was in the developed countries. The situation changed after 1980 as a consequence of the stabilization programme. Financial liberalization has been a component of the programme. New entries into the banking sector have increased competition. The banks has realized the increasing importance of customers' portfolio requirements. In other words, determinants of financial innovation began to appear in the Turkish financial system after the 1980 stabilization program.

Celasun et al. (1999) note, "The arrival of foreign banks raised the overall standards in the banking sector, especially in terms of human capital, and information technology, which was low prior to reforms". Işık, Gündüz, Kılıç, Uysal (2002) claim that domestic firms were able to capture productivity changes which arose from the adoption of new technology and practices introduced by the foreign banks. The increase in the number of banks and qualified personnel, in turn, enhanced competition and contributed to broad utilization of new financial instruments and techniques.

As declared in the 2004 report of The Bank Association of Turkey, Turkish banking system uses advanced information technology. Such technology-intensive services as ATM (Automatic Teller Machine), POS (Point of Sale terminal), telephone banking and internet banking are available. Having an important place in the vision of banks, electronic banking activities have been growing rapidly for the purpose of improving quality of services and saving costs.

This study examines the determinants of the ATM number in Turkey, according to the provinces focusing on two big banks of Turkey that are T. İş Bankası and T. C. Ziraat Bankası for the years between 1990 and 2004. In Turkey the adoption of ATM was started by T. İş Bankası in December 1987. The number of ATMs increased rapidly after 1987 in Turkey especially in the more developed provinces. As of the end of 2004 the number of ATMs reached 13,544. The automated teller machines in Turkey have the similar technological qualities compared with the automated teller machines in Europe and in the United States. T.C. Ziraat Bankası has the greatest number of ATMs all over Turkey according to the recent data collected from the archive of the bank.

For this study panel data on eighty-one provinces of Turkey are gathered. The districts that became provinces after 1990 are evaluated as they were still districts for the sake of the study as there exists no data for the new provinces before the date they became province. Thus, the number of provinces used in this paper is seventy-three. The data set covers the period between 1990 and 2004.

It was impossible to access the data on total number of ATMs in Turkey according to provinces. The reason is that, there is no source publishing the number of ATMs according to provinces in Turkey. Moreover, the banks do not want to reveal this information because it is not convenient to give information outside of the bank for personal studies due to their own legislations. They evaluate data on ATM number as ‘secret’ information. I was allowed to access the archives of T. İş Bankası and T. C. Ziraat Bankası. Data on T.C. Ziraat Bankası and T. İş Bankası are gathered from the archives of the banks after some study for this thesis. All the other

data used in this thesis are either officially published or obtained as a result of calculations using some other officially published data.

T. C. Ziraat Bankası is ranked as number one and T. İş Bankası as number two by total assets, by the number of branches, by the number of employees and by the number of automated teller machines, by the as of September 30, 2004 according to The Banks Association of Turkey. This is why the analysis conducted in this study focusing on these two banks may give an idea about the determinants of the number of automated teller machines for the whole of the Turkish banking system.

The estimation method used in this thesis to reveal the determinants of the number of ATMs is "panel generalized method of moments". With panel generalized method of moments, fixed effects and random effects are estimated. To decide which one should be used, Hausman (1978) specification test is conducted. By conducting Hausman (1978) specification test, it is decided that "fixed effects" should be used to describe the model better. At the end of the analysis it is concluded that that the number of ATMs of T. İş Bankası and T. C. Ziraat Bankası in the previous year and the total number of branches of the banks in Turkey are the indicators of ATM adoption for both of the banks concerned. However, population has a negative sign for T. C. Ziraat Bankası which is a state bank whereas it has a positive sign for T. İş Bankası which is a quasi-private bank. This shows that T. C. Ziraat Bankası reacts as the implementer of the policies conducted by the government. The findings also indicate that the number of ATMs is higher in more developed provinces of Turkey. The effects of population and the number of branches are greater for T. İş Bankası.

This study makes a couple of contributions to the literature. First of all, different from the existing literature this study is an empirical study in the field of financial innovations. Taking the few number of financial innovation studies in the literature into account, it is not surprising that there exists no study examining the number of automated teller machines in Turkey particularly. Thus, focusing on the determinants of the number of ATMs in Turkey is the second contribution of this

thesis to the literature. Moreover the information of ATMs gathered for this study is not published. Third, the study examines the determinants of the number of ATMs according to provinces. This enables the evaluation of the determinants of the number of ATMs for each of the provinces or regions as well as for the whole country.

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APPENDIX A

Calculations on Data

Since some of the data set was not proper to be used in this thesis, I was able to use them in this study only after some calculations. For example, I divided the total deposit amount and total credit amount by [CPI (1987=100)* POPULATION] to obtain the real values per capita;

Total Amount of Deposits / (CPI * POPULATION)

Total Amount of Credits / (CPI * POPULATION)

I also divided the value of GDP by population to obtain the value of GDP per capita;

GDP/POPULATION

Information about population according to provinces exists only for two census years, 1990 and 2000. However, I needed to use population variable for all of the years between 1990 and 2004. Using the values in 1990 and in 2004, I calculated the population for each of the years as follows[18]:

P t +n = Population of the last census

Pt = Population of the previous census

r = The increase of the growth of population

n = The number of years between two census

$$P_{t+n} = P_t * e^{r\,n}$$

[18] See, Kocaman (2002) "Plan Nüfus Projeksiyon Yöntemleri"

$$\frac{P_{t+n}}{P_t} = e^{rn}$$

We take the logarithm of both sides;

$$\log_e \frac{P_{t+n}}{P_t} = r\,n \log_e e$$

Since $\log_e e = 1$,

$$r = \frac{\log_e \frac{P_{t+n}}{P_t}}{n}$$

Then, using r the procedure followed in this study can be exemplified as below:

The population in 1985; **Pt+n =** $P_{1985} = 50.664.458$

The population in 1990; **Pt =** $P_{1990} = 56.473.035$

The number of years between two census; **n =** 5

$$e^{r5} = \frac{56.473.035}{50.664.458} = 1,11\ 4647965$$

$$r = \frac{\log e = 1.11\ 4647965}{5}$$

0.1 08538628

r = ---------- = 0,021707725 **r** = 2,1 7%
5

Using the populations of 1985 and 1990, the populations of 1991, 1992, 1993, and 1994 can be calculated by finding the anti-log of the increase of the annual population growth:

The population in 1985; **P t +n =** $P_{1\,985}$ = 50.664.458

The population in 1990; **Pt =** $P_{1\,990}$ = 56.473.035

The average increase in the annual growth rate of population between 1985 and 1990 = **r =** 0,021707725

Anti-log of the increase in the annual growth rate of population = 1,021945053

1 985 population = 50.664.458

1 986 population = 1,02 1 945053 * 50.664.458 = 5 1 .776.292 (estimation)

1 987 population = 1,02 1 945053 * 5 1 .776.292 = 52.9 1 2.526 (estimation)

1 988 population = 1,02 1 945053 * 52.9 1 2.526 = 54.073.694 (estimation)

1 989 population = 1,02 1 945053 * 54.073.694 = 55.260.344 (estimation)

1 990 population = 1,02 1 945053 * 55.260.344 = 56.473.035

APPENDIX B

Two versions of the original model are as follows:

Model 1

$$\textbf{Log } (N_{i,t}^{\ is} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ is} + 1) + \beta_2 \log (N_{i,t-1}^{\ iz} + 1) + \beta_3 \log (P_{i,t}) + \beta_4 (Year_{i,t})$$

$$\textbf{Log } (N_{i,t}^{\ iz} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ iz} + 1) + \beta_2 \log (N_{i,t-1}^{\ is} + 1) + \beta_3 \log (P_{i,t}) + \beta_4 (Year_{i,t})$$

Model 2

$$\textbf{Log } (N_{i,t}^{\ is} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ is} + 1) + \beta_2 \log (N_{i,t-1}^{\ iz} + 1) + \beta_3 \log (B_{i,t} + 1) + \beta_4 (Year_{i,t})$$

$$\textbf{Log } (N_{i,t}^{\ iz} + 1) = \alpha_i + \beta_1 \log (N_{i,t-1}^{\ iz} + 1) + \beta_2 \log (N_{i,t-1}^{\ is} + 1) + \beta_3 \log (B_{i,t} + 1) + \beta_4 (Year_{i,t})$$

MODEL 1

Table B.1 Fixed Effects for T. İş Bankası

Dependent Variable: LOG(NIS+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 10:00
Sample (adjusted): 1994 2003
Cross-sections included: 73
Total panel (balanced) observations: 730
Identity instrument weighting matrix
Instrument list: C LOG(NIS(-2)+1) LOG(NIZ(-1)+1) LOG(P) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-218.3506	25.72676	-8.487295	0.0000
LOG(NIS(-1)+1)	0.418236	0.045562	9.179412	0.0000
LOG(NIZ(-1)+1)	-0.064239	0.042790	-1.501243	0.1338
LOG(P)	0.339189	0.029099	11.65643	0.0000
YEAR	0.108926	0.012920	8.430936	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.958081	Mean dependent var	1.888538
Adjusted R-squared	0.953202	S.D. dependent var	1.126463
S.E. of regression	0.243685	Sum squared resid	38.77684
Durbin-Watson stat	1.487608	J-statistic	0.016721
Instrument rank	77.00000		

Table B.2 Fixed Effects for T. C. Ziraat Bankası

Dependent Variable: LOG(NIZ+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 10:03
Sample (adjusted): 1993 2003
Cross-sections included: 73
Total panel (balanced) observations: 803
Identity instrument weighting matrix
Instrument list: C LOG(NIZ(-2)+1) LOG(NIS(-1)+1) LOG(P) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-106.0153	15.91319	-6.662104	0.0000
LOG(NIS(-1)+1)	0.066403	0.017800	3.730471	0.0002
LOG(NIZ(-1)+1)	0.401947	0.053523	7.509775	0.0000
LOG(P)	-0.044217	0.019305	-2.290432	0.0223
YEAR	0.053758	0.008021	6.701803	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.967995	Mean dependent var	1.995495
Adjusted R-squared	0.964645	S.D. dependent var	0.937984
S.E. of regression	0.176369	Sum squared resid	22.58306
Durbin-Watson stat	1.197136	J-statistic	0.001699
Instrument rank	77.00000		

MODEL 2

Table B.3 Fixed Effects for T. İş Bankası

Dependent Variable: LOG(NIS+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 10:01
Sample (adjusted): 1994 2003
Cross-sections included: 73
Total panel (balanced) observations: 730
Identity instrument weighting matrix
Instrument list: C LOG(NIS(-2)+1) LOG(NIZ(-1)+1) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-289.2726	26.86136	-10.76910	0.0000
LOG(NIS(-1)+1)	0.457704	0.045471	10.06574	0.0000
LOG(NIZ(-1)+1)	-0.042203	0.043819	-0.963131	0.3358
LOG(B+1)	0.803223	0.085867	9.354306	0.0000
YEAR	0.143799	0.013441	10.69852	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.956474	Mean dependent var	1.888538
Adjusted R-squared	0.951408	S.D. dependent var	1.126463
S.E. of regression	0.248313	Sum squared resid	40.26371
Durbin-Watson stat	1.533960	J-statistic	0.001901
Instrument rank	77.00000		

Table B.4 Fixed Effects for T. C. Ziraat Bankası

Dependent Variable: LOG(NIZ+1)
Method: Panel Generalized Method of Moments
Date: 06/22/05 Time: 10:04
Sample (adjusted): 1993 2003
Cross-sections included: 73
Total panel (balanced) observations: 803
Identity instrument weighting matrix
Instrument list: C LOG(NIZ(-2)+1) LOG(NIS(-1)+1) LOG(B+1) YEAR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-98.38070	15.61023	-6.302321	0.0000
LOG(NIS(-1)+1)	0.061997	0.017946	3.454581	0.0006
LOG(NIZ(-1)+1)	0.395715	0.053924	7.338404	0.0000
LOG(B+1)	-0.006938	0.057472	-0.120723	0.9039
YEAR	0.049832	0.007844	6.353055	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.967620	Mean dependent var	1.995495
Adjusted R-squared	0.964231	S.D. dependent var	0.937984
S.E. of regression	0.177399	Sum squared resid	22.84743
Durbin-Watson stat	1.179612	J-statistic	0.000349
Instrument rank	77.00000		